WWF
GREECE

Blueprint
for a green recovery in Greece

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WWF Greece is the Greek national office of the WWF global network.

Our mission is to stop the degradation of our planet's natural environment and build a future in which humans live in harmony with nature.

In order to achieve this mission, we focus our efforts on biodiversity conservation, combating climate change and reducing the ecological footprint of human activity.

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PROLOGUE

Whether it's dramatic loss of biodiversity or rapid climate change, we are all becoming painfully aware of a very real planetary crisis. To make matters even worse, the outbreak and spreading of the covid19 pandemic throughout the world, has revealed to us in the most dramatic way that humanity is losing its balance with natural systems that something has gone very wrong in our relationship with nature and the services it so generously offers. So now, on top of planetary challenges requiring urgent response, we also face the tragic loss of human lives from covid19, the suffering from the illness and the crippling of economies throughout the world.

So the real challenge is how can we regain the balance? What needs to happen so that the injured natural world and the failing economy can recover?

For Greece, this challenge is compounded by additional factors. The pandemic has hit this country after a decade of austerity, at a time when it was struggling to recover its battered economy and society, but through the same flawed economic development model that brought us here and carried with it, a heavy environmental footprint.

So now is the time for transformational change. Beyond the necessary vision and political will, there is no doubt that adequate resources will also be a critical factor in such a transformation. Greece has been allocated a serious amount of funding from the EU Recovery Fund and the Multiannual Financial Framework. This funding represents a unique opportunity but also carries with it an important responsibility. Learning from the lessons and mistakes of the past, and building on the EU Green New Deal, it is critical that Greece achieves a recovery that is green, just and socially inclusive. We will not have another chance in the foreseeable future to transform the economy of this country and set it on a more prosperous, equitable and sustainable path. We must not let this opportunity be lost.

WWF wishes to assist in turning this central objective into a reality. We have thus prepared this study, with the hope that the proposals included herein will be useful in the process of formulating a national recovery plan for the country. We encourage the government to see this as the real opportunity it is to bring about much needed change, for the good of the people and our natural heritage.

Demetres Karavellas, CEO, WWF Greece

EXECUTIVE SUMMARY

In July 2020, the European Council agreed to the creation of the Recovery and Resilience Facility (RFF), an instrument designed to provide financial support for economic recovery efforts across EU member-States. Greece has been allocated approximately €17 billion of grants, while it can also have access to additional loans via the same facility. For accessing RRF funds Greece needs to submit a "recovery and resilience plan", detailing how it intends to use those funds.

This report is a response to the recovery and resilience plan that the Greek government needs to submit. More specifically it first sets 5 key principles that should guide the design of recovery and stimulus measures; and subsequently proposes 10 indicative examples of national green investment programmes that could create 120,000 new jobs while contributing to climate, circular economy, and biodiversity objectives.

For WWF Greece, given the global environmental emergency, 50% of funds available to Greece should be channeled towards nature-positive investments. Further, investments that are channeled towards other priorities should abide to a "do no significant harm principle" i.e. they should not harm national or EU climate and wider environmental goals.

As such, the green investment plan we propose represents about half of RRF grants available to Greece (€8.2 billion). Indeed, given Greece's public debt stock, absorbing the grants component of the RRF should be the absolute priority. However, this report also identifies additional (not costed) green investment needs, should the Greek government decide to also use the loan component of the RRF.

After ten years of crisis, stagnation, austerity and dearth of investment in the real economy, followed by the pandemic-induced economic shock, this is a unique opportunity for Greece to invest in transforming its pre-COVID 19 development model; a model that was neither economically sustainable nor environmentally viable. In short, the recovery plan should avoid the easy solution of simply propping up the existing development model. Instead it should reorient the Greek economy and jobs towards green sectors of the future.

5 key principles

Principle 1: The recovery and resilience plan should entail stimulus interventions that can immediately create jobs, and alleviate the socio-economic pain created by the pandemic. Investments with the highest possible employment footprint should be prioritized, and green investments perform particularly well against this criterion.

Principle 2: The plan should contribute to transformational goals both for the economy and the environment. Green economy sectors are among the fastest growing sectors globally: harnessing those through strategic investments that accelerate decarbonization, the circular economy transition and low impact activities for ecosystems and biodiversity, is a win-win.

Principle 3: The plan should account for co-benefits by taking into consideration wider socio-economic resilience. For example, interventions that contribute to better health outcomes by reducing pollution, or that enhance socio-economic resilience by reducing the costs of natural disasters (e.g. flood risk) via nature-based solutions, should be prioritized.

Principle 4: The plan should abide to the "do no significant harm" principle. Both for environment and economic reasons, it should exclude any investment or measure that harms key climate and biodiversity goals, and avoid locking the economy into high carbon infrastructure and a high environmental footprint development path. Most notably it should de facto exclude any investment in new oil and gas upstream or downstream infrastructure.

Principle 5: The plan should be designed in a way that generates shared benefits for all, by reaching the maximum possible regions and local communities. This includes, but is not limited to, alleviating adverse impacts for sectors, workers, or regions that have been disproportionally hit by the pandemic and the decade-long crisis and stagnation. It also

includes channeling additional (to the EU's Just Transition Fund) investments towards coal regions, to support their decarbonization process.

10 investment programmes

Based on these principles, we propose 10 indicative investment programmes that would provide a stimulus to the economy while a) accelerating decarbonization, b) laying the foundations for a circular economy, and c) restoring and protecting Greece's nature, while preserving and enhancing the essential socio-economic benefits it provide.

Stimulus programme 1: Accelerating investments towards decentralized clean energy via the participation of all municipalities, through on the Greek law on energy communities (equivalent of energy cooperatives). The participation of citizens in the energy transition is extremely low compared to other countries, while decentralized clean energy systems can ensure shared benefits in all parts of the country. We estimate that an additional capacity of 1.3 GW could be installed over three years.

Stimulus programme 2: Increasing the NECP's[1] 2030 target for the energy upgrade of the private building stock (to 20%, up from 12-15%), and delivering planned renovations along with the additional new target upfront. As per previous research, renovation investments have a significant employment generation potential.

Stimulus programme 3: Redirecting planned investments in new gas production and distribution infrastructure through a public investment support programme towards clean energy production, storage and distribution alternatives that are already financially viable. Any clean energy infrastructure has a much larger employment footprint than gas.

Stimulus programme 4: Increasing investment in public transport infrastructure by 25% for three consecutive years, for reducing the disproportionate share (compared to other EU countries) of road and private passenger-kilometers. This can include both clean public transport infrastructure, as well as innovative shared transport models.

Stimulus programme 5: Providing the necessary capital investments for reaching the EU municipal waste recycling target of 55% by 2025. In line with the European Commission's recommendations, investments should focus primarily on solutions in the "upper level" of the waste management hierarchy (prevention, reuse, and recycling infrastructure) while minimizing or even excluding those at the "lower level" of the waste management hierarchy (e.g. incineration infrastructure).

Stimulus programme 6: Covering the investment cost of bringing the resource efficiency of SMEs to the resource efficiency frontier in four resource-intensive sectors of the economy (construction, food and beverage production, energy, and environmental technologies such as waste management). Beyond significant resource savings, this measure would also reduce input costs, and enhance productivity

Stimulus programme 7: Doubling organic farmland, by providing the necessary upfront investment that farmers need for financing a transition from conventional to organic production. Indeed, evidence suggests that these costs act as significant barrier. Organic farming has a higher labour intensity, while the organic market is extremely dynamic across the EU. Greece can harness this opportunity. This investment programme could place a particular emphasis on transitioning the organic production within Natura 2000 areas.

[1] Hellenic Republic, Ministry of the Environment and Energy. (2019, December). National Energy and Climate Plan.

Stimulus programme 8: Investing in flood risk reduction via a natural restoration of rivers and their retention areas. Indeed nature-based solutions to reduce flood risk are the most cost-effective option for reducing flood risks, as attested by a number of influential publications. At the same time, this investment programme would contribute to achieving the targets of the Water Framework Directive.

Stimulus programme 9: Closing the investment gap in Marine Protected Areas (MPAs) that, to this date, remain "paper parks". A properly managed network of MPAs requires both upfront investments (that can fall under the remit of a one-off instrument such as the RRF) and funding for covering ongoing operational costs. We propose to harness RRF funds for covering the former. Upfront investment should notably entail investments in ecotourism-related infrastructure, as ecotourism can subsequently provide a revenue stream to cover part of future operational needs.

Stimulus programme 10: Providing the necessary upfront funding for enhancing restoration and management of forest ecosystems within the Natura-2000 network. One-off restoration and management activities can include, among others, removing invasive species, addressing diseases and pests, and upfront investments for reintroducing sustainable traditional management (e.g. related to timber and non-timber forest products related activities). This evidently presupposes an investment in updated management plans for respective areas. Crucially, according to available evidence, all restoration and management activities present a high labour intensity, as well as providing multiple co-benefits.

These proposals are clearly not exhaustive, and additional green investment needs for decarbonization, the circular economy, and ecosystems and biodiversity, are identified and presented throughout the report.

We estimate that these 10 indicative investment programmes would, combined, require the mobilization of 8.2 billion EUR from the RRF, and would create about 120.000 full time equivalent (FTE) jobs across the economy. We provide a range of estimates for job creation, based on different employment intensity assumptions.

This is a conservative estimate as for circular economy-related interventions we only account for direct and indirect employment impacts. If factoring in induced jobs (employment effects of the additional consumption triggered by direct and indirect jobs created) for those interventions, the estimated impact would be higher.

Finally, it worth noting that we assume funds are channeled in the economy over the period 2021-23. Indeed, although the absorption of RRF can be extended to 2026, failing to implement a stimulus programme quickly would seriously jeopardize the possibility of a swift economic recovery.

	Total investment needs, million EUR (2021-2023)	RRF funding, million EUR	Additional public or private participation, million EUR	Additional jobs created, FTEs (central estimate)	*Additional jobs created, FTEs (maximum)*	*Additional jobs created, FTEs (minimum)*
Accelerating the energy transition						
1. Expanding energy communities and renewable self-generation	1,328	930	398	7,739	*9,960*	*5,519*
2. Accelerating retrofitting and energy efficiency	3,796	2,657	1,139	28,490	*54,760*	*14,800*
3. Redirecting fossil fuel investments towards clean energy alternatives (including RE, storage technologies, grid infrastructure, heat pumps, district heating infrastructure)	1,650	825	825	7,719	*n/a*	*n/a*
4. Increase green public transport investment by 50% (2021-2023)	2,800	1,960	560	29,693	*40,125*	*19,260*
Accelerating the shift towards a circular economy						
5. Infrastructure investments to reach EU municipal waste 2025 targets	1,623	812	812	21,262	*n/a*	*n/a*
6. Increasing the resource efficiency of SMEs to BAT in four key sectors	455	455	n/a	21,697	*35,501*	*7,892*
Restoring and protecting ecosystems and biodiversity						
7. Convert 500,000 hectares of farmland to organic production	147	147	n/a	1,680	*n/a*	*n/a*
8. Reducing flood risk through nature-based solutions	110	110	n/a	1,870	*n/a*	*n/a*
9. Closing the investment gap in Marine Protected Areas (MPAs)	102	102	n/a	1,819	*n/a*	*n/a*
10. Investing in forest restoration & management in the Natura 2000 network	206	206	n/a	3,692	*n/a*	*n/a*
TOTAL	**12,217**	**8,203**	**3,734**	**125,661**	***156,865***	***91,599***

INTRODUCTION
BUILDING BACK BETTER

Following a decade of austerity and dearth of investments in the real economy, the financial support provided under the EU's Recovery and Resilience Facility is a unique opportunity for Greece, not only as vital economic stimulus in the short-term, but also as pathway towards the transformation of a pre-pandemic development model that was neither economically nor environmentally sustainable

In July 2020, the European Council agreed to the creation of a Recovery and Resilience Facility (RRF), a temporary funding instrument whose objective is to assist EU member States with limited fiscal room to implement stimulus programs, in order to mitigate the pandemic-induced economic crisis. To access RRF funds, EU member states need to submit national recovery and resilience plans, detailing the investment and structural measures they intend to finance for driving a recovery.

The present report aims to contribute to the recovery and resilience plan that the Greek government is currently preparing. It is estimated that approximately 17 billion EUR of grants from the RRF will be available for disbursement over the period 2021-2026. Although there are ongoing debates on net amounts (as respective member states will directly or indirectly contribute to the RRF e.g. through the provision of guarantees), the total amount is not negligible: put in perspective, it represents 9% of Greece's 2019 GDP. Grants can be complemented by the loans component of the RRF.

The European Commission has already pointed out that at least 30% of the funds will have to be allocated to climate-related investments. At the same time, calls for "green" recovery and stimulus packages are now commonplace across a wide range of international institutions.[2]

Indeed, whether it is the loss of biodiversity or climate change, we are facing a planetary crisis; the outbreak and spreading of the COVID-19 pandemic is a harsh reminder that something has gone very wrong in the way humanity exploits natural systems.[3] However, unlike the current pandemic, the dramatic impacts of the climate crisis and the collapse of biodiversity and ecosystems cannot be reversed - they will be permanent.

In the case of Greece, after a decade of austerity and dearth of investments in the real economy, the financial support provided under the EU's Recovery and Resilience Facility constitutes a unique opportunity not only for providing a vital stimulus in the short-term, but also for contributing the transformation of a pre-pandemic development model that was neither economically nor environmentally sustainable.

This opportunity to build a better post-pandemic development model should not be wasted.

WWF Greece's report provides a concise overview of the impacts of the COVID-19 crisis on the national economy and lays out five key principles for designing an effective Recovery and Resilience Plan. On the basis of these five principles, the report sets out a series of indicative flagship green investment programmes that can deliver for the economy and employment in the short-term, while accelerating Greece's necessary green transition.

It is important to note that the scope of this report is the use of the RRF (and eventual mobilization of additional national funds) as a means to undertake a green stimulus that addresses immediate social and economic needs, while catalyzing a green transformation of the economy through tangible sustainable investments. This limited scope evidently does not mean that long term structural measures in the crucial domains of green taxation, the phasing out environmentally harmful subsidies, green financial system reform or environmental governance, are not important for a post-COVID recovery strategy. Indeed, WWF Greece has already submitted detailed proposals[4] to the "Pissarides Commission" (responsible for the development of a growth strategy for Greece), focusing precisely on green reforms. We plan to synthesize our longer term reforms vision in future work.

[2] See for example: a) IMF. (2020). Greening the recovery. IMF Special Series on Fiscal Policies to Respond to COVID-19. https://www.imf.org/~/media/Files/Publications/covid19-special-notes/en-special-series-on-covid-19-greening-the-recovery.ashx. b) OECD. (2020). Building back better: A sustainable, resilient recovery after COVID-19. OECD Policy Responses to Coronavirus (COVID-19). https://www.oecd.org/coronavirus/policy-responses/building-back-better-a-sustainable-resilient-recovery-after-covid-19-52b869f5/ https://www.smithschool.ox.ac.uk/publications/wpapers/workingpaper20-02.pdf

[3] WWF International. (2020). COVID-19: Urgent call to protect people and nature. https://wwfeu.awsassets.panda.org/downloads/wwf_covid19_urgent_call_to_protect_people_and_nature_1.pdf

[4] https://www.wwf.gr/images/pdfs/sholia_sto_shedio_anaptyxis_gia_tin_elliniki_oikonomia.pdf

COVID-19
AND THE GREEK ECONOMY

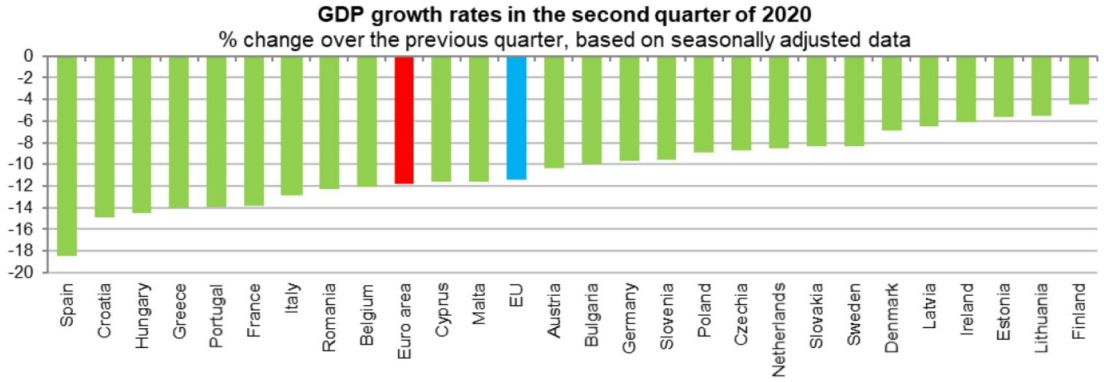
According to forecasts by the European Commission, the OECD and the IMF, Greece was expected to experience the largest fall of economic activity and steepest rise of unemployment across the EU, mainly due to its disproportionally large dependence on inbound tourism revenue.

THE IMPACT OF COVID-19

According to forecasts by the European Commission, the OECD and the IMF, Greece was expected to experience the largest fall of economic activity and steepest rise of unemployment across the EU, mainly due to its disproportionally large dependence on inbound tourism revenue.

These dire predictions may seem overblown as per the 2nd quarter economic performance (Figure 1). However, as some analysts have pointed out, it is highly likely that performance will get worse than EU average during the 3rd quarter, as the latter coincides with the peak of the tourism season.[5]

Figure 1: Comparative economic performance of EU member States



Source: Eurostat[6]

At the time of this writing, Greece's unemployment rate was up to 18.3%, from about 16% in early 2020, according to the Hellenic Statistical Authority. This is likely to be a significant underestimate as furloughed workers are classified as inactive. In either case, according to the Greek Workforce Employment Organization (OAED), more than 120 thousand jobs had been lost by August 2020.

Whether Greece significantly stands out in terms of the depth of the pandemic-induced recession and decline in employment remains to be seen.

However, the major specificity lies in that the current crisis comes on the backdrop of one of the largest and longest peacetime recessions ever experienced by a developed economy: this is what renders Greece's economy particularly fragile, and what makes the capacity of the state to respond to such a major shock particularly challenging.

[5] Bensasson, Marcus. (2020, September 4). Macro roundup: Record contraction. Grecology. https://grecology.substack.com/p/macro-roundup-record-contraction

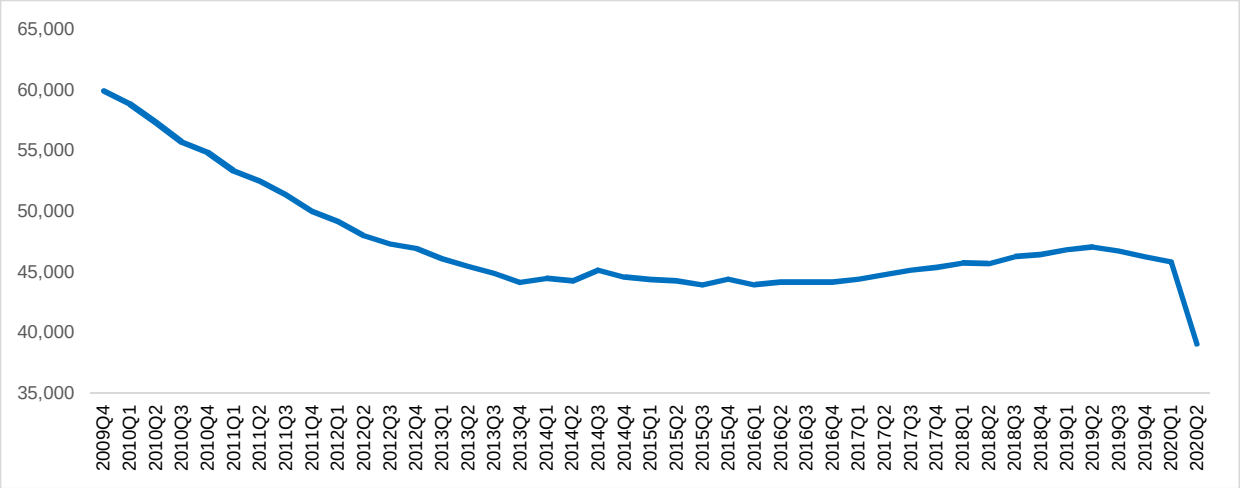
[6] Eurostat. (2020, September 8). GDP down by 11.8% and employment down by 2.9% in the euro area. Newsrelease – Euroindicators 133/2020. https://ec.europa.eu/eurostat/documents/2995521/10545471/2-08092020-AP-EN.pdf/43764613-3547-2e40-7a24-d20c30a20f64

AN ECONOMICALLY UNSUSTAINABLE DEVELOPMENT MODEL

The dramatic economic impacts of the pandemic should not blind us to the fact that the pre-COVID 19 development model was fundamentally fragile from an economic standpoint and unsustainable from an environmental one.

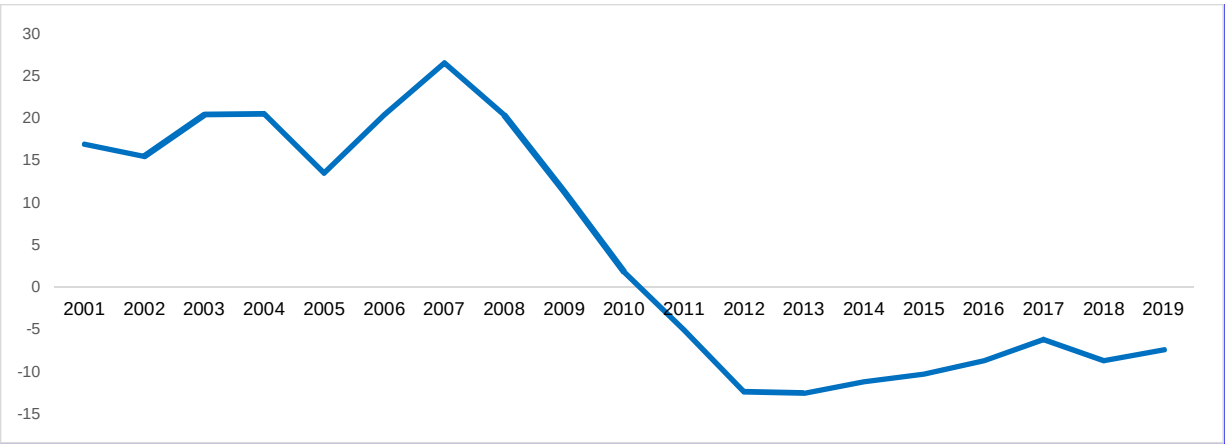
From an economic performance point of view, on the eve of the pandemic the unemployment rate still stood at 16%, real economy investment levels remained disappointing,[7] and the timid pick-up of economic activity post-2016 already showed signs of leveling off over the last quarter of 2019. In early 2020 Greece's economy was still more than 20% smaller than it was in 2008. However one defines "resilience", it is crystal clear that 10 years of crisis and "structural adjustment" left the economy and society woefully unprepared to deal with any shock.

Figure 2: Greece's quarterly GDP (2009-2020), seasonally adjusted current prices (million EUR)



Source: Eurostat

Figure 3: Net fixed capital formation (investment), billion Euros



Source: Eurostat

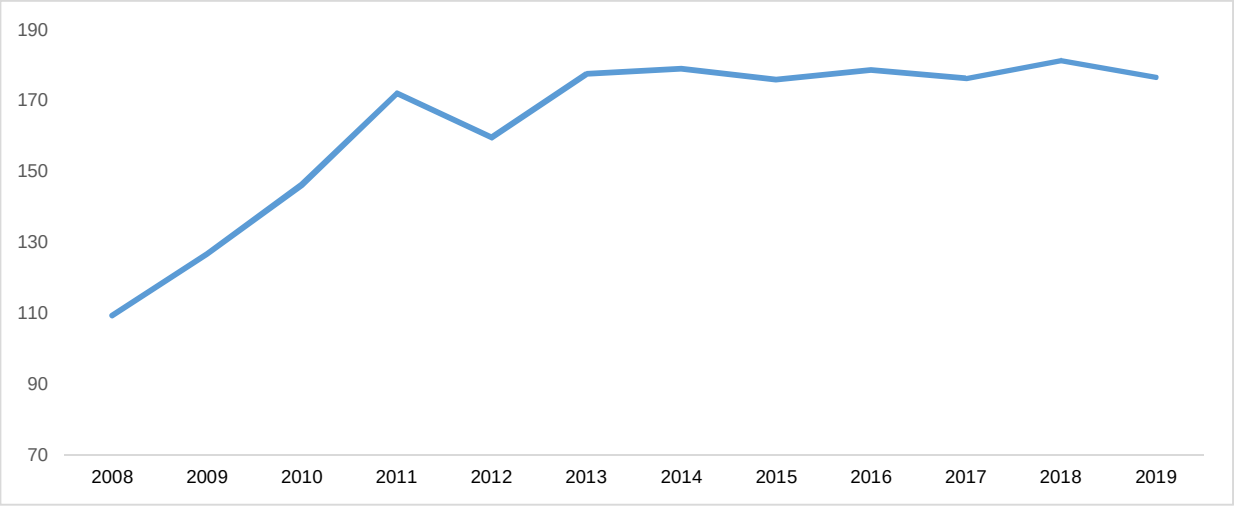
[7] Mouzakis, Yiannis. (2018, December 13). Chasing investment, the Greek dream. Macropolis. https://www.macropolis.gr/?i=portal.en.the-agora.7825

Crucially, far from delivering a productive transformation and diversification of the economy, the crisis period and structural adjustment policies implemented throughout the "memoranda" period (2010-2018) deepened Greece's dependence on inbound tourism revenue, while weakening other sectors such as the manufacturing base.

Along with unsustainable private debts (non-performing loans), the crisis period left a significant public debt burden, leaving the economy exposed to external shocks and limiting the state's capacity to undertake countercyclical policies in response to such shocks (Figure 4).

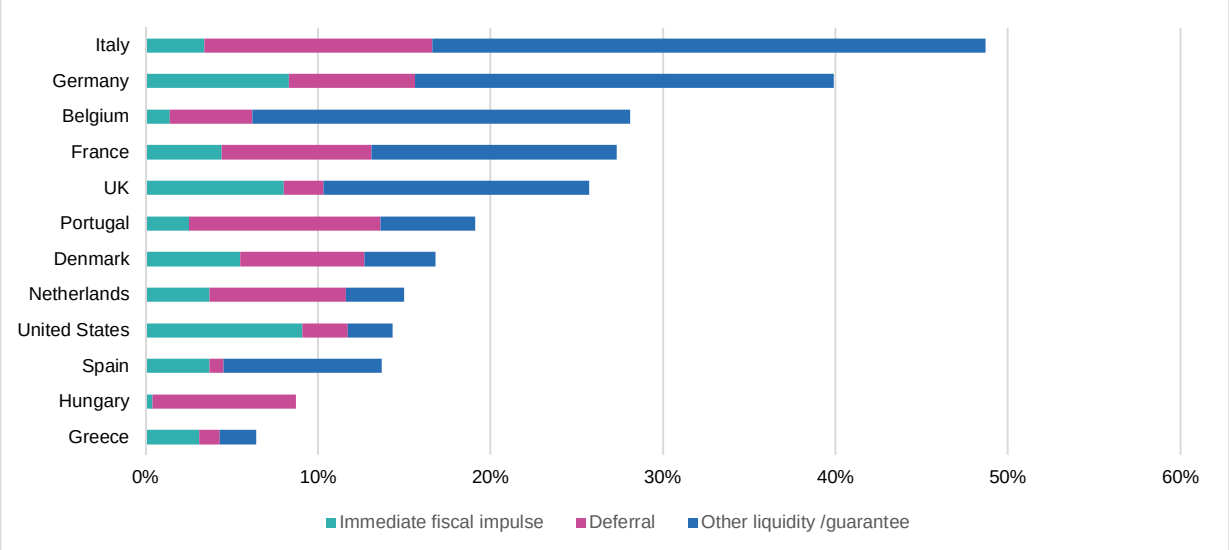
Indeed, according to the Bruegel Institute's data, as per June 15th (latest data), Greece's emergency response to protect businesses and workers throughout the pandemic was one of the lowest of all developed countries (Figure 5). Regardless of the debate over whether this has been best possible policy decision of not, there is little doubt that concerns of debt sustainability and possible future (post-pandemic) "fiscal consolidation" demands from creditors, played their role.

Figure 4: Public debt to GDP ratio



Source: Eurostat

Figure 5: Fiscal support measures in response to COVID-19, % of 2019 GDP



Source: Bruegel Institute

The big picture is that a recovery plan for Greece cannot simply be about going back to the pre-pandemic model. It needs to both alleviate immediate needs that come as a consequence of the crisis, while not losing sight of transformational goals: interventions and investments that can allow the economy to recover not just from the COVID-19 induced crisis, but arguably from the decade-long crisis and stagnation that followed the 2008 financial crash.

AN ENVIRONMENTALLY UNSUSTAINABLE DEVELOPMENT MODEL

On the green transition front, despite the talk of transforming the Greek economy into a beacon of sustainable development in the Mediterranean by harnessing the growth and employment potential of green sectors, the blunt reality is that on a number of critical fronts Greece's green economy performance has been lagging behind (Table 1).

Greece is expected to hit its 2020 renewables target in the energy mix, and probably its energy efficiency target. Both emissions per capita and material consumption per capita expectedly declined during the crisis, as a result of the collapse in consumption and production. But on a structural level, the energy intensity of the economy worsened, while progress on other key indicators was practically interrupted.

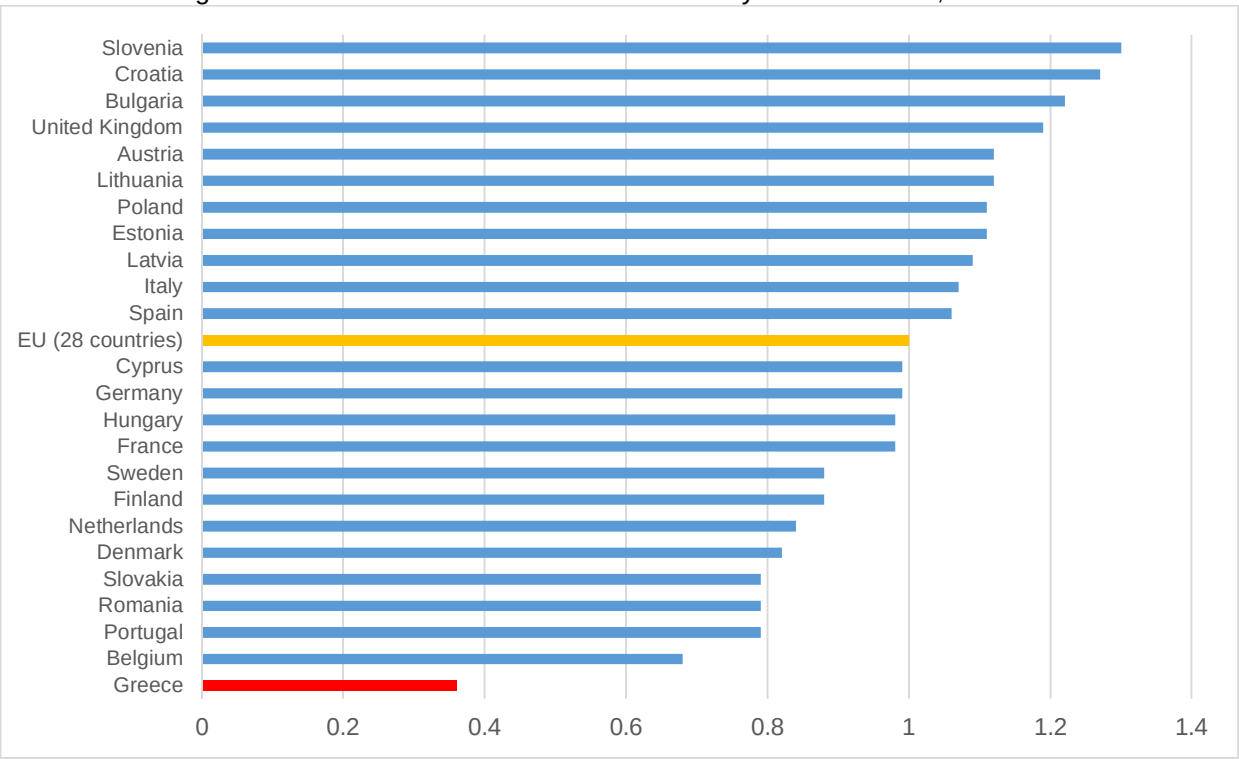
Table 1: Selected green transition indicators

Indicator	Greece (2010)	EU average (2010)	Greece (2018)	EU average (2018)
Per capita GHG emissions, kg	10.9	9.7	9	8.7
Energy intensity of GDP, kg of toe per €1000 of GDP	136.5	141.5	140.8	120.9
Share of RES, % of final energy consumption	10.1%	14.4%	18%	18.8%
Cost of premature mortality due to air pollution, % of GDP	5.5%	4.2%	5.9%	3.2%
Per capita material consumption, tons	15.9	13.7	11.9	13.3
Resource productivity of GDP, € per kg of final resource consumption	1.2	1.8	€1.4	2
Municipal waste recycling, %	17.1%	38.3%	18.9%	46.4%
Circular economy products use, % of domestic material consumption	2.7%	11%	1.3%	11.7%
Organic agriculture, % of farmland	3.7%	5.1%	6%	7.7%
Freshwater abstraction, m^3 per capita	893	383	1,042	360

Sources: Eurostat, OECD, FiBL

Although Eurostat data provides an estimate of the size of green economy sectors, data for Greece is unavailable. However, estimates of the size, jobs and investments of circular economy sectors, for instance, point to poor comparative performance (Figure 6).

Figure 6: Gross Value Added of circular economy related sectors, % of GDP



Source: Eurostat

According to a 2019 assessment on the achievement of Sustainable Development Goals of EU member states,[8] significant challenges remain in achieving the targets of land and marine protection, responsible production and consumption, climate action, affordable and clean energy, and transitioning to sustainable cities (Figure 7).

Figure 7: Progress towards achieving sustainable development goals.

Source: SSDN and IIEP

In short, there is a significant "green investment gap" in enabling the transition of the economy towards climate neutrality, circular economy and biodiversity and ecosystems protection. This

[8] SDSN & IEEP. 2019. The 2019 Europe Sustainable Development Report. Sustainable Development Solutions Network and Institute for European Environmental Policy: Paris and Brussels.

investment gap is holding Greece back from harnessing the significant development and employment potential of the environmental transition.[9]

At the same time, a failure to transform Greece's economic tissue in line with the environmental transition will likely pose new risks to the economy and society. As per international terminology, these can be divided into "transition risks" (impacts of policies to address the environmental crisis on the economy), and "material risks" (defined as impacts of the environmental crisis on the economy).

Vis-à-vis "transition risks", some research suggests that Greece's productive tissue would be particularly vulnerable to an abrupt and aggressive climate mitigation scenario.

Figure 8: Productive capital at risk of stranding (exposed to transition risks)

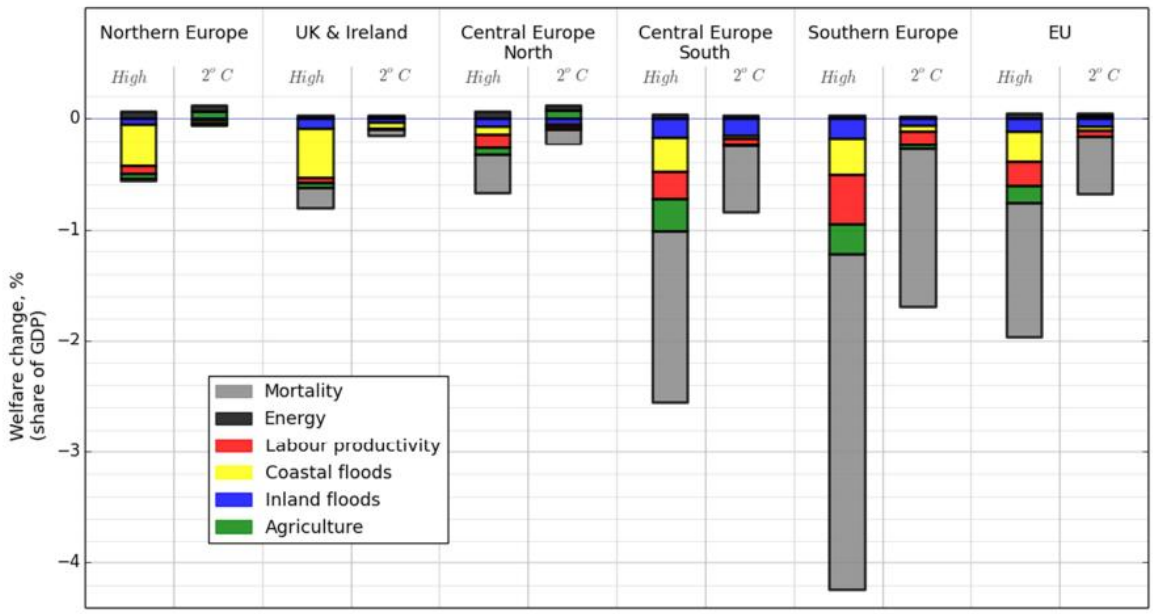
	Total capital		**Mining (B)**		**Manufacturing (C)**		**Electricity/gas (D)**	
Austria	5,689	(0.8%)	431	(16.0%)	1,706	(2.4%)	3,315	(12.5%)
Belgium	3,181	(0.6%)	1	(0.1%)	2,692	(3.0%)	285	(1.2%)
Czechia	17,536	(3.7%)	4,075	(60.9%)	2,772	(3.3%)	6,718	(25.7%)
Germany	40,752	(1.0%)	3,629	(29.6%)	12,702	(2.8%)	21,627	(12.2%)
Greece	8,774	(2.7%)	1,313	(48.7%)	1,800	(8.1%)	2,683	(17.1%)
France	35,514	(1.4%)	3,644	(21.4%)	3,877	(2.1%)	21,913	(23.3%)
Italy	58,589	(2.1%)	2,252	(10.7%)	19,776	(4.9%)	30,565	(14.0%)
Sweden	3,970	(0.8%)	55	(1.4%)	1,762	(2.2%)	1,856	(3.1%)
Slovakia	18,749	(8.2%)	473	(15.1%)	3,220	(7.7%)	13,458	(35.1%)
UK	84,678	(3.6%)	45,900	(69.3%)	7,385	(2.9%)	28,384	(35.7%)

Source: Caren-Fouhaut et al, 2019[10]

Regarding material risks, a 2011 Bank of Greece report estimates that climate change could cost the Greek economy at least 700 billion EUR by 2100, while assessing the significant investment needs for adapting to climate change.[11] More recent research by the Joint Research Center (JRC) of the European Commission estimates that Mediterranean EU countries, among which Greece, are likely to be hit particularly hard in a high warming scenario.[12]

[9] International Labour Organization (2018). World employment and social outlook: Greening with jobs.
[10] Cahen-Fourot, Louison and Campiglio, Emanuele and Dawkins, Elena and Godin, Antoine and Kemp-Benedict, Eric (2019) Capital stranding cascades: The impact of decarbonisation on productive asset utilisation. *Ecological Economic Papers*, 18. WU Vienna University of Economics and Business, Vienna.
[11] Bank of Greece report
[12] J.C. Ciscar, D. Ibarreta, A. Soria, A. Dosio, A.Toreti, A. Ceglar, D. Fumagalli, F. Dentener, R. Lecerf, A. Zucchini, L. Panarello, S. Niemeyer, I. Pérez-Domínguez, T. Fellmann, A. Kitous, J. Després, A. Christodoulou, H. Demirel, L. Alfieri, F. Dottori, M.I. Vousdoukas, L. Mentaschi, E. Voukouvalas, C. Cammalleri, P. Barbosa, F. Micale, J.V. Vogt, J.I. Barredo, G. Caudullo, A. Mauri, D. de Rigo, G. Libertà, T. Houston Durrant, T. Artés Vivancos, J. San-Miguel-Ayanz, S.N. Gosling, J. Zaherpour, A. De Roo, B. Bisselink, J. Bernhard, L., Bianchi, M. Rozsai, W. Szewczyk, I. Mongelli and L. Feyen, Climate impacts in Europe: Final report of the JRC PESETA III project, EUR 29427 EN, Publications Office of the European Union, Luxembourg, 2018

Figure 9: Welfare losses (% of GDP) for the high warming scenario and 2°C



Source: Joint Research Centre, European Commission

There are very significant investment needs to address these risks, as entire spans of the economy will need to transition towards sustainable production models while enhancing their resilience in the face of future risks. An effective recovery and resilience strategy that aims to transform Greece's development model, is not only essential for harnessing the employment and growth potential of the environmental transition, but equally for the protection and resilience of the economy and society.

THE RRF AS A RESPONSE TO THE COVID-19 CRISIS

By and large we can distinguish two government response stages to the crisis triggered by the pandemic.

First, the emergency response stage, throughout lockdowns and social distancing measures, whereby governments provide emergency assistance to affected workers and firms i.e. to an important fraction of the economy. During this phase, the policies implemented include among others firm bailouts, loan guarantees, furlough schemes and ramping up health systems and public services. Despite a gradual lifting of lockdown measures since May 2020 this phase is still ongoing, as governments introduce varying degrees of social distancing measures that affect workers and businesses.

Second, the recovery stage, expected after the worst of the pandemic runs its course. At this stage, governments will be expected to provide a stimulus, a "positive spending shock" to revive their economies that have been impaired (for some business or workers potentially permanently) by the pandemic-induced crisis. The implementation of a stimulus programme, for example in the form of public investment, presupposes a relative "normality": workers able to get to their workplace, and businesses able to operate relatively seamlessly and deliver projects. However, this distinction isn't necessarily binary in the sense that some investment projects can be delivered with relatively limited human contact, even throughout the pandemic.

The 672.5 billion EUR Recovery and Resilience Facility is designed to address the second stage, while the emergency response stage has mostly been financed by individual member-state, with the support of the European Central Bank, and to a lesser extent of other European instruments.

Box 1: The Recovery and Resilience Facility (RFF) explained

The RFF's stated objective is to provide *"financial support to both public investments and reforms, notably in green and digital, which make EU countries' economies more resilient and better prepared for the future"*. The instrument is designed to provide maximum support to most vulnerable EU member States, in particular those whose fiscal position is weak and cannot easily finance a stimulus package on their own.

Available funds to member states are split between a grant and a loan component. Greece has been allocated approximately 17 billion EUR of grants, while it can borrow from the facility an additional amount equivalent to a maximum of 4.7% of its Gross National Income (the "loan component" of the RRF). Note however that "net" amounts are less clear, as member states will need to contribute to the facility for example through the provision of guarantees. And, by definition, loans will have to be repaid albeit on favorable terms and long maturities.

To access funds, member states need to present detailed recovery and resilience plans, proposing investments and reforms to be financed using RRF funds. The plans will be assessed by the European Commission and the EU Council. In the words of the European Council statement, plans will be assessed against the following criteria: "*the criteria of consistency with the country-specific recommendations [of respective EU semester reports], as well as strengthening the growth potential, job creation and economic and social resilience of the Member State shall need the highest score of the assessment. Effective contribution to the green and digital transition shall also be a prerequisite for a positive assessment*". Overall, 30% of total spending in recovery and resilience plans should be earmarked for contributing to climate goals.

Grant commitments need to be allocated before 2024, although grant payments can be extended to 2026.

Finally, it is important to note that the RRF is a one-off instrument. As such, it is not designed to finance recurrent expenditures, but one-off expenditures or reforms that present one-off, transition costs.

After a decade of recession, followed by stagnation and now, a huge economic shock due to the pandemic, the RRF is a unique opportunity to accelerate the pace towards a more efficient, greener and resilient economic model – while addressing immediate socio-economic needs. However, if Greece is to harness the RRF's potential for implementing a green stimulus programme and respond to the crisis, a key prerequisite is to ensure a rapid absorption of funds and frontload disbursements as quickly as possible.

5

PRINCIPLES FOR AN EFFECTIVE RECOVERY AND RESILIENCE PLAN

Recovery and resilience plans addressed to the RRF need to be based on a number of principles and criteria, against which the stimulus interventions can be assessed with transparency.

We propose five sustainability principles that, in our view, should underpin the philosophy of Greece's Recovery and Resilience Plan. These principles can be fulfilled through a green stimulus plan that puts the environmental transition at its heart.

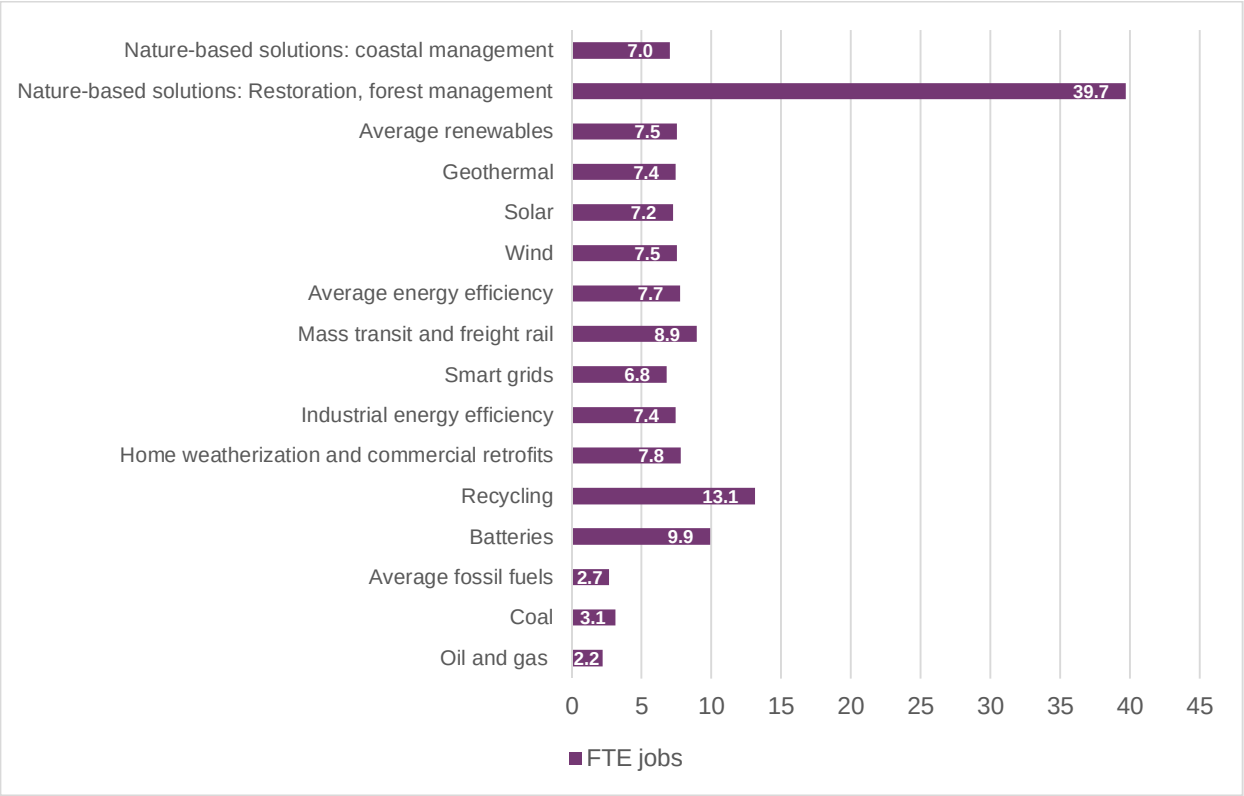
PRINCIPLE 1: MAXIMIZING THE RECOVERY POTENTIAL

Stimulus interventions should be selected on the basis of high domestic employment and economic multipliers, to ensure that they address the socio-economic distress caused by the pandemic.

On this point, two elements are crucial to consider.

First, all international evidence suggests that green investments perform above average when it comes to maximizing employment and economic activity impacts. For example, any green investment presents much higher employment multipliers compared to fossil fuel infrastructure (Figure 10). Evidence from Greece also points to a significant growth and employment potential of green economy investments[13].

Figure 10: FTE jobs created per million invested



Sources: Garrett-Peltier, 2016[14]; IEA, 2020[15]; Edwards et al, 2013 [16] ; Garrett-Peltier & Pollin, 2009[17]

[13] See for example: Λάλας Δ, Σαρτζετάκης Ε, Μπελεγρή-Ρομπόλη Α, Μιχαηλίδης Π, Μοιρασγεντής Σ, Μαρκάκη Μ, Γκέκας Ρ (2011). Πράσινη Οικονομία, Κοινωνική Συνοχή και Απασχόληση. ΙΝΕ/ΓΣΕΕ.

[14] Heidi Garrett-Peltier (2017). Green Versus Brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model. Economic Modelling Vol 61.

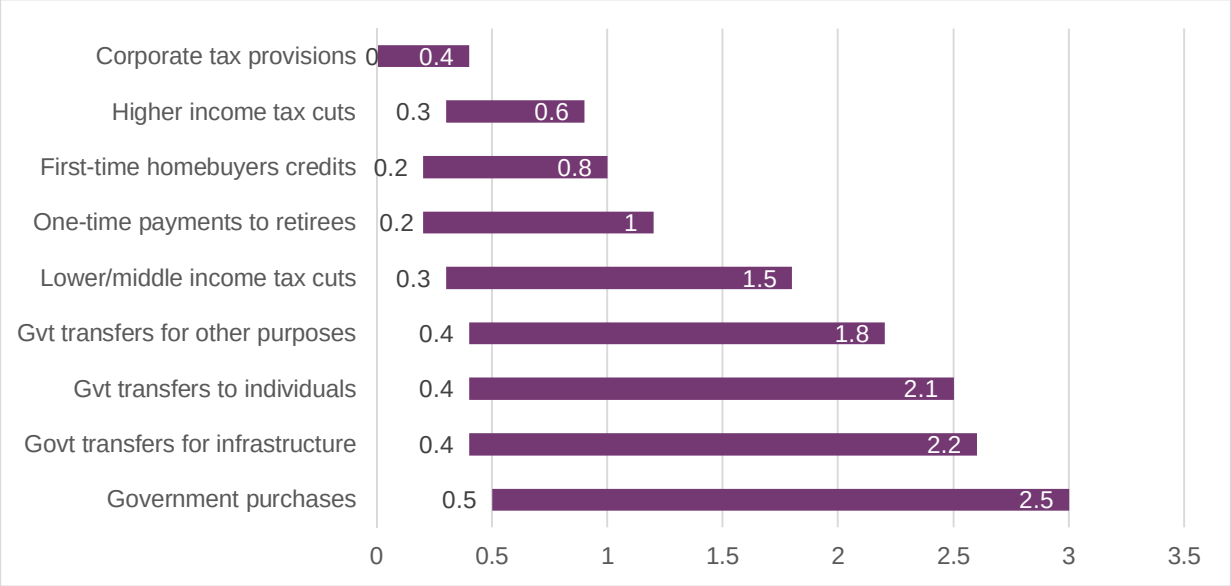
[15] IEA (2020), Sustainable Recovery, IEA, Paris https://www.iea.org/reports/sustainable-recovery

[16] Edwards, P. E. T., Sutton-Grier, A.E., & Coyle, G. E. (2013). Investing in nature: Restoring coastal habitat blue infrastructure and green job creation. Marine Policy, 38, pp. 65-71,https://doi.org/10.1016/j.marpol.2012.05.020

[17] Garrett-Peltier, Heidi and Pollin, Robert (2009) Job Creation per $1 Million Investment. Political Economy and Research Institute, University of Massachusetts

Second, from a macroeconomic standpoint, evidence suggests that the GDP multipliers of public expenditures and public investment are considerably higher than other stimulus measures, such as tax cuts (Figure 11). Similarly, IMF research suggests that during recessions the GDP multipliers of public investment are of 1.8 EUR per 1 EUR invested.[18]

Figure 11: Range of GDP multipliers of stimulus measures after the global financial crisis within one year



Source: US Congressional Budget Office

The combination of these two pieces of evidence suggests that, from a recovery perspective, the optimal path for Greece is to dedicate a substantial proportion of the funds available from the RRF to finance in particular green infrastructure investments that provide both high GDP multipliers and comparatively high job creation potential.

This evidently doesn't mean that targeted measures with lower GDP multipliers should not be undertaken - on grounds of social equity, or needed reliefs to workers and businesses post-COVID. It doesn't mean either that other investment policies, for example in infrastructure supporting a digital transformation, or education and R&D, are not important (in fact they are often strongly related to the green transition). It does though mean that, if the objective is to maximize the impact of stimulus on economic activity and unemployment reduction, a significant proportion of the RFF should be used to fill the green investment gap.

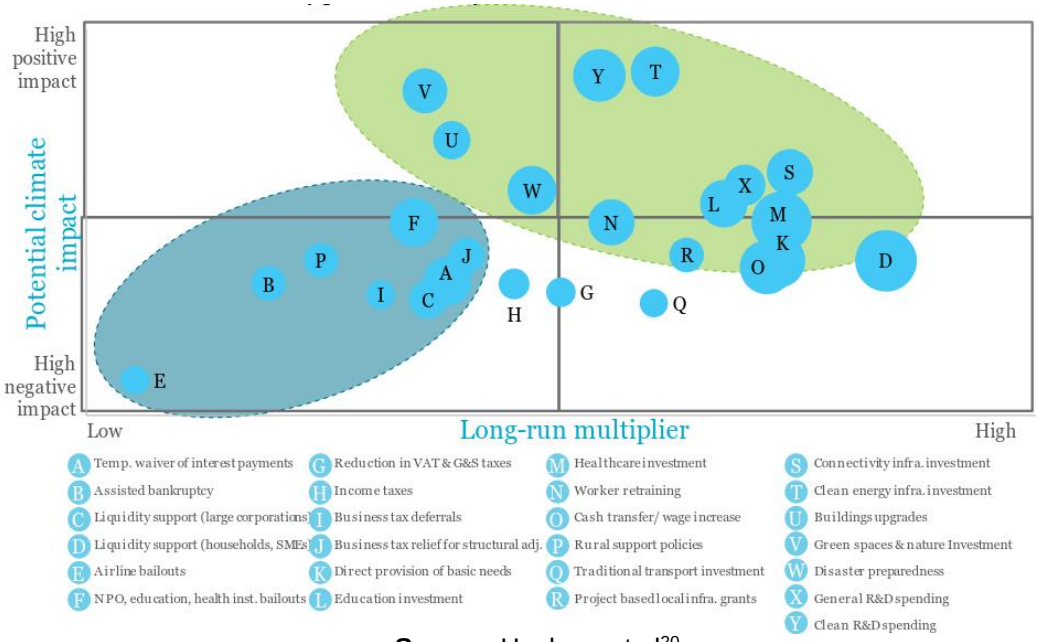
[18] IMF. (2016, February 29). The Welfare Multiplier of Public Infrastructure Investment. IMF Working Papers. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/The-Welfare-Multiplier-of-Public-Infrastructure-Investment-43752

PRINCIPLE 2: CONTRIBUTING TO TRANSFORMATIONAL GOALS

Short-run recovery potential should be combined with investments that have a long-term transformational potential. From an economic standpoint, the objective is to address long-term structural problems of the economy, by enhancing specialization in higher value added activities. From an environmental standpoint, the objective is at minimum, to achieve decarbonisation, circular economy and biodiversity objectives set out by the EU Green Deal. A green stimulus programme can address both objectives.

Hepburn et al surveyed 231 influential economists, government and central bank officials on the impacts of different stimulus and fiscal support measures on long term economic performance. Orienting fiscal stimulus towards green investments and R&D in particular was seen as strongly supportive of economic performance in terms of multiplier impacts and long-term productivity.[19]

Figure 12: Effects of fiscal recovery policies, survey results



Source: Hepburn et al[20]

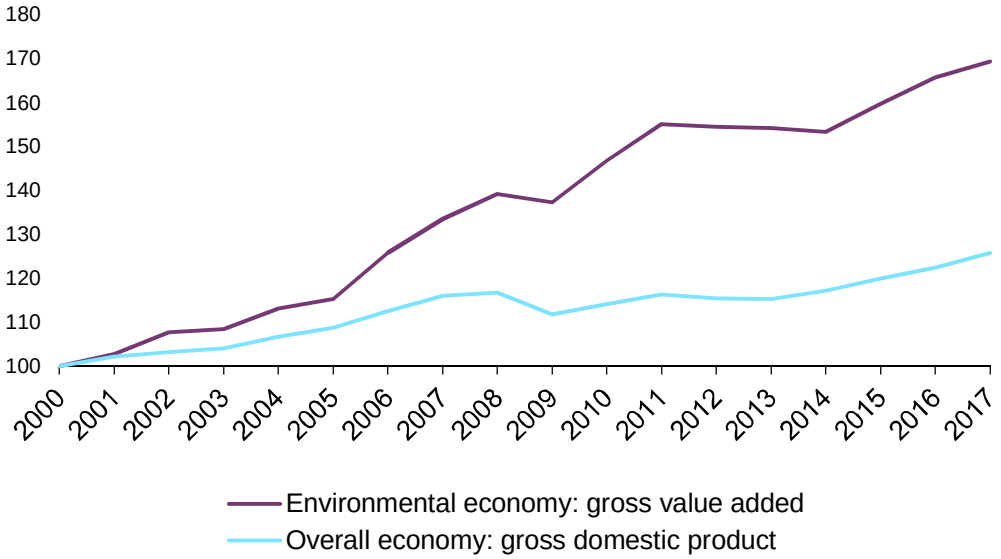
If we accept that Greece's objective post COVID-19 should be to enhance its economic resilience through a diversification strategy, notably by reducing its disproportionate reliance on inbound tourism revenue, then investing in the green transition is essential. The green economy is composed of some of the fastest growing sectors globally.[21] In the EU, to take one example, green economy sectors have been growing substantially faster than average economic activity since the year 2000.

[19] Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J. & Zenghelis, D. (2020). Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change. Forthcoming in the Oxford Review of Economic Policy 36(S1). Retrieved from https://www.smithschool.ox.ac.uk/publications/wpapers/workingpaper20-02.pdf

[20] Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J. & Zenghelis, D. (2020). Op. Cit.

[21] WWF (2019). Ten signals the green economy is underway. https://wwfeu.awsassets.panda.org/downloads/10signaux_green_230119_pages_1.pdf

Figure 13: Growth of the green economy vs average growth in the EU (2000=100)



Source: Eurostat

Specializing in these sectors opens a realm of possibilities both for transforming Greece's productive tissue to reduce the domestic environmental footprint, and for exploiting a globally dynamic market - for example in the sectors of clean energy, construction (retrofitting techniques and technologies and zero emission buildings), or agro-food products from sustainable agriculture.

On this note, it is worth mentioning that the Greek economy has significant room for improving its performance in green sectors. Mealy et al use the Economic Complexity Index methodology (a good predictor for the international competitiveness of countries' specialization) to create the Green Complexity Index (GCI), ranking countries in accordance with the number and complexity of green products they export.[22] Their key finding is that although Greece currently ranks 44th globally, its GCI Potential, an index representing a set of green products that are technologically proximate to its current productive structure, is 33rd.

Unsurprisingly, their findings also suggest that GCI performance of respective countries is strongly correlated with more stringent domestic environmental policies and a lower carbon emission intensity. In short, pushing for ambitious, transformational, national targets is a key determinant for future international competitiveness in sectors contributing to the environmental transition, and a green stimulus can contribute to this direction of travel.

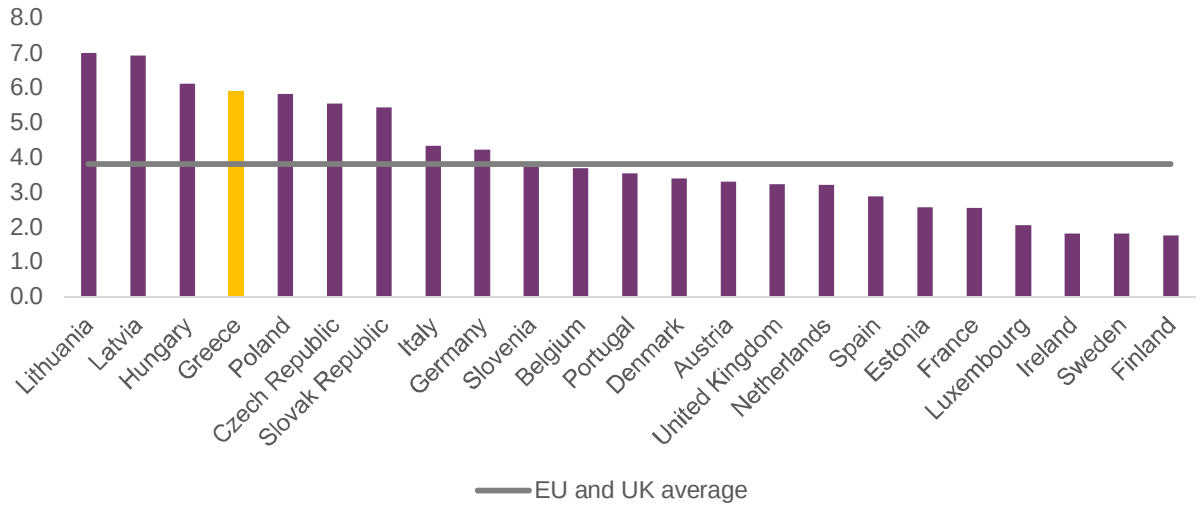
[22] Mealy, Penny & Teytelboym, Alexander. (2020). Economic complexity and the green economy. Research Policy. 103948. 10.1016/j.respol.2020.103948.

PRINCIPLE 3: ACCOUNTING FOR CO-BENEFITS

Beyond strict employment and economic outcomes, wider socio-economic outcomes should play a central role when selecting stimulus interventions.

For example, reducing premature mortality and morbidity due to atmospheric pollution should be given priority given Greece's comparatively poor performance, and high health costs. Investments that contribute to a transformation of the transport model could significantly reduce unnecessary mortality, and the toll on the health system.

Figure 14: Welfare costs of premature deaths due to atmospheric pollution (% of GDP)



Source: OECD

Protecting and restoring important ecosystems and biodiversity can provide significant benefits in terms of ecosystem services - such as disaster risk reduction, avoided soil erosion, water purification, pollination, health and well-being. For example, the ecosystem services provided by the (woefully underfunded) Natura 2000 network in Greece could be estimated to at least 8.7 billion EUR a year (4.7% of Greece's 2019 GDP).[23] The same holds for Marine Protected Areas.[24] Similarly restoring rivers and natural retention areas around those is a viable strategy to reduce to risks and costs of floods across Greece, while contributing to achieving Water Framework Directive (WFD) targets and adapting to climate change.[25] Indicatively, the cost of floods has been estimated to 300 million EUR per year over the past decade.[26] Significant co-benefits are also created through the adoption of circular economy models, for example investing to reduce plastic pollution.[27]

[23] ten Brink P, Bassi S, Badura T, Gantioler S, Kettunen M, Mazza L, Hart K (2013). The Economic benefits of the Natura 2000 Network. European Commission. https://ec.europa.eu/environment/nature/natura2000/financing/docs/ENV-12-018_LR_Final1.pdf
[24] Pantzar et al. (2018) Study of the economic benefits of Marine Protected Areas. European Commission, Brussels.
[25] Dige, Gorm & Eichler, Lisa & Vermeulen, Jurgen & Ferreira, Alipio & Rademaekers, Koen & Adriaenssens, Veronique & Kolaszewska, Dagna. (2017). Green Infrastructure and Flood Management — promoting cost-efficient flood risk reduction via green infrastructure solutions. European Environment Agency, Report No 14/2017
[26] European Commission (2020). 2020 European Semester: Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011: Greece country report.
[27] Dalberg Advisors, WWF Mediterranean Marine Initiative (2019). Stop the Flood of Plastic: How Mediterranean countries can save their sea. http://awsassets.panda.org/downloads/05062019_wwf_greece_guidebook.pdf

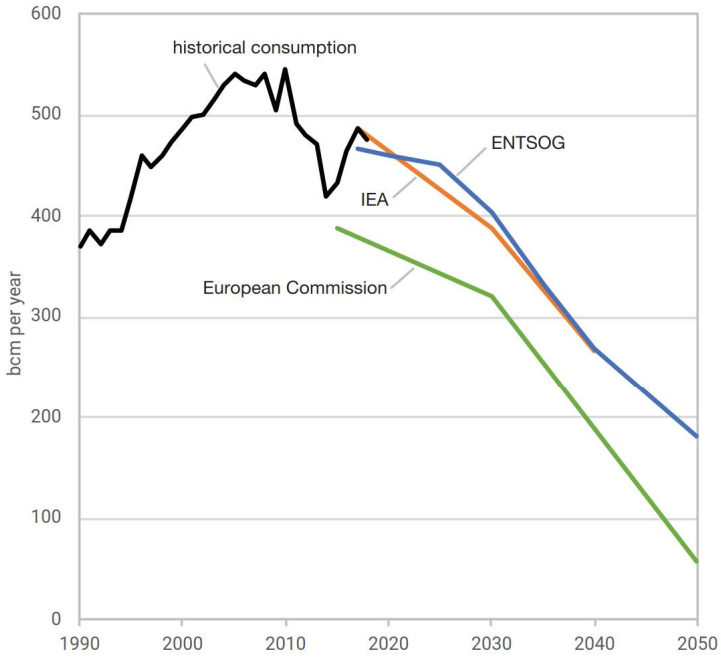
In short, enhancing socio-economic resilience, the capacity of society to respond and adapt to current and future challenges, requires accounting for wider cost-benefit considerations when designing stimulus interventions.

PRINCIPLE 4: DO NO HARM

A sustainable recovery and resilience plan should exclude investments in infrastructure that is locking the economy into a high carbon, high environmental footprint development path. Stimulus investments should be aligned with the EU taxonomy regulation on sustainable finance.[28] For investments that fall outside the scope of the green transition, a "do no significant harm" to environmental objectives criterion should be applied. These objectives, as per the EU taxonomy, are (a) climate mitigation and adaptation, (b) the circular economy, (c) pollution prevention, (d) protecting and restoring ecosystems and biodiversity.

In Greece's case, two investment areas should particularly be avoided: no funds of the RRF should be used for (a) new gas production, transport, and distribution infrastructure and (b) oil and gas exploration and extraction activities. Beyond their incompatibility with the Paris Agreement targets (Figure 15), such investments put Greece's medium-term economic outlook and resilience at risk.

Figure 15: Scenarios for EU's natural gas consumption



The European Commission line is the average of two scenarios for achieving net-zero emissions, called 1.5TECH and 1.5LIFE (European Commission, 2018). The ENTSOG line is the average of the two low-emissions scenarios in the Ten Year Network Development Plan 2020, called Global Ambition and Distributed Energy (ENTSOG and ENTSO-E, 2019).

Source: Global Energy Monitor

[28] European Commmission (2020). Taxonomy: Final report of the Technical Expert Group on Sustainable Finance. https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf

Greece's National Energy and Climate Plan (NECP) projects new gas production and distribution investments worth 5.5 billion EUR to 2030. Instead of maximizing a shift from coal to renewables, Greece intends to enter the gas age at a moment when gas is becoming the "new coal". Investments in new gas plants and associated distribution infrastructure, have a payback period of 25 to 30 years and will likely end up standing much earlier, as a result of more aggressive EU emission reduction targets and increased cost competition from clean energy and storage technologies whose costs are plummeting year-by-year.[29]

In the exact same way policy-makers sleepwalked into the moment when the PPC ended up with heavily loss-making coal assets, a consequence of aggressive climate policies (ETS prices), new gas assets that haven't amortized their investments will end up stranding.[30] This would come at great cost to the domestic financial sector, taxpayers and workers specialized in a sector with little future ("stranded jobs"). It is precisely for these reasons that the EIB's revised Energy Lending Policy has excluded new gas infrastructure projects from its portfolio,[31] and that other countries are already planning for the phase out and replacement of gas distribution infrastructure.[32]

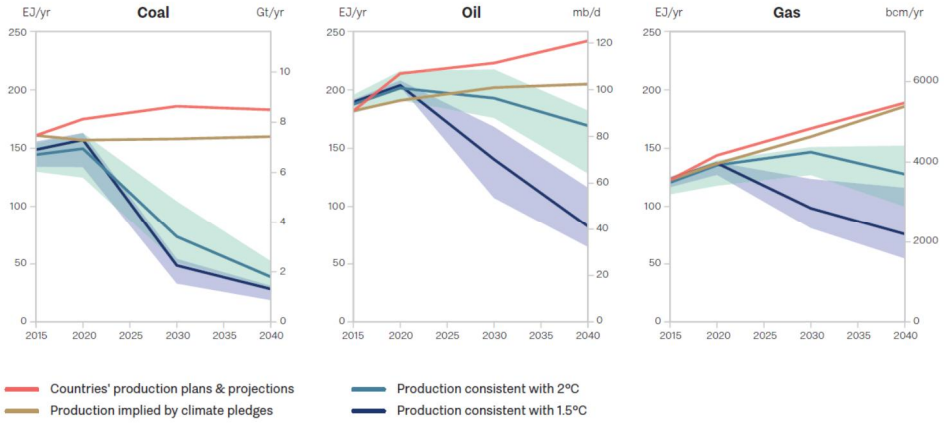
The picture is even bleaker for oil and gas drilling plans across Greece's mainland and maritime area.[33]

First, these investments are likely to have dramatic negative impacts on Greece's nature,[34] as well as sectors and regions that are highly dependent on it – those that have precisely been disproportionally affected by COVID-19.[35] As such, these are clearly win-lose investments in a best case scenario, and lose-lose in a worst case scenario (see below).

Second, COVID-19 can be described as a "day of reckoning" for the oil and gas industry.[36] To be consistent with the Paris agreement targets, the oil and gas majors need to write down trillions of assets, as the production gap between planned investments, and production levels that are compatible with a 1.5 degree worlds are already sizeable (Figure 16 below). Indeed, oil majors are already writing down billion[37] worth of assets and downsizing their capital investment plans[38] while investors are increasingly turning their back to the industry.[39] For many analysts oil prices are unlikely to fully recover (hence rendering expensive fields financially unviable) as peak oil and gas demand is either approaching or could be already here, as DNV GL[40] and BP[41] have been recently suggesting for oil.

[29] Lazard (2019). Lazard's Levelized Cost of Energy analysis version 13.
[30] IRENA (2017), "Stranded assets and renewables: how the energy transition affects the value of energy reserves, buildings and capital stock", International Renewable Energy Agency (IRENA)
[31] European Investment Bank (2019). Energy Lending Policy.
[32] For example, a recent report of the Confederation of British Industries (the equivalent of Greece's SEV), calls for a progressive phase out of gas boilers in homes. Greece, by contrast, is incentivizing the installation of gas boilers. CBI and University of Birmingham (2020). Net zero: the road to low-carbon heat. Retrieved from: https://www.cbi.org.uk/media/5123/heat-policy-commission-final-report.pdf
[33] Olivier Vardakoulias (2019). The oil and gas debate Greece is not having. Macropolis.
The https://www.macropolis.gr/?i=portal.en.the-agora.8600
[34] The Guardian, "why replace dolphins with oil drilling?': the battle for Greece's marine life" https://www.theguardian.com/environment/2019/jun/07/why-replace-dolphins-with-oil-drilling-battle-for-greece-marine-life-hellenic-trench
[35] EFTEC (2018). Economic impacts of the exploitation of hydrocarbons in Greece. An analysis for World Wide Fund for Nature (WWF) –. Greece. https://www.wwf.gr/images/pdfs/oil-gas-report.pdf
[36] https://carbontracker.org/covid-19-and-the-energy-transition/
[37] The Guardian, "Seven top oil firms downgrade assets by $87bn in nine months" https://www.theguardian.com/business/2020/aug/14/seven-top-oil-firms-downgrade-assets-by-87bn-in-nine-months
[38] Transition Pathways Initiative (2020). Carbon Performance of European Integrated Oil and Gas Companies: Briefing paper.
[39] Kingsmill Bond, COVID-19 and the energy transition: crisis as midwife to the new. Carbon Tracker blog,
[40] DNV GL (2020). Energy transition outlook 2020. https://download.dnvgl.com/eto-2020-download
[41] British Petroleum (2020). Energy outlook 2020.https://www.bp.com/en/global/corporate/energy-economics/energy-outlook.html

Figure 16: Fossil fuel production gaps



Source: United Nations Environment Programme[42]

The prospects for Greece's hydrocarbon extraction plans are gloomy. In a world of reduced oil and gas demand, depressed prices, and over-supply, any new drilling project is highly likely to be unviable. This is especially the case for expensive deepwater and ultra-deepwater projects such as the ones planned West and Southwest of Crete.[43] And those that may be viable in the short-term may never amortize capital investment costs, hence becoming unviable in the medium term.

Hence, the idea that after ten years of crisis, specializing in a fading sector that puts Greece's nature at risk constitutes a viable development strategy, is deeply misguided.

PRINCIPLE 5: A JUST STIMULUS PROGRAMME FOR ALL

Stimulus interventions should be designed in a decentralized fashion, to reach the maximum possible number of regions and local areas. They can also be designed in ways that maximize the impacts on sectors, regions and social groups that have been disproportionally hit by the COVID-19 crisis. Indeed, although this is an economy-wide crisis, impacts are clearly not symmetric.

For example instead of large scale, concentrated, clean energy investments, a national investment programme could finance the roll-out of energy communities (Law 4513/2018, Greece's legal equivalent of energy cooperatives and municipal energy) across all municipalities – creating jobs and income across the territory.

Similarly, a national energy upgrading programme can steer public investment towards vulnerable, energy poor households that are likely to have been particularly affected both by the previous (debt crisis) and the current crisis.[44]

Investments for the decarbonisation of the transport sector could be designed in a way that maximizes public transport and shared transport modes to benefit all social groups, instead of solely focusing on tax incentives for replacing ICEs with electric cars, an option that is only viable for some social groups.

[42] SEI, IISD, ODI, Climate Analytics, CICERO, and UNEP. (2019). The Production Gap: The discrepancy between countries' planned fossil fuel production and global production levels consistent with limiting warming to 1.5°C or 2°C. http://productiongap.org/

[43] Rystad Energy. (2015, October). Global liquids cost curve. Available at: https://www.rystadenergy.com/newsevents/news/press-releases/global-liquids-supply-cost-curve

[44] EU Energy Poverty Observatory. (2020, February). Member State Report – Greece. Avalable at: https://www.energypoverty.eu/

The stimulus should also contribute to the transition of coal regions. Funds provided by the EU's Just Transition Mechanism (JTM) are clearly insufficient for dealing with the substantial investment needs to deliver a sustainable transition in Greece's coal regions. As such, funds from the RRF could be used to complement JTM funding.

Finally a national investment programme to increase the resource and energy efficiency of businesses can target SMEs in sectors that have been disproportionally hit by health-related restrictions and the collapse of inbound tourism revenue.

In short, a green stimulus programme can be taken as an opportunity to reverse the post-2008 trend of spiraling inequalities. Indeed these are highly likely to be further accentuated by the COVID-19 crisis.

Table 2: Post-tax national disposable, by income groups, 2008-2017 (*latest available data*)

	2008		2017	
	Greece	EU average	Greece	EU average
Top 1% share	7.3%	8.5%	10.3%	8.8%
Top 10% share	29.6%	30.6%	33.2%	31.0%
Middle 40% share	47.7%	46.4%	46.5%	46.0%
Bottom 50% share	22.6%	23.0%	20.2%	23.0%

Source: World Inequality Database, Paris School of Economics

BUILDING A SUSTAINABLE STIMULUS PROGRAMME FOR GREECE

ALIGNMENT WITH THE GREEK SEMESTER REPORT

As has already been mentioned, Greece's recovery and resilience plan needs to align with actions identified in the EU semester report. As such, the investment areas we propose and develop in the following sections, are assessed against key gaps, actions and priorities mentioned in the latest semester report vis-à-vis the environmental transition (Table 3).

Table 3: Links between the EU Semester report, the RRF and the stimulus measures proposed

RRF green & digital transition objective[45]	Semester / Enhanced surveillance	Blueprint for green recovery
Reducing greenhouse gas emissions.	Greece produces high greenhouse gas emissions - 9.2 tons per capita every year, compared to 8.8 tons per capita at EU level. While closing down the lignite sector will have positive environmental and health impacts, it poses significant economic and social challenges. An estimated 5,500 jobs in the lignite mines and power plants are directly at risk. An additional 20,000 jobs are indirectly at risk. At 31% (2016), the region already has one of the highest unemployment rates of all EU coal/lignite regions, and its GDP/capita collapsed from 86% to 59% of the EU average between 2009 and 2017. Key to the success of the decommissioning plan will be the post-lignite transition in areas particularly reliant on the sector.	**Stimulus measure 3:** *Redirect gas investments planned by the NECP towards clean energy alternatives* **Uncosted proposal:** *Using RRF funds to complement Just Transition Fund resources allocated to Greece, for channeling additional investments to coal regions in transition (if and when necessary)*
Improving the energy and resource efficiency of public infrastructures.	NECP provides the basis for further investments. NECP provides timeline for non-interconnected islands. "Investing in energy efficiency of buildings would also help alleviate energy poverty"	*For non-interconnected islands (among others) see stimulus measure 2 below.* *For energy efficiency of buildings see stimulus measure 1 below.*
Improving energy performance in buildings.	NECP provides the basis for further investments.	***Stimulus measure 1:*** *Accelerate investments for energy upgrades (target of +20% above NECP).*
Supporting clean energy deployment.	NECP provides the basis for further investments.	**Stimulus measure 2:** *Accelerate investments in decentralized energy systems via an investment programme to roll out 1300 MW through energy communities, by 2024*

[45] European Commission. (2020, September 17). Guidance to member states. Recovery and Resilience Plans. Commission Staff Working Document SWD(2020) 205 final.

Promoting the circular economy, the sustainable blue economy and bio-economy.	"Greece will need significant efforts in reaching the revised recycling targets for the future (up to 65% by 2035)". "Additional investment in resource efficiency and new products is essential to support economic recovery in Greece".	**Stimulus measure 5:** *Dedicate €1.6 billion of capital investments to achieve 2025 EU municipal recycling targets.* **Stimulus measure 6:** *Increase the resource efficiency of all SMEs in 4 key sectors by providing the capital investments for the implementation of best available techniques*
Increasing the use of sustainable and environmentally friendly transport.	Limited progress on sustainable transport. Focus investment-related economic policy on sustainable transport and logistics.	**Stimulus measure 4:** *Increasing public transport expenditures by 25% for 3 years (via RFF funds) to enhance sustainable transport modes – including urban transport and mass transit railways.*
Improving environmental infrastructure.	Greece has not yet submitted its National Air Pollution Control Programme.	
Reducing waste, improving waste management systems.	The use of financial instruments to incentivise prevention, reuse and recycling is insufficient and the existing schemes are performing poorly. Investments are needed to improve water treatment, also with a view to respecting the guidelines of the Urban Waste Water Treatment Directive.	*See above: stimulus measures 5 and 6*
Restoration of ecosystems, such as forests, wetlands, peatlands, protection of biodiversity and promoting nature-based solutions.	Significant investments are still required to fully comply with the Water Framework Directive and the Floods Directive.	*Stimulus measure 8:* *Investment programme to reduce flood risk through nature-based solutions* **Stimulus measure 9:** *Closing the "investment gap" in Marine Protected Areas.*
Promoting sustainable food production and consumption.	Policy measures proposed include "*building of clusters to increase the scale for agro-food producers, brand biodiversity and promote the uptake of 'quality label'*".	**Stimulus measure 7:** *Convert 500,000 hectares of farmland to certified organic production, with special focus on Natura 2000 regions*

Source: WWF synthesis based on the EU's 2020 semester report

The rationale, costs, and employment impacts for each one of the investment measures we propose are further detailed below. These are split into the three major transformational objectives of (a) accelerating the transition to net zero, (b) accelerating the transition from a linear to a circular economy model and (c) restoring and protecting Greece's nature.

As a first step, we assume that only the grants component of the RRF are used, and propose a series of indicative national investment programmes representing about 50% of grants available to Greece. In addition to those, we also identify a number of additional (not costed) investment needs that could be considered should the government decide to use the loans component of the RRF.

ACCELERATING THE TRANSITION TO NET ZERO

State of play

Despite its ambition, the National Energy and Climate Plan (NECP), which sets Greece's emission reduction targets to 2030, is not aligned with the 1.5°C target set by the Paris Agreement[46]. Although this is not the case only for Greece, as current EU targets are not aligned either, the European Commission has already announced that the latter will be revised in the context of the EU Green Deal and is currently negotiating an increase to up to 60%.[47] Therefore, Greece's NECP will need to be revised anyway.

More concretely, the NECP has four major weaknesses, the tackling of which can and should be part of the recovery plan.

First, it is unambitious on the energy efficiency front: despite theoretically achieving a target of a 20% reduction of energy consumption *relative to baseline growth*, it is forecasted that Greece's final energy consumption in 2030 will essentially be at the level of 2018. This is inconsistent with EU targets, which explicitly set a goal of an *absolute reduction* by 2030.

Second, it pushes for significant investment in new fossil gas-powered plants and fossil gas infrastructure, as the main alternative to coal phase out: this option has a number of implications, among which (a) locking Greece into capital-intensive and carbon-intensive energy infrastructure for many decades, (b) investing in an energy source with significantly lower labour and domestic economic intensity compared to renewable, storage and demand management alternatives (i.e. low economic recovery potential), and (c) triggering a negative effect on the trade balance, hence on GDP, compared to clean energy alternatives.

Third, it leaves very limited room for public participation in the energy transition via decentralized systems of energy generation: according to the NECP, out of the total 8GW of additional renewable installed capacity planned to 2030, only 500MW come from self-generation and energy communities (Greece's equivalent legal status of energy cooperatives). This strongly contrasts with other countries, such as Germany or Denmark, where the share of renewable capacity owned by individuals and cooperatives is significant (e.g. of more than 40% in Germany according to 2018 data).[48]

Fourth, it is unimaginative in reducing carbon emissions from transport: the NECP is notably based on a forecast of an increase of private passenger-miles throughout the period 2020-30. Based on the measures it proposes, the NECP forecasts an increase of the final energy consumption of transport by 1% to 2030, despite a shrinking of Greece's population over the same period. Reducing emissions by switching private passenger-km to public ones in the transport mix is an essential policy component for reducing emissions. Although the NECP mentions a wide range of measures, it is in fact strongly reliant on a (relatively modest) uptake of private electric vehicles, and on the electrification of the, very limited, rail network. A more ambitious target should involve a more aggressive expansion of public transport, rail network, shared mobility and wider public infrastructure (such as urban cycling lanes). Given Greece's extremely shallow domestic content of vehicle production, as the majority of the private transport fleet is imported weighing on the trade balance, significantly expanding public (and shared) passenger-miles through an integrated transport strategy could be a win-win for the economy and environment.

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[46] WWF Greece and Greenpeace (2019). Comments on the National Energy and Climate Plan (in Greek). https://www.wwf.gr/images/pdfs/koina_sholia_greenpeace_WWF_gia%20esek.pdf

[47] European Commission. (2020, September 17). State of the Union: Commission raises climate ambition and proposes 55% cut in emissions by 2030. https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1599

[48] Clean Energy Wire (2018). Factsheet:Citizens' participation in the Energiewende https://www.cleanenergywire.org/factsheets/citizens-participation-energiewende

Reversing these weaknesses and expanding the ambitions of the NECP can and should constitute the backbone of a green recovery and resilience strategy and of the post-COVID economic stimulus.

Description of possible stimulus measures

A proportion of the RFF funds should be used in a four-part investment plan addressing the key weaknesses of the NECP and accelerating the pace to a net zero emissions target that is compliant with the Paris Agreement.

Stimulus measure 1: Accelerating energy efficiency investments

The NECP plans to upgrade (retrofitting) approximately 60,000 private buildings (including in the households and services sector) per year, in order to reach a target of upgrading 12-15% of Greece's building stock by 2030. However, achieving an absolute reduction of energy consumption by 2030 requires a higher target, and the RRF could be used to deliver it upfront, over the period 2021-2024.

More concretely, we propose a 20% renovation target of the building stock by 2030, with the difference (over and above the 60,000 annual target) being delivered throughout the recovery phase. This translates into the additional retrofitting of 5% of Greece's building stock in the period 2021-2023, as well as hitting the 60,000 annual target set by the NECP. In total this would translate into a target of approximately 98,000 building upgrades per annum for a period of three years, for delivering a strong economic stimulus.

This additional investment could target energy upgrades of energy poor households for reducing energy poverty in line with the recommendations of the NECP, as well as services sectors that have been particularly hit by COVID-19 (e.g. hospitality and food services).

Stimulus measure 2: Rolling out energy communities across all municipalities

The NECP has set a target of additional self-generation and energy communities (Law 4513/2018, Greece's legal equivalent of energy cooperatives and municipal energy) of 500MW by 2030. Boosting this share could provide a viable recovery measure, while accelerating the progress towards net zero.

WWF Greece proposes an investment plan that calls on all municipalities (332 in total) to establish energy communities, while instituting a minimum of MW capacity installed per municipality by 2024. The minimum could vary depending on the population size of municipalities, for example 2MW for less populated ones to 6MW for densely populated ones. On average, we assume that an average of 4MW per municipality is installed as a consequence of this investment plan (i.e. 1328 MW in total across Greece). This measure could require a legislative provision rendering the formation of municipal energy communities mandatory. Alternatively, a specific funding instrument could be set, directed solely to Energy Communities, and which municipalities have a participation level over a certain threshold (e.g. 20% and above).

Beyond boosting employment and economic activity, such a national investment plan would present a number of advantages.

- First, economic activity would be boosted across the country in a decentralized manner, as opposed to concentrated renewable investment projects. In particular this would benefit regions that have particularly been affected by the COVID-19 crisis, such as those highly dependent on tourism revenue.
- Second, municipal energy communities can be used to effectively address energy poverty at a local level – a goal of paramount importance in the context of the current economic crisis, so as to ensure that no one is left behind during the transition.
- Third, it would provide a viable solution to non-interconnected islands, which currently rely on polluting fuel-oil in order to cover their energy needs , at a higher cost compared to the mainland.
- Fourth, taking for granted that the environmental impacts of all construction projects need to be assessed ex ante, and that certain plans may indeed have a heavy footprint on specific sensitive areas, evidence suggests that overall public acceptance is greatly enhanced through citizen participation in decentralized, community-based renewables. It is also anticipated that plans for the development of renewables through energy communities will be sufficiently sensitive to the

specific ecological needs of the project sites. While it is clear that large projects will be needed to achieve net zero, there is a strong case for boosting the participation of local communities in the energy transition. The EU's Clean Energy Package and Greece's law on energy communities provide an enabling institutional framework for this purpose.

Box 1: The Tilos project

Tilos sets a new paradigm for clean energy development in small islands: thanks to EU Horizon 2020 funding, an innovative hybrid energy production and storage system, exclusively powered by renewable energy sources, now covers at the maximum possible level the energy demands of the island, in the presence also of advanced energy management, demand response and clean EV-charging. The example of Tilos could be replicated in other islands, through the creation of local energy communities, in which municipalities can participate. A public investment programme, using the RRF funds to finance such schemes, could accelerate the transition from polluting diesel-based generation to clean energy.

The Greek law on energy communities (Law 4513/2018) provides significant flexibility in terms of eligible investments, ranging from renewables to storage and renewable-based desalination plants, for example. Similarly the proceeds from energy communities can be invested in further decarbonisation infrastructure, such as clean transport investments at a local level. In short, co-benefits are likely to be multiple across the country.

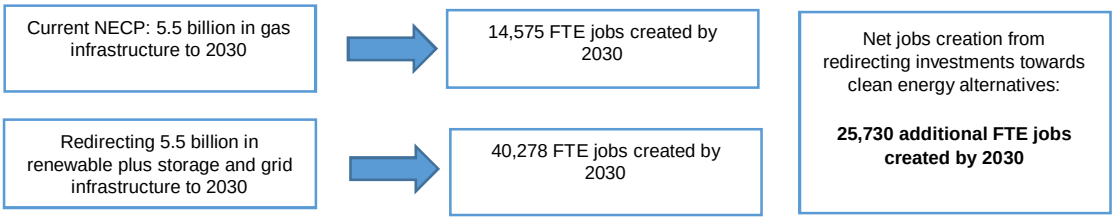
Stimulus measure 3: Redirecting gas investments towards clean energy

The NECP estimates investment needs of 5.5 billion EUR for new gas infrastructure to 2030, including both production and distribution infrastructure. From a climate and economic recovery standpoint, this pathway is highly problematic.

From a climate standpoint, there is now widespread evidence countering the claims that gas constitutes a viable so-called "transition fuel", especially at this point in time. Indeed, carbon emissions across the life cycle seem widely underestimated, and new infrastructure with very long payback periods is highly likely to lock Greece's energy model (production and distribution) into a Paris non-aligned carbon emissions path. This will undermine the decarbonisation process, as the latter becomes more demanding due to increased ambition on the EU level.

From an economic recovery perspective, gas infrastructure presents significantly lower employment and economic multipliers compared to renewable plus storage alternatives. A simple back-of-the-envelope calculation would suggest that if the 5.5 billion EUR were instead invested in clean energy alternatives and associated projects in distribution (e.g. smart grids, heat pumps etc.) 25,000 *additional* FTE jobs could be created across Greece until 2030.

Figure 17: Employment impacts of redirecting planned fossil fuel investments towards clean energy alternatives



Source: Author's calculation based on Garrett-Peltier[49]

[49] Heidi Garrett-Peltier (2016). Op. Cit.

Box 2: Solar plus storage increasingly outcompetes fossil fuels

A major argument used to support the development of new gas-powered plants and associated gas distribution infrastructure in Greece (ahead of the full closure of lignite plants by 2028) is related to the intermittency of renewables and the need to maintain system adequacy. However, this argument ignores viable storage alternatives, possible demand management measures through the roll-out of smart grids, and even "oversizing"[50] options to provide system adequacy. Most notably, the plummeting costs of solar PV[51] means that storage options that remain expensive compared to the fossil fuel range as standalone investments[52] can compete on par with gas cost ranges, when combined with cheap solar PV.[53] This is already the case in a number of markets such as the US[54] and recently Portugal where many solar plus storage projects compete on par with gas.[55] A recent Bloomberg New Energy Finance (BNEF) report considers that Greece needs very little gas infrastructure, and that dedicating substantial amounts for new gas infrastructure is both unnecessary and uneconomical.[56]

Finally, from a long-term economic resilience standpoint it should be evident that new gas infrastructure is a high risk bet. A number of new capital investments are likely to end up morphing into stranded assets over the coming decade, assuming the world accelerates its transition towards achieving the Paris agreement target. This is likely to create high costs both to investors (including domestic investors) as well as the national economy more widely. It is also evident that relying on imports of gas is not exactly conducive to energy security, for reducing energy dependence, or for tackling Greece's structural trade deficit.

We propose leveraging RRF funds to redirect investment expenditures towards viable, innovative alternatives to gas – including for example higher shares of investments in renewables plus storage, installations of heat pumps and district heathing models, and demand-management infrastructure such as smart grids. Assuming that the 5.5 billion EUR is spread over a decade (i.e. 550 million EUR per annum), we estimate the impacts of redirecting a total of 1.65 billion EUR, spread over 2021-2023, towards clean infrastructure.

Such an approach would ensure a stronger post-COVID 19 stimulus in terms of job creation potential, and positive effects on economic activity more widely.

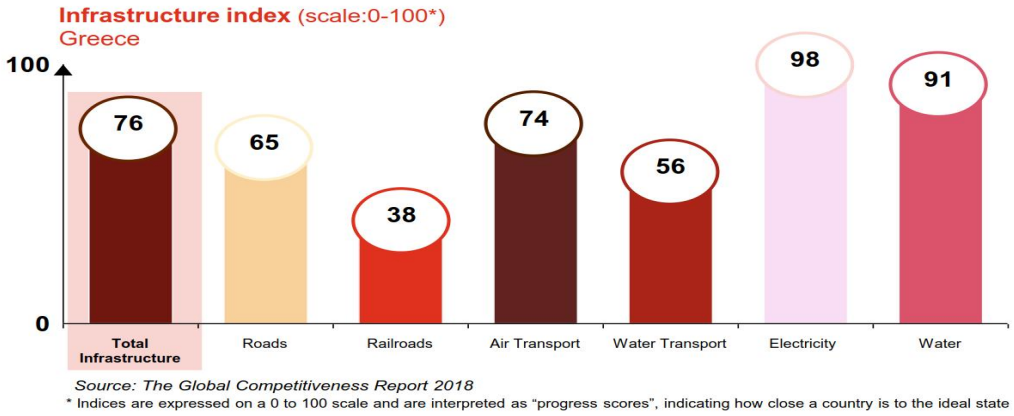
Stimulus measure 4: increasing public investment for clean transport

Greece's transport model performs poorly by EU standards from all standpoints, as analyzed in the latest EU Semester Report for Greece. This poor performance is due, to a great extent, to the weak penetration of public transport in the transport mix.

From a competitiveness standpoint, Greece ranks 39th in transport infrastructures globally and 18th among EU Member States. A major reason is the poor penetration of rail in the transport mix (Figure 18), as the share of rail in freight transport and passenger traffic (based on passenger-kilometers) remains at 1.3% (EU average of 16.6%) and 1% (EU average of 7.6%) respectively.

[50] Perez, Marc & Perez, Richard & Rabago, Karl & Putnam, Morgan. (2019). Overbuilding & curtailment: The cost-effective enablers of firm PV generation. Solar Energy. 180. 412-422. 10.1016/j.solener.2018.12.074.
[51] Lazard (2019). Lazard's Levelized Cost of Energy analysis: version 13
[52] Lazard (2019). Lazard's Levelized Cost of Storage analysis: version 5
[53] REN21 (2020). Renewables 2020 Global Status Report (Paris: REN21 Secretariat).ISBN 978-3-948393-00-7 https://www.ren21.net/gsr-2020/chapters/chapter_06/chapter_06/#target_164
[54] Beers et al (2019). Solar + Storage as a Mid-Merit, Utility-Scale Generating Asset. Carnegie Mellon University Tepper School of Business. https://info.fluenceenergy.com/hubfs/Collateral/White%20paper_TepperFluenceS+SasMid-Merit_final.pdf?hsLang=en
[55] PV magazine, "Initial results of Portugal's solar+storage auction", 2020. https://www.pv-magazine.com/2020/09/02/analysis-initial-results-of-portugals-solarstorage-auction/
[56] Bloomber New Energy Finance (2020). Greece market outlook. Summarized in: https://about.bnef.com/blog/economics-alone-could-drive-greece-to-a-future-powered-by-renewables/

Figure 18: Greece's infrastructure competitiveness



Source: Global competitiveness report[57]

Similarly, Greece faces significant economic costs related to road congestion, which are estimated to 2.2% of GDP (EU average of 1.8%), due to the predominance of passenger cars in the transport mix.

From an environmental standpoint, the transport sector has the highest share of final energy consumption, with the overwhelming majority (88%) down to road transport. The external cost of Greece's road transport in terms of carbon emissions has been estimated to 1.8 billion EUR per annum (0.88% of GDP), while the cost of air pollution (a substantial fraction of which emanates from road transport) in terms of premature mortality is among the highest of the EU.[58]

Due to the disproportionate share of road transport (particularly private passenger-km) in the transport mix, a strategy founded on an expansion of public transport infrastructure, and shared mobility schemes, is essential for reducing emissions from transport (beyond the progressive electrification of road vehicles).

Yet, despite substantial investment needs for decarbonisation and enhancing the competitiveness of the sector, public investment in transport remains low: at 1.4% of GDP in 2018 and 1.7% in 2019 compared to an EU average of 2%.

Given this investment gap, the funds of the RFF could be used to temporarily increase capital investments in public transport infrastructure for the period 2021-23. More concretely, we propose a one-off 25% increase of public transport expenditures for three consecutive years, to finance necessary capital investments in green transport infrastructure, such as:

- Electrifying the existing rail network
- Expanding the passenger and freight railway network, starting from "investment-mature" projects that haven't started yet, or are being delayed.
- Rolling out electric vehicles charging infrastructure
- Financing urban electro-mobility shared schemes, e.g. a network of public (or PPP) electric micro-mobility vehicles (public "zipcar"-like models), to complement public transport infrastructure while reducing private passenger-miles
- Replacing the bus fleet and other special-purpose public vehicles with clean vehicles.
- Investing in construction of cycle lanes and pavements across urban centers.

[57] World Economic Forum (2018). Global competitiveness report.

[58] European Commission. Sustainable transport: Internalisation of transport external costs [webpage]. https://ec.europa.eu/transport/themes/sustainable/internalisation-transport-external-costs_en

A combination of these measures could drive a reduction of the use of private vehicles in urban areas, while increasing the share of rail transport across mainland Greece.

Estimated investment costs and employment impact

We estimate the costs, and employment impacts, for an investment programme aiming to roll out energy communities across Greece's municipalities, to increase the ambition of energy upgrades of buildings to 2030, and to sizably increase clean public transport expenditures. Relevant references, assumptions and methodology steps are available in Appendix 1.

Assuming these investments can be undertaken over the period 2021-23, an additional 73,000 FTE jobs (including direct and indirect) could be created over the same period, while a proportion of FTE jobs will be permanent thereafter. For example, energy efficiency and energy communities' measures translate into permanent additional income, having a positive demand effect thereafter. Similarly, a proportion of jobs will be maintained throughout the operational lifespan of respective infrastructures.

Table 4: Employment impact of a stimulus programme to accelerate the energy transition

	Total investment needs, million EUR (FY 2021-23)	Covered via RRF funding, million EUR	Covered via additional participation, million EUR	Additional jobs created, FTEs (central estimate)	Additional jobs created, FTEs (maximum)	Additional jobs created, FTEs (minimum)
1. Expanding energy communities and renewable self-generation	1,328	930	398	7,739	9,960	5,519
2. Accelerating retrofitting and energy efficiency	3,796	2,657	1,139	28,490	54,760	14,800
3. Redirecting fossil fuel investments towards clean energy alternatives (including RE, storage, grid infrastructure, heat pumps etc.)	1,650	825	825	7,719	n/a	n/a
4. Increase green public transport investment by 50% (for FY 2021-23)	2,800	1,960	560	29,693	40,125	19,260
ENERGY TRANSITION STIMULUS PACKAGE – TOTAL:	**9,574**	**6,372**	**2,922**	**73,641**	**112,564**	**47,298**

Source: Author's calculations (for detailed references and methodology see Appendix 1)

Regarding investment costs, we assume that only a fraction of those necessitate the use of RRF funds. For example, transfers and tax rebate schemes for energy efficiency rely on private households contributing to retrofitting expenditures (the latter are not entirely covered through public expenditures). Similarly investments in public transport will involve some form of private sector contribution, through a crowding in effect, while MFF budget lines are already available for covering a fraction of these investments and can be leveraged for co-financing. However, given the dire condition of households, and the balance sheet effects of the current crisis on the private sector, the State's contribution could be significantly higher than normal.

It is worth noting that these investments are over and above planned investments as per the NECP, with the exception of energy upgrades of private buildings. We assume other NECP planned investments in energy efficiency, and the upgrading of public buildings, will occur anyway under a baseline scenario.

Other investment needs

Additional investment needs, which could be part of a green stimulus strategy, are synthesized both in the NECP and the EU Semester report. The table 5 provides a synthesis. Note that these are investments already planned to 2030, but a fraction of those could be brought forward in the context of the recovery package.

Table 5: Examples of additional possible measures for a green stimulus

Measure	Investment need to 2030 (million EUR)	FTEs per million invested (indicative) [59]
Electrical system Infrastructure	5,500	7.2
Development of the electricity distribution network and digitization	3,500	5.5
Research and innovation	800	n/a
Storage systems for clean energy, batteries	n/a	6.5

Sources: NECP and International Energy Agency[60]

Likewise, RRF funds could be used for financing additional investments in Greece's coal regions in transition. Indeed, the funds provided by the EU's Just Transition Mechanism are likely to be insufficient for fully addressing investment needs. For example, the RRF could be harnessed to finance investments for the restoration of coal mines, or for financing additional clean energy infrastructure in these regions.

[59] Hellenic Republic (2019). National Energy and Climate Plan.
[60] International Energy Agency (2020). Op. Cit.

KICKSTARTING A CIRCULAR ECONOMY

State of play

Beyond reducing pressure on ecosystems by minimizing resource extraction and waste, circular economy models, and progressive "decoupling" of economic activity from primary resource use, can deliver substantial benefits in terms of job creation, economic activity, or reducing dependence on imports.

Although there are no estimates for Greece specifically, evidence at an EU level and from other countries suggests these benefits can be substantial (examples are provided in Table 6).

Table 6: Examples of studies on economy-wide impacts related to the circular economy

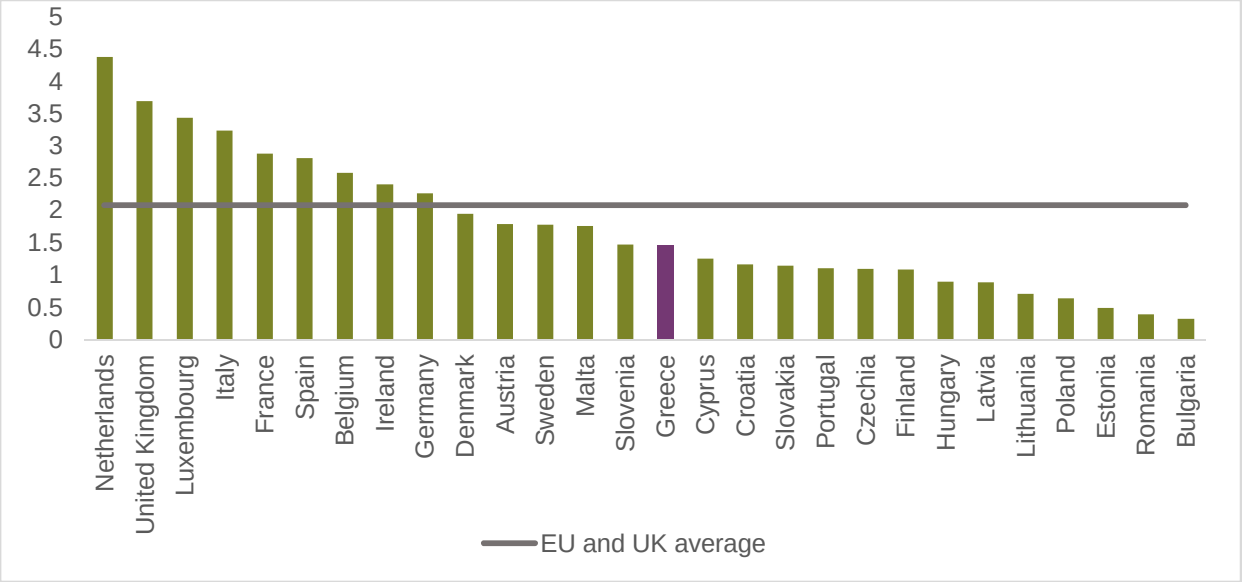
Study	Scope	Description	Employment impact
WRAP, 2015[61]	UK	Ambitious scenario of reuse, recycling and material efficiency	102,000 (decrease in net unemployment)
Club of Rome, 2015[62]	France, Finland, Sweden, Netherlands, Spain	Material efficiency scenario: 25% increase in resource efficiency 50% replacement of virgin material inputs with recycled inputs	France: 500,000 Finland: 75,000 Sweden:100,000 Netherlands: 200,000 Spain: 400,000
ECOAP, 2014[63]	EU	Resource productivity increase of 30%, leading to an 1% increase in the EU GDP	2,000,000
Meyer, 2011[64]	EU	Increasing resource efficiency with 25%	2,600,000
European Commission, 2014[65]	EU	3% increase of resource productivity per annum	2,000,000

Source: Cambridge Econometrics, Trinomics, and ICF[66]

Given Greece is lagging behind both in terms or recycling and reuse infrastructure, and of resource efficiency of its productive apparatus, there are significant opportunities in growing circular economy sectors while enhancing the material efficiency (hence overall efficiency and productivity) of key economic sectors.

[61] WRAP, 2015. Employment and the circular economy -Job creation in a more resource efficient Britain
[62] Club of Rome, 2015. The Circular Economy and Benefits for Society Jobs and Climate Clear - Winners in an Economy Based on Renewable Energy and Resource Efficiency
[63] ECOAP, 2014. Transforming jobs and skills for a resource efficient, inclusive and circular economy
[64] Meyer (2011). Macroeconomic modelling of sustainable development and the links between the economy and the environment.
[65] European Commission (2014). Study on modelling of the economic and environmental impacts of raw material consumption.
[66] Cambridge Econometrics, Trinomics, and ICF (2018). Impacts of circular economy policies on the labour market. Final report to the European Commission.

Figure 19: Resource efficiency of the economy, GDP per ton of domestic material consumption (2017)



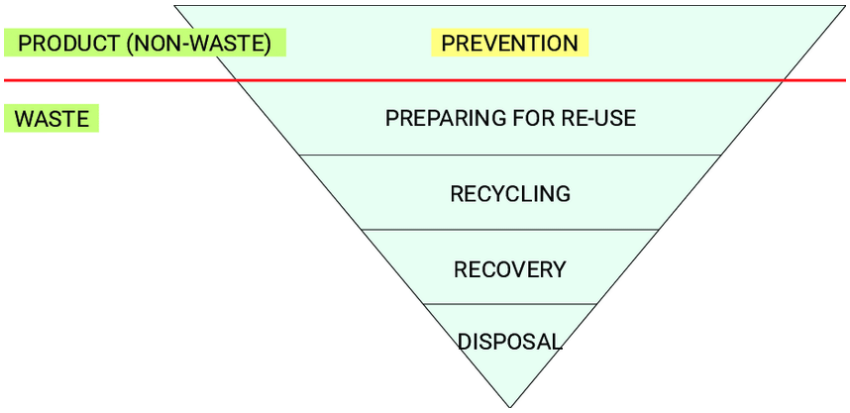
Source: Eurostat

Crucially Greece is not on track for achieving important EU targets, as acknowledged in the 2020 Semester Report.[67] For example recycling sits at 18% of total municipal waste, against an EU target of 50% in 2020, and the overwhelming majority of waste ends up in (legal or illegal) landfills.

Further, according to a European Commission report on municipal waste performance across the EU, infrastructure financing for waste management in Greece is overwhelmingly biased towards "inferior" solutions in the waste hierarchy, such as incineration or "energy recovery", instead of prioritizing investments for waste prevention, reusing and recycling infrastructure.[68] It is also worth noting that mainstream "waste-to-energy" investments are, with few exceptions and strong conditions, discouraged by the recent EU taxonomy on sustainable finance.[69]

[67] European Commission (2020). Op. Cit.
[68] European Commission (2019) Study on investment needs in the waste sector and on the financing of municipal waste management in Member States.
[69] European Commmission (2020). Taxonomy: Final report of the Technical Expert Group on Sustainable Finance.

Figure 20: The waste "hierarchy"



Source: DG Environment, European Commission

Overhauling Greece's waste management system towards recycling and reuse infrastructure is, along with waste prevention, a pre-condition for harnessing the employment potential of circular economy sectors, while reducing pressures on natural resources and Greece's terrestrial and marine environment. The RRF's resources can be used for significantly accelerating this necessary shift.

Description of possible stimulus measures

There a number of investment and structural reform needs across different waste streams, the life cycle of products, and various sectors. WWF Greece has formulated detailed proposals for shifting towards a circular economy across different sectors and markets.[70]

We here propose two "flagship" investment programmes to accelerate a transformation from a linear to a circular economy, while other investment possibilities are subsequently presented (see "other investment possibilities" subsection below). However, it is important to note that these capital investments should be complemented by further structural reforms to create circular economy markets.

Stimulus measure 5: Achieve the EU's 2025 municipal waste recycling target.

According to EU legislation, Greece needs to attain a 55% municipal waste recycling target by 2025 and 65% by 2035. This goal is unrealistic unless significant recycling and reuse infrastructure is rolled out over the next two to three years – along with many other policy measures available in our comments to the latest legislation proposals.[71]

According to a Eunomia study for the European Commission, Greece faces investment needs of at least 658 million EUR from 2020 onwards to reach a 2035 target of 65%. Investment needs identified by the European Commission focus on the upper level of the waste hierarchy, and include infrastructure for: waste collection, biowaste treatment (composting), waste sorting, recycling and reprocessing, residual treatment, and finally the creation of a digital waste registry. Note that the European Commission estimates that only a small proportion (less than 3%) of investments should be allocated to residual treatment, such as Mechanical Biological Treatment (MBT), and virtually none to new incineration ("energy recovery") infrastructure projects.[72] This contrasts with the new waste

[70] WWF Greece (2020) Το Εθνικό Σχέδιο Διαχείρισης Αποβλήτων προωθεί ατεκμηρίωτα την καύση στην Ελλάδα. [Available in Greek only: comments on the new waste legislation]
[71] European Commission (2019). Op. Cit.
[72] European Commission (2019). Op. Cit.

management plan put forward by the Greek government[73], which disproportionally channels investments precisely towards lower tiers of the waste hierarchy (75.59% of total investments to 2030) while disregarding investment needs in the upper tier (20.43% of total investments to 2030).

The 658 million EUR investment estimate assumes that the 2020 target of 50% has already been reached, whereas Greece municipal waste recycling rate still sat at 18% as of 2019[74]. As such, we use the detailed waste amounts, and unit cost data, provided by the European Commission to scale investment needs to Greece's actual starting point.

Based on this data and adjustments that are detailed in Appendix 2, we estimate that Greece faces capital investment needs of 1.6 billion EUR if it is to increase municipal waste recycling to 55% by 2025 - up from 18% today. The investment costs taken into account include:

- Waste collection costs include, separate streams, vehicles and containers costs for door-to-door, bring sites and kerbside collection and for costs associated with Civic Amenity sites, such as "green points".
- Biowaste treatment facilities costs, including household and other composting facilities, for new assets as well as for replacement of biowaste facilities that have reached end-of-life during the period considered.
- Sorting facilities costs which cover materials recovery facilities (MRFs) for the sorting of mixed recyclables
- Recycling reprocessing costs for major waste streams
- Sorting costs in residual treatment facilities, which include the installation of Mechanical Recovery and Biological Treatment (MRBTs) plants.

As per Eunomia estimates for the European Commission, only a very small fraction of investment are assumed to be channeled towards residual treatment facilities. Beyond environmental and circularity considerations, this is consistent with the objectives of maximizing employment impact in the context of a post-COVID-19 recovery: all available evidence suggests that the employment intensity of waste-to-energy plants and MBT is considerably smaller than reuse, recycling and reprocessing activities.[75]

Stimulus measure 6: Increase resource efficiency of SMEs to frontier practices.

Beyond waste management, an *ex ante* minimization of resource use and waste generation is equally important for shifting from a linear to a circular economy model.

Similarly, improving resource efficiency can significantly reduce production costs by minimizing inputs for production, and reducing waste management costs.[76] As such, this strategy could both reduce environmental pressures, and deliver significant efficiency gains across Greece's productive tissue. In particular, enhancing the productivity performance of SMEs (that have been hit disproportionally both by the previous and the current crisis) should be a policy priority.

A 2015 report of RPA for the European Commission examined the possibilities of an EU investment programme aiming to bring the resource efficiency of SMEs in four key sectors to Best Available Techniques (BAT), in other terms to the efficiency frontier.[77] SMEs in these four sectors are significant

[73] Hellenic Republic (2020). National plan for waste management 2020-2030.
[74] Salvetti, M. (2020) Municipal Waste Regulation in Europe: paving the road for upcoming challenges: Paper in preparation of the FSR workshop on Municipal Waste Management.
[75] See for example: A) FOE (2010). More jobs, less waste: Potential for job creation through higher rates of recycling in the UK and EU. Friends of the Earth. B) Eory et al (2017). Evidence review of the potential wider impacts of climate change Mitigation options: Agriculture, forestry, land use and waste sectors. Report prepared for the Scottish government. https://www.gov.scot/publications/evidence-review-potential-wider-impacts-climate-change-mitigation-options-agriculture/pages/8/
[76] RPA (2015): Assessing the Potential Cost Savings and Resource Savings of Investments in 4 SME sectors, report for DG Environment, February 2015, Loddon, Norfolk, UK https://ec.europa.eu/environment/integration/green_semester/pdf/SME%20Investments%20in%20Resource%20Efficiency.pdf
[77] RPA (2015). Op. Cit.

in terms of their pressure on resource use, and material in terms of a circular transition – namely: Energy, power and utilities (D35 and E36 NACE codes), food and beverages (C10 and C11 NACE codes), environmental technologies (E37, E38, E39 NACE codes), and construction (F41, F42, F43 NACE codes).

Data on the number of SMEs in the Energy, Power and Utilities and Environmental Technologies sectors was unavailable for Greece. However, RPA's findings suggest that an investment programme reaching all SMEs in the food and beverages and construction sectors would cost up to 369 million EUR, while delivering resource cost savings of 578 million EUR annually, through (quantified) energy savings, material resource savings, water savings and waste savings.

We update RPA's 2015 figures, to include (a) more up-to-date data on SMEs numbers and (b) SMEs in the Energy, Power and Utilities and Environmental Technologies sectors - now available via Eurostat's structural business statistics.

Replicating RPA's methodology we estimate that total capital investment needs to reach all SMEs in the four aforementioned sectors (a total of approximately 47 thousand SMEs) is of 455 million EUR, an investment that would deliver annual benefits (cost savings) worth 712 million EUR.

Estimated investment costs and employment impact

Our findings suggest that the two investment programmes outlined in the previous section would cost in total about 2 billion EUR. We assume that a proportion of funds are covered through additional private sector leverage or MFF funding for one of the measures. The SME resource efficiency measure assumes no private contribution, simply because COVID-19 is likely to particularly hit the balance sheet of SMEs, and as a consequence we consider unlikely that the latter would be apt or willing to increase their leverage for financing these investments in present circumstances. As such, the total RRF funds that need to be mobilized are estimated to 1.2 billion EUR.

Our central estimate is that almost 43,000 FTE additional jobs would be created as a result, with a margin between 29,000 and 56,000 depending on the assumptions used (see Appendix 2). The large discrepancy between maximum and minimum FTE jobs created by intervention number (6) is down to that fact that RPA combines an estimate of additional FTEs, and FTEs retained as a consequence of improved productivity. The low estimate excludes "retained FTEs" while the high estimate includes them. Our central estimate simply assumes that only 50% of the maximum FTEs retained are eventually retained.

This is a conservative estimate as we only consider direct and indirect effects while excluding induced employment impacts (employment effects of the additional consumption triggered by direct and indirect jobs created).

In addition to employment impacts, increasing the resource efficiency of SMEs is estimated to yield substantial environmental co-benefits in terms of reduced resource use, namely saving:

- Energy (17 million GWh per year)
- Water (5.9 million m^3 per year)
- Materials (376 million tons per year)
- Waste (6.9 million ton per year)

Table 7: Employment impact of a stimulus programme accelerating the circular economy transition

	Total investment needs, million EUR (FY 2021-24)	Covered via RRF funding, million EUR	Covered via additional public or private participation, million EUR	Additional jobs created, FTEs (central estimate)	Additional jobs created, FTEs (maximum)	Additional jobs created, FTEs (minimum)
5. Infrastructure investments to reach EU municipal waste 2025 targets	1,623	812	812	21,262	n/a	n/a
6. Increasing the resource efficiency of SMEs to BAT in four key sectors	455	455	n/a	21,697	35,501	7,892
CIRCULAR ECONOMY STIMULUS PACKAGE – **TOTAL**:	**2,078**	**1,276**	**812**	**42,959**	**56,764**	**29,154**

Source: Author's calculations (for detailed references and methodology see Appendix 2)

Other investment needs

There are significant needs for increasing the circularity across other (than municipal) waste streams, and sectors of the economy.[78] However, it is not possible to quantify investment needs at this stage, and to determine the extent to which public investment needs to step in – or whether regulatory changes and price incentives would suffice to drive a change. The same holds for accelerating resource "decoupling" in other sectors of the economy: possibilities haven't been assessed in a systematic, quantitative way, to this date.

Further possible measures related to resource use and waste that merit attention are the following.

First, there are substantial investment needs for upgrading Greece's business and industrial parks infrastructure, towards the creation of green industrial parks in line with circular economy and "industrial symbiosis" practices.[79] This measure should be complemented by strong regulatory changes to drastically curtail industrial activities located outside organized structures, as they lack necessary infrastructure to limit environmental damages (e.g. modern waste treatment infrastructure), and as a consequence are heavily polluting[80]. In tandem, the combination of green upgrading and of a change in incentives could significantly reduce the environmental footprint of industrial activities, while driving a productive modernization.

Second, according to the European Commission and the OECD,[81] the water sector faces substantial investment needs for achieving full compliance with targets of (a) the Water Framework Directive (2000/60/EC), (b) the Urban Waste Water Treatment Directive (91/271/EEC), and (c) the Drinking Water Directive (98/83/EC). Improving wastewater collection and treatment is notably identified as a priority area, along with improving water use efficiency (leakage reduction at the distribution stage).[82] Finally, the Bank of Greece estimates that substantial investment needs will arise are a consequence of climate change impacts on water supply, particularly in arid regions.[83]

Given Greece's public finances and socio-economic situation, it is challenging to envisage a significant capacity to raise public expenditures, or to enforce other alternatives (e.g. significant water pricing for raising funds).[84] As such, using the RRF's funds could be an opportunity to frontload necessary investments is order to reach relevant EU targets. Additional investment needs to 2030 have been quantified by the OECD and could be used as basis to cost a precise investment programme.[85]

[78] See for example needs in the plastics sector: Eunomia (2020). Policy Measures on Plastics in Greece. Report prepared for WWF Greece.
[79] Foundation for Economic and Industrial Research (2019). Economic, Social and Environmental footprint of Industrial Areas: The Importance of ETVA Industrial Area S.A http://iobe.gr/docs/research/RES_05_F_03122019_REP_GR.pdf
[80] WWF Greece (2013). A living economy for Greece. https://wwf.gr/images/pdfs/Living-Economy-Vision-in-Greece-EN.pdf
[81] OECD. (2020). Financing Water Supply, Sanitation and Flood Protection: Challenges in EU Member States and Policy Options, OECD Studies on Water, OECD Publishing, Paris
[82] European Commission and OECD. Joint review of investment needs and financing capacities for water supply, sanitation and flood protection: Greece country Factsheet.
[83] Bank of Greece (2011). The environmental, economic, and social impacts of climate change in Greece. Climate Change Impacts Study Committee. Athens, Greece. http://www.bankofgreece.gr/BogEkdoseis/ClimateChange_FullReport1.pdf.
[84] European Commission and OECD. Op. Cit.
[85] OECD (2020), Op. Cit.

Figure 21: Projected investment needs in water supply to 2050

GREECE		Baseline 2015	2020	2030	*Total by 2030*	2040	2050
BAU water supply and sanitation	**CAPEX**	**335**	**418**	**549**	-	**670**	**780**
	TOTEX	**1445**	**1427**	**1388**		**1346**	**1301**
Scenario Compliance + for water supply and sanitation	**ADD. CAPEX**	-	**140**	**178**	***1675***	-	-
	ADD. TOTEX		**470**	**456**	***5048***		
Compliance with DWD, access and efficiency (water supply)	ADD. CAPEX	-	15	15	*149*	-	-
	ADD. TOTEX		44	44	*437*		
Compliance with UWWTD (sanitation)	ADD. CAPEX		125	163	1526		
	ADD. TOTEX		427	412	4611		

Source: OECD

Third, enhancing the circularity of wastewater use, through environmentally sound techniques, could be explored - for instance in agriculture.[86] According to existing estimates, about 9% of Greece's agricultural irrigation needs could be covered via wastewater treatment and recycling.[87] Infrastructural investment needs to reach that target can be estimated by using European Commission data.[88] However, reusing wastewater would only be an environmentally sound policy if adequate treatments are applied. Indeed, despite the obvious environmental benefit of reducing pressures on water resources, inappropriate treatment can equally entail harmful environmental impacts – such as soil salinization, eutrophication in irrigation canals, and soil contamination[89].

[86] United Nations Environment Programme. Water and wastewater reuse: An Environmentally Sound Approach for Sustainable Urban Water Management. https://www.unenvironment.org/resources/report/water-and-wastewater-reuse-environmentally-sound-approach-sustainable-urban-water

[87] European Commission (2018). Impact assessment: Proposal for a Regulation of the European Parliament and of the Council on minimum requirements for water reuse. Commission staff working document.

[88] European Commission (2018). Op. Cit.

[89] Morugán, Alicia & García-Orenes, Fuensanta & Mataix-Solera, Jorge. (2012). Salinity effect of irrigation with treated wastewater in basal soil respiration in SE of Spain. EGU General Assembly 2012, held 22-27 April, 2012 in Vienna, Austria., p.1169

RESTORING AND PROTECTING GREECE'S NATURE

State of play

According to the IUCN, Greece is one of the ecologically richest countries in the European Union.[90] It hosts 17.8% of the animal species present in Europe and has the highest number of endemics in Europe (22% of the total indigenous flora and 26% of the flora species of the Mediterranean).[91] The fauna comprises 115 mammal species, 12 of which are marine, 450 bird, 24 amphibian and 72 reptile species. Moreover, Greece has the richest freshwater fish fauna of Europe with 154 species of which 83 are endemics. Greek seas host 476 marine fish species out of the 600 present in the Mediterranean. Some 30,000-50,000 invertebrates are also present, exhibiting a very high degree of endemism, higher than 50% in some groups.

Yet, Greece's natural wealth is under pressure due a combination of deficient protection and restoration expenditures, the impacts of unsustainable economic activities and practices, as well as widespread deregulation, insufficient law enforcement and poor governance.[92]

As mentioned in the European Commission's 2020 Semester Report, Greece suffers from *"serious and longstanding inefficiency in the field of environmental protection"* while investment in environmental protection is relatively low.[93] Particularly concerning freshwater ecosystems, *"significant investments are still required to fully comply with the Water Framework Directive and the Floods Directive, in order to proceed with important actions such as the removal of obstacles to fish migration, the renaturalisation of the flow of rivers, and measures for flood prevention and mitigation".*

Beyond the inherent value of protecting our natural heritage, the economics of nature restoration and protection suggest these are essential from a recovery and stimulus perspective.

First, all available evidence suggests that restoration measures have a particularly high labour intensity and strong domestic multipliers.[94]

Second, restoring ecosystems pays significant dividends in terms of socio-economic resilience. To give but two examples, the restoration of rivers, wetlands and their natural retention areas can significantly contribute to reducing flood risk and costs associated with floods; similarly, sustainable forest management is considered to be a key prevention measure for reducing risks or impacts of wildfires.[95]

Third, the restoration and protection of terrestrial and marine ecosystems are key to mitigating, and adapting to, climate change. Healthy ecosystems indeed act as major carbon sinks,[96] while protecting society from the impacts of climate change.

Fourth, a number of crucial economic activities are fully or partly dependent on healthy ecosystems. This is obviously the case of so-called "blue economy" sectors that are directly dependent on healthy

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[90] IUCN (2013, December 16). Greece's natural wonders. Retrieved from http://www.iucn.org/content/greeces-natural-wonders

[91] Dimopoulos, P., Raus, Th., Bergmeier, E., Constantinidis, Th., Iatrou, G., Kokkini, S., Strid, A. & Tzanoudakis, D. (2013). Vascular plants of Greece: an annotated checklist. Botanischer Garten und Botanisches Museum Berlin -Dahlem, Freie Universität Berlin; Athens: Hellenic Botanical Society. Englera

[92] World Wide Fund for Nature Annual report on environmental legislation in Greece, December 2019

[93] European Commission (2020). Op. Cit.

[94] BenDor et al (2014). Exploring and Understanding the Restoration Economy. Center for Urban and Regional Studies, University of North Carolina. Working Paper No. 2014-01.

[95] WWF (2019) The Mediterranean burns: WWF's Mediterrenean proposal for the prevention of rural fires. Retrieved from: https://wwfes.awsassets.panda.org/downloads/wwf__the_mediterranean_burns_2019_english_3.pdf?51162%2FThe-Mediterranean-burns-2019

[96] See for example: A) Donata Melaku Canu, Andrea Ghermandi, Paulo A.L.D. Nunes, Paolo Lazzari, Gianpiero Cossarini, Cosimo Solidoro (2015). Estimating the value of carbon sequestration ecosystem services in the Mediterranean Sea: An ecological economics approach, Global Environmental Change, Volume 32, Pages 87-95. B) Díaz-Almela E, et al.(2019). Carbon stocks and fluxes associated to Andalusian Saltmarshes. Deliverable C.2.2, Results Report Life Blue Natura project, (LIFE14CCM/ES/00957)

marine and coastal ecosystems, and of agriculture and forestry. But it is equally the case of other sectors and their supply chains, including utilities, construction, chemicals, and material industries.[97] Reversing environmental degradation is synonymous of enhancing the resilience of important sectors for the Greek economy.

Box 3: The value of a sustainable blue economy

A 2010 report[98] estimated the value of sustainable benefits rendered by Mediterranean marine ecosystems to at least 26 billion EUR a year. These are split between resource rents in the coastal economy (tourism, real estate, and hospitality sectors), fisheries and other benefits such as protection against coastal erosion.

A 2017 report[99] uses more up-to-date data, and considering a larger set of ocean benefits, to estimate that the natural asset base of the Mediterranean, including primary assets such as marine fisheries and seagrass, and other assets such as productive coastlines and carbon absorption, is worth an equivalent of 5.6 trillion USD. According to the same report, activities that are directly dependent on ecosystem health of the Mediterranean generate (the "gross marine product") an annual economic revenue worth 450 billion USD split among marine and coastal tourism, fisheries and aquaculture and other direct services provided by the ocean.

However, increased unsustainable activities, notably in the fisheries and the tourism sectors, and insufficient protection of marine and coastal habitats, are seriously eroding this shared wealth.

Last but not least, the EU Green Deal has set ambitious targets for reversing biodiversity loss and restoring Europe's ecosystems. These targets are to be fulfilled both by ramping up direct conservation and restoration measures, as well as transforming the practices of sectors that affect biodiversity loss and ecosystem degradation, such as the food system.[100] Achieving these targets will require substantial additional investments.[101]

Description of possible stimulus measures

Stimulus measure 7: Doubling organic farmland

Drastically reforming our food system is a pre-condition both for curbing greenhouse gas emissions and reversing biodiversity loss and unsustainable pressures on natural resources.[102] The recent Farm-to-Fork strategy of the European Commission takes an integrated approach towards enhancing the sustainability of the food system across all related supply chains, production and consumption. On the sustainable production front, one of the flagship targets is for at least 25% of the EU's agricultural to be under organic farming by 2030. For Greece, this would imply tripling the proportion of farmland under organic production in less than a decade (Figure 23).

[97] PWC and World Economic Forum (2019). Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy. http://www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf

[98] Mangos, A., Bassino, J-P., Sauzade, D. (2010). The economic value of sustainable benefits rendered by the Mediterranean marine ecosystems. Plan Bleu, Valbonne. (Blue Plan Papers 8).

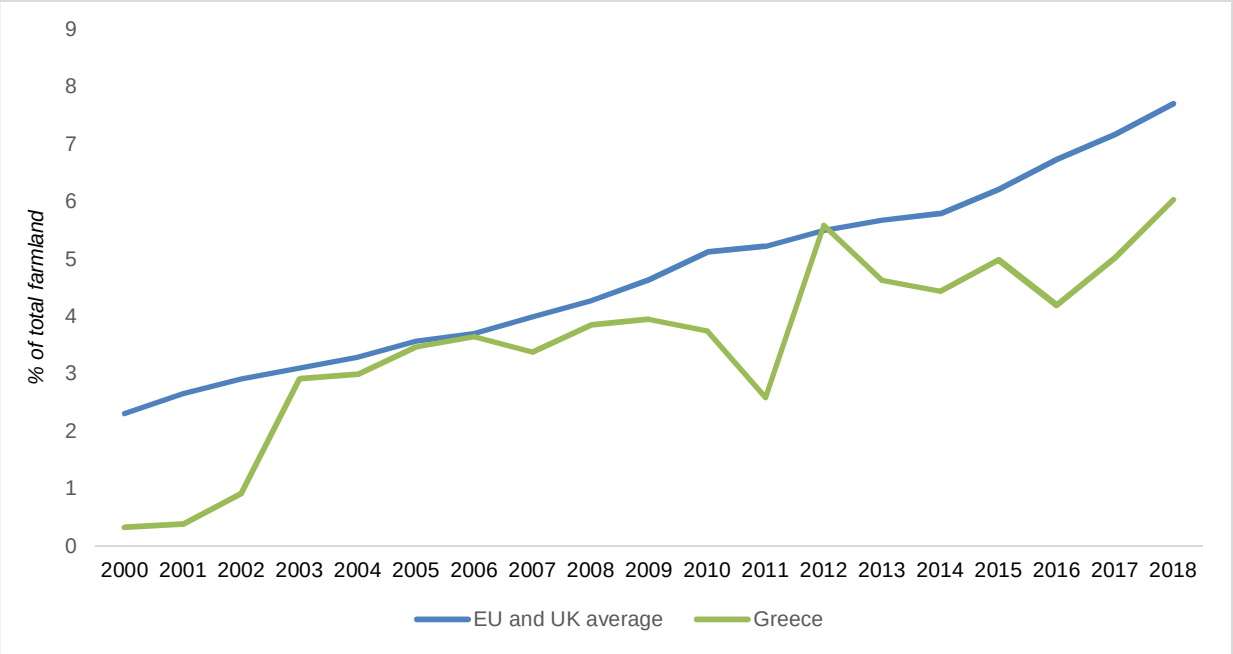
[99] Randone et al (2017). Reviving the Economy of the Mediterranean Sea: Actions for a sustainable future. WWF Marine Mediterranean Initiative, Rome, Italy. Retrieved from: https://wwfeu.awsassets.panda.org/downloads/reviving_mediterranean_sea_economy_full_rep_lowres.pdf

[100] European Commission (2020). Farm to Fork strategy. Retrieved from: https://ec.europa.eu/food/sites/food/files/safety/docs/f2f_action-plan_2020_strategy-info_en.pdf

[101] European Commission (2020). EU biodiversity strategy for 2030. https://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm#:~:text=EU%20Biodiversity%20Strategy%20for%202030&text=It%20aims%20to%20put%20Europe's,global%20post%2D2020%20biodiversity%20framework.

[102] The Economics of Ecosystems and Biodiversity (TEEB) (2018). Measuring what matters in agriculture and food systems: a synthesis of the results and recommendations of TEEB for Agriculture and Food's Scientific and Economic Foundations report. Geneva: UN Environment.

Figure 22: Proportion of farmland under organic production



Source: FiBL και IFOAM[103]

The socio-economic advantages of accelerating organic production are multiple. International and national evidence suggests that the employment intensity of organic production is higher than conventional agriculture.[104] Organic production equally requires less chemical and other inputs that, in the case of Greece, are mostly imported.[105] As a consequence expanding organic production would have an immediate positive effect on the trade balance. Further, despite lower yields, the profit margins of organic production are, on average, higher as products are sold at a premium.[106]

Greece's agricultural land tenure structure, consisting of a large number of small-scale producers, is much more tailored to an organic production model than to intensive agriculture. Indeed whereas this has historically been considered a disadvantage when competing with countries posting much higher productivity (partly a consequence of different ownership structures, mechanization and intensification possibilities on large conventional farms), a shift towards sustainable agriculture can turn it into an advantage. The organic market is a fast growing sector in the EU[107] and internationally,[108] and harnessing it presents clear development opportunities.

[103] Organic world. Statistics on organic farming. https://www.organic-world.net/statistics.html
[104] For the case of Greece, see for example: Ζέρβας (2007) Υπολογισμός και τεκμηρίωση του πρόσθετου κόστους, διαφυγόντος εισοδήματος και του κόστους συναλλαγής που συνεπάγεται για τους γεωργούς η εφαρμογή των γεωπεριβαλλοντικών μέτρων (Άρθρο 39 του Καν. 1698/05). Γεωπονικό Πανεπιστήμιο Αθηνών.
[105] Δαγκαλίδης Α (2013). Βιολογική γεωργία. Τράπεζα Πειραιώς: Κλαδική μελέτη 19, μονάδα οικονομικής ανάλυσης και αγορών. http://www.minagric.gr/images/stories/docs/agrotis/Biologika/ekthesh_trapezas_peireos2013.pdf
[106] Δαγκαλίδης Α (2013). Op. Cit.
[107] European Commission (2019). Organic farming in the EU: A fast growing sector. EU agricultural market brief No 13. https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/market-brief-organic-farming-in-the-eu_mar2019_en.pdf
[108] WWF. (2019). 10 signals – Evidence the green economy is underway. https://wwfeu.awsassets.panda.org/downloads/10signaux_green_230119_pages_1.pdf

Organic farming also provides a series of important co-benefits, in the form of avoided costs of run-off, spills, depletion of natural resources, reliance on energy-intensive inputs (emissions) as well as avoided health costs for farmers exposed to pesticides.

Expanding organic production in Greece requires actions at different levels, including reforming the subsidies structure of Common Agricultural Policy funds. However, RRF funds can be leveraged to cover one-off investment costs of transitioning farms from conventional to organic production. Indeed, transition costs, including costs of certification, often act as a major inhibitor for farmers.

We estimate the cost of a national investment programme aiming to cover the upfront transition costs for doubling the share of farmland under organic production by 2024, in order to accelerate the pace for reaching the EU's 2030 target. Although the unit costs of transition vary substantially across different locations, farms, and type of production, and in the absence of publicly available national data, a defensible assumption is that on average this would cost 300 EUR per hectare.[109] In total, converting 500,000 hectares would consequently require an upfront investment worth approximately 150 million EUR. Full results are presented below ("estimated investment costs and employment impacts"), while a sensitivity analysis related to cost assumptions is available in Appendix 3.

Conversion efforts could especially target farmland located in the Natura 2000 network, where "horizontal" organic certification could be combined with the creation of a special certification and branding schemes for agricultural produce emanating from the Natura 2000 areas, thus further enhancing the value added of produce.[110]

Stimulus measure 8: Investing in nature-based solutions to reduce flood risks

Beyond the human toll, over the past decade the cost of inland floods in Greece has amounted to 3 billion EUR in infrastructure damages, an average of 300 million EUR per year (or about 0.2% of every year). The cost of floods is likely to rise in the next decades as a consequence of climate change.[111]

BOX 4: Floods in Evia

In August 2020, severe flood incidents hit of Evia claiming 8 lives and inflicting incalculable infrastructural damages. The floods occurred mainly in three distinct basins, close to the city of Chalkida: i) around the river Lilantas affecting the cities of Vasilika and Lefkandi and the heavily developed flooding area of the river's estuary ii) around Messapios river thus flooding the city of Psachna and iii) a smaller seasonal stream in the area of Politika.

In all three cases, the main cause for the extended damages seems to be the human interventions in the rivers banks, delimiting their boundaries and restricting their width. An even more crucial factor is the reduction of natural flooding areas, as the latter have either been converted into agricultural land or have been partially built. Weather extremes as a result of climate change are increasing the intensity of precipitations and flood events, and this event was no exception. Indeed, what happened on the island of Evia in August 2000 has been a recurrent situation across Greece over the past decade, and all credible forecasts indicate that such extreme weather events will worsen as a consequence of climate change.

As such, significant efforts are required for restoring rivers and natural flooding areas, especially in urban and peri-urban areas. Efforts are equally required for limiting infrastructure and buildings on wetlands and estuaries, and this may often involve relocating existing infrastructure.

[109] GHK. (2011, July 19). Evaluating the Potential for Green Jobs in the next Multi-annual Financial Framework. http://awsassets.panda.org/downloads/investing_for_the_future___more_jobs_out_of_a_greener_eu_budget___summary.pdf
[110] https://www.natura2000branding.eu/natura-2000-benefits/
[111] Bank of Greece (2011). The environmental, economic, and social impacts of climate change in Greece. Climate Change Impacts Study Committee. Athens, Greece. http://www.bankofgreece.gr/BogEkdoseis/ClimateChange_FullReport1.pdf.

Investing in flood prevention is considered a priority by the latest EU semester report, and the absence of flood hazard risk assessments and flood hazard maps has been subject of an infringement procedure by the European Commission.[112] At the same time, the implementation of the water framework directive is facing significant delays, while only 49% and 6% of natural surfaces water bodies and heavily modified or artificial surface bodies respectively, achieve a good ecological status.[113]

A national investment programme, using the funds from the RRF to renaturalize rivers and water courses can respond both to biodiversity targets and to flood prevention objectives. Indeed evidence from across the EU suggests that nature-based solutions to flood prevention are the most cost effective options to reduce flood risks.[114] Similarly, according to a Joint Research Center (JRC) report, restoring and recreating natural retention areas (i.e. floodplains) across rivers and water streams in Greece has a Benefit Cost Ratio (BCR) of 2.5 EUR compared to 1.1 EUR for "grey" infrastructure solutions, such as creating and strengthening dyke systems.[115] Importantly, these figures do not account for additional biodiversity co-benefits provided nature-based solutions.

In the absence of robust data from national sources, we use JRC estimates for assessing investment needs to restore or recreate natural retention areas. According to the JRC, a strategy to reduce flood costs via retention areas would imply investment needs of between 5 and 15 million EUR per year to 2100 (depending on the global warming scenario used) with a mid-point estimate of 11 million EUR per annum under a 2°C scenario.

Based on the mid-point estimate, the cost of meeting investment needs to 2030 would be of 110 million EUR, on top of planned flood protection expenditures (currently estimated to about 64 million EUR per year).[116] As part of a stimulus programme, this investment can be delivered upfront by using the RRF funds. In essence, it would amount to an almost 50% increase of annual flood protection expenditures for FY 2021-24.

Note that this is a conservative estimate: beyond the restoration of floodplains and recreation of, or reconnection with, natural retention areas, it is likely that such an investment programme may require some infrastructure relocation.

Investments should be targeted in priority to most significant flood risk zones, as per Greece's preliminary flood risk assessment.[117]

Stimulus measure 9: Closing the investment gap in Marine Protected Areas

Greece is characterised and is greatly influenced by its marine and coastal environment, also being a hot-spot of marine biodiversity at the European and Mediterranean level, as it hosts a great variety of important and rare species (marine mammals, sea-birds, reptiles, fish) and of critical marine habitats (e.g. Posidonia meadows). Relatively recently the Greek government expanded the network of marine protected areas by designating almost one hundred new areas as sites community importance (i.e. NATURA 2000 sites), thus now covering 20.1% of its national waters.

However, the vast majority of the existing, and virtually all new, MPAs remain practically "paper parks", as they lack management plans as well as human, technical, and financial resources for

[112] European Commission (2017), The EU Environmental Implementation Review Country Report – GREECE. Accompanying The EU Environmental Implementation Review: Common Challenges and how to combine efforts to deliver better results (SWD (2017) 39 final).
[113] European Commission (2017). Op. Cit.
[114] Dige, Gorm & Eichler, Lisa & Vermeulen, Jurgen & Ferreira, Alipio & Rademaekers, Koen & Adriaenssens, Veronique & Kolaszewska, Dagna. (2017). Green Infrastructure and Flood Management — promoting cost-efficient flood risk reduction via green infrastructure solutions. European Environment Agency, Report No 14/2017.
[115] Dottori F, Mentaschi L, Bianchi A, Alfieri L and Feyen L, Adapting to rising river flood risk in the EU under climate change, EUR 29955 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-12946-2 , doi:10.2760/14505, JRC118425
[116] European Commission and OECD (2017). Op. Cit.
[117] Available at: http://cdr.eionet.europa.eu/gr/eu/floods

becoming an effectively managed network. Indeed, a 2015 report estimated that the "financial gap" for Greece's MPAs (difference between actual expenditures and expenditures needed for effective management) could be of the order of 120 million EUR per annum.[118]

In view of the new global and European targets that are being set for the protection of the marine environment, it is now the time for Greece to actively invest in the protection of its marine natural capital, by establishing a fully operational and well-managed network of MPAs. We estimate this can be achieved within the next two years. Investment activities could consist in the following:

1) Setting up the proper management structures and management plans (the recent law 4685/2020 has established a new national body that will be responsible for the management of PAs and MPAs)
2) Providing the upfront capital investments for relevant infrastructure (such as visitor centres), equipment (such as boats and vehicles), modern guarding systems, and setting up monitoring programmes.
3) Providing necessary capital investments for eco-tourism activities, as the latter can provide a revenue stream to finance future operational expenditures of MPAs. Upfront investments for eco-tourism activities can include the placement of eco-moorings (for boating tourism), infrastructure for eco-visitor activities and diving tourism, and interpretation tools.

Box 5: MPAs and targeted management actions linked with local development

As marine Natura 2000 sites are spread across Greece's coastline and islands, the effective management of MPAs can have a significant and immediate positive impact on local communities. Beyond their direct employment effect, they can provide new opportunities for local entrepreneurship linked with the management MPAs and eco-tourism activities. Two such examples are the development of underwater trails for diving, and the construction of eco-mooring for boaters.

Underwater trails are a key attraction for visitors and divers in MPAs worldwide and can easily be developed within all respective MPAs. Local diving businesses can take advantage of trails by attracting visitors for snorkelling or diving in some of the most pristine areas in the Mediterranean. For example, a network of trails that highlight the natural wealth was designed, delineated, signed posted and enhanced with interpretation material in the Gyaros MPA (located in the Cyclades archipelago). The project was completed within two years.

Similarly, the construction of eco-mooring within MPAs is a management activity that has been utilised in numerous sites in other countries, such as France and Spain. The placement of such moorings throughout Greece's MPAs could ensure the protection of one of the most important marine habitats, Posidonia meadows. The latter are threatened by uncontrolled anchoring or boats. Eco-moorings also provide easy and safe mooring to boaters, while increasing the number of visitors. Local construction, maintenance and management of such a mooring system can create new jobs for local communities and provide additional income for management purposes.

It is important to note that the RRF can only be leveraged for one-off investment purposes (as opposed to recurrent expenditures) to the extent that it is a one-off funding instrument. As such, the investments proposed will need to be complemented with subsequent actions to cover operational needs. For example, MFF funding (as a permanent funding instrument) could be leveraged for that purpose. Similarly, the benefits generated from investments in infrastructure for revenue-generating ecotourism activities can subsequently be recycled towards conservation - for financing day-to-day operational expenditures.

[118] Binet, T., Diazabakana, A., Hernandez, S. 2015. Sustainable financing of Marine Protected Areas in the Mediterranean: a financial analysis. Vertigo Lab, MedPAN, RAC/SPA, WWF Mediterranean. 114 pp.

In the absence of publicly available detailed unit costs at a national level, we use figures reported by Gantioler et al[119] to estimate the one-off, upfront investment costs for establishing a functioning network of MPAs that now exist only on paper. Greece-specific figures are available. Based on those, we estimate an investment need of 108 million EUR.

Calculation and methodology details are available in Appendix 3, while synthesized investment needs and employment impacts are presented further below.

Stimulus measure 10: Forest management and restoration in the Natura2000 network

The multiple benefits provided by Greece's forests have been estimated to approximately 1% of GDP, including benefits provided by timber and non-timber forest products, animal husbandry, recreation, soil protection, carbon sequestration, and biodiversity.[120]

However, only a limited proportion of forests are under effective management and, as acknowledged by the National Strategy for Forests,[121] there are substantial needs for restoring degraded forest ecosystems in particular within protected areas, improving the hydrological management within forest areas, and enhancing sustainable forest management via economic activities related to timber and non-timber forest products, whose role in forest management has progressively been eroded.[122] Restoration might be either active or passive through the adoption of specific management measures that will help restore a habitat to a previous status. Many European and Greek habitats depend on active management.

Beyond the necessity of achieving target 2 of the EU's Biodiversity Strategy, a sustainable management of forests is necessary both for climate and adaptation and mitigation purposes, and as a disaster risk reduction strategy in particular concerning wildfires. Indeed, as analysed in a 2019 WWF report, the "flammability" of the north Mediterranean forest landscape is markedly increasing due to a combination of absence of land and forest management, the progressive reduction of extensive herding, and the wider abandonment of traditional activities that used to contribute to a reduction of forest fuel.[123] As such, investing in restoration and management is also a viable prevention strategy for wildfires or reducing their scale thereof.

As is the case for previous measures examined, it is important to distinguish between one-off costs (pertinent for the use of RRF funds) and ongoing maintenance and management costs. Concerning investments in forest restoration activities, a detailed assessment of the Institute for European Environmental Policy[124] has estimated unit costs for a set of restoration one-off investments detailed below (Table 8).

Not all measures are relevant and applicable to Greece's forests. For example, active reforestation is not necessarily an optimal option for burned forest areas in Mediterranean ecosystems (depending on the type of forest), as natural regeneration by protecting burned areas from development is often

[119] Gantioler S., Rayment M., Bassi S., Kettunen M., McConville A., Landgrebe R., Gerdes H., ten Brink P.(2010). Costs and Socio-Economic Benefits associated with the Natura 2000 Network. Final report to the European Commission, DG Environment on Contract ENV.B.2/SER/2008/0038. Institute for European Environmental Policy / GHK / Ecologic, Brussels.
[120] Αλμπάνης, Κ., Ξανθόπουλος, Γ., Σκουτέρη, Α., Θεοδωρίδης, Ν., Χριστοδούλου, Α. και Παλάσκας, Δ (2015). Μεθοδολογία εκτίμησης της αξίας της δασικής γης στην Ελλάδα - Αναλυτικό Εγχειρίδιο. ΕΛΓΟ - "ΔΗΜΗΤΡΑ", Ινστιτούτο Μεσογειακών Δασικών Οικοσυστημάτων. Αθήνα. Σελ. 201.
[121] Hellenic Republic (2018). National Strategy for Forest Management.
[122] WWF (2013). Op. Cit.
[123] WWF (2019) The Mediterranean burns: WWF's Mediterrenean proposal for the prevention of rural fires. Retrieved from: https://wwfes.awsassets.panda.org/downloads/wwf__the_mediterranean_burns_2019_english_3.pdf?51162%2FThe-Mediterranean-burns-2019
[124] Tucker, Graham; Underwood, Evelyn; Farmer, Andrew; Scalera, Riccardo; Dickie, Ian; McConville, Andrew; van Vliet, Wilbert. (2013) Estimation of the financing needs to implement Target 2 of the EU Biodiversity Strategy. Report to the European Commission. Institute for European Environmental Policy, London.

preferred. Similarly conversion to plantations is not necessarily a major driver of forest degradation in Greece. In fact the forest cover has been expanding in recent years.

Table 8: Average unit costs of restoration needs to address current degradation

Key pressure	Key restoration measure	One-off costs (€ per ha)
Intensification of forest management	Planting	1000
Conversion to plantation	Planting	1000
	Removal of trees	n/a
Fire damage	Planting	1000
Inadequate burning management	Controlled burning	10
Invasive alien species	Removal of invasive species	2265
Insects and diseases	Pest and disease control	n/a
Hydrological modification & drainage	Restoration of hydrology	8
Soil degradation	Sustainable forest management	116
Abandonment of traditional management	Reintroduction of management	264

Source: IEEP[125]

In the context of the RRF, we propose an investment programme specifically targeting restoration actions for forests located within the Natura 2000 network, as a first step towards the a strategic vision of effective management and restoration for the entirety of Greece's forests. The Natura 2000 network comprises 24% of Greece's forests (15,550 km²), and is facing similar funding gaps and management constraints to MPAs,[126] albeit to a lesser extent. Such an investment programme could partially cover one-off funding gaps while contributing to a more effective management of the network.

To estimate investment needs for such a programme, we use only the relevant unit cost figures compiled by the IIEP (i.e. excluding those irrelevant to pressures facing Greece's forests), namely: the removal and limitation of invasive species, pest and disease control measures, the restoration of hydrology, measures related to soil degradation and sustainable forest management, and investments for the reintroduction of traditional management.

A major weakness is the lack of data or robust information over the ecosystem extent (proportion of forest cover within Natura-2000 areas) that would need to be targeted by each measure – for example, what percentage of forest areas located in Natura-2000 sites are affected by invasive species. This information would be necessary to derive a precise estimate of investment needs, based on the total hectares affected and unit costs available. In the absence of such information, and based on experiences of restoration programmes in other EU countries, we assume that 20% of the total forest cover within Natura-2000 sites would require at least one of the restoration measures mentioned above. Given the uncertainty of this assumption a sensitivity analysis is presented in section 3. Based on this assumption, we estimate an investment need of 206 million EUR. Calculation and methodology details are available in Appendix 3, while synthesized investment needs and employment impacts are presented further below.

Estimated investment costs and employment impacts

We estimate the investment needs for delivering the aforementioned interventions as part of an RRF-financed stimulus programme. Overall, an investment of approximately 560 million EUR in

[125] Tucker, Graham; Underwood, Evelyn; Farmer, Andrew; Scalera, Riccardo; Dickie, Ian; McConville, Andrew; van Vliet, Wilbert. (2013). Op cit.
[126] European Court of Auditors (2017). Special report: More efforts needed to implement the Natura 2000 network to its full potential (pursuant to Article 287(4), second subparagraph, TFEU)

investments aiming to restore and protect Greece's nature could deliver 9000 FTE jobs across the country. The full calculation assumptions are synthesized in Appendix 3.

This is a conservative estimation, as we avoid using assumptions posting extremely high labour intensities for restoration activities. Similarly, the direct employment impacts of accelerating a shift to organic production are substantially higher than when accounting for both direct and indirect effects. Indeed, evidence suggests that the net indirect employment impacts of shifting to organic production are substantially lower than the net direct impacts.[127] This is because organic production requires less inputs, and as such results in reduced supply chain-related jobs. The total net effect (direct and indirect) is positive, albeit lower than when only accounting for direct effects only. By accounting for both, our estimate is consequently very conservative.

Finally, investment costs should only be treated as indicative to the extent that national publicly available data is of poor quality. As such, a significant number of secondary assumptions needed to be made. In the absence of systematic information, we consider these assumptions defensible. However, a precise costing would require more detailed information for estimating the unit costs in an empirical way.

[127] GHK, Cambridge Econometrics and IEEP, 2007. Links between the environment, economy and jobs. Final Report for DG Environment

Table 9: Employment impact of a stimulus programme accelerating the circular economy transition

	Total investment needs, million Euros (FY 2021-23)	Covered via RRF funding, million Euros	Covered via additional public or private participation, million Euros	Additional jobs created, FTEs (central estimate)	*Additional jobs created, FTEs (maximum)*	*Additional jobs created, FTEs (minimum)*
7. Convert 500,000 hectares of farmland to organic production	147	147	n/a	1,680	*n/a*	*n/a*
8. Reducing flood risk through nature-based solutions	110	110	n/a	1,870	*n/a*	*n/a*
9. Closing the investment gap in Marine Protected Areas (MPAs)	102	102	n/a	1,819	*n/a*	*n/a*
10. Investing in forest restoration & management in the Natura 2000 network	206	206	n/a	3,692	*n/a*	*n/a*
TOTAL	**565**	**565**	**n/a**	**9,061**	***n/a***	***n/a***

Source: Author's calculations (for detailed references and methodology see Appendix 2)

Beyond job creation potential in the short-term, the most significant benefits of these investments would come in the form of improved "ecosystem services",[128] enhancing socio-economic resilience across Greece.

Other investment needs

The flagship investment programmes presented above are but a sample of investment needs to restore and protect Greece's nature. We further present additional investment areas that could not be costed in the context of this work, but could be the object of a recovery and resilience plan.

Terrestrial protected areas: beyond forest restoration and management terrestrial protected areas (PAs) have further "investment gaps" even though the actual amount of this gap remains unknown.[129] Terrestrial protected areas cannot deliver their full potential for nature (species and habitats) and local communities, mainly due to lack of implementation and adequate funding. According to a Fitness Check Evaluation Study, *"the availability of public funding has probably had the most influence on implementation*".[130]

More specifically, protected areas lack site-specific legal protection (Presidential Decrees) and operate without formally adopted and updated management plans. There are not long-term and properly funded monitoring programmes to assess nature trends within PAs or progress against defined objectives in respective management plans. Further, management bodies are struggling to fulfil their mandate with limited financial resources, personnel and authority. Their area of responsibility increased substantially (law 4685/2018) in order to cover the whole Greek Natura 2000 network, but no additional funds were allocated in order to operationalise this expansion in terms of personnel and/or equipment.

In Europe in general and Greece in particular, biodiversity protection needs both upfront investments and ongoing management: investments in restoration (e.g. wetlands and river flows, sand dunes, mosaic ecosystems), and management to alleviate threats (e.g. fires, alien species), instead of non-intervention. Greece's protected areas allow for various activities and can provide the enabling conditions for increased financial benefits to local communities that are active within them. Restoring and protecting their natural asset base is directly linked to jobs and livelihoods.[131]

Transitioning to low impact fisheries: Although it was not possible to quantify those in the context of this study, there are significant investment needs both for helping fishers adopting gears and practices with less destructive impacts, and for diversifying fisher's incomes while reducing pressures on fish stocks[132]. The former entails, among others, the adoption of lower impact (selective) gear and equipment to reduce bycatch and pressure on birds and marine life. The latter includes measures to retrain fishers into ecotourism activities, fishing tourism showcasing traditional practices, or even investments adding value to fishers' catch such as local processing and marketing infrastructure. This is particularly applicable to small scale coastal fisheries. A combination of diversification and higher added value of produce can ensure that a reduced, more sustainable fishing effort, is compensated via other income opportunities. However, small scale fisheries in

[128] WWF Ελλάς. Το φυσικό κεφάλαιο: θεμέλιο μιας ζωντανής οικονομίας. Κείμενο θέσης WWF Ελλάς. Αθήνα. 2014.
[129] European Court of Auditors (2017). Op. Cit.
[130] Sabien Leemans (2017). Preventing paper parks: How to make the EU nature laws work. WWF report. Retrieved from: https://wwfeu.awsassets.panda.org/downloads/wwf_preventing_paper_parks_full_report.pdf
[131] Mutafoglu K., ten Brink, P., Schweitzer J-P., , Underwood E., Tucker G., Russi D., Howe M., Maréchal A., Olmeda C., Pantzar M., Gionfra, S. and Kettunen M. (2016) Natura 2000 and Jobs: Scoping Study. Brussels. April 2017.
[132] Campos et al (2020). Turning the tide on EU seas with a green recovery. https://wwfeu.awsassets.panda.org/downloads/turningthetideoneuseas_june2020.pdf

particular require strong support and reskilling to harness these opportunities. And despite such investments being eligible for funding by the European Maritime and Fisheries Fund,[133] evidence suggests that financing and uptake has been insufficient compared to the task at hand. As such, a proportion of RRF funds could target investments that can both reduce pressures on marine life and ecosystems, while providing viable income alternatives for Greece's small scale coastal fleet.

Box 6: Transforming small scale fisheries in the Mediterranean

WWF's initiative "Transforming Small Scale Fisheries in the Mediterranean" aims at promoting sustainable fishing practices while improving fishers' livelihoods. In the context of this initiative, small scale fishers of the Northern Cyclades archipelago have been trained to diversify their fishing activities, notably via fishing tourism.

To specialize in fishing tourism, fishers need to invest in their vessels, equipment, health and safety necessities, and obtain a license. Within the mark of this initiative, fishers had the opportunity to a) get acquainted with the legal framework of fishing tourism, b) understand the necessary modifications to their vessels and c) obtain critical information on available financial tools to finance this transition, as well as key prerequisites for accessing EMFF funds.

As a result, more fishers have applied for a fishing tourism license. This will provide them with an alternative income source, while in parallel reducing their fishing effort to prevent them from endangering further already overexploited stocks (hence their future revenue stream).

WWF defines fishing tourism as "only intended for professional fishers, allowing the diversification of their activities while continuing their traditional trade". The objective of an alternative income stream is to eventually reduce overfishing via a sustainable management of stocks while promoting "the cultural heritage of artisanal fishing". This income diversification approach not only has positive effects on marine ecosystems, but also contributes to the resilience of coastal communities in the face of present and future environmental and economic shocks.

In the context of a green recovery, Greece could harness RRF funds to finance a national investment programme aiming to upscale similar activities across all coastal communities.

Wider protection, restoration and management needs: As analysed in a number of EU-wide publications there are significant additional needs for improving the management and restoration of coastal ecosystems, freshwater ecosystems (beyond rivers), grasslands and croplands[134]. These are necessary not only for reversing unsustainable pressures on biodiversity, but also for preventing the loss of key ecosystem services. For Greece in particular, investments in restoration and management for reversing soil erosion, coastal erosion and unsustainable water use, are a *sine qua non* for adapting to climate change[135]. Whilst investment needs in these areas have been quantified for virtually all other EU member-States.[136] systematic data for Greece is still missing and, as such, it was not possible to quantify those in the context of this study.

[133] European Commission (2017). Support from the European Maritime and Fisheries Fund (EMFF) - Opportunities for Small-Scale Coastal Fishermen

[134] Tucker, Graham; Underwood, Evelyn; Farmer, Andrew; Scalera, Riccardo; Dickie, Ian; McConville, Andrew; van Vliet, Wilbert. (2013) Estimation of the financing needs to implement Target 2 of the EU Biodiversity Strategy. Report to the European Commission. Institute for European Environmental Policy, London.

[135] For the impacts of climate change on coastal floods see for example: Vousdoukas M., Mentaschi L., Mongelli I., Ciscar J-C, Hinkel J.(a), Ward P.(b) , Gosling S.(c) and Feyen L. (2020). Adapting to rising coastal flood risk in the EU under climate change. Joint Research Center. EUR 29969 EN, Publications Office of the European Union.

[136] Tucker, Graham; Underwood, Evelyn; Farmer, Andrew; Scalera, Riccardo; Dickie, Ian; McConville, Andrew; van Vliet, Wilbert. (2013), Op. Cit.

CONCLUSION

The objective of this report is to inform the public debate on harnessing the possibilities of the EU's Recovery and Resilience Fund, in order to achieve the transformation of Greece's economy towards a more sustainable direction.

Through a series of indicative investment programmes, we find that using approximately half of the grants provided by the RRF for financing nature-positive investments could deliver a total of 120 thousand direct and indirect FTE jobs in the short term, while contributing to longer term objectives of decarbonization, reducing pressures on resources by harnessing circular economy models, and nature protection and restoration.

The impact on employment is conservative, as we do not account for induced impacts (employment effects of the additional consumption triggered by new job creation) for some key investment areas. If accounting for those, estimated total job creation would be higher.

The interventions we propose are indicative, to the extent that Greece's green economy requires significant investments across a number of areas, not all of which could be quantified with publicly available data. Particularly regarding investments in nature protection and restoration, there are significant uncertainties vis-à-vis costs, and the estimates we provide should only be treated as indicative. The five principles for a sustainable recovery we set out in this report should serve as a guide to design further possible interventions.

Similarly we do not analyse the specific design of interventions – for example through which public finance instrument they should be delivered. Depending on the investment area, a range of possibilities should be examined, for example harnessing the Hellenic Development Bank.

Beyond uncertainties, our key message is consistent with previous research on the growth and employment potential of the green economy in Greece at national,[137] sector-specific,[138] or regional[139] levels. The interventions proposed in this report by WWF Greece can be used as a basis for designing Greece's recovery and resilience plan.

[137] Λάλας Δ, Σαρτζετάκης Ε, Μπελεγρή-Ρομπόλη Α, Μιχαηλίδης Π, Μοιρασγεντής Σ, Μαρκάκη Μ, Γκέκας Ρ (2011). Πράσινη Οικονομία, Κοινωνική Συνοχή και Απασχόληση. ΙΝΕ/ΓΣΕΕ.
https://www.inegsee.gr/sitefiles/files/GreenEconomy_FinalReport.pdf

[138] Foundation for Economic and Industrial Research (2018). Improving the energy efficiency of buildings as a lever of growth for Greek economy. http://iobe.gr/docs/research/en/RES_05_C_04122018_REP_EN.pdf

[139] Rovolis, A and Kalimeris P. (2016). Roadmap for the transition of the western Macedonia region to a post-lignite era. Report prepared for WWF Greece.

APPENDIX 1
ESTIMATION SOURCES FOR DECARBONIZATION MEASURES

Measure	Cost data source	Employment central estimate	Employment +/- estimate	Comments
Energy communities	Cost / MW installed based on NECP average estimate.	Average of (+/-)	Minimum: NECP[140] Maximum: Garrett-Peltier[141]	Variations in the employment footprint depend to a large extent on the strength of domestic supply chains i.e. indirect job creation. Regarding renewable energy investments, the NECP assumes a relatively low employment footprint, based on an input-output approach. However an input-output approach assumes a static relationship i.e. further investments not influencing at all the strength of Greece's domestic supply chains in clean energy sectors. As such, a higher employment intensity figure was selected for the central scenario.
Energy efficiency	Average cost / renovated building based on NECP estimate.	Garrett-Peltiep	Minimum: NECP Maximum: IEA[142]	
Redirecting gas investments	Assumes that annual gas infrastructure investments to 2030 are dropped and channeled towards production and distribution clean infrastructure alternatives.	Average of (+/-)	Minimum: NECP Maximum: Garrett-Peltier	
Public transport	25% increase based on actual expenditures in public transport, derived from OECD data.	Average of (+/-)	Minimum: IEA Maximum: Daly et al[143]	

[140] Hellenic Republic (2019). National Energy and Climate Plan.
[141] Heidi Garrett-Peltier (2017). Green Versus Brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model. Economic Modelling Vol 61.
[142] IEA (2020). Sustainable Recovery. International Energy Agency: Paris
[143] Daly E., Pieterse M., Medhurst J. (2011) Evaluating the potential for Green Jobs in the next Multi-annual Financial Framework. GHK: London, GHK.

APPENDIX 2: ESTIMATION SOURCES FOR CIRCULAR ECONOMY MEASURES

Measure	Cost data source	Employment, central estimate	Employment, +/- estimate	Comments
Waste management	Eunomia and COWI for the European Commission[144]	IEA[145]	n/a	Figures provided by Eunomia and COWI assume that 2020 targets have been achieved, when estimating additional needs to 2035. As such we scale figures for investment needs to 2025 to represent Greece's 2020 starting point. Employment figures are conservative. Other estimates point to a much larger employment footprint.[146]
Resource efficiency of SMEs	Cost estimate based on RPA[147]	Average of (+/-)	Minimum: RPA (only jobs created) Maximum: RPA (jobs created and retained)	Sectors missing in original study (for Greece) were added via Eurostat's structural business statistics, and were costs adjusted accordingly. Job creation for 2 additional sectors (excluded in study due to lack of data) was added.

[144] Eunomia and COWI. (2019). Study on investment needs in the waste sector and on the financing of municipal waste management in Member States. Report prepared for the European Commission.
[145] IEA. (2020). Sustainable Recovery. International Energy Agency: Paris
[146] See for example: FOE (2010). More jobs, less waste: Potential for job creation through higher rates of recycling in the UK and EU. Friends of the Earth.
[147] RPA. (2015). Assessing the Potential Cost Savings and Resource Savings of Investments in 4 SME sectors. Report prepared for DG Environment of the European Commission. Loddon, Norfolk, UK

APPENDIX 3: ESTIMATION SOURCES FOR NATURE RESTORATION MEASURES

Measure	Cost data source	Employment estimate	Comments
Organic farming transition	Daly et al[148]	Daly et al	"Transition cost" estimates can vary substantially among different crops, farms, geographic location etc. Some anecdotal estimates from Greece point to transition costs ranging from €200 to €1000 per hectare for some crops. However, we found no defensible average for Greece. Ideally costs should be broken down by crop, which we plan to do in future research. Regarding employment, we factor indirect employment loss, for the reasons explained in the report. Figures represent net job creation. Gross job creation on-farm would be substantially higher (more than 10 times higher than our estimate).
Nature-based solutions for flood risk reduction (rivers)	Joint Research Center, EC[149]	Edwards et al.[150]	We assume that investment needs to 2030 as estimated by the JRC are covered upfront via the RRF. The employment intensity assumption is conservative, as other studies point to a considerably higher employment intensity.[151] Figures for river ecosystems restoration specifically were not available, and assume that the employment footprint for coastal restoration is similar to river restoration projects.
Marine Protected Areas	Unit costs: Gantolier et al[152] Ecosystem extent: WWF MPAs scorecard.	Mutafoglu et al[153]	One-off costs relating to the establishment of MPAs have not been systematically synthesized. We use Greece-specific average figures on protected areas. The same holds for the employment footprint: average figures are available for protected areas, not specifically distinguishing MPAs. However imperfect, these estimates are based on the only systematic EU-wide studies synthesizing the costs and employment impacts of investing in protected areas.

[148] Daly E., Pieterse M., Medhurst J. (2011) Evaluating the potential for Green Jobs in the next Multi-annual Financial Framework. GHK: London, GHK.
[149] Dottori F, Mentaschi L, Bianchi A, Alfieri L and Feyen L, Adapting to rising river flood risk in the EU under climate change, EUR 29955 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-12946-2 , doi:10.2760/14505, JRC118425
[150] Edwards, P.E.T., Sutton-Grier A.E. & Coyle, G.E. (2013). Investing in nature: Restoring coastal habitat blue infrastructure and green job creation. Marine Policy. 38: 65-71. DOI:10.1016/j.marpol.201 2.05.020
[151] See for example: Garrett-Peltier, Heidi and Pollin, Robert (2009) Job Creation per $1 Million Investment. Political Economy and Research Institute, University of Massachusetts
[152] Gantioler S., Rayment M., Bassi S., Kettunen M., McConville A., Landgrebe R., Gerdes H., ten Brink P.(2010). Costs and Socio-Economic Benefits associated with the Natura 2000 Network. Final report to the European Commission, DG Environment on Contract ENV.B.2/SER/2008/0038. Institute for European Environmental Policy / GHK / Ecologic, Brussels.
[153] Mutafoglu K., ten Brink, P., Schweitzer J-P., Underwood E., Tucker G., Russi D., Howe M., Maréchal A., Olmeda C., Pantzar M., Gionfra, S. and Kettunen M. (2016) Natura 2000 and Jobs: Scoping Study. Brussels. April 2017.

Forest management & restoration in Natura-2000	Unit costs: IEEP[154] Ecosystem extent: European Commission[155]	Mutafoglu et al	We use a synthetic average of unit costs for interventions that are relevant to Greece's forests. Unit costs that are not relevant, or marginally relevant, are excluded for simplicity. However, whereas "passive management" is relevant for all forests, there are large uncertainties over the area requiring some degree of "active management", and even more regarding one-off investments. We assume that about 20% of forests within Natura 2000 areas may require some degree of active measures, from which one-off costs can be derived. However, this estimate is based on limited evidence from case studies across other member-states. The estimates for this measure are consequently highly uncertain.

[154] Tucker, Graham; Underwood, Evelyn; Farmer, Andrew; Scalera, Riccardo; Dickie, Ian; McConville, Andrew; van Vliet, Wilbert. (2013) Estimation of the financing needs to implement Target 2 of the EU Biodiversity Strategy. Report to the European Commission. Institute for European Environmental Policy, London.
[155] European Commission (2016). Natura 2000 and forests. https://bit.ly/3izATAd

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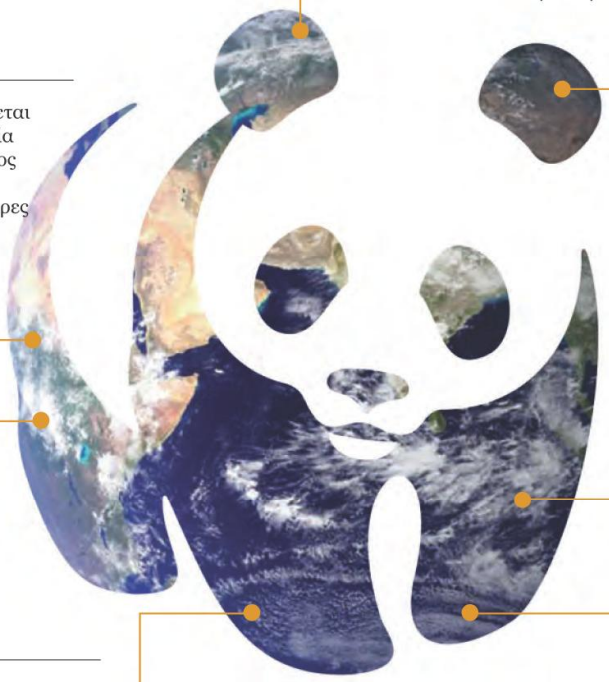

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