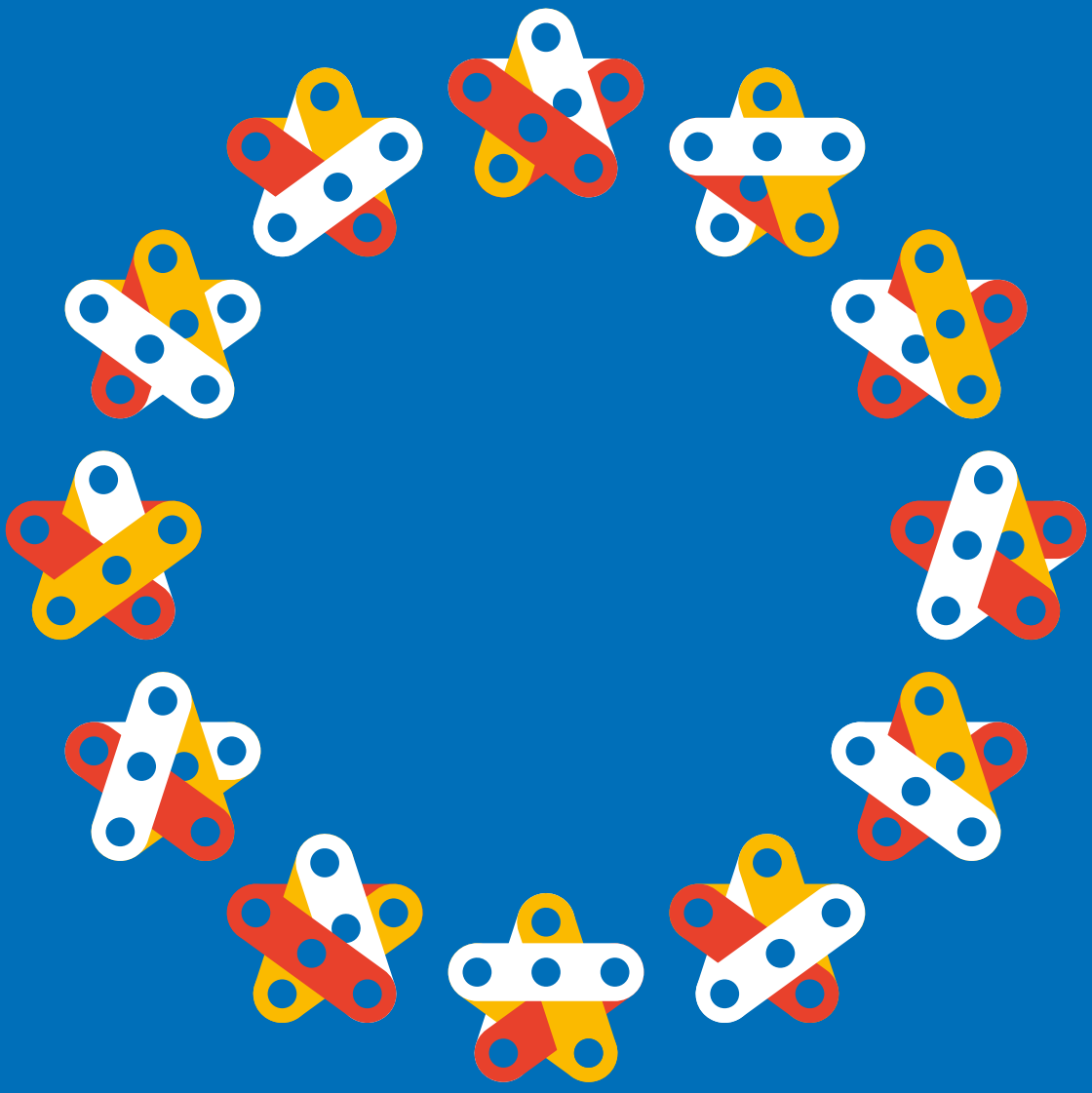
Circular Europe

How to successfully manage the transition
from a linear to a circular world



The European House Ambrosetti

enel Foundation

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Work successfully with Acrobar Reader

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Preface

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The European Commissioner for the Environment, Oceans and Fisheries, Virginijus Sinkevičius, said: "We only have one Planet Earth, and yet by 2050 we will be consuming as if we had three. The EU Circular Economy Action Plan will make circularity the mainstream in our lives and speed up the green transition of our economy."

The EU Circular Economy Action Plan, issued by the European Commission in March 2020, is one of the main pillars of the European Green Deal. The Plan aims at making sustainable products the norm in the European Union (EU) and puts Europe at the forefront of the global efforts to adopt a Circular Economy model. The development of increasingly circular supply chains in strategic sectors, such as renewables, electric mobility, storage and manufacturing, would foster synergies among actors and sectors (e.g. electricity, transport) accelerating the economic growth and the environmental sustainability of the entire continent.

Though we all agree on the goal, we are becoming increasingly aware that the starting points and speed of adoption differ from country to country. Embracing a Circular Economy is a great opportunity to boost Europe's competitiveness, modernize its economy, revitalize the industrial sector as well as reinforce its supply chains, create jobs and ensure sustainable, lasting growth. The challenge ahead is of paramount importance not only for future prosperity and well-being, but also for a current model of development that guarantees that no one is left behind. The success of the EU and its Member States is within our reach and will prove to be very rewarding.

Further integrating renewable generation with the electrification of final energy uses can multiply the benefits and represents the most efficient way to fully decarbonize our economy and society. At the same time, we must use wisely and ultimately preserve natural resources – water, soil, raw materials, and biodiversity. It is a challenge that requires a coordinated effort to rethink and redesign in a circular perspective many, if not all, productive schemes and business models, just as we are redesigning and reshaping the energy system, where renewables are progressively replacing fossil fuels as the main source of power generation and electricity is becoming the main vehicle for achieving extensive decarbonization in all sectors.

As always, the flip side of a challenge that needs to be tackled is an opportunity to be seized. Just a few years ago, decarbonization was considered by many as an additional burden and sustainability – in the best case – a further cost. Now it is evident that they instead represent a huge opportunity. Last year's study, Just E-volution 2030, underlined how by 2030, thanks to the transition towards a decarbonized energy system, the economic value of the electricity sector could grow in Europe from 113 to 145 billion euros (with Italy growing from 14 to 23 billion euros), while additional employment could range approximately between 997,000 and 1.4 million jobs (from 98,000 to 173,000 in Italy).

With the same ambition, this study, *"Circular Europe"*, shows what benefits the Circular Economy has already brought to the EU and its Member States, even if this model is just in its infancy. According to the study, in 2018 Circular Economy accounted for an amount between 296 and 376 billion euro of GDP, equivalent to 2-3 percent of current GDP, (in Italy between 27 and 29 billion euro, equivalent to 1-2 percent of current GDP) and it created between 2.4 and 2.5 million jobs (190.000 and 220.000 in Italy). At the same time, Circular Economy can bring a remarkable benefit to the environment. For example, the use of recycled instead of virgin aluminum reduces greenhouse gases emissions by almost 95% for each unit of material used; using 100 percent recycled polyethylene packages reduces CO_2 emissions by almost 70 percent compared to using virgin polyethylene.

This evidence suggests that the EU Circular Economy Action Plan is the natural continuation of a deep-rooted European legacy, which is particularly strong in some Member States. Italy, for example, has been capable of turning its lack of natural resources into a virtue through a strong focus on innovation and design, making it one of the world leaders in manufacturing in the most resource efficient way. The study confirms that Italy is well positioned with respect to "sustainable inputs" and "end of life". Yet, there is still much room for improvement, as confirmed by a lower positioning on "increase of intensity of use" which is enabled by the so-called sharing economy. Spain is also well positioned on most of the pillars, showing, like Italy, an overall intermediate to high level of development of Circular Economy. Romania, though not so well positioned, is indeed showing a quick pace of improvement especially on "end of life" and "extension of useful life" pillars.

The results achieved from the efforts in this field are encouraging, despite the fact that they are mostly the outcome of an otherwise traditional approach to manufacturing and business in general, naturally inclined towards cost and resource optimization, an approach mainly based on a sparing, parsimonious use of raw materials and the recycling of waste. Circular Economy is much more than this. It is rather a fundamentally new approach to how products are produced, assets are built, and services are provided. The so-called "circular by design" concept is relatively new, and must still be fully explored, developed, and above all applied to create innovative circular products, services and business models. Europe can play a key role in this endeavor, where creativity, innovation and the ability to make the most out of scarcity are key assets.

We will share many common challenges going forward and should start preparing now, with courage, determination and vision. Every Member State will, of course, follow its own path but we can learn from each other and from the history of the EU, which, since its foundation, has shown us that the most ambitious common goals can be attained, even while moving towards them at different speeds. With a clear vision and strategy and with measurable objectives, the EU can take the lead not only in the energy transition but also in the transition from a linear to a circular development model.

"A sustainable Europe is one that opens up opportunities, innovates, creates jobs and offers a competitive edge to its industries. The Circular Economy is key for developing Europe's future economic model"

Ursula von der Leyen

Valerio De Molli
Managing Partner and Chief Executive Officer, The European House – Ambrosetti

The world is facing major challenges. The profound and fast-paced economic, climatic and technological changes are moulding society and lifestyles, opening areas of uncertainty and stimulating new needs, including protection and social equality. Within this context, the Covid-19 outbreak has underlined the fragilities of our societies and the need of a system-oriented project capable of developing a positive vision of the future, by catalysing energy, resources and consent.

This is Europe's moment. If there exists one project which has the power to develop a positive vision for the European Union, it is definitely Circular Economy: it has the potential to become a "catalyst for the common good", around which developing a grand vision for the future. European Institutions have strongly acknowledged this potential. The New Circular Economy Action Plan issued in March 2020 represents an important milestone towards the transition and even the new recovery instrument introduced by the Commission, Next Generation EU, with a total budget of 750 billion Euros, identifies Circular Economy as a pressing need for the European recovery.

However, many European countries still lack a national strategic roadmap for transposing the European directives at national level and there are still some outstanding issues, starting from the need to have clearer operational guidelines for the adoption of circular models and metrics for monitoring the transition towards circular models.

To assess the state-of-the-art of Circular Economy in the European Union (EU27+UK), The European House – Ambrosetti, in collaboration with Enel and Enel Foundation, has devised a brand-new Circular Economy Scoreboard. It covers all the macro dimensions of the phenomenon, introducing comprehensive and homogenous metrics for all European Member States in the four pillars of Circular Economy: sustainable inputs (using renewable energy and of recyclable, recycled and biodegradable materials to manufacture goods and provide services in consecutive lifecycles), end-of-life (recovering end-of-life value of asset, products and materials through reuse, remanufacturing and recycle), extension of useful life (extending the duration of the useful life of products/services)

and increase of the intensity of use (increasing the load factor of a product/service to minimize the resource-to-benefit ratio).

Analysing the 23 Key Performance Indicators and the 10 key indicators identified through Principal Component Analysis, it emerges that EU countries display a very heterogenous performance in the transition towards Circular Economy. Doing a deep dive on the three focus countries of the study, Italy and Spain show an intermediate-high level of current development of Circular Economy, while Romania is lagging behind. The Scoreboard has seen the collaboration with the Joint Research Centre (JRC) of the European Commission in obtaining the statistical and econometric validation of its soundness. To the JRC go my heartfelt thanks.

The quantitative assessment of the socio-economic and environmental impacts of Circular Economy is a precondition to guide policymakers' agendas to successfully manage the transition from a linear to a circular world. The European House – Ambrosetti and Enel Foundation research team has devised a first-of-its-kind assessment model for estimating the economic, social and environmental impacts of Circular Economy. This model is unique in combining an econometric model to evaluate the quantitative relation between Circular Economy KPIs and a set of macroeconomic variable (GDP, investment, employment, labour productivity) and specific case studies and "what-if" analyses in order to assess the environmental impacts.

The results of the model highlight that Circular Economy, despite being in a very embryonic phase in many Member States, represents an opportunity for boosting European industries and employment. It is connected to approximately 300-350 billion Euros of GDP in the EU27+UK (2%-3% of the current GDP), 27-29 billion Euros in Italy (1%-2% of the current GDP), 10-12 billion Euros in Romania (5%-6% of the current GDP) and 33-35 billion Euros in Spain (2%-3% of current GDP) in 2018. It can also stimulate investment, with an estimated effect of 8-9 billion Euros on Italian investment, 1-2 billion Euros in Romania, 9-11 billion in Spain and an overall impact of 90-110 billion Euros in the European Union in 2018. Also the final impact on employment shows a positive effect: in the European Union, the shift from a linear to a circular development model is associated to almost 2.5 million jobs in 2018 (200,000 in Italy, 20,000 in Romania and 350,000 in Spain in the same year).

The transition towards a circular development model can generate several environmental benefits, associated with the use of secondary materials instead of primary materials and the reduction of GHG emissions, mainly connected to the reduction of use of virgin raw material and to use of renewable energy. In addition, circular solutions can positively affect the environment, by extending the useful life of products and services and/or increasing their intensity of use. The analysis undertaken in this study on the extension of the useful life of vehicle batteries, circular smart meters, re-use and reparability of white goods and the spread of sustainable mobility offer evidence of the positive externalities of Circular Economy.

In order to tackle the challenges associated to the circular transition and reap its benefits, ten policy matters, entailing specific policy actions, have been identified in the study: defining National Strategies for EU Member States; redefining Circular Economy governance in order to support strategic and cross sectorial transition; leveraging on legislation for enhancing circular transition; levelling the playing field with linear solutions; using finance as a leverage to promote R&D and best practices; addressing the lack of a clear definition and of comprehensive and homogenous metrics; turning waste-oriented business models into circular ones; promoting cross-cutting and coordinated measures for all the sectors involved in the transition; leveraging on Circular Economy as a framework to reimagine cities and urban areas; promoting culture and awareness on the benefits associated to Circular Economy.

This ambitious study would not have been possible without the concerted efforts of the top management of Enel, Enel Foundation and Enel X, starting with Francesco Starace, Carlo Papa and Francesco Venturini, together with their teams, in exploring a theme at the forefront of debate today, and without the invaluable contribution of the Scientific Committee – Amparo Moraleda (Member of the Royal Academy of Economic and Financial Sciences; Board Member of Solvay, Caixabank, Airbus and Vodafone), Jyrki Katainen (President, Sitra; former Vice President, European Commission) and Enrico Giovannini (Professor of Economics and Statistics, Università di Roma «Tor Vergata»; Spokesperson, Alleanza Italiana per lo Sviluppo Sostenibile – ASviS) – and the International Energy Agency – Fatih Birol (Executive Director) and Laszlo Varro (Chief Economist)– to whom go my deepest thanks.

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The economic, social, and environmental challenges that the world is facing call for new responses. The coronavirus epidemic triggered a serious global recession. While energy use and emissions declined, this came at an unacceptable human and economic cost. The International Energy Agency has consistently advocated putting clean energy and sustainability into the heart of the economic recovery efforts. The IEA Clean Energy Transitions summit hosted in July 2020 endorsed this vision, specifically emphasizing the unique contribution of energy efficiency into a sustainable recovery. In this context the Circular Economy could represent an innovative approach to develop a long-term vision in Europe and other regions of the world economy, by catalyzing economic resources and public consent. I'm pleased to note that in March 2020 the European Commission confirmed its commitment by issuing the New Circular Economy Action Plan, that sets new challenging objectives for the transition towards circular models. To support these policies and ensure a sustainable recovery from the current crisis, the European Commission has established a new recovery instrument, the Next Generation EU, with a budget of 750 billion Euros, that identifies Circular Economy as a priority for European recovery.

Benefitting from the political momentum that Circular Economy is living, concrete actions are needed to support the transition from a linear to a circular world. From the analysis conducted in the study *"Circular Europe"*, it emerges that the state-of-the-art of circular transition is very heterogeneous in European Union countries, being at an embryonal stage in many Member States. The study has leveraged on the elaboration of the Circular Economy Scoreboard, a first comprehensive attempt to monitor Circular Economy deployment along all the phases of a product or service life cycle (sustainable input, end-of-life, extension of useful life and increase of the degree of use).

The transition towards a circular development paradigm is associated with relevant and positive externalities on economic, social, and environmental dimensions. The results of the study emphasize that Circular Economy is associated with relevant economic and industrial benefits (in terms of Gross Domestic Product, employment, investment, and labor productivity), with positive social impacts (in terms of Gross Domestic Product per capita) and with a wide range of environmental benefits, associated with the use of secondary materials instead of primary materials and the reduction of GHG emissions, mainly connected to the reduction of use of virgin raw material and to use of renewable energy.

IEA analysis of the technology pathways for a low carbon economy emphasized the importance of recycling and materials efficiency for clean energy transitions. In the recently issued "Sustainable Recovery", the IEA outlined a pathway to make the recovery sustainable and resilient by dealing with global recession and unemployment, but also taking into account the key challenges of building a cleaner and more secure energy system. Moreover, the IEA is a key partner in the Global Alliance for Building and Construction that mobilize stakeholders to achieve energy efficiency in buildings and to use a life-cycle and Circular Economy approach for materials.

Reflecting the state-of-the-art of the Circular Economy and shedding light on the potential impacts of the transition towards this paradigm, the study *"Circular Europe"* could represent a solid foundation and milestone for strategic decisions for a circular economic knowledge and development in Europe, and we have been very glad to actively contribute to it.

Enrico Giovannini
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The world is amidst major transformations. The global population continues to grow rapidly: it has quadrupled over the past 100 years and is forecasted to exceed nine billion by 2050. This is increasing the demand for materials, while the availability of natural resources is constantly declining. The extraction and consumption of resources have an impact on the environment, increasing carbon emissions, as well as higher energy consumption and often pollution, with a negative impact on people's health. Beside this very well know evidence, the Covid-19 outbreak has accelerated the consciousness about ongoing trends and highlighted even more the fragility of our system, forcing us to rethink our economy and society.

Circular Economy has recently gained traction among economists, policymakers and business leaders when debating on the right approach to sustainable development. Five years after the introduction of United Nations Agenda 2030 for Sustainable Development, it is evident that "business as usual" will hardly help to achieve the Sustainable Development Goals (SDGs). A shift from a linear to a circular development model is needed, as well as convenient from a business perspective.

From this standpoint, the EU political programme for the next five years proposed by the President of the European Commission, Ursula von der Leyen, contains an extremely ambitious message: Circular Economy is key for developing Europe's future economic model and societal wealth and wellbeing. These declarations paved the way to the unveiling, in the midst of the Covid-19 outbreak, of the new "Circular Economy Action Plan", one of the main building blocks and priorities of the European Green Deal. This Europe's new agenda for sustainable growth aims to transform the European Union into the pioneering geo-political institution worldwide towards a sustainable development based on Circular Economy, able to put forward significant legislative proposals to enable the circular transition and setting the bar high for a green and inclusive economy.

However, the commitment of the new President has to be followed by the acceleration of every Member State towards the right and necessary change towards Circular Economy. But today, only one fifth of the European countries holds national strategic roadmap for transposing European directives on Circular Economy into practical activities. Moreover, the spreading of the Circular Economy paradigm within the Member States has been slowed down by some outstanding issues such as, among the others, the unclear meaning of "being circular" and the lack of metrics to properly measure this phenomenon. For example, the Italian Ministry of Environment and Ministry of Economic Development in 2017 issued the document «Verso un modello di Economia Circolare per l'Italia», representing a declaration of intent within the wider Italian Green New Deal, but too little happened since then to say that Italy has embraced in practice the new economic model.

"Circular Europe" study, aimed at defining the state-of-the-art of the Circular Economy in Europe and in the three countries of interest (Italy, Romania and Spain), and at assessing its impact on the economic, social and environmental dimensions, is an opportunity to fill the knowledge gap in understanding what Circular Economy is, which is the starting point in the European Union and what has to be done for its further deployment. The in-depth analysis carried out, net of simplifications and hypotheses, brings out a clear and relevant message: Circular Economy is not only beneficial for the environment, but the advantages of the transition to this model appear to be also connected to economic, industrial and social dimensions, showing how it could provide a significant boost to Gross Domestic Product, employment, investments and labor productivity of the European Union and its Member States.

Citing the title of the study, successfully managing the transition from a linear to a circular world requires a joint effort by all sectors and levels of the socioeconomic system. Universities, together with companies, can contribute to the transition by developing competencies in circular design to implement product reuse and recycling. Policy makers can support the transition by promoting the reuse of materials and higher resource productivity, by rethinking incentives and providing the right set of policies and access to financing. Citizens and consumers can facilitate the transition by becoming more aware of the chances to be circular in the everyday life and by acting accordingly. In this sense, the final part of the study is focused on identifying the main policy matters, entailing specific policy actions at both national and corporate levels, with direct implications on citizens' and consumers' behaviors.

Nowadays, more than ever, it is pivotal to think strategically about how to address the obstacles connected to the Circular Economy deployment, in particular to benefit from the new opportunities offered by the European policies in the framework of recovery financial programming. The European Council recently agreed on a proposal for a major recovery plan. To ensure that the recovery is sustainable, just, inclusive and fair for all Member States, the new recovery instrument "Next Generation EU" is clearly linked to the Green New Deal. This is why relaunching the economy cannot mean going back to the status quo before the crisis, but "bouncing forward", through an in-depth revision of the old production models, putting the Circular Economy at the very heart of the new European sustainable development agenda.

Jyrki Katainen
President, Sitra;
former Vice President,
European Commission

Circular Economy (CE) is a new model of market economy, which aims to maximise productivity, material and resource efficiency and sustainability. Addition to that I consider it as means of addressing climate change. When boosting Circular Economy, it is important to concentrate on the functioning of market mechanisms, create right incentives and tackle market barriers. CE cannot be based on subsidies, but normal functioning of market mechanisms. Public sector financing can play a role providing support to R&D&I but even more important is to create favorable business environment for CE businesses.

European Union is a significant enabler for developing CE. EU as a continent-wide market regulator can create not only level playing field but also favorable business environment for CE businesses. Product design policies and common standards and other market regulations are the elements of Single Market based on CE. This has also global impact, because all those who want to act in EU's Single Market must apply EU's rules and standards. Having said this I must admit that market regulation is not always an easy job. One must be careful not to overregulate or create regulation based on certain current technologies or business interests. One additional challenge for the regulators is a risk of sub-optimization especially in the areas where one should recognize the role of the whole value chain.

CE is often seen only as a waste recycling. It is important part of CE, but not the only one. Industrial CE is more about business models which are based on services and industrial symbiosis, where one's by-products are other's primary raw material. In order to boost European industrial CE, we need investments to new innovations and favorable business environment. Here the new EU budget and stimulus package can pay a significant role.

In order to better develop business environment by renewing existing Single Market we need data and better statistical base. The Circular Economy Scoreboard developed by the study *"Circular Europe"* is a significant contribution to better understand where we are and what should be done.

Since the first industrial revolution the world has been relying on the intensive use of natural resources to fuel economic growth and raise our standards of living... but is it possible to decouple them both? This study brings a potential answer by positioning Circular Economy (CE) as a key enabler to achieving that objective. The conclusions of the study suggest that climate action and economic growth far from being mutually exclusive are not only compatible but also increasingly interdependent and I strongly believe in it .

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Member of the Royal Academy of Economic and Financial Sciences chaired by the King of Spain; Board Member of Solvay, Caixabank, Airbus and Vodafone; former General Manager, IBM Spain, Portugal, Greece, Israel and Turkey

The way the public and the private sector embraced the telecommunications and the Information Technology revolutions in the US has been at the core of the country´s competiveness and leadership in digital economy over the past decades. The transition to Circular Economy promises equally far-reaching economic advantages. Europe cannot miss this opportunity to innovate and lead the world on climate policy and Circular Economy given its compelling economic, geopolitical and national security rationales. Even for those skeptical of the environmental urgency should recognize the overwhelming strategic advantages of EU environmental action at home and potentially abroad.

The recent European Green Deal and the related Circular Economy Action Plan set new and more challenging objectives. They represent a great opportunity to transition to Circular Economy models. However political statements won´t change the course of action unless regulation is both developed and enforced and public and private investment flow into that space. In that sense the private sector has major role to play through capital allocation, corporate governance and executive leadership.

Universal investors can have a major impact on this effort by funneling capital to firms that are willing to engage in that path. Major asset holders can also push companies to commit to aggressive targets to decarbonize its business models and insist on report of their progress.

Statements such as the one made by the CEO of Black Rock, Larry Fink: "climate risk is investment risk" and his commitment to ask every firm in its portfolio to disclose its carbon emissions, set a clear course of action. What if Black Rock follows through on its threat to vote against the board of companies that do not adequately disclose their progress? Every major firm will have to report in an auditable, standardized way its degree of compliance to these commitments potentially triggering a cascade of major investors voting against boards of companies lagging behind. Someone however will need to monitor the progress and such metrics are not yet

standardized. In that sense, the scoreboard presented in the study is particularly interesting and especially relevant since it provides a meaningful framework to create a European standard to assess the state of the art of CE for countries and companies.

With most of our domestic economies growing at an anemic pace, many companies will struggle to execute on Circular Economy strategy having to balance efficiency, innovation an austerity in difficult times. In order to do so, they will have to bet beyond their short-term ROI requirements to undertake the significant retrofitting and transformation requirements of their business models. Despite these challenges, it is encouraging that 95% of the CEO´s interviewed in the study consider it as a strategic priority. It proves that most business leaders have already realized its benefits and are pushing for this transition, engaging and mobilizing their vast array of resources (financial, human, brand and political) to bring it to reality. Not only because their customers and shareholders are demanding it but also because facts on the ground are affecting their bottom line.

A new contract is definitely required reconciling the needs for a winning strategy capable to create sustainable competitive advantage while strengthening the social contract. Most of the ingredients for a new vitality for European companies exist today, we just need to bring them together by leveraging on this initiative promoted by the EU and mobilize them.

Contribution of the Joint Research Centre of the European Commission

Michaela Saisana
Head of Unit, Directorate I – Competences, Monitoring, Indicators & Impact Evaluation Unit, Directorate-General Joint Research Centre

The Joint Research Center (JRC), in the figure of the Competence Centre on Composite Indicators and Scoreboards, has worked together with The European House – Ambrosetti to verify and ensure statistical quality and robustness of the Circular Economy Scoreboard created by The European House - Ambrosetti and Enel Foundation to measure the state of the art of Circular Economy in the European Union countries and the United Kingdom. The Circular Economy Scoreboard is an innovative tool that proposes a new definition of Circular Economy, driven by the desire to represent Circular Economy as comprehensively as possible. The Circular Economy Scoreboard is developed across four pillars of Circular Economy describing the current level of development of the phenomenon in each country under analysis: sustainable inputs, end-of-life, extension of useful life, increase of the intensity of use. To assess the level of development of one country along the four pillars, 23 Key Performance Indicators (KPIs) have been identified, generating a unique repository of data on Circular Economy, with more than 3.000 observations along a 5-year period (from 2014 to 2018). Moreover, thanks to the collaboration between the JRC and The European House – Ambrosetti it was possible to use an innovative Scoreboard analysis methodology (Copeland) that consists of a pairwise aggregation of countries that are ordered based on the ultimate sum of all “wins” subtracting all the “defeats” of all pairwise comparisons of one country versus all other countries across the KPIs (within the specific pillar considered).
Therefore, the newly created Circular Economy Scoreboard boasts a solid and accurate statistical and econometric methodology that leads to interesting results and considerations on the level of Circular Economy of European countries that I recommend you to read within this study. The last phase of the joint work between the JRC and The European House-Ambrosetti will see the release of a statistical audit by the JRC to the Circular Economy Scoreboard.
The detailed statistical audit certifying the econometric and statistical soundness of the Circular Economy Scoreboard will be available on The European House – Ambrosetti website (https://www.ambrosetti.eu/) and Enel Foundation website (https://www.enelfoundation.org/).

www.ambrosetti.eu
www.enelfoundation.org

1

Circular Economy has reached the center stage of European policy debate, but many European countries still lack a national strategic roadmap to implement Circular Economy as a competitive advantage

The world is facing major challenges. The profound and fast-paced economic, climatic and technological changes are molding society and lifestyles, opening areas of uncertainty and stimulating new needs, with environmental protection and social equality at the center of the debate. Science and innovation are increasingly enabling a historic convergence of decarbonization and competitiveness. Within this context, Circular Economy is a system-oriented approach capable of developing a positive vision of the future of the European Union. It has the potential to become a "catalyst for the common good" around which developing a "grand vision" for the European future. The recent European Green Deal and the related New Circular Economy Action Plan issued in March 2020 by the European Commission set new and more challenging objectives for Europe with regard to the transition to Circular Economy models. However, the Circular Economy development across the EU countries is far from being homogeneous. Many European countries still lack a national strategic roadmap to turn Circular Economy into a transition driver at national level, considering Circular Economy as a game changer and not just an environmental issue.

2

To assess the state-of-the-art of Circular Economy in the European Union (EU27+UK) a Circular Economy Scoreboard has been devised, covering all the macro dimensions of the phenomenon

Circular Economy is still evolving in the European Union and in Italy, Romania and Spain. Its operational modes have only been internalized to a limited extent, especially if a system-wide comprehensive approach is adopted as a reference: defining and monitoring the operational aspect of Circular Economy is of paramount importance, as a premise to find the best ways to maximize the benefits for the industrial value chains involved, the environment and society as a whole. For this reason, to assess the **state-of-the-art of Circular Economy in Europe**, the dimensions relevant for the introduction of circular models have been analyzed, identifying quantitative metrics comparable for 27 European Union countries and United Kingdom, with a specific focus on three countries of interest (Italy, Romania and Spain). To assess the level of development of each European country, **23 Key Performance Indicators** (KPIs) have been selected, among which a subset of **10 indicators** has been identified using the principal components analysis method, along four pillars:

- **Sustainable inputs**, which captures the use of renewable energy and of recyclable, recycled and biodegradable materials to manufacture goods and provide services in consecutive lifecycles.
- **End-of-life**, which describes ways of recovering end-of-life value of asset, products and materials through reuse, remanufacturing and recycling.
- **Extension of useful life**, which reflects the capability of increasing the duration of the useful life, with respect to usual end-of-life of a product or its components.
- **Increase of the intensity of use**, which rates the increase of the load factor of a single item (for example with product as a service or sharing services models). It measures the increase of the benefit obtainable with each unit of input (material and energy) used.

3 Italy and Spain show an intermediate-high level of current development of Circular Economy, while Romania is lagging behind

Analysing the current performance of the three countries of interest, it emerges that:

- Italy belongs to the cluster of best performers for **End-of-life**, while it belongs to the intermediate-high clusters for **Sustainable inputs** and for **Extension of useful life**, while much more effort is needed to improve the performance on the Increase of the intensity of use of products/services.
- Romania is in the cluster of **worst performing** countries in all the considered pillars.
- Spain belongs to the cluster of countries with a good level of development of Circular Economy, with three pillars (**Sustainable inputs**, **End-of-life** and **Increase of the intensity of use**) in the medium high cluster of positioning and the pillar **Extension of useful life** in the medium-low part of the European ranking.

4 Spain and Romania have shown a good level of improvement during the 2014-2018 period, while Italy has displayed a medium-low level of progress

The progress over time of the level of development of Circular Economy of all European countries has also been evaluated. The synoptic view of the progress along the four pillars highlights that:

- Italy shows significant improvement regarding **Sustainable inputs** and **End-of-life**, while it is lagging behind in terms of progress over time in the **Extension of useful life** and **Increase of the intensity of use**.
- Romania has improved its performance over time in the **Extension of useful life** and **End-of-life**, while its improvement is relatively slow for **Increase of the intensity of use** and it is much below the EU average for **Sustainable inputs**.
- Spain has improved its performance over time in the **Extension of useful life**, it has shown a medium-low progress for the **Sustainable inputs** and **Increase of the Intensity of use**, while it has displayed a low level of improvement for the **End-of-life** pillar.

5 Almost all (95%) of the 300 European business leaders responding a dedicated survey on Circular Economy consider the shift from linear to circular models a strategic choice for their company

The analysis of the "level of circularity" of the EU countries and the United Kingdom has been complemented with a view on the **sentiment of European business leaders** about the need to intervene in favour of circular models in their business. An online survey has been administered to a sample of **550 EU27+UK business leaders**, with a specific focus on the three countries of interest. The first significant result of the survey is that Circular Economy is a **strategic priority** for European business leaders, despite the economic and health downturn Europe is experiencing: **95%** of the 300 European business leaders (90% restricting the sample to SMEs) consider the shift from linear to circular models a **strategic choice** for their company. Moreover, Circular Economy is considered a **tool to gain competitive advantage** for diversification, market expansion and cost reduction. However, most European business leaders consider their countries **unprepared to face the Circular Economy challenge**. In Italy and Spain, 62% and 69% of respondents respectively think their country is not ready for Circular Economy, compared to an EU average of **75%**. **Uncertainty about value creation** (43.6% of responses) and **lack of skills** (35.9%) are the top two answers on the stumbling blocks to the development of Circular Economy in Europe. The required changes to the production chain are also perceived by about 31% of respondents as an obstacle. Also because of their nature, the access to new markets and/or new channels is the most urgent area of intervention for the transition to Circular Economy for 55%. In this context, to support their transition towards Circular Economy, companies – but also public administrations and other similar entities – would benefit of **practical tools** capable not only to measure Circular Economy, but also to provide them with a clear, quantitative understanding of the benefits of this approach and to offer a range of concrete, actionable solutions.

6 A first-of-its-kind assessment model has been devised to evaluate the economic, social and environmental benefits of Circular Economy in the EU27+UK and in Italy, Romania and Spain

The relevance gained by Circular Economy within the current policy debate at European and national levels is making increasingly important to understand the socio-economic and environmental effects associated to the adoption of a circular paradigm in the economy and society. The quantitative assessment of the socio-economic and environmental benefits of Circular Economy is essential to guide the European policymakers' agenda. The assessment model focuses on the European Union plus UK as a whole and on three countries of interest: Italy, Romania and Spain. Timewise, the analysis goes from 2014 to 2018. Methodologically, the model adopts a macro level approach, combining a set of KPIs of the Circular Economy Scoreboard with a series of variables related to the macroeconomic structure of each single country. The model evaluates both the **increase in the positive externalities** (dealing with the economic and industrial dimensions and with the social dimension) and the **reduction in the negative externalities** (dealing with the environmental dimension). The assessment model is twofold. The **economic**, **industrial and social dimensions** are analysed using a **statistical econometric model** to evaluate the quantitative relation between the Circular Economy KPIs and a set of macroeconomic variables. The **environmental dimension** has been examined leveraging on **specific case studies and "what-if" analyses**.

7 Circular Economy is associated with relevant economic and industrial benefits, in terms of Gross Domestic product, employment, investments and labor productivity

The model shows **statistically significant and positive results for all the economic and industrial dimension**. This means that Circular Economy appears to be positively correlated to all the considered variables related to the economic and industrial dimension. Specifically:

- Circular Economy is connected to approximately **300-350 billion Euros of GDP** in the **EU27+UK** in 2018 (2%-3% of the current GDP), **27-29 billion Euros** in **Italy** in 2018 (1%-2% of the current GDP), **10-12 billion Euros** in **Romania** (5%-6% of the current GDP) and **33-35 billion Euros** in **Spain** (2%-3% of current GDP) in 2018.
- Circular Economy is also related to the employment of **200,000 individuals** in 2018 in **Italy**. In **Romania**, around **20,000** jobs in the same year can be associated to the circular paradigm, while in **Spain** the overall effect ranges slightly in excess of **350,000 employees**. Overall, in the **European Union**, the shift from a linear to a circular paradigm is associated to almost **2.5 million jobs** in 2018.
- As far as investment is concerned, Circular Economy is associated in 2018 to about **8-9 billion Euros in Italy**, **1-2 billion Euros in Romania**, **9-11 billion Euros in Spain**, **90-110 billion Euros** in the **European Union** (EU27+UK).
- Circular Economy is associated also to an increase in labour productivity: around **560-590 Euros per employee per year in Italy** (0.8%-0.9% of current annual labor productivity) and **1,210-1,270 Euros per employee** (5%-6% of annual labour productivity) **in Romania**, the most impacted country. The impact in **Spain** is equal to **640-670 Euros per employee**. Finally, in the **EU**, the circular paradigm enables **570-940 Euros per employee**, with an impact on the current annual value of 1%-2%.

8 The transition towards a circular development model is associated also to positive social impacts, in terms of Gross Domestic Product per capita

The model shows that Circular Economy is associated to improvements in Gross Domestic Product per capita: in 2018, around **450 Euros per capita** in **Italy**, **570** in **Romania**, **650** in the **European Union**. **Spain** is the country with the highest expected impact, where Gross Domestic Product per capita resulting from the shift to the circular paradigm exceeds **700 Euros per capita**.

9 The transition towards Circular Economy leads to a wide range of environmental benefits

The transition towards a circular development model can generate several environmental benefits, associated with the **use of secondary materials** instead of primary materials and the **reduction of GHG emissions** mainly connected to the reduction of use of virgin raw material and to use of renewable energy. An increase of 10 percentage points in the circular materials use of the 4 materials considered in the analysis (iron, aluminium, zinc and lead), could bring a reduction in the GHG emission related to their production of **15.6%** for aluminium, **14.1%** for iron, **16.7%** for lead and **13.7%** for zinc in the European Union. The use of **renewables in energy production is also a key driver of the environmental benefits of Circular Economy**. Assuming a 100% coal substitution with 1 percentage point increase in renewables, Italy would present a GHG reduction of 6.3 million tonnes of CO_2e, equivalent to -1.8% of the current energy sector GHG emissions, the highest decrease in absolute terms among the 3 selected countries (-1.3 million tonnes of CO_2e in Romania and -5.4 million tonnes of CO_2e in Spain). In addition, circular solutions can positively affect the environment, by extending the useful life of products and services and/or increasing their intensity of use. The extension of the useful life of vehicle batteries, circular smart meters, re-use and reparability of white goods and the spread of sustainable mobility are concrete examples of this important aspect.

10 Ten policy matters have been identified in order to tackle the challenges related to circular transition and effectively reap its benefits

To effectively reap the benefits of Circular Economy, it is necessary to further advance the shift from a linear to a circular development model. **Ten policy matters**, entailing **specific policy actions**, have been identified:

1. **Defining National Strategies** for EU Member States for an economic development consistent with the Circular model.
2. **Redefining Circular Economy governance in order to support strategic and cross sectorial transition**.
3. Leveraging on **legislation** for **enhancing circular transition**.
4. **Levelling the playing field** with linear solutions.
5. Using **finance as a leverage** to promote Circular Economy Research & Development and best practices.
6. Addressing the **lack of a clear definition** and of **comprehensive and homogenous metrics**.
7. Turning **waste-oriented business models into circular ones**.
8. Promoting **cross-cutting and coordinated** measures for all the sectors involved in the Circular Economy transition.
9. Leveraging on Circular Economy as a framework to **reimagine cities and urban areas**.
10. Promoting **culture and awareness on the benefits** associated to Circular Economy.

Executive Summary

The state-of-the-art of Circular Economy in the European Union

- The world is facing major challenges. The profound and fast-paced economic, climatic and technological changes are molding society and lifestyles, opening areas of uncertainty and stimulating new needs, with environmental protection and social equality at the center of the debate. Within this context, the Covid-19 outbreak has underlined the fragilities of our society and the **need of a system-oriented project capable of developing a positive vision of the future of the world and**, in particular, **of the European continent**, by catalyzing energy, resources and consent.
- In recent years, a growing number of international institutions and policy makers have put environmental sustainability, above all **decarbonization**[1], **and resilience** at the heart of their political agenda. Greenhouse gases (GHG) emissions generate global warming, which causes several negative effects like food insecurity, natural disasters, extreme poverty and human disease. It is therefore urgent, on one hand, to tackle main environmental challenges and first of all global warming reducing GHG emissions and, on the other, to increase systemic resilience, defined as the ability of a system to respond to and recover from a severe perturbation (natural disaster, financial crisis, infrastructure breakdown, etc.), to be able to deal with the negative effects connected with climate change. **Circular Economy** is of paramount importance in facing these challenges and at the same improving competitiveness.
- The recent **European Green Deal** and the related **New Circular Economy Action Plan** issued in March 2020 by the European Commission set new and more challenging objectives for Europe with regard to the transition to Circular Economy models. However, the Circular Economy development across the EU countries is far from being homogeneous. Some countries, especially in Eastern Europe, are in an early phase of transition and far from best performers like Finland (which established the first national roadmap towards Circular Economy four years ago). As of to date, many European countries still **lack a national, strategic roadmap** considering Circular Economy as a game changer and not just an environmental issue, for transposing the European directives on Circular Economy at national level.

1 Decarbonization refers to the reduction of the release of greenhouse gases (GHG) into the earth's atmosphere to curb the global warming effect.

- Although the New Circular Economy Action Plan represents an important milestone in the transition towards a sustainable economic model, there are still some outstanding issues related to Circular Economy, starting from the need for a **strategic approach towards circular transition** and, subsequently, for supporting **clear regulations, standards** and **operational guidelines** for the implementation of circular economic models.

FIG 1 **The national transposition of European directives on Circular Economy**

Austria ●
First country to measure the circularity gap

Finland ●
Finnish roadmap to a Circular Economy (2016-2025)*
An update of the plan was released in 2019 to reform its economic model to ensure successful sustainability

France ●
French act of law against waste and for Circular Economy

Germany ●
Resource efficiency program for the sustainable use and conservation of national resources

Greece ●
National Action Plan on Circular Economy

Italy ●
Declaration of intent with the Italian Green New Deal**

Luxembourg ●
National waste and resource management plan

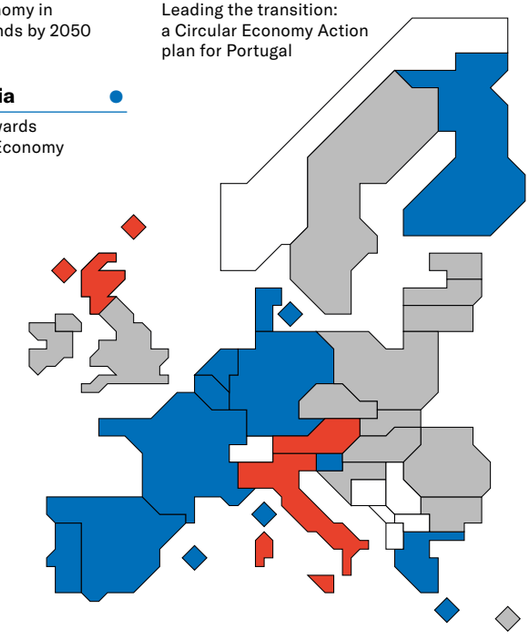
Netherlands ●
Circular Economy in the Netherlands by 2050

Portugal ●
Leading the transition: a Circular Economy Action plan for Portugal

Scotland ●
Circular Economy Strategy for Scotland

Slovenia ●
Roadmap towards the Circular Economy

Spain ●
España Circular 2030, a national strategy for Circular Economy in Spain until 2030



(*) It is the world's first national roadmap towards a Circular Economy

(**) The document «Verso un modello di Economia Circolare per l'Italia» was issued by the Italian Ministry of Environment and Ministry of Economic Development in 2017

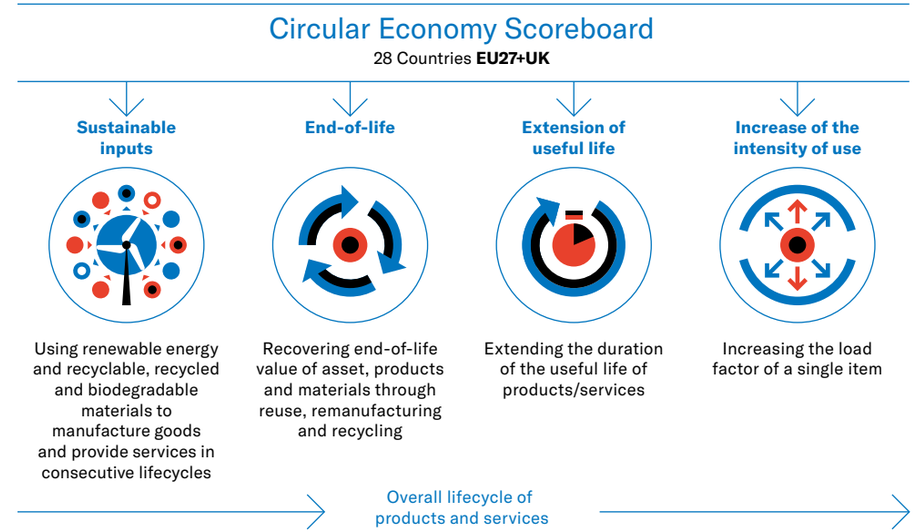
● National strategy ● Declaration of intent or regional activities ● Neither strategy nor regional activities

Source: The European House – Ambrosetti and Enel Foundation elaboration on European Commission and European Circular Economy Stakeholder Platform, 2020.

- As the Circular Economy Action Plan clearly states, Circular Economy does not start with recycling. It is instead about redesigning entire business models, where recycling is the last step of a journey starting from the drawing board, developing along the entire value chain and starting all over again where linear models just end. Recycling should in a way be the last resort, and in any case is just one of the available options.
- Circular Economy is still in an initial phase in the European Union and in Italy, Romania and Spain with the main focus still on waste management. Circular Economy approaches have only been implemented to a limited extent, especially if a system-wide comprehensive approach is adopted as a reference. **Defining and quantifying the targets of Circular Economy** is as crucial as identifying the best ways to exploit it to maximize the benefits for the industrial value chains involved, the environment and society.
- **Assessing the state-of-the-art of Circular Economy** in Europe is one of the key objectives of this study. For this purpose, the relevant dimensions for the introduction of circular models have been analyzed, identifying comparable quantitative metrics for **27 European Union countries** and **United Kingdom**, with a specific focus on three countries of interest: Italy, Romania and Spain.
- A **Circular Economy Scoreboard** has been elaborated using a **multi-level methodology** aimed at providing a comprehensive picture of the circularity level of each country. The analysis has been carried out at the **macro level** (country-system level) adopting an approach matching the micro (corporate) level framework of Enel circular metrics.
- The Circular Economy Scoreboard covers all the macro dimensions of the phenomenon along four pillars:
  - **"Sustainable inputs"**: it captures the use of renewable energy and of renewable, recyclable, recycled and biodegradable materials to manufacture goods and provide services in consecutive lifecycles.
  - **"End-of-life"**: it describes ways of recovering end-of-life value of asset, products and materials through reuse, remanufacturing and recycling. The focus of this pillar is on what is actually recovered, and not just sent to recycling.
  - **"Extension of useful life"**: it reflects the capability of increasing the duration of the useful life, with respect to usual end-of-life of a product or its components.
  - **"Increase of the intensity of use"**: it rates the increase of the load factor of a single item (for example with product as a service or sharing services models). It measures the increase of the benefit obtainable with each unit of input (material and energy) used.

Please refer to the **subsection 1.3** of the study for a detailed explanation of the corresponding aspects of the two approaches.

FIG 2 **The structure of the Circular Economy Scoreboard**



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

- The macro dimensions used match with existing metrics used at micro (e.g. corporate) level. The pillars are logically – and practically – connected by the "**circular-by-design**" approach, connecting the use of sustainable inputs, the extension of the useful life, the management of the end-of-life and the maximization of the intensity of use since the moment a product or a service is conceived. Finally, it is worth noting that the four pillars of the Circular Economy Scoreboard (macro level) perfectly **match with the micro level** (e.g. corporate level) metrics adopted by Enel, in turn based on its CirculAbility Model©.
- To assess the level of development of a country on each of the the four pillars, **23 Key Performance Indicators (KPIs)** have been selected, among which a **subset of 10 main indicators** has been identified using the principal components analysis method. The 23 KPIs were identified studying the main international datasets available for all the considered countries with reference to indicators capturing aspects related to the pillars under consideration, also leveraging the suggestions of the Scientific Committee and from external experts (e.g., Istat, European Commission, Joint Research Centre – JRC and Organisation for Economic Co-operation and Development – OECD). To rule out the country dimension-bias (i.e., overweighting bigger countries vis-à-vis smaller ones), all the KPIs have been normalized using either the GDP or population, depending on the KPI considered.

Please refer to the **subsection 1.3** of **Part 1** for a detailed explanation of the corresponding aspects of the two approaches.

FIG 3 **The Key Performance Indicators of Circular Economy Scoreboard**

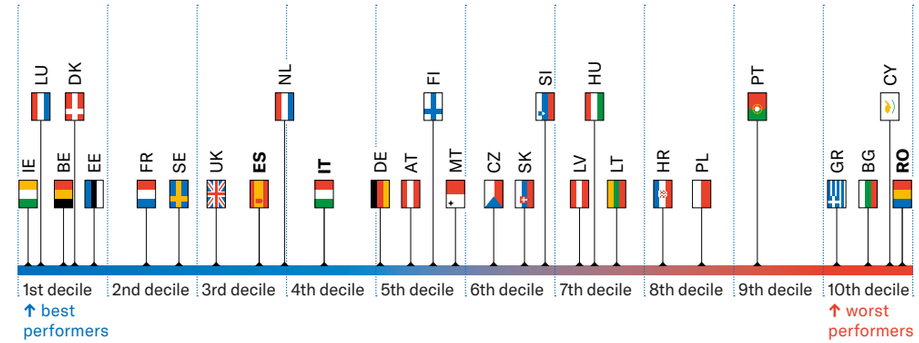
Sustainable inputs	**Circular material use rate**	%	Eurostat
	Resource productivity	€ per tonne of material consumption	Eurostat
	Share of total organic area in total utilized agricultural area	%	Eurostat
	Water productivity	€/m³ of water	EEA
	Energy intensity	TOE per thousand Euros	Eurostat
	Share of energy from RES	% of final energy consumption	Eurostat
	Final energy consumption by RES in transport	% of final energy consumption	Eurostat
	Final energy consumption by electricity in manufacturing sector	% of final energy consumption	Eurostat
	Final energy consumption by electricity by households	% of final energy consumption	Eurostat
End-of-life	Packaging waste recycled	%	Eurostat
	Total generation of waste per GDP unit	kg per million Euros	Eurostat
	Industrial waste treated by recycling	% on total industrial waste generated	Eurostat
	Municipal waste treated by recycling	% on total municipal waste generated	Eurostat
	Patents related to recycling and secondary raw material per employees in Circular Economy sectors	patent per employees	Eurostat
	Sewage sludge treated and disposed in agriculture or as compost	% of sewage sludge produced	Eurostat
Extension of useful life	End-of-life vehicles recovered and reused	% of end of vehicles scrapped	Eurostat
	Load factor	tonne-km / vehicle-km	Eurostat
	Value added of retail sale of second-hand goods	Euro per capita	Eurostat
	Employment in repair and reuse sectors	% of total employment	Eurostat
Increase of the intensity of use	**Individuals using any website or app to arrange an accommodation from another individual**	%	Eurostat
	Individuals using dedicated websites or apps to arrange a transport service from another individual	%	Eurostat
	Collective transport on total passenger transport	% of total inland passenger-km	Eurostat
	Individuals using the internet	% of individuals aged 16 to 74 in the last 12 months	Eurostat

N.B.: In **bold** the 10 KPIs that represent the key indicators of Circular Economy. Data are referred to the latest available year (2018).

Source: The European House – Ambrosetti and Enel Foundation elaboration on various sources, 2020.

- The European Union is characterized by a **heterogenous performance** in the transition towards Circular Economy, as of to date.

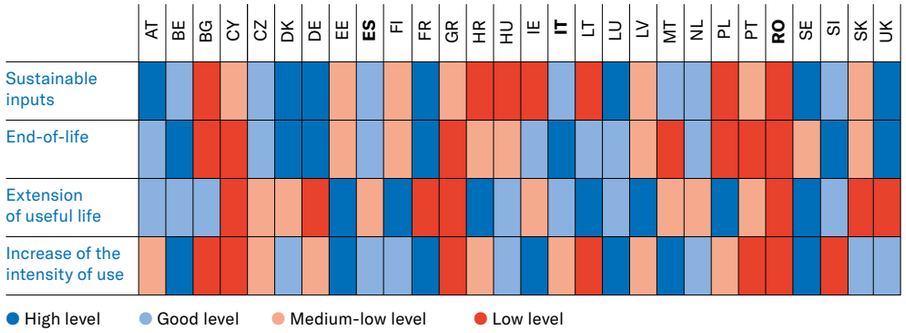
FIG 4 **Synoptic view of the European (EU27+UK) countries in the Circular Economy Scoreboard**
(deciles based on the score)



N.B.: Data are referred to the latest available year (2018).
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

- Analyzing the **three countries of interest**, it is possible to observe that:
  - Italy belongs to the cluster of **best performers** for End-of-life (although currently the indicators available capture what is sent to recycling and not what is actually recovered) while it belongs to the **intermediate-high clusters** for Sustainable inputs and for Extension of useful life, while much **more effort is needed** to improve the performance on the Increase of the intensity of use of products/services.
  - Romania is in the cluster of **worst performing** countries in all the pillars.
  - Spain belongs to the cluster of countries with a good level of development of Circular Economy, with three pillars (Sustainable inputs, End-of-life and Increase of the intensity of use) in the **medium-high** cluster and the pillar Extension of useful life in the **medium-low** part of the European ranking.

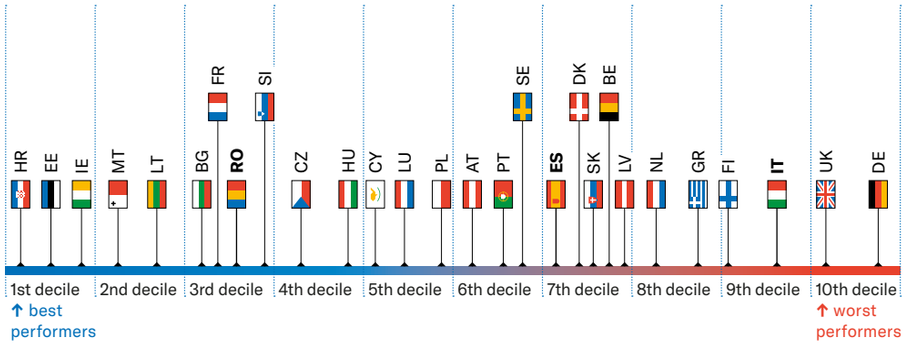
FIG 5 **Synoptic view of the European (EU27+UK) countries in the Circular Economy Scoreboard** (clusters of positionings)



N.B.: Data are referred to the latest available year (2018).
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

- To measure the performance over time, the Circular Economy Scoreboad has been analyzed over a **5-year timeline**. To this end, considering all the KPIs, the variation between the value of a KPI in 2014 and the same KPI in 2018 has been calculated for each European country. Overall, **Spain** and **Romania** have shown an **intermediate improvement** over the last 5 years, while **Italy** has displayed a **medium-low level of progress**.

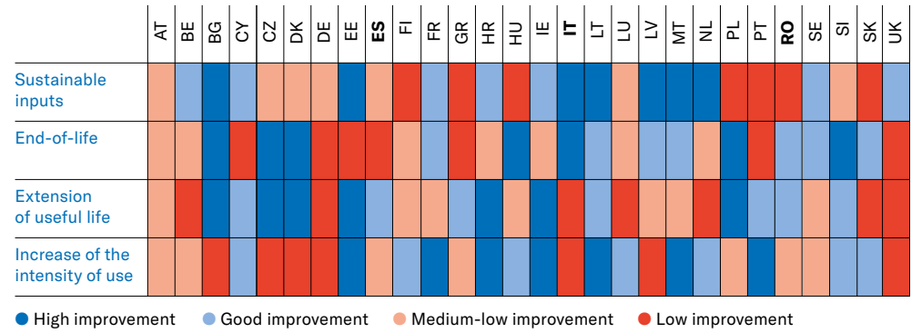
FIG 6 **Synoptic view of the progress in the Circular Economy Scoreboard for EU27+UK countries over the period 2014-2018** (deciles of based on score)



N.B.: Data are referred to the period 2014-2018.
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

- More specifically:
  - Compared to 5 years ago, Italy shows **significant improvement regarding Sustainable inputs and End-of-life**, while is **lagging behind in terms of** progress over time in the **Extension of useful life** and **Increase of the intensity of use**.
  - Romania has **improved its performance** over time in the **Extension of useful life and End-of-life**, while its improvement is comparatively slow **for Increase of the intensity of use** and it is **much below the EU average for Sustainable inputs**.
  - Spain **has improved its performance** over time in the **Extension of useful life**, it has shown a **medium-low progress** for the **Sustainable inputs** and **Increase of the Intensity of use**, while it has displayed a **low level of improvement** for the **End-of-life pillar**.

FIG 7 **Synoptic view of the progress in the Circular Economy Scoreboard for EU27+UK countries over the period 2014-2018** (clusters of positionings)



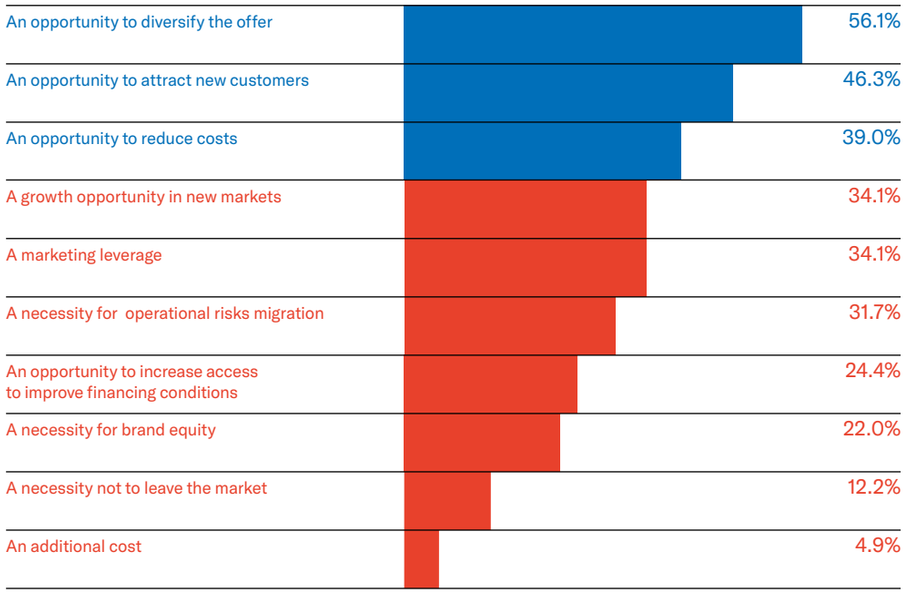
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

- The analysis of the "level of circularity" of the EU countries and the United Kingdom has been complemented with a view on the sentiment of European business leaders about the need to intervene in favour of circular models in their business. An online survey has been administered to a sample of 550 EU27+UK business leaders[2], with a specific focus on the three countries of interest. The aim of the survey is threefold:
  - Assessing the interest of companies to **invest** in the transition towards a circular model.
  - Collecting companies' opinion on the **main areas of intervention** for the development of Circular Economy.
  - Understanding expectations about **future growth prospects** and **priorities for policymakers**.

2 Italian and European members of the The European House – Ambrosetti Club, CEOs of the Spanish network of The European House – Ambrosetti and the network of small and medium enterprises, partners of Ecopreneur.eu (European Sustainable Business Federation).

- The first significant result of the survey is that Circular Economy is a **strategic priority for European business leaders**, despite the economic and health downturn Europe is experiencing. In fact, **95%** of the 300 European business leaders (90% restricting the sample to Small and Medium Enterprises) consider the shift from linear to circular models a strategic choice for their company.
- Circular Economy is considered a tool to **gain competitive advantage** for **diversification, market expansion** and **cost reduction**. In particular, the three most frequent answers were: an opportunity to diversify their offer (**56.1%**), an opportunity to attract new customers (**46.3%**) and an opportunity to reduce costs (**39.0%**). Only **4.9%** of respondents consider Circular Economy as an additional cost for their company. These results are in line with the SME focus group, with the exception of the opinion regarding cost reduction, which was selected by **17.9%** of respondents.

FIG 8 **Response to the question "Circular Economy represents for your company...", 2020**
(% values – multiple choices allowed)



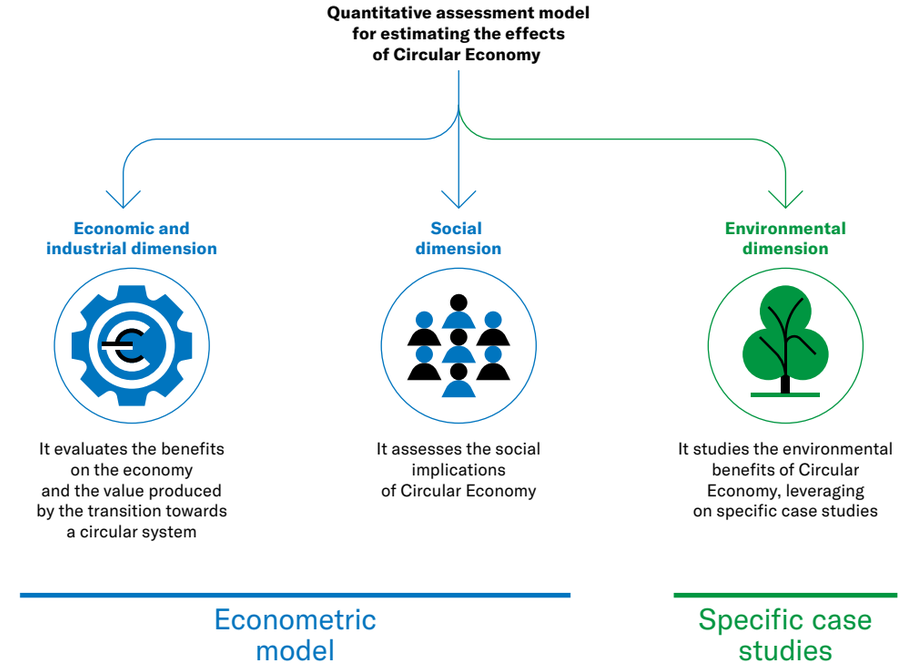
Source: The European House – Ambrosetti and Enel Foundation on Circular Economy online survey, 2020.

- However, most European business leaders **consider their countries unprepared** to face the Circular Economy challenge. In Italy and Spain, **62%** and **69%** of respondents respectively think their country is not ready for Circular Economy, compared to an EU average of 75%. The level of unpreparedness of the surrounding ecosystem also affects the business leaders perception of the obstacles to the development of Circular Economy. In fact, **uncertainty about value creation** (**43.6%** of responses) and **lack of skills** (**35.9%**) are the top two answers on the stumbling blocks to the development of Circular Economy in Europe. In Italy, 46.1% of respondents think that companies face the skill gap as a first obstacle to the deployment of Circular Economy models. The required **changes to the production chain** are also perceived by about **31%** of respondents as an obstacle. Also because of their nature, the access to new markets and/or new channels is the most urgent area of intervention for the transition to Circular Economy for **55%** of European SMEs. These concerns have some recurring micro-factors in common: uncertainty about access to financial resources and return on investment, lack of adequate university courses and skills both within the company and along the supply chain, and inadequate information on regulatory measures. In this context, to support their transition towards Circular Economy, companies – but also public administration and other entities – would benefit of practical tools capable not only to measure circular economy, but also to provide them with a clear, quantitative understanding of the benefits of this approach and offering a range of concrete, actionable solutions.

An innovative assessment model for socio-economic and environmental benefits of Circular Economy in the European Union, with a focus on Italy, Romania and Spain

- The relevance gained by Circular Economy within the current policy debate at European and national levels, is increasing the importance of understanding the socio-economic effects associated to the adoption of a circular paradigm in the economy and society. The **quantitative assessment** of the socio-economic benefits of Circular Economy is essential to guide the European policymakers' agenda.
- With this purpose, a **first-of-its-kind assessment model of Circular Economy** benefits has been devised. The model focuses on the **European Union** plus UK **as a whole** and on **three countries of interest**: Italy, Romania and Spain. Timewise, the analysis goes from 2014 to 2018. Methodologically, the model adopts a macro level approach, combining a set of KPIs of the Circular Economy Scoreboard with a series of variables related to the macroeconomic structure of each single country.
- The objective of the model is to assess the benefits of Circular Economy. Specifically, the model evaluates both the **increase in the positive externalities** (dealing with the economic and industrial dimensions and with the social dimension) and the **reduction in the negative externalities** (dealing with the environmental dimension). The assessment model is twofold. The economic, industrial and social dimensions are analyzed using a statistical econometric model to evaluate the quantitative relation between the Circular Economy KPIs and a set of macroeconomic variables. The environmental dimension has been examined leveraging on specific case studies and "what-if" analyses. The reason for this approach, coherent with the existing literature on the topic, is that environmental variables change slowly over time. As a consequence, the econometric model specified above would not be able to detect the effect of Circular Economy—which is at a very early stage in many European Union countries—on this dimension.

FIG 9 **Objects and methodological framework of the quantitative assessment model for estimating the impacts of Circular Economy**



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

- The model shows **statistically significant and positive results** for all the economic and industrial dimension. This means that Circular Economy appears to be **positively correlated** to all the considered variables related to the **economic and industrial dimension**. As far as the social dimensions, the result is statistically significant for the Gross Domestic Product per capita only. Instead, income inequality and people at risk of poverty do not show statistical significance[3].

FIG 10 **Results of the assessment model for the economic, industrial and social effects of Circular Economy**

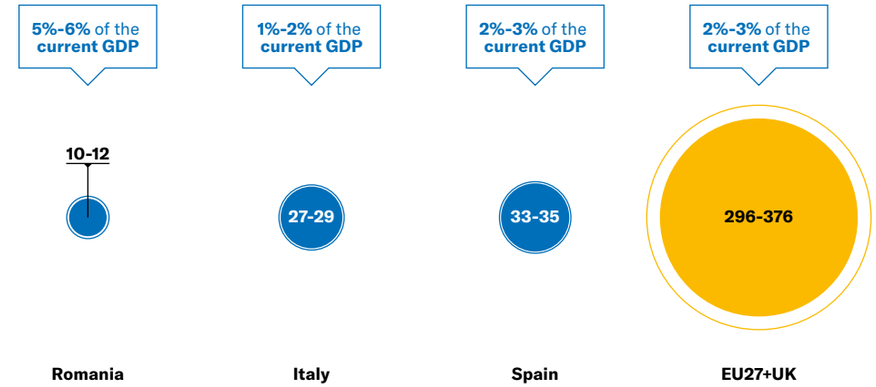
		Italy	Romania	Spain	EU27+UK
Economic and industrial dimension	Gross Domestic Product (Billion Euros)	27-29	10-12	33-35	296-376
	Employment (thousands)	190-220	5-40	360-370	2,400-2,500
	Investments (Billion Euros)	8-9	1-2	9-11	90-110
	Labour productivity (Euros per employee)	560-590	1,210-1,270	640-670	570-940
Social dimension	GDP per capita (Euros per capita)	450-480	520-620	700-740	580-730
	Income inequality	Statistically not significant	Statistically not significant	Statistically not significant	Statistically not significant
	People at risk of poverty	Statistically not significant	Statistically not significant	Statistically not significant	Statistically not significant

Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

3 This does not provide evidence that Circular Economy does not have an effect on the variables, but it indicates that, with the data currently available and considering the current level of development of Circular Economy, it is not possible yet to conclude that the results are consistent and solid with a given probability (e.g., 95%).

- Circular Economy is connected to approximately 300-350 billion Euros of GDP in the EU27+UK in 2018 (**2%-3%** of the current[4] GDP), **27-29** billion Euros in Italy in 2018 (**1%-2%** of the current GDP), **10-12** billion Euros in Romania (**5%-6%** of the current GDP) and **33-35** billion Euros in Spain (**2%-3%** of the current GDP).

FIG 11 **Annual relationship between Circular Economy and GDP for the countries of interest, 2018**
(billion of Euros)

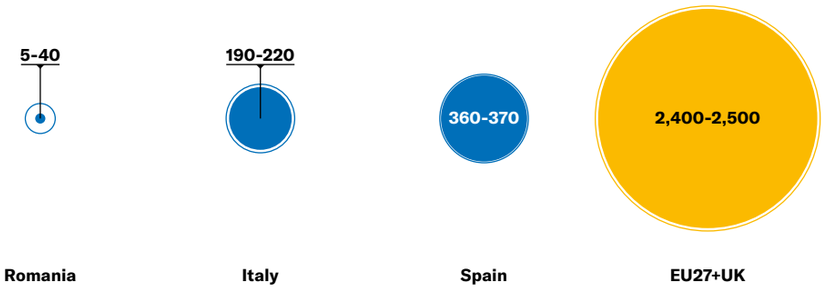


Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

4 All the variables refer to the last available year (2018).

- Circular Economy is also related to the **employment** of **200,000** individuals in 2018 in Italy. In Romania, **around 20,000** jobs in the same year can be associated to the circular paradigm, while in Spain the overall effect ranges slightly in excess of **350,000 employees**. Overall, in the European Union, the shift from a linear to a circular paradigm is associated to almost **2.5 million jobs** in 2018.

FIG 12 **Annual relationship between Circular Economy and employment for the countries of interest, 2018**
(thousands of employees)



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

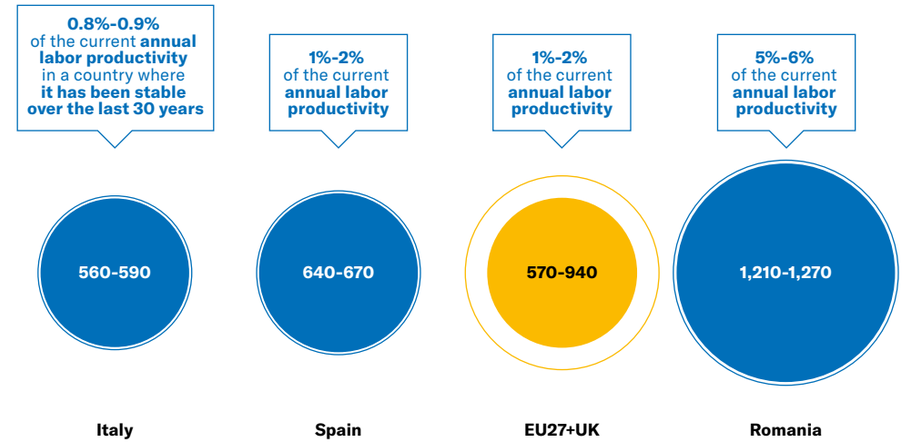
- As far as **investment** is concerned, Circular Economy is associated in 2018 to about **8-9** billion Euros in Italy, **1-2** billion Euros in Romania, **9-11** billion in Spain, **90-110** billion Euros in the European Union (EU27+UK).

FIG 13 **Annual relationship between Circular Economy and investment for the countries of interest, 2018**
(billion of Euros)

Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

- Circular Economy is associated also to an increase in **labour productivity**: around **560-590** Euros per employee per year in Italy (0.8%-0.9% of current annual labor productivity) and **1,210-1,270** Euros per employee (5%-6% of annual labour productivity) in Romania, the most impacted country. The impact in Spain is equal to **640-670** Euros per employee. Finally, in the EU, the circular paradigm enables **570-940** Euros per employee, with an impact on the current annual value of 1%-2%.

FIG 14 **Annual relationship between Circular Economy and labor productivity for the countries of interest, 2018**
(Euros per employee)



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

- Focusing on social dimensions, Circular Economy contributed to creating **450-480 Euros per capita** in 2018 in **Italy**. In **Romania**, Gross Domestic Product per capita enabled by Circular Economy was **520-620 Euros per capita** in 2018. **Spain** is the country with the highest expected impact, where Gross Domestic Product per capita resulting from the shift to the circular paradigm is between **700-740 Euros per capita**. Finally, in the **European Union** the impact was around **580-730 Euros per capita**.
- Along with economic benefit, Circular Economy generates at the same time important **environmental benefits**. The impact of Circular Economy on the environmental dimension follows a specific methodology, leveraging on **specific case studies, "what-if" analysis** and an **in-depth literature review** along the four Circular Economy pillars. The rationale for this different approach, coherent with the existing literature on the topic, is that environmental variables change slowly over time. As a consequence, the econometric model specified above would not be able to detect the effect of Circular Economy – which is at a very early stage in many European Union countries – on this dimension.
- To assess the environmental benefits associated with a shift from a linear to a circular paradigm, the Circular Economy pillars have been clustered according to the way they bring benefit to the environment. Specifically, the first two pillars (Sustainable inputs and End-of-life) mainly deal with how a product is manufactured, and are therefore grouped in a "**product cluster**". The other two pillars (Extension of useful life and Increase of the intensity of use) mainly deal with how the product or service is used, and then grouped in a "**use cluster**".
- The "use cluster" is analyzed focusing on six key materials and on energy. Environmental impacts are associated with different parts of the life cycle of resource use: from extraction to processing and discarding as waste. In this regard, the direct and indirect environmental consequences of resource use along their life cycle stages have been reported for **six materials** (aluminum, iron, copper, nickel, lead and zinc)[5], through a normalized index that takes into account the different measures to estimate the environmental impacts in **nine different environmental dimensions**[6]. According to the analysis, primary production of copper and nickel has the highest impact per kilogram of produced metals for the selected environmental impacts. On average, the use of secondary nickel makes it possible to reduce the environmental impact by 96 percentage points in 5 out of 9 dimensions considered, while the mean declines to around 89 percentage points for copper. Secondary aluminum use seems to be effective in reducing the impacts on climate change and cumulative energy demand. These results must be seen jointly with the current domestic materials consumption of materials. In fact, consumption in absolute terms sheds light on the direction materials management policies must take.

5 Environmental impact assessment methodology utilizes the life-cycle analysis (LCA) of materials, in reference to cradle-to-gate impacts. Cradle-to-gate impacts cover the upstream portion of the life-cycle (extraction and processing).
6 Acidification, climate change, cumulative energy demand, eutrophication, freshwater aquatic ecotoxicity, human toxicity, land use, photochemical oxidation and terrestrial ecotoxicity.

- An increase of 10 percentage points in the circular materials use rate for the two most impacting materials for each dimension leads to an **environmental impact reduction**. The results vary in relation to the normalized index value underpinning the specific materials. It is worth noting that nickel, one of the most damaging materials, almost always has the highest impact reduction, around **-13.1%** on average. Moreover, the shift from primary to secondary materials allows to reduce the GHG emissions. Taking into account 4 materials (iron, aluminum, zinc and lead), average reduction of GHG emission per kg of materials produced is **73.5%**, with a peak of **94.6%** for aluminum. An increase of 10 percentage points in the circular materials use of the 4 materials considered, could bring a reduction in the GHG emission related to their production of **15.6%** for aluminum, **14.1%** for iron, **16.7%** for lead and **13.7%** for zinc.

FIG 15 **GHG emissions reduction for the selected materials due to an increase of 10 percentage points in the circular material use rate at European Union level, 2018** (% values and tonnes of CO_2e)

Aluminium	Iron	Lead	Zinc
-15.6% (-507,772)	-14.1% (-9,097,246)	-16.7% (-35,549)	-13.7% (-148,999)

Source: The European House – Ambrosetti and Enel Foundation elaboration on E. Van der Voet et al., "Environmental Implications of Future Demand Scenarios for Metals: Methodology and Application to the Case of Seven Major Metals", 2018 and Eurostat data, 2020.

- As far as energy is concerned, in 2018, the energy sector was responsible for around **53%** of the overall European Union GHG emissions, split between 29% of energy industries and 24% of fuel combustion by energy users. Therefore, when analyzing the effect of Circular Economy on the environment, the energy dimensions cannot be excluded, specifically the increase of the **renewable energy sources penetration** in energy production. Toward this, a "what-if" analysis was performed that estimated the GHG emissions savings of an increase of 1 percentage point in the share of renewables.
- Assuming a 100% substitution of 1 percentage point increase in renewables with coal, Italy presents a GHG reduction of **6.3 million tonnes of CO_2e** (126 if Italy reaches the best performer in EU[7]), equivalent to **-1.8%** of the current energy sector GHG emissions, the highest decrease in absolute terms among the 3 countries selected. The result is impressive if compared to

7 The European best performer is Latvia, with around 39% of primary production coming from renewables.

the GHG emissions of the Italian capital and other areas: 6.3 million tonnes CO_2e of GHG reduction are equivalent to around 50% of the annual GHG emissions in the city of Rome and around 25% of the annual GHG emission in the province of Milan. Clearly, the energy mix is an important variable guiding the results. Assuming a 50% substitution between coal and natural gas, the results decrease to **-5.0 million tonnes CO_2e** of GHG reduction (-100 reaching the best EU performer), equivalent to **-1.5%** of the current energy sector GHG emissions and to **-3.7 million tonnes CO_2e** of GHG reduction (-74 reaching the best EU performer), equivalent to **-1.2%** of the current energy sector GHG emissions, with a 100% substitution with natural gas. The spread in results is due to the fact that natural gas has a lower emission factor than coal.

FIG 16 **GHG emission avoided due to an increase of 1 percentage point in the share of renewables in primary energy production in three different scenarios, 2018**
(million tonnes CO_2e and % vs. current GHG emissions of energy sector)

	Italy	Romania	Spain	EU27+UK
100% coal substitution	**-6.3** (-1.8%)	**-1.3** (-1.6%)	**-5.4** (-2.1%)	**-72.6** (-2.2%)
50% coal substitution and 50% natural gas substitution	**-5.0** (-1.5%)	**-1.1** (-1.4%)	**-4.3** (-1.7%)	**-57.8** (-1.8%)
100% natural gas substitution	**-3.7** (-1.2%)	**-0.75** (-1.0%)	**-3.2** (-1.3%)	**-42.9** (-1.3%)

Source: The European House – Ambrosetti and Enel Foundation elaboration on Ispra and IRENA data, 2020.

- When it comes to the "**use cluster**", the potential benefits for the environment are reviewed by means of specific examples:
  1 **Second-life of batteries**. Closing the loop for batteries would allow to cut out the **51%** of the environmental impact of their manufacturing process.
  2 **White goods**. In Europe, households own more washing machines than cars. Replacing five 2,000 cycle machines with one 10,000 cycle machine yields savings of almost 180 kg in steel and more than 2.5 tonnes in CO_2e.
  3 **Circular smart meters**. Enel started the replacement of first-generation smart meters with the new, second generation smart meter, and developed a plastic regeneration process, starting from plastic coming from dismissed smart meters. Manufacturing one circular smart meter emits 6% less CO_2. The replacement of 10 million first-generation smart meters with circular ones will produce about 1.200 tons less waste.
  4 **Dismissed power plants.** Enel created a company for recovery and conversion of unused areas and structures adjacent to power plants to be used as customs warehouses for logistics, handling and storage of goods, allowing significant environmental benefits due to the extension of life of dismissed areas, reducing soil consumption.
- The sharing economy has enjoyed remarkably rapid growth in recent years and looks set to scale new heights over the next decade. Some projections[8] put the sector's revenues at **$335 billion globally by 2025**, when in 2014 it was estimated to reach only $15 billion. The sharing economy is one aspect of Circular Economy and can have positive externalities on the environment by increasing load factor of a product or service.
  Urban density reduces emissions by enabling the sharing of carbon-intensive goods among households in a similar way as in a multi-person household. In fact, dense urban environments characterized by sharing consumption patterns drive per capita CO_2 emissions downward. It has been estimated that a shared passenger car has the potential to substitute from **4 to 13 personal cars**. Taking into account potential increases in new car sales to car-sharing fleets and an increase in the degree of use of shared cars, CO_2 emissions could be reduced by roughly **40 to 140 kg per driver per year**[9].

8 Source: Statista, 2019.
9 The CO_2 reduction estimate takes into account: the reduction of emissions attributable to the production, maintenance and disposal of a new car; the number of cars not produced; the average age of a car (thus calculating the average emission reduction per year); the average number of users using a shared car.

Policy proposals for successfully managing the transition from a linear to a circular world

- As shown by the assessment model, the transition towards a Circular Economy has several economic, social and environmental benefits.
- However, the shift from a linear to a circular development model must face some **outstanding issues**:
  - The **meaning of being circular is unclear** and, subsequently, there is a **lack of adequate tools** for measuring and monitoring Circular Economy.
  - Circular Economy involves all sectors of production and services and there is a **need for cross-cutting measures coordinated in the framework of a general strategy**.
  - Implementing Circular Economy requires **transformative investments** that need to be sustained and incentivized.
  - Companies and Public Administrations **are not** fully **aware** about Circular Economy benefits.
  - There is a **mismatch between workers' skills and companies' needs**.
- In this sense, **10 areas of intervention**, entailing specific **policy actions**, have been identified to tackle the challenges related to circular transition and effectively reap its benefits.

1 Defining National Strategies for EU Member States for a circular economic development: setting comprehensive and ambitious strategies and roadmaps at national and at local level, with a strategic cross sectorial focus on Circular Economy, with measurable objectives to be achieved in a specific time frame.

2 Redefining Circular Economy governance in order to support strategic and cross sectorial transition: defining an effective governance, to include all the departments (both at national and at corporate level) avoiding that Circular Economy reach is limited to environmental department activities.

3 Leveraging on legislation for enhancing circular transition: enhancing the development of circular business models leveraging also on legislation.

4 Levelling the playing field with linear solutions: eliminating incentives to linear models or giving incentives to circular business models (e.g. reducing the taxation on circular factors, human labour first of all).

5 Using finance as a leverage to promote Circular Economy Research & Development and best practices: launching adequate financial instruments that can support companies' investments on Circular Economy model and promoting a circular public procurement that could also accelerate innovation.

6 Addressing the lack of a clear definition and of comprehensive[10] and homogenous metrics: defining clear and homogeneous metrics to measure Circular Economy at macro and micro level.

7 Turning waste-oriented business models into circular ones: incentivizing circular by design approach, warranty time extension, making repair easier, creating financial incentives for reparability and ensure availability of information on durability and reparability.

8 Promoting cross-cutting and coordination measures for all the sectors involved in the Circular Economy transition: sustaining the creation of districts and clusters to maximize synergies at local, national and European level, creating an ecosystem for innovation by identifying some strategic sectors.

9 Leveraging on Circular Economy as a framework to reimagine cities and urban areas: leveraging on cities and urban areas to promote the cooperation among different stakeholders and coordinating different contributions towards a more circular territory.

10 Promoting culture and awareness on benefits associated to Circular Economy: clarifying the value of Circular Economy, raising public awareness and promoting communication on Circular Economy benefits among consumers, promoting Circular Economy playbooks, addressing the issue of skill mismatch, implementing a "Circular Economy Apprenticeship Erasmus Program", strengthening the commitment towards lifelong learning programs.

10 An example is the lack of the indication of the fraction of recycled waste that is actually recovered. This parameter is generally not disclosed.

FIG 17 **Ten policy matters for successfully managing the transition from a linear to a circular world**

1 Defining National Strategies for EU Member States for a Circular Economic development

→ Setting comprehensive and ambitious strategies and roadmaps at national and at local level, with measurable objectives to be achieved in a specific time frame

2 Redefining Circular Economy governance in order to support strategic and cross sectorial transition

→ Defining an effective governance, to include all the departments (both at national and at corporate level) avoiding that Circular Economy reach is limited to environmental department activities

3 Leveraging on legislation for enhancing circular transition

→ Enhancing the development of circular business models leveraging also on legislation

4 Levelling the playing field with linear solutions

→ Eliminating incentives to linear business models or reducing the taxation on circular factors (human labor first of all)

5 Using finance as a leverage to promote Circular Economy R&D and best practices

→ Launching adequate financial instruments that can support companies' investments on Circular Economy model and promoting a circular public procurement that could also accelerate innovation

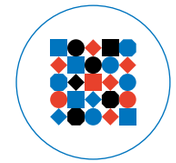
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

6 Addressing the lack of a clear definition and of comprehensive and homogenous metrics

→ Defining clear and homogeneous metrics to measure Circular Economy at macro and micro level

7 Turning waste-oriented business models into circular ones

→ Incentivizing circular by design approach, warranty time extension, making repair easier, creating financial incentives for reparability and ensure availability of information on durability and reparability

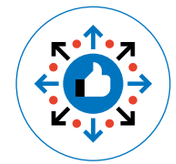


8 Promoting cross cutting and coordinated measures for all the sectors involved in the Circular Economy transition

→ Sustaining the creation of districts and clusters to maximize synergies at local, national and European level, creating an ecosystem for innovation by identifying specific strategic sector

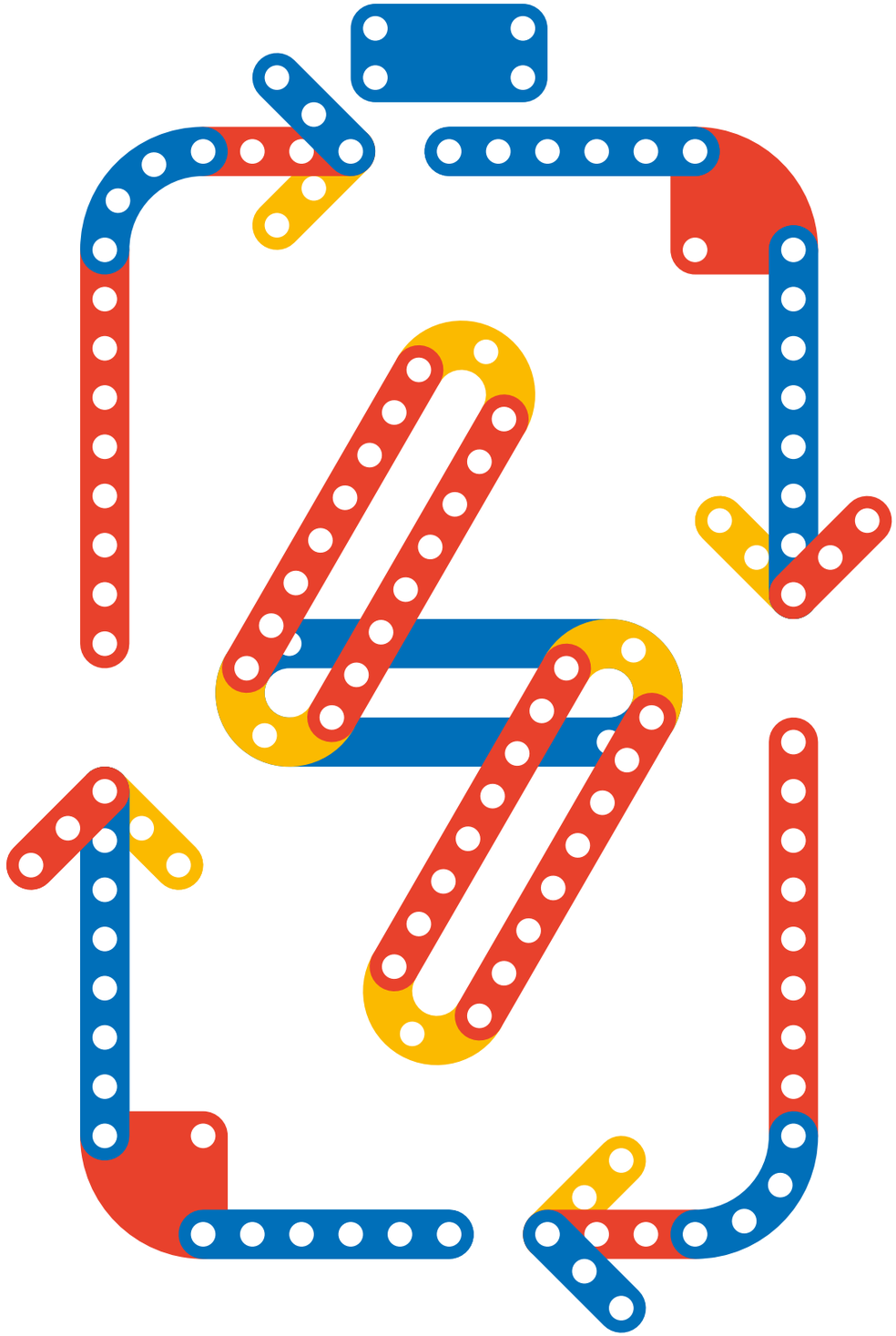
9 Leveraging on Circular Economy as a framework to reimagine cities and urban areas

→ Leveraging on cities and urban areas to promote the cooperation among different stakeholders and coordinating different contributions towards a more circular territory



10 Promoting culture and awareness on the benefits associated to Circular Economy

→ Raising public awareness on Circular Economy benefits, promoting a Circular Economy playbooks, addressing the issue of skill mismatch, implementing a “Circular Economy Apprenticeship Erasmus Program”, strengthening the commitment towards lifelong learning programs



Part 1

The state-of-the-art of Circular Economy in the European Union

Key messagges

1

Science and innovation are increasingly enabling an historic convergence of decarbonization and competitiveness. Circular Economy is a system-oriented approach capable of developing a positive vision of the future of the European Union. It has the potential to become a "**catalyst for the common good**" around which developing a "**grand vision**" for the European future.

2

Circular Economy has gained the full attention of the policy debate. The **New Circular Economy Action Plan** issued in March 2020 represents an important milestone towards the transition. However, many European countries still **lack a national strategic roadmap** for transposing the European directives at national level and there are still some outstanding issues, starting from the need to have **clearer operational guidelines** for the adoption of circular models and **metrics** for monitoring the transition towards circular models.

3

To assess the state-of-the-art of Circular Economy in the EU27+UK, a **Circular Economy Scoreboard** has been devised. The assessment covers all the macro dimensions of the phenomenon along **four pillars**: **Sustainable inputs** (the use of renewable energy and of recyclable, recycled and biodegradable materials to manufacture goods and provide services in consecutive lifecycles), **End-of-life** (recovering end-of-life value of asset, products and materials through reuse, remanufacturing and recycle), **Extension of useful life** (extending the duration of the useful life of products/services) and **Increase of the intensity of use** (increasing the load factor of a product/service to minimize the resource-to-benefit ratio). The macro dimensions analyzed match with the existing metrics used at micro (e.g. corporate) level. The pillars are logically - and practically - connected by the "circular-by-design" approach, linking the use of sustainable inputs, the extension of the useful life, the management of the end-of-life and the maximization of the intensity of use since the moment a product or a service is conceived. Within the four pillars, **23 Key Performance Indicators** have been selected, among which a subset of **10 main indicators** has been identified using the principal components analysis method.

4

The EU27+UK displays a **heterogenous performance** in the transition towards Circular Economy. **Italy** belongs to the cluster of **medium-high performing** countries for **Sustainable inputs**, to **best performing countries** for **End-of-life**, to **medium-high cluster** for **Extension of useful life** and **medium-low** for **Increase of intensity of use**; when compared to 5 years ago, it shows a significant improvement on Sustainable inputs and End-of-life, while it is lagging behind for the progress over time in the Extension of useful life and Increase of the intensity of use. **Romania** is in the cluster of **worst performing countries** in all the considered pillars, but it has **improved its performance over the last 5 years** in the Increase of the degree of use, Extension of useful life and End-of-life, while its improvements are below the EU average for Sustainable inputs. **Spain** belongs to the cluster of countries with a **good level of Circular Economy performance**, ranking in the **medium-high cluster on 3 pillars** (Sustainable inputs, End-of-life and Increase of intensity of use) and in the **medium-low cluster for the Extension of useful life pillar**. Spain has improved in Extension of useful life, while the performance over the last 5 years has been modest for other pillars, especially for End-of-life.

5

To assess the interest of companies to invest in the transition towards a circular model, and collect their opinions on the main areas of intervention, an **online survey** has been submitted to **more than 550** European companies. **300** high standing respondents have been surveyed and **95%** of the sample perceives Circular Economy as a pressing priority.

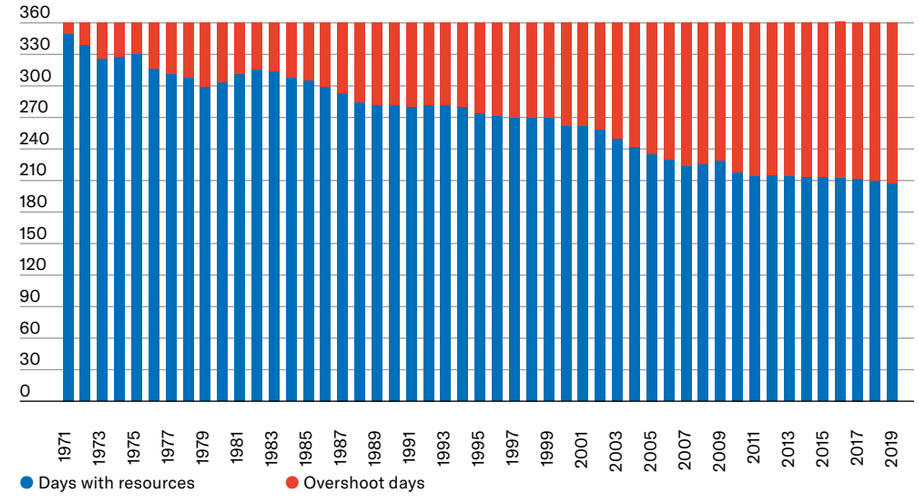
1.1 The reference context of Circular Economy in the European Union

1. The world is facing major challenges. The profound and fast-paced economic, climatic and technological changes are molding society and lifestyles, opening areas of uncertainty and stimulating new needs, including protection and social equality. Within this context, the Covid-19 outbreak has underlined the fragilities of our civilitazion and the **need of a system-oriented project capable of developing a positive vision of the future of the world and**, in particular, **of the European continent**, by catalyzing energy, resources and consent.

2. There is only one planet Earth, yet at the current pace by 2050 humanity will be consuming resources as if there were three. Global consumption of materials such as biomass, fossil fuels, metals and minerals is expected to double in the next forty years, while annual waste generation is projected to increase by 70% by 2050. Population growth, together with urbanization, increase in consumption and industrialization have had a significant impact on the exploitation of resources. Today, the planet **is consuming more resources than it is able to produce**. Last year, **Earth Overshoot Day**[1] was **July 29th**. Since July 30, 2019, resources have been borrowed from the future and, if this pace is maintained, around 2050, in a year, the Earth will consume twice the resources generated during that year. If the world's population lived like the Unites States, 5 Earths would be needed (4.1 considering Australia, 3.2 focusing on Russia).

1 The Earth Overshoot Day is the date in which humanity's demand for natural resources exceeds the quantity of resources the planet Earth is able to generate in that year.

FIG 1 **Overshoot days – number of days per year in which humanity's resource consumption for the year exceeds Earth's capacity to regenerate those resources that year**



Source: The European House – Ambrosetti and Enel Foundation elaboration on Global Footprint Network data, 2019.

3. Within this context, science and innovation are increasingly enabling an historic convergence of decarbonization and competitiveness. A system-oriented project capable of developing a positive vision of the future of the European continent—by catalyzing energy, resources and consensus—is that of **sustainable development**, to provide a response to the growing demands from public opinion requesting concrete action to combat climate change.

4. Although the coronavirus outbreak has changed the reference scenario, it also further underlined the need of a robust, resilient and sustainable economic system. Sustainable development remains a pressing need for the global economy. Short-term, emergency-driven policy approaches adopted to address the crisis have necessarily to be matched with a long-term view capable of fueling sustainable prosperity in the next decades. An approach exclusively based on traditional measures would not only jeopardize our capacity to face similar social, economic and humanitarian shocks that might emerge in the short term, but it would also limit our ability to respond to the key challenge for the future of the planet, the effects of climate change and global warming. Global competitiveness has to make a bounce forward and, in this sense, Circular Economy has to be set as a **reference principle**, since it is a **catalyst for the common good** around which to develop a concrete strategic vision capable of coalescing a broader consensus and guiding policy, organizational and operational choices in the various economic sectors on a global level, through leveraging on the specific features of each single country.

Even – and above all – in the midst of the Coronavirus outbreak, Circular Economy remains a pressing need for the European Union

Paolo Gentiloni, European Commissioner for Economy, in the midst of the health crisis due to the coronavirus outbreak, has declared that the European Green New Deal is alive and kicking. The founding principles of the European Green New Deal will be the pillars on which to rebuild European economies after the crisis. Innovation, digitization, sustainability, and Circular Economy are the backbone of the European recovery plan. To kick-start the European recovery, protect lives, livelihoods and jobs, the European Commission is proposing a major €2,4 trillion recovery plan based on using a powerful and modern EU budget to deliver a more sustainable, digital, and fair Europe. President von der Leyen said: "These investments will not only preserve the outstanding achievements of the last 70 years, but will also ensure that our Union is climate neutral, digital, social and a strong global player. This is Europe's moment."

Source: The European House – Ambrosetti's webinar "Priorities of the European Commission during the coronavirus outbreak", April 4 and EU Commission Recovery Plan for Europe 2020.

5. In the current scenario, it is fundamental to define a "**grand strategy**" for the transition towards a Circular Economy model, shedding light on the **current level of development** and assessing **economic, social and environmental benefits** associated with Circular Economy, while formulating policy recommendations to **successfully manage the transition from a linear to a circular world**.

1.1.1 The international and European policy targets

6. In recent years, a growing number of international institutions and policy makers have put **decarbonization and resilience** at the heart of their political agenda. Decarbonization refers to the reduction of the release of greenhouse gases (GHG) into the earth's atmosphere[2]. GHG emissions generate several negative effects on the overall ecosystem: global warming, food insecurity, natural disasters, extreme poverty and human disease. As a result, the urgency of greater resilience has increased with the aim of enhancing the ability to respond to and recover from a perturbation and turmoil of any type (financial crisis, natural disaster, infrastructure breakdown, etc.), with reduction of negative effects generated by GHG emissions being a key strategic target.

7. Decarbonization and resilience are pivotal for achieving the **17 Sustainable Development Goals** (SDGs), the blueprint to achieve a better and more sustainable future for all introduced in the United Nations 2030 Agenda for Sustainable Development. Through them, the United Nations recognize that ending poverty must go together with strategies that build economic growth and address a range of social needs, including education, health, social protection and job opportunities, while tackling climate change and favoring environmental protection. Although the United Nations Goals are not binding, countries are expected to take action to meet them and to regularly present a progress report of their initiatives.

8. While both Circular Economy and Sustainable Development Goals aim at social and economic prosperity within the natural capacity of our planet, the connections between these two agendas are not immediately obvious. Analyzing the 17 Sustainable Development Goals and the corresponding 169 targets, it emerges that Circular Economy practices can be applied as a **"toolbox" for achieving many of the SDG targets**. For instance, circular practices such as small-scale water purification, sustainable sanitization, waste water treatment, water reuse and recycling, nutrient recovery and biogas systems can help to increase access to safe drinking water and equitable sanitation, reduce pollution and improve water quality (SDG6), while renewable energy systems, including small-scale biomass technologies and second generation biofuels, energy (heat) recovery and improved utilization in industrial systems contribute to the achievement of affordable and clean energy (SDG7). Furthermore, new circular business models are a major potential source of increased resource effectiveness and efficiency, waste valorization and green jobs (SGD8). At the core of Circular Economy practices there is also the aim to restore natural capital (SDG15) and circular practices are all about decoupling economic activity from resource use and associated environmental and social impacts making cities more sustainable, which is also very much at the heart of SDG on **more sustainable cities** (SDG11), **sustainable consumption and production** (SDG12) and **reducing climate change** (SDG13). Importantly, this goal is a significant enabler for achieving most of the other SDGs, making the direct or indirect impact of Circular Economy practices even more profound on all SDGs.

2 The greenhouse effect is the problem caused by increased quantities of gases such as carbon dioxide in the air. These gases trap the heat from the sun and cause a gradual rise in the temperature of the Earth's atmosphere.

FIG 2 **17 United Nations Sustainable Development Goals (SDGs)**

Source: The European House – Ambrosetti and Enel Foundation elaboration on United Nations data, 2019

9. Circular Economy has gained the full attention of the policy debate, especially at the European level. The **New Circular Economy Action Plan** issued in March 2020 represents an important milestone towards the transition. However, there are still some outstanding issues related to Circular Economy, starting from the need to have clearer operational guidelines for the adoption of circular models.

A new Circular Economy Action Plan for a cleaner and more competitive Europe

Issued in March 2020, the European Commission New Circular Economy Action Plan provides a future-oriented agenda for achieving a cleaner and more competitive Europe in co-creation with economic players, consumers, citizens and civil society organizations. It aims at accelerating the transformational change required by the European Green Deal, while building on Circular Economy actions implemented since 2015.

This plan will ensure that the regulatory framework is streamlined and fit for a sustainable future and the new opportunities from the transition are maximized, while minimizing burdens on people and businesses, through initiatives to:

- Make **sustainable products** the norm in the European Union.
- **Empower consumers**: consumers will have access to reliable information on issues such as the reparability and durability of products to help them make environmentally sustainable choices.
- Focus on the **sectors** that use the largest amount of resources and can reap the largest benefits. The Commission will launch concrete actions on the following value chains: electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, and agri-food.
- Ensure **less waste**: the focus will be on avoiding waste altogether and transforming it into high-quality secondary resources that benefit from a well-functioning market for secondary raw materials.

This plan also aims at ensuring that the Circular Economy works for **people** and **regions and cities**, fully contributes to climate neutrality and harnesses the potential of **research**, **innovation, green financing**, **decarbonization** and **digitalization**.

Source: The European House – Ambrosetti and Enel Foundation elaboration on European Commission, 2020.

10. The recent European Green Deal and the related Circular Economy Action Plan set new and more challenging objectives for Europe with regard to the transition to Circular Economy models. Moreover, the Circular Economy development across the EU countries is far from being homogeneous. Some countries, especially in Eastern Europe, are in an embryonic phase of transition and far from best performers like Finland (which established the first national roadmap towards Circular Economy four years ago). As of today, many European countries still **lack a national, well-defined strategic roadmap** for transposing the European directives on Circular Economy at national level.

FIG 3 **The national transposition of European directives on Circular Economy**

Austria
First country to measure the circularity gap

Finland
Finnish roadmap to a Circular Economy (2016-2025)*
An update of the plan was released in 2019 to reform its economic model to ensure successful sustainability

France
French act of law against waste and for Circular Economy

Germany
Resource efficiency program for the sustainable use and conservation of national resources

Greece
National Action Plan on Circular Economy

Italy
Declaration of intent with the Italian Green New Deal**

Luxembourg
National waste and resource management plan

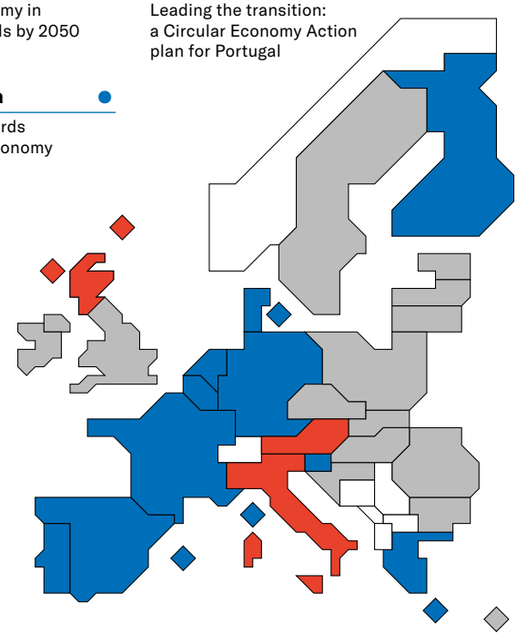
Netherlands
Circular Economy in the Netherlands by 2050

Portugal
Leading the transition: a Circular Economy Action plan for Portugal

Scotland
Circular Economy Strategy for Scotland

Slovenia
Roadmap towards the Circular Economy

Spain
España Circular 2030, a national strategy for Circular Economy in Spain until 2030



(*) It is the world's first national roadmap towards a Circular Economy

(**) The document «Verso un modello di Economia Circolare per l'Italia» was issued by the Italian Ministry of Environment and Ministry of Economic Development in 2017

● National strategy ● Declaration of intent or regional activities ● Neither strategy nor regional activities

Source: The European House – Ambrosetti and Enel Foundation elaboration on European Commission and European Circular Economy Stakeholder Platform, 2020.

1.1.2 The reference context of Circular Economy in Italy, Romania, and Spain

11. Italy has not yet issued a proper Circular Economy roadmap, although some attempts have been made in recent years. In 2017, the Italian Ministry of Environment, together with the Ministry of Economic Development, issued a **declaration of intent related to the Circular Economy** ("*Verso un modello di Economia Circolare per l'Italia*") aimed at providing a strategic Circular Economy framework for Italy. This initial effort was followed in 2018 by a more operational document ("*Economia Circolare ed Uso Efficiente delle Risorse. Indicatori per la misurazione dell'Economia Circolare*") that outlined the importance of mapping and measuring Circular Economy initiatives to achieve concrete results. Moreover, the 2020 Italian Budget Law contains the first measures to implement the "European Green Deal" at the national level. Among the measures, the law establishes **a €4.24 billion fund** designed to finance highly-innovative and environmentally-sustainable projects over the 2020-2030 period.

IT

12. Focusing on Romania, the country is lagging behind in transposing European directives on Circular Economy into a strategic national roadmap to manage the transition, but the Romanian government has taken some major steps forward in recent years. An **institutional committee** on sustainable development, with specific focus on Circular Economy that also involves the Prime Minister was recently established.

RO

13. Spain recently adopted a new national strategy for Circular Economy. At the beginning of June 2020 the Spanish Government published **España Circular 2030**, the **new Strategy for Circular Economy in Spain until 2030**. It contains Circular Economy objectives and a series of strategic orientations for the 2020-2030 period. More specifically, the strategy:

- Sets up a series of objectives for 2020-2030 which will allow a **30%** reduction in the national consumption of resources and a **15%** reduction in waste generation (as compared to 2010 levels).
- Contributes to Spain's efforts to transition to a **sustainable**, **decarbonized**, **resource-efficient** and **competitive economy**.
- Takes the form of **consecutive three-year action plans** providing for concrete measures to deliver on Circular Economy.

ES

14. Given the above, Circular Economy is still evolving in the European Union and in Italy, Spain and Romania. Its operational modes have only been internalized to a limited extent, especially if a system-wide "holistic" approach is adopted as a reference. **Defining and quantifying the operational aspect of Circular Economy** is as crucial as identifying the best ways to exploit it to maximize the benefits for the industrial value chains involved, the environment and society as a whole.

1.2 The Circular Economy Scoreboard for the European Union and Italy, Romania, and Spain

15. To assess the state-of-the-art of Circular Economy in Europe, the dimensions relevant for the introduction of circular models have been analyzed, identifying quantitative metrics comparable for **27 European Union countries** and **United Kingdom**, with a specific focus on three countries of interest (**Italy**, **Romania** and **Spain**).

16. The analysis has been carried out at the **macro level** (country-system level). The macro approach has been reconciled with the micro approach (corporate level) of Enel circular metrics.

Please refer to the **subsection 1.3** of this Part 1 for a detailed explanation of the corresponding aspects of the two approaches.

1.2.1 Methodology of the Circular Economy Scoreboard

17. The Circular Economy Scoreboard has been elaborated using a **multi-level methodology** aimed at providing a comprehensive picture of the circularity level of a country. Therefore, the choice of both the pillars and of the variables included in the scoreboard is driven by the desire to represent Circular Economy as comprehensively as possible. The Circular Economy Scoreboard is developed across four pillars of Circular Economy and it describes the current level of development of the phenomenon in each country under analysis.

18. The **four pillars** comprising the Circular Economy Scoreboard cover all the macro-dimensions characterizing circularity:

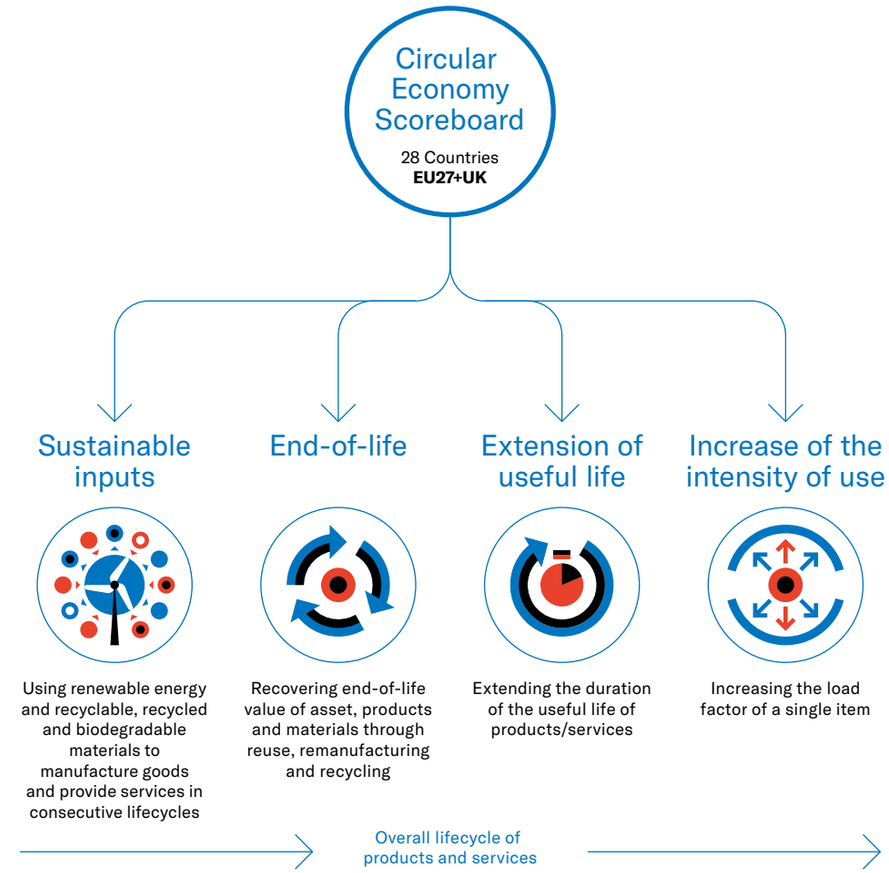
- **Sustainable inputs** captures the use of renewable energy and of recyclable, recycled and biodegradable materials to manufacture goods and provide value in consecutive lifecycles.
- **End-of-life** describes ways of recovering end-of-life value of asset, products and materials through reuse, remanufacturing and recycling.
- **Extension of useful life** reflects the capability of increasing the duration of the useful life, with respect to usual end-of-life of a product or its components.
- **Increase of the intensity of use** rates the increase of the load factor of a single item (for example with product as a service or sharing services models). It measures the increase of the benefit obtainable with each unit of input (material and energy) used.

19. The four pillars are logically - and practically - connected by the "**circular-by-design**" approach, linking the use of sustainable inputs, the extension of the useful life, the management of the end-of-life and the maximization of the intensity of use since the moment a product or a service is conceived.

20. These four pillars have been identified starting from a literature review on Circular Economy and from an in-depth analysis of the main dimensions considered in existing Circular Economy assessment models. Moreover, these pillars are chosen to be **representative of the overall life cycle of products and services**, capturing the production patterns in the first two pillars (Sustainable inputs and End-of-life) and the consumption and usage patterns in the last two pillars (Extension of useful life and Increase of the intensity of use). Finally, it is worth noting that the four pillars of the Circular Economy Scoreboard at macro level match with the micro level (e.g. corporate level) approach of Enel, based on its **CirculAbility Model©**.

Please refer to the **subsection 1.3** of this Part 1 for a detailed explanation of the corresponding aspects of the two approaches.

FIG 4 The structure of the Circular Economy Scoreboard



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

21. It is worth mentioning that Sustainable inputs (and also End-of-life for what concerns waste heat recovery) captures both the material and the energy dimension. Energy is an important enabler of the transition towards circular models. For example, a well-developed waste management system does not capture the full potential benefit of Circular Economy if operations are not powered by renewable energy.

22. Moreover, another important clarification to be made is that because of the lack of precise indicators related to the pillar Increase of the intensity of use, the related KPI selected are enabling factors (such as the use of sharing platforms and services) for the phenomenon, they are meant as a proxy of the intensity of use.

23. To assess the level of development of one country along the four pillars (Sustainable inputs, End-of-life, Extension of useful life and Increase of the intensity of use), **23 Key Performance Indicators** (KPIs) have been identified. The KPIs were identified studying the main international datasets available for all the considered countries with reference to indicators capturing aspects related to the pillars under consideration, while also leveraging the suggestions of the Scientific Committee and from external experts (e.g., Istat, European Commission, Joint Research Centre – JRC and Organisation for Economic Co-operation and Development – OECD).

23 KPIs
and a subset of
10 main indicators

4
pillars

5
years time frame

24. The Circular Economy Scoreboard generates **a unique repository of data** on Circular Economy, with more than 3.000 observations along a 5-year period (from 2014 to 2018), involving the 28 countries analyzed (27 European Union and the United Kingdom). The choice of each single Key Performance Indicator in the final database is guided by the need to provide the best information currently available about the pillar considered, in order to capture the level of development of one country with respect to a specific aspect of Circular Economy considered.

25. The Principal Component Analysis (PCA) statistical technique was used to simplify the dataset without significant loss of information[3]. The PCA therefore allowed to identify a subset of **10 KPIs** from the Circular Economy Scoreboard better representing the **main indicators of Circular Economy** as of to date and considered for the impact assessment model in order to better isolate economic, social and environmental effects of Circular Economy.

Please refer to **Chapter 2** for a detailed explanation of the Principal Component Analysis methodology and for results of the impact assessment model.

26. To rule out the country dimension-bias (i.e., overweighting bigger countries *vis-à-vis* smaller ones), all the KPIs have been **normalized** using the GDP or population depending on the considered KPI.

3 The Principal Component Analysis is a statistical method for reducing data with many dimensions by projecting the data with fewer dimensions using linear combinations of the variables, namely the principal components. The Principal Components represent the directions of the data that explain a maximal amount of variance.

FIG 5 **The Key Performance Indicators of Circular Economy Scoreboard**

Sustainable inputs	**Circular material use rate**	%	Eurostat
	Resource productivity	€ per tonne of material consumption	Eurostat
	Share of total organic area in total utilized agricultural area	%	Eurostat
	Water productivity	€/m³ of water	EEA
	Energy intensity	TOE per thousand Euros	Eurostat
	Share of energy from RES	% of final energy consumption	Eurostat
	Final energy consumption by RES in transport	% of final energy consumption	Eurostat
	Final energy consumption by electricity in manufacturing sector	% of final energy consumption	Eurostat
	Final energy consumption by electricity by households	% of final energy consumption	Eurostat
End-of-life	Packaging waste recycled	%	Eurostat
	Total generation of waste per GDP unit	kg per million Euros	Eurostat
	Industrial waste treated by recycling	% on total industrial waste generated	Eurostat
	Municipal waste treated by recycling	% on total municipal waste generated	Eurostat
	Patents related to recycling and secondary raw material per employees in Circular Economy sectors	patent per employees	Eurostat
	Sewage sludge treated and disposed in agriculture or as compost	% of sewage sludge produced	Eurostat
Extension of useful life	End-of-life vehicles recovered and reused	% of end of vehicles scrapped	Eurostat
	Load factor	tonne-km / vehicle-km	Eurostat
	Value added of retail sale of second-hand goods	Euro per capita	Eurostat
	Employment in repair and reuse sectors	% of total employment	Eurostat
Increase of the intensity of use	**Individuals using any website or app to arrange an accommodation from another individual**	%	Eurostat
	Individuals using dedicated websites or apps to arrange a transport service from another individual	%	Eurostat
	Collective transport on total passenger transport	% of total inland passenger-km	Eurostat
	Individuals using the internet	% of individuals aged 16 to 74 in the last 12 months	Eurostat

N.B.: In **bold** the 10 KPIs that represent the key indicators of Circular Economy. Data are referred to the latest available year (2018).

Source: The European House – Ambrosetti and Enel Foundation elaboration on various sources, 2020.

27. The Circular Economy Scoreboard methodology has led to the creation of **clusters of positioning of different European countries** according to the most frequent positions they hold along the considered pillars. For the definition of the clusters:

- All the 28 countries **have been ranked from 1 to 28** according to their **relative positioning** with respect to minimum and maximum values of the specific KPI considered.
- **Four clusters** (corresponding to the four quartiles) have been identified for each of the four pillars, grouping the best performing countries, the intermediate performing countries, the intermediate-low performing countries and the worst performing countries (i.e., if a country, on average, consistently ranks in the top 7 of all the KPIs in a given pillar, it is considered to belong to the "best performers" cluster for that pillar).
- As for the **missing data**, these have been treated using the unconditional mean imputation methodology, assigning the sample mean of the recorded value to the missing values. These values have been doubled checked with the Joint Research Centre of the European Commission, using expected maximization methodology, which consists in finding the maximum likelihood for model parameters when the dataset is incomplete.
- In particular, the Joint Research Centre of the European Commission double checked the methodological framework of the Circular Economy Scoreboard and contributed with an important methodological refinement for the creation of clusters. More specifically, the use of the **Copeland method** has been suggested for clustering countries. This method consists of a pairwise aggregation of countries that are ordered based on the ultimate sum of all "wins" subtracting all the "defeats" of all pairwise comparisons of one country versus all other countries across the KPIs (within the specific pillar considered).
- This further methodological refinement has been useful and necessary for the **creation of clusters** reflecting properly the performance of countries.

The methodological refinement of the Circular Economy Scoreboard: the Copeland method

The Copeland methodology allows to compare countries in a pairwise way for each specific Key Performance Indicator in each specific dimension. The overall positioning depends on the "wins and losses" of each country along the four pillars. For example Ireland is the best performing country considering all the dimensions: it gets a score of 22 meaning that it is better than 22 countries and worse than 6 in the pairwise comparison between countries.

An adjustment has been made for the scores reported below, namely the total achievable score is 27 (which would mean that a specific country has performed better than all the other countries). Likewise, the minimum score that a country can get is -27, meaning that all other countries are performing better. This is because this methodology considers that a given country, when compared to itself, is neither a winner nor a loser.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Joint Research Centre – JRC data, 2020.

28. With the aim of having a very clear representation of the phenonmenon, besides the creation of clusters (corresponding to the quartiles) a further assessment has lead to the creation of **deciles of positioning**. This was driven by the need to understand whether the countries were concentred around specific deciles. This further representation allows to understand that in some cases countries might belong to the 3rd cluster (intermediate-low performing countries) but being posioned half way in the decile representation meaning that overall in that pillar countries are performing particularly well.

29. In order to measure the performance over time, all the Key Performance Indicators have been analyzed over a **5-year period**. To this end, considering all the KPIs, the variation of every KPI from 2014 to 2018 has been calculated for each European country. The countries were then assigned to different clusters depending on the improvement (or worsening) of their performance in the considered period. As with the Circular Economy Scoreboard related to current performance, four positioning clusters have been created for the variation.

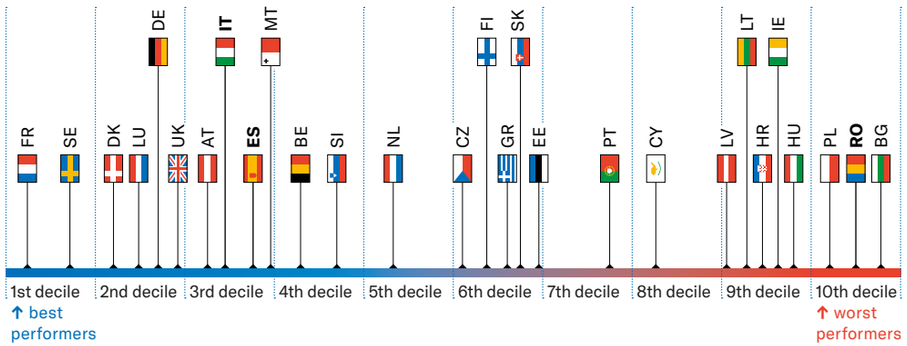
1.2.2 Preliminary results of the Circular Economy Scoreboard

1.2.2.1 Assessment of the current performance of European countries

30. Starting from the **Sustainable inputs** pillar, countries across Europe show very heterogenous performance, as can be seen in Figure 6, with countries distributed along the deciles with a little concentration around the 6th and the last two deciles. Focusing on the three countries under analysis:

- Italy presents good performance in resource productivity (positioned among top performers in the European Union) and in the circular material use rate[4], but it lags behind in water productivity and the percentage of renewables in the transport sector for which it is positioned among the intermediate-low performers.
- Romania is characterized by a good level of share of renewables; however it performs badly in the circular material use rate and in the share of total organic area in total utilized agricultural area, positioning itself in the last decile.
- Spain can count on good resource productivity and on high electrification of households, however it is characterized by low water productivity.

FIG 6 **Circular Economy Scoreboard for the Sustainable inputs pillar for EU27+UK countries**
(deciles based on the score)



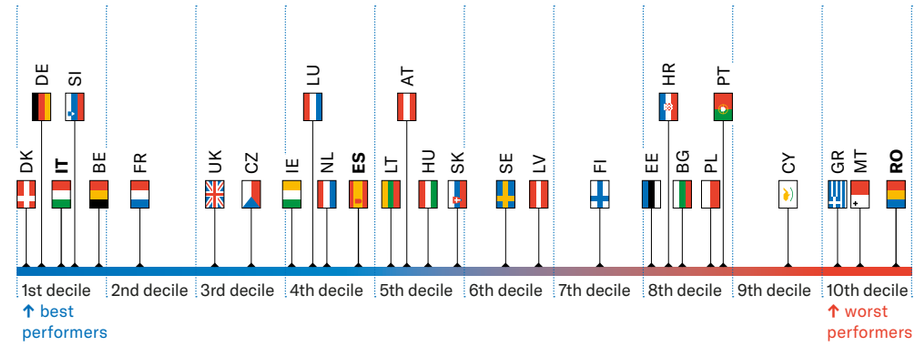
N.B.: Data are referred to the latest available year (2018).
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

4 The circular material use rate measures the share of material recovered and fed back into the economy – making it possible to limit the extraction of primary raw materials – in overall material use.

31. Moving to **End-of-life** pillar, countries are almost homogenously distributed along the ten deciles, as is shown in Figure 7. For the three countries under analysis:

- Italy performs very well in this pillar, in particular for the industrial and municipal waste treated by recycling, however it lags behind with respect to the number of patents related to the recycling sector.
- Romania performs very poorly in all the Key Performance Indicators considered in this pillar, in particular with very high generation of waste with only limited recycling. Its highest ranking is 21st in the packaging waste recycled KPI.
- Spain is characterized by a small quantity of waste generated, however it lags behind in waste treated by recycling.

FIG 7 **Circular Economy Scoreboard for the End-of-life pillar for EU27+UK countries**
(deciles based on the score)



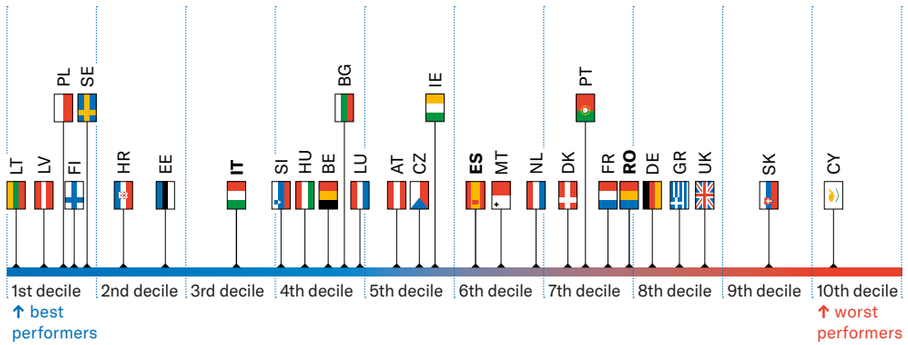
N.B.: Data are referred to the latest available year (2018).
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

32. The third pillar analyzed is the **Extension of useful life.** It is characterized by a concentration of the countries in some deciles (e.g. first and fourth deciles) and none of the considered countries outperforms the others by a distance. **Lithuania** is the best performer in this pillar with a high level of employees in the repair and reuse sectors, while **Cyprus** is at the bottom of the European ranking, positioned among the worst performers in all the KPIs considered with the exception of the employment in repair and reuse sector. However, it is worth poiting out that from the Copeland analysis emerges that the best performing country is better than 16 countries, meaning that most countries do not perform particularly well in this pillar and have an intermediate positioning.

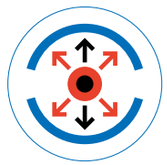
Looking more specifically at the countries under analysis:

- Italy is characterized by high logistic efficiency in the transport sector (high load factors), but it has a low percentage of end-of-life vehicles recovered and reused out of total scrapped vehicles.
- Romania is characterized by efficient transport logistics, but it lags behind in the number of vehicles salvaged and reused among end-of-life vehicles and has a limited number of employees in the repair and reuse sector.
- Spain is characterized by high employment in the repair and reuse sectors, positioned in the second quartile for this KPI, but with low transport system efficiency and, in general, more effort is needed to increase the level of preparedness favoring the transition towards circular models.

FIG 8 **Circular Economy Scoreboard for the Extension of useful life pillar for EU27+UK countries**
(deciles based on the score)



N.B.: Data are referred to the latest available year (2018).
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

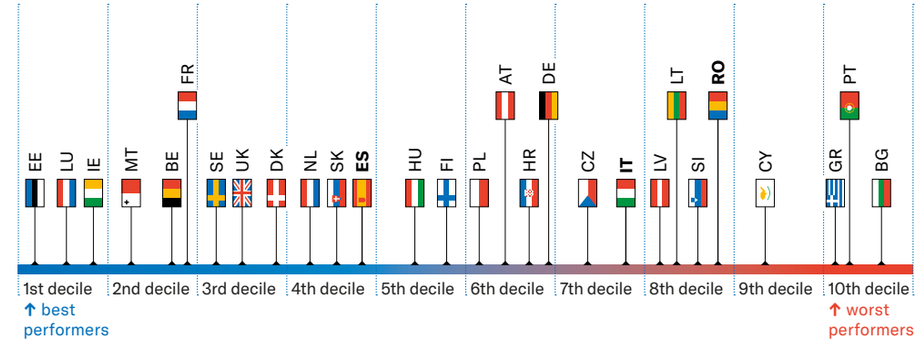


33. Finally, the **Increase of the intensity of use** pillar (that considers the enabling factors that would allow the diffusion of sharing economy and of product as a service approach) shows a very varied picture with a few countries outperforming the rest (**Estonia**, **Luxembourg** and **Ireland**) in the diffusion of a sharing economy culture and usage patterns. Most countries are concentrated in the central deciles, with Bulgaria and Portugal lagging behind (as shown in Figure 9).

Looking more specifically at the three countries analyzed, they perform as follows:

- Italy is characterized by a good share of collective transport in total passenger transport, however, it has a limited number of individuals who use the internet[5] compared to the rest of European countries.
- Romania is characterized by good development of collective transport in total passenger transport, but with a limited usage of the internet by individuals and a limited use of sharing economy services compared to other European countries.
- Spain has a good diffusion of sharing services and individuals using the internet, but limited development in the collective transport as part of overall passenger transport.

FIG 9 **Circular Economy Scoreboard for the Increase of the intensity of use pillar for EU27+UK countries**
(deciles based on the score)

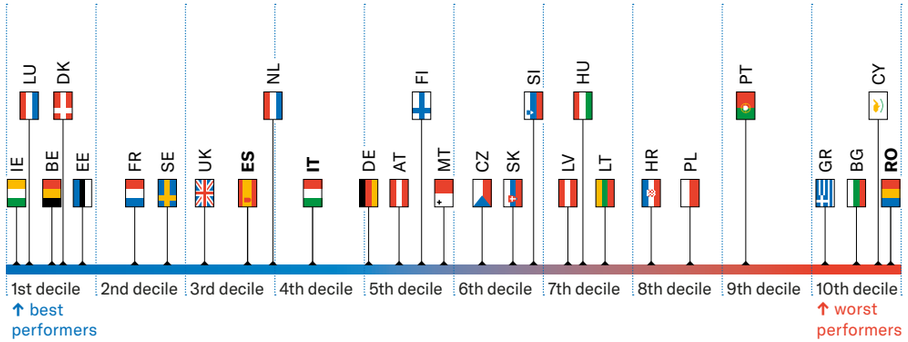


N.B.: Data are referred to the latest available year (2018).
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

34. Finally, a **synoptic view** of the four pillars is provided below. First, it is worth noting that countries are distributed fairly homogenously along all the deciles (with the exception of the 4th and the 9th in which only one country is present). **Italy** and **Spain** show an **intermediate-high level of development of Circular Economy**, while **Romania** is **lagging behind**.

5 This Key Performance Indicator measures the percentage of individuals between 16 and 74 years of age using the internet in the last 12 months of observation.

FIG 10 **Synoptic view of the EU27+UK countries in the Circular Economy Scoreboard**
(deciles based on the score)

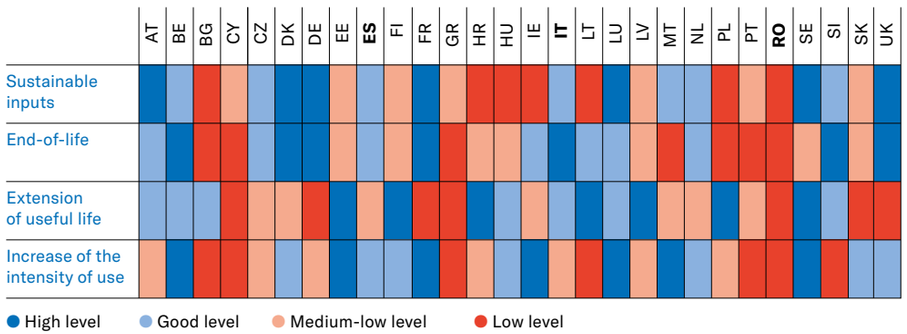


N.B.: Data are referred to the latest available year (2018).
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

35. Analyzing the three countries of interest, it is possible to observe that:

- Italy belongs to the cluster of **best performers** for End-of-life, while it belongs to the **intermediate-high clusters** Sustainable inputs and for Extension of useful life for the (medium-high), while much **more effort is needed** to improve the performance on the Increase of the intensity of use of products/services.
- Romania is in the cluster of **worst performing countries in all the pillars**.
- Spain belongs to the cluster of countries with a good level of preparedness towards Circular Economy, with three pillars (Sustainable inputs, End-of-life and Increase of the intensity of use) in the **medium high cluster** of positioning and the pillar Extension of useful life in the **medium low** part of the European ranking.

FIG 11 **Synoptic view of the European (EU27+UK) countries in the Circular Economy Scoreboard**
(clusters of positionings)



N.B.: Data are referred to the latest available year (2018).
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

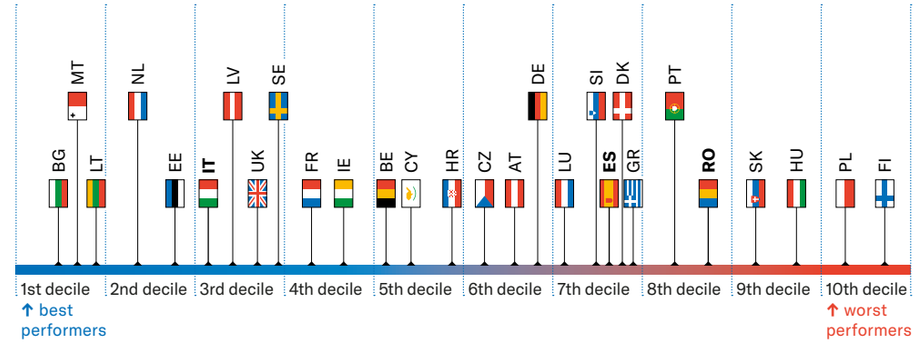
1.2.2.2 Assessment of the evolution of European countries over time

36. The **progress** of European countries over time (**5-year** time frame) has also been considered, measured by the variation of the level of development of each country, which creates different clusters of countries by performance quartiles for the various clusters.

37. Starting from the **Sustainable inputs** pillar, on average, countries show a moderate improvement with some countries performing particularly well (e.g., Bulgaria which has improved significantly the circular material use rate and has reduced the final energy intensity) and others that, because of a very high starting point 5 years ago, have slowed progress (e.g. Finland). As for the three paradigmatic countries:

- Italy has improved significantly in the circular material use rate and has seen an increase of more sustainable agricultural production patterns.
- Romania shows good improvement compared to 5 years ago in energy intensity use.
- Spain shows significant improvement in resource productivity and electrification of the manufacturing sector.

FIG 12 **Progress in the Circular Economy Scoreboard for the Sustainable inputs pillar for EU27+UK countries, over the period 2014-2018**
(deciles based on the score)

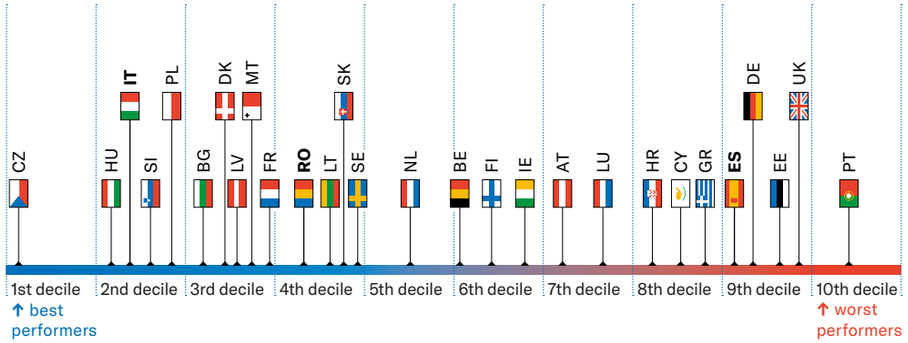


Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

38. Moving to the second pillar, **End-of-life**, and looking at the three paradigmatic countries we can observe that:

- Italy shows major improvement over the last five years in recycled waste treatment.
- Romania has significantly reduced industrial generation of waste and improved packaging recycling.
- Spain shows intermediate improvement in the municipal recycled waste treatment and recycled packaging waste.

FIG 13 **Progress in the Circular Economy Scoreboard for the End-of-life pillar for EU27+UK countries, over the period 2014-2018** (deciles based on score)

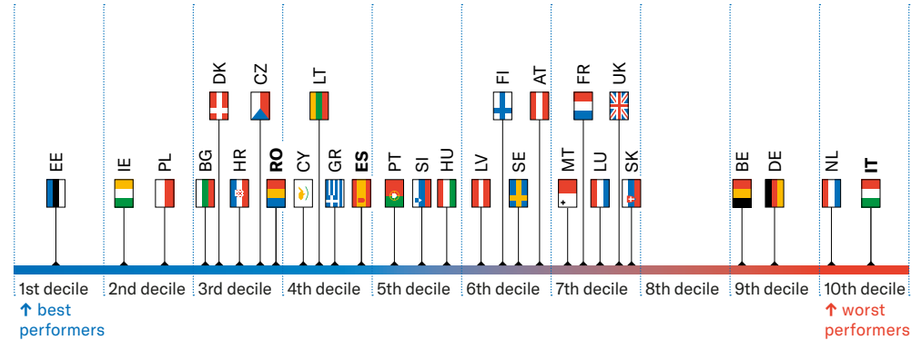


Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

39. As for the third pillar, **Extension of useful life**, countries are evenly distributed. Estonia is the best performer with a significant increase in the value added of second-hand goods and an in the load factor. Looking at the three countries under analysis:

- Italy has improved its performance very moderately with an increase in the value added of second-hand goods, while it has slowed the progress in other dimensions considered thus ending up in the last position. Looking at the Copeland score determining the positioning, Italy scores worse than 24 countries, meaning that in general other countries perform better and none of the countries is performing particularly bad and distanced.
- Romania has increased the number of end-of-life vehicles reused.
- Spain shows an increase in the number of people employed in the repair and reuse sectors.

FIG 14 **Progress in the Circular Economy Scoreboard for the Extension of useful life pillar for EU27+UK countries, over the period 2014-2018** (deciles based on score)

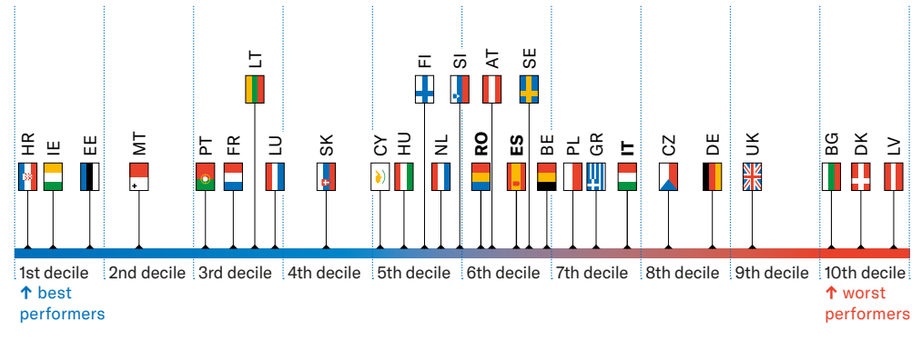


Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

40. As for the fourth pillar, **Increase of the intensity of use** (measured as the enabling factors that favor the diffusion of sharing economy and product as a service models), countries are spread across all the deciles, but with **high concentration in the 6th decile** where Spain is also positioned. Croatia is the best performer with a significant increase in internet use (considered as an enabler of sharing economy services both for transport and accommodation). Looking at the three countries under analysis:

- Italy has increased the number of people using the internet regularly and, as a result, also shows a moderate improvement in the usage of sharing economy services.
- Romania has increased significantly the number of people using the internet.
- Spain shows a relevant improvement in the diffusion of the use of the internet.

FIG 15 **Progress in the Circular Economy Scoreboard for the Increase of the intensity of use pillar for EU27+UK, over the period 2014-2018 countries** (deciles based on score)

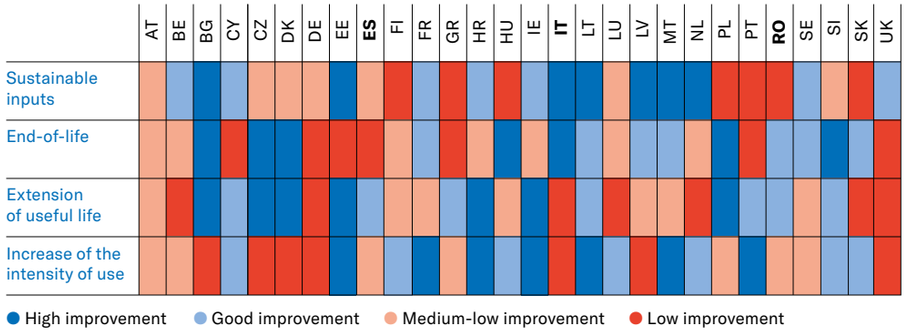


Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

41. Figure 16 summarizes the positioning of the countries in the four clusters (Circular Economy Scoreboard regarding progress).

- Countries that have significantly improved their performances compared to the past (1st quartile, colored dark blue in the chart below).
- Countries that have improved over time but at a slower pace (2nd quartile, colored light blue in the chart below).
- Countries that are moving towards the Circular Economy below the EU average (3rd quartile, colored in pink).
- Countries that are moving towards the Circular Economy much slower than the EU average (4th quartile, colored in red).

FIG 16 **Synoptic view of the progress in the Circular Economy Scoreboard for EU27+UK countries over the period 2014-2018** (clusters of positionings)

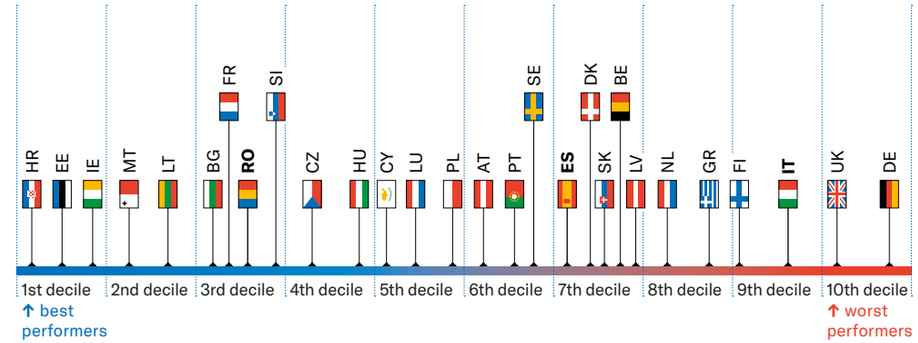


Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

42. A synoptic view of the progress along the four pillars is provided below with countries appearing in all deciles. Overall, **Spain** and **Romania** have shown **an intermediate improvement** over the last 5 years, while **Italy** has displayed **a medium-low level of progress**. More specifically:

- Compared to 5 years ago, Italy shows **significant improvement regarding Sustainable inputs and End-of-life** (which measures among other the recycling rate of municipal and industrial waste), while it is **lagging behind in terms of** progress over time in the **Extension of useful life** and **Increase of the intensity of use**.
- Romania has **improved its performance** over time in the **Extension of useful life** and **End-of-life**, while its improvement is relatively slow **for Increase of the intensity of use** and it is **much below the EU average for Sustainable inputs**.
- Spain has improved its performance over time in the **Extension of useful life**, it has shown a **medium-low progress** for the **Sustainable inputs** and **Increase of the Intensity of use**, while it has displayed a **low level of improvement** for the **End-of-life pillar**.

FIG 17 **Synoptic view of the progress in the Circular Economy Scoreboard for EU27+UK countries over the period 2014-2018** (deciles of based on score)



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

A point of attention: the performance of Eastern European Countries

Eastern European countries are showing great interest towards Circular Economy, with an increase of initiatives supporting the shift towards Circular models launched at national, local and regional level in Eastern Europe.

Eastern European Countries have a very varied performance along the pillars considered. In particular:

- As far as **Sustainable Inputs** are concerned Eastern European countries currently show an intermediate performance that however is the result of **significant efforts** in the last five years. These have driven relevant improvements, starting from the electrification of the manufacturing sector and the diffusion of organic farming.
- Analysing the **End-of-life** pillar, Eastern European Countries perform particularly well in industrial waste treated by recycling and in the recycling sector these countries have registered the **most significant improvements** both in the industrial and in the municipal waste treated by recycling.
- In the **Extension of useful life** pillar, Eastern European countries are not performing particularly well (with the exception of the KPI End-of-life vehicles recycled and reused) and even the progress over time is not significant.
- Finally, looking at the **Increase of the intensity of use**, the considered countries show a **moderate spread of sharing economy** services that have however **improved compared to 5 years ago**. It is worth pointing out the performance of Croatia in this pillar that has registered important improvements along all the variables considered.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Circular Economy Scoreboard data, 2020.

1.2.2.3 Comprehensive assessment of the current level and of the evolution over time of European countries

43. To provide a comprehensive description of the phenomenon, the **current state-of-the-art** of Circular Economy and the **progress** over time have been **combined**. Interesting considerations can be drawn from the combination of these two aspects.

44. More specifically, looking at the **Sustainable inputs** pillar, starting from a differentiated level of development of Circular Economy to-date, with the outstanding performance of France and Sweden, the overall improvement over the last 5 years is moderate. This kind of progress could be explained by the **significant resources, in terms of investments, assets and competences, required in the manufacturing sector to make it circular** and improve the level of circularity in the use of energy, also in light of the evolution of the European legislative framework.

45. As far as **End-of-life** is concerned, the current performance of European countries is more concentrated in **medium-high/high deciles**. This is a result of the **efforts deployed over the last 5 years** that have led to significant improvements in the amount of waste recycled (both industrial and municipal) and use of recycled packaging.

FIG 18 **Comparison between the score of the Circular Economy Scoreboard (x-axis) and the Circular Economy Scoreboard-progress (y-axis) for the Sustainable inputs pillar, over the period 2014-2018**

Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

FIG 19 **Comparison between the score of the Circular Economy Scoreboard (x-axis) and the Circular Economy Scoreboard-progress (y-axis) for the End-of-life pillar, over the period 2014-2018**

Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

46. European countries start from a very differentiated positioning in the **Extension of useful life pillar**, as a result of differentiated past efforts that have heterogenously affected awareness of the importance of the repair and reuse sector and extended the use of products/services over their lifecycles.

FIG 20 **Comparison between the score of the Circular Economy Scoreboard (x-axis) and the Circular Economy Scoreboard-progress (y-axis) for the Extension of useful life pillar, over the period 2014-2018**

Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

47. Focusing on **Increase of the intensity of use pillar**, EU countries are characterized by a very heterogenous performance to date and many of the KPIs in this dimension (e.g. use of internet, shared mobility, etc.) require a medium-long time frame for displaying their effects. In addition, the increase of the degree of use of products/services has recently risen as a key component of Circular Economy.

FIG 21 **Comparison between the score of the Circular Economy Scoreboard (x-axis) and the Circular Economy Scoreboard-progress (y-axis) for the Increase of the intensity of use pillar, over the period 2014-2018**

Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

1.3 The metrics for measuring Circular Economy at micro level

48. The previous chapter presented a Circular Economy Scoreboard model at macro level, aimed at evaluating the state-of-the-art of Circular Economy at a country system level in a comprehensive and complete way. However, the macro level results are the compound outcome of each initiative and practice carried out at the **micro level**. Several initiatives have been undertaken by companies and private entities to monitor their efforts towards Circular Economy, compensating for the lack of uniform metrics and standards at a national and European level. These attempts have in common the awareness that setting goals and measuring performance over time is the starting point for successfully managing the transition from a linear to a circular development paradigm.

49. Circularity raises multiple questions for industry, including waste management, consumer behavior, corporate responsibility and decarbonization. The challenge is to move from a Circular Economy vision to a **viable and sustainable business model**. While circularity provides a framework to potentially reduce corporate environmental footprints, it takes sound measurement with a Life Cycle Assessment (LCA) methodology to guide companies to prioritize and analyze the effectiveness of their efforts. Businesses are still developing relevant circularity performance indicators. They tend to focus on the impact of end-of-life processes, considering for example how much they recycle and the portion of their products that is in fact recyclable. The result is a diversity of scientific considerations, which currently does not allow for aggregation in a single metric.

50. Among these attempts, it is certainly worth mentioning the **approach developed by Enel[6] to measure circularity at micro level**, which can be accessed by all companies and public bodies wishing to have a reference for the assessment of their degree of circularity in relation to a specific asset or product considered. This model is based on the **CirculAbility Model© approach** developed by Enel[7], which has introduced the five dimensions below and draw the global attention on the theme of Circular Economy. To assess the effective implementation of Circular Economy practices, additional tools were developed which go beyond the assessment and evaluation of a product and tackle the challenge of Circular Economy both at corporate and at public administration level. In particular the tools developed are the Circular Economy Corporate Index, the Circular Energy Site Score and the Circular my City Score.

For further information on Enel CirculAbility Model© please refer to

51. The CirculAbility Model© provides an overall circularity index that sums up two aspects: **circular flow** (describing the circularity in the overall flow of materials and energy) and **circularity use** (representing the circularity in the use approach).

52. The methodological approach proposed by Enel brings together several aspects promoting an economic business model that fosters sustainable solutions (for example considering the use of renewables and the use of recycled material). It takes into account **five pillars** of the Circular Economy that resemble the different phases of a product life cycle:

1. **Sustainable inputs**: using renewable energy and renewable, recyclable or biodegradable materials in consecutive lifecycles.
2. **Life extension**: design and production involving extension of the product lifecycle by companies, by recovering value from repair, updating, regeneration and remarketing of products.
3. **Product as a service**: offering clients other services related to products (training, assistance, etc.) or in which customers buy the product in the form of a service from the seller (car sharing).
4. **Sharing platform**: promoting the use of a platform for collaboration among assets users.
5. **End-of-life**: creating production and consumption systems that preserve the end-of-life value of products and where assets previously regarded as waste are reused as input for new processes.

53. Furthermore, Enel analysis follows **five key dimensions**, which measure the level of circularity along the entire value chain:

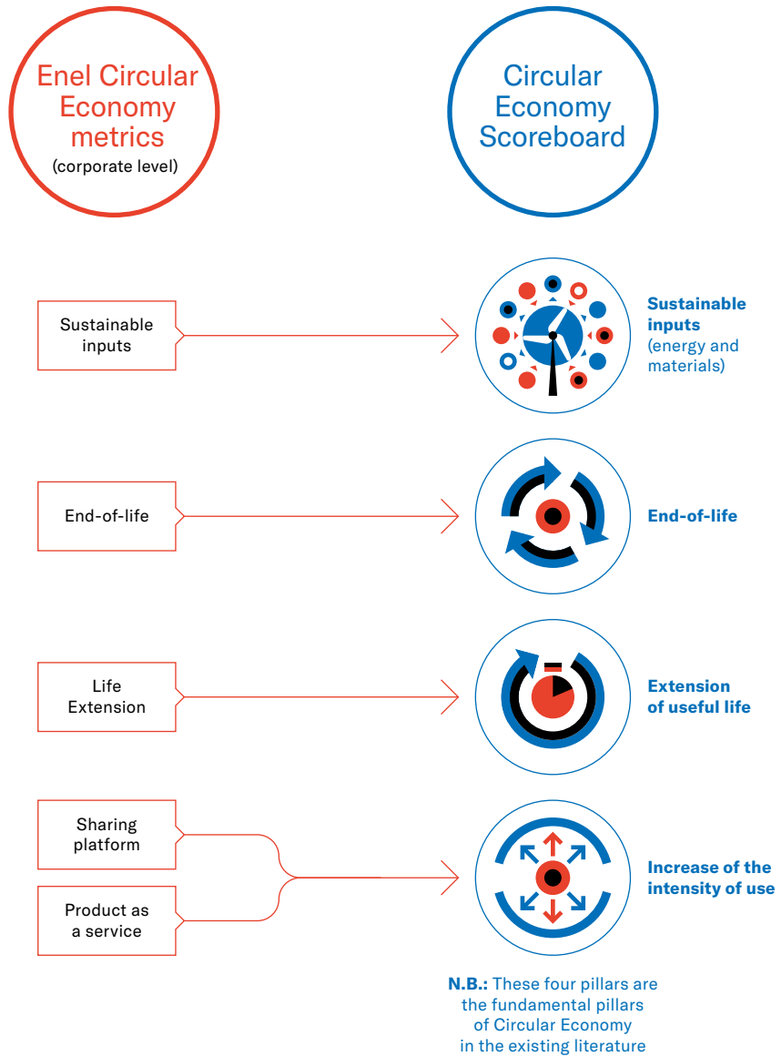
- **Commitment of suppliers** to Circular Economy principles in the creation of the products and services used in the solution.
- Presence of **elements that facilitate the circular consumption model** and incentivize its full use and reuse, thereby increasing the life cycle of the product.
- **Benchmarking best practices** and programs to increase efficiency in the use of resources and in the phases of installation and maintenance.
- **Managing the end-of-life** of individual products with innovative and sustainable methods for recovering materials.
- Encouraging and supporting the **development of environmental** awareness for clients and the **involvement of suppliers** in virtuous mechanisms to improve the performance and the environmental impact of the products and services offered.

The model is articulated in order to be applicable to different specific sectors (e.g., manufacturing companies, service companies and public administration), leveraging on *ad hoc* key performance indicators.

6 Through its subsidiary Enel-X.
7 Please refer to https://corporate.enel.it/en/circular-economy-sustainable-future/performance-indicators for further information on Enel Circulability Model©.

54. The micro approach of Enel and the macro approach provided by the Circular Economy Scoreboard have been reconciled by **pairing the pillars of Circular Economy considered at macro level with those at the micro level**. The micro and macro approach match perfectly to provide a **uniform representation** to different stakeholders. This would allow all private and public bodies to refer to a common and shared scheme and to define the measurement parameters according to the specific needs of their business and sector of reference.

FIG 22 **Reconciliation of Enel dimensions of Circular Economy with the Circular Economy Scoreboard pillars**



Source: The European House – Ambrosetti and Enel Foundation elaboration on Enel data, 2020.

55. The dimensions embrace a complete representation of Circular Economy dealing with production and consumption patterns along the entire value chain of products and services. The two levels of analysis complement each other, providing, on one side, a representation of the phenomenon relative to a specific production chain and, on the other, a comprehensive representation of the phenomenon at system level. More specifically:

- The **Sustainable inputs** pillar captures the use of renewable solutions and inputs at micro level, while it measures using of renewable energy and recyclable, recycled and biodegradable material to manufacture goods and provide services in consecutive lifecycles at macro level.
- The **End-of-life pillar** measures ways of recovering end-of-life value of asset product and materials, both at micro and macro level.
- The **Extension of useful life**, in both approaches, promote the extension of the duration of products and/or services useful life.
- The **Increase of the intensity of use** pillar of the macro approach reconciles the sharing platform and the product as service dimensions of Enel, as both of these micro dimensions represent alternative ways to increase the load factor of a single item.

56. The match between the micro and macro approach has been useful also to assess the overall representativeness of the chosen metrics. The pillars identified and the Key Performance Indicators used capture the **entire life cycle of products and services**, at business level and at country-system level. Both levels of analysis promote sustainable production and consumption models: while the micro approach refers to the corporate level, the macro approach analyzes the system/industrial level thus encompassing the entire life cycle of products and services.

Two examples of circularity at micro level: Demand Response and digitalized networks

Among the examples of circularity, it is worth mentioning **Demand Response** as a complete circular product/service and **digitalized networks**.

These services enable sustainable development and circularity of the overall electric system and favor:

- The penetration of renewables in electric systems.
- An increase of the intensity of use of machineries and tools (e.g. by reducing the need to have generation plants for peak hours running for just short periods).

More specifically, Demand Response changes the power consumption patterns inducing a **better match between the demand and supply sides**. Demand Response enhances Circular Economy opportunities from the demand side by enabling end-users to adjust their normal consumption behaviors to price signals or grid signals. Through signaling, it is possible to adapt electricity use in the system to market prices or to system stress. It represents an example of Circular Economy because it tackles energy efficiency (in particular promoting the integration of renewable energy sources) opportunities by reducing carbon dioxide emissions and promoting the diffusion of new consumption behaviors based on enhanced consumer awareness.

Demand Response affects different dimensions of Circular Economy, in particular:

- As far as the pillar **Sustainable inputs** is concerned, Demand Response favors the integration of renewable energy sources by tackling the grid intermittencies problems. Moreover, through the use of smart meters, it would allow to reduce the renewable energy generation curtailment during peak hours.
- As far as the **Increase of the intensity of use** (sharing economy) is concerned, Demand Response (in the more sophisticated forms) allows for the creation of a collaborative platform that favors energy sharing among end-users, but in general it favors the optimization of already existing assets.

Focusing on digitalized networks (i.e. smart grids), they are crucial for both the integration of renewables in the energy system and to enable advanced services like, as seen above, Demand Response, or vehicle to grid, a model where the electric batteries of vehicles connected to the rechargers are digitally managed and used to provide valuable network services.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Enel data, 2020.

1.4 The perception of the business community on Circular Economy

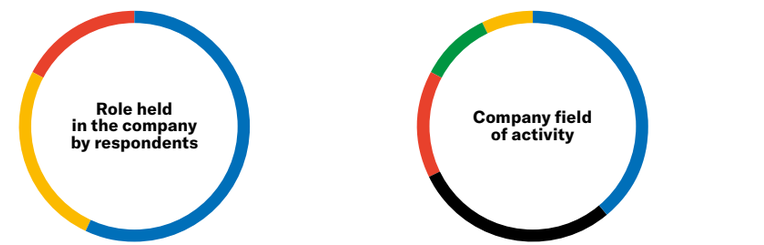
57. To assess the opinion of European business leaders about Circular Economy, an **online survey** has been implemented for the business community in the EU27+UK, with a specific focus on the countries of interest. The aim of the survey is threefold:

- Assessing the interest of companies to **invest** in the transition towards a circular model.
- Collecting companies' opinion on the **main areas of intervention** for the development of Circular Economy.
- Detecting expectations about **future growth prospects** and **priorities for policymakers**.

The survey request was sent to **more than 550** Italian and European members of the The European House – Ambrosetti Club, CEOs of the Spanish network of The European House – Ambrosetti and the network of small and medium enterprises, partners of Ecopreneur.eu (European Sustainable Business Federation), in the period between the end of March and the beginning of June, in the midst of the Coronavirus outbreak.

58. About **300 business leaders** filled out the survey: **57%** of them are top managers (Presidents, CEOs or General Manager), while **26%** held the role of Head of Sustainability or Circular Economy Manager. Among the respondents, **39%** works in the service sector, **29%** in manufacturing, **15%** in energy-related sectors, **7%** in retail or wholesale and the remaining **10%** in other sectors.

FIG 23 **Role held in the company by respondents – on the left and company field of activity – on the right, 2020**
(% values)



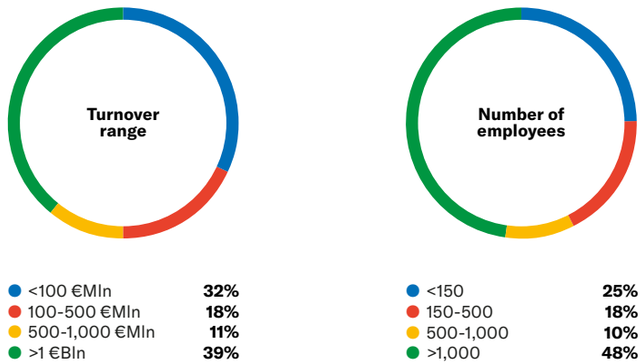
Top management (President, CEO or Director General)	57%	Services	39%
Head of Sustainability/Circular Economy Manager	26%	Manufacturing	29%
Other*	17%	Energy	15%
		Other	10%
		Retail or wholesale	7%

(*) C-level executives and Members of the Board

Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

The interviewed companies represent a total turnover of around **€1,800 billion**. The sample consists predominantly of large companies: **39%** of them generate a turnover of over €1 billion and **48%** of the surveyed companies employ more than 1,000 individuals. The online survey on Circular Economy does not claim to be statistically significant, but it does provide a significant picture of the willingness of companies to invest in the transition towards Circular Economy and their opinion on the main stumbling blocks and priorities for policymakers.

FIG 24 **Turnover range – on the left – and number of employees – on the right, 2020**
(% values)

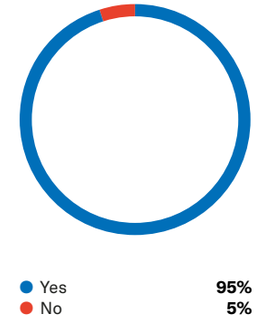


Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

59. As mentioned previously, the Circular Economy survey was completed **during the Coronavirus outbreak**, thus interpretation of the responses must take into consideration potential impacts of the economic crisis on respondents sentiment regarding Circular Economy (uncertainty about the future, reticence in making investments, setting new priorities etc.). In this sub-section, where relevant, the results from the **focus on European small and medium enterprises** (SMEs) will be highlighted. Although they represent a special case, they are at the same time the backbone of the economy for many EU Member States (including Italy).

60. The first significant result of the survey is that Circular Economy is a **strategic priority for European business leaders**, despite the economic and health downturn Europe is experiencing. In fact, **95%** of European business leaders consider the shift from linear to circular models in the production and/or delivery of services as a strategic choice for their company. For SMEs, Circular Economy is also a priority: **90%** of them consider it a strategic choice for their business.

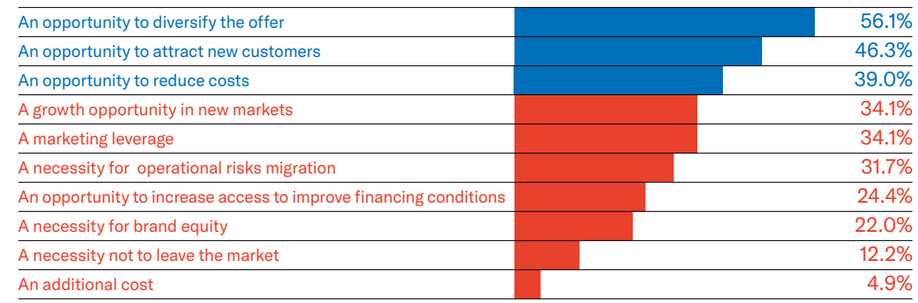
FIG 25 **Response to the question "Is it strategic for your company to shift from linear to circular models in the production and/or delivery of services?", 2020**
(% values)



Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

61. Circular Economy is considered a tool to **gain competitive advantage** for **diversification**, **market expansion** and **cost reduction**. Asking survey participants what the Circular Economy represents for their business, the following three answers were the most frequent: an opportunity to diversify their offer (**56.1%**), an opportunity to attract new customers (**46.3%**) and an opportunity to reduce costs (**39.0%**). It is also worth mentioning that only **4.9%** of respondents consider Circular Economy as an additional cost for their company. These results are in line with the SME focus group, with the exception of the opinion regarding cost reduction, which was selected by **17.9%** of respondents.

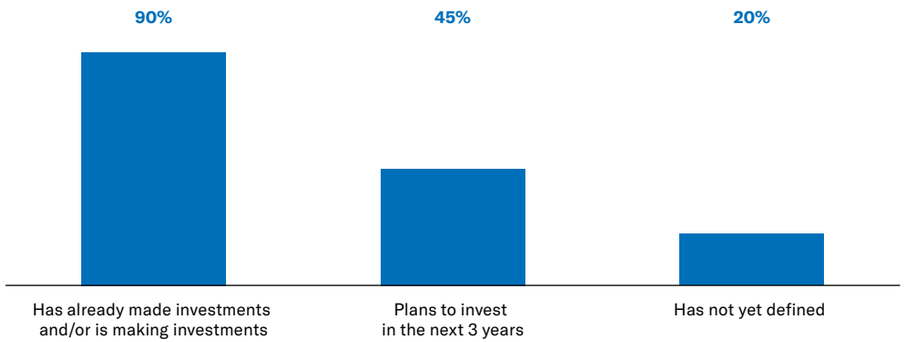
FIG 26 **Response to the question "Circular Economy represents for your company...", 2020**
(% values – multiple choices allowed)



Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

62. To assess the degree of commitment of the companies interviewed in the transition from linear to circular models, their willingness to make investments in this field has been analyzed. The survey shows that **90%** European companies are making or have already made investments in Circular Economy, investing on average **3%** of their turnover in this field. Moreover, **45%** of European business leaders plan to invest in Circular Economy in the next three years. Again regarding the future, the survey shows that **86%** of European companies intend to increase investment in Circular Economy in the next 5 years and none of the surveyed companies foresees a reduction in Circular Economy investment. This is a significant result if the fact that business leaders are facing a severe economic shock within an uncertain scenario is taken into consideration. However, looking at the sectors in which respondents operate, the financial sector seems to be below the sample average on the investment side to-date. In fact, only **57%** of financial companies have already invested or are investing in Circular Economy.

FIG 27 **Response the question "With reference to Circular Economy, your Company...", 2020**
(% values – multiple choices allowed)

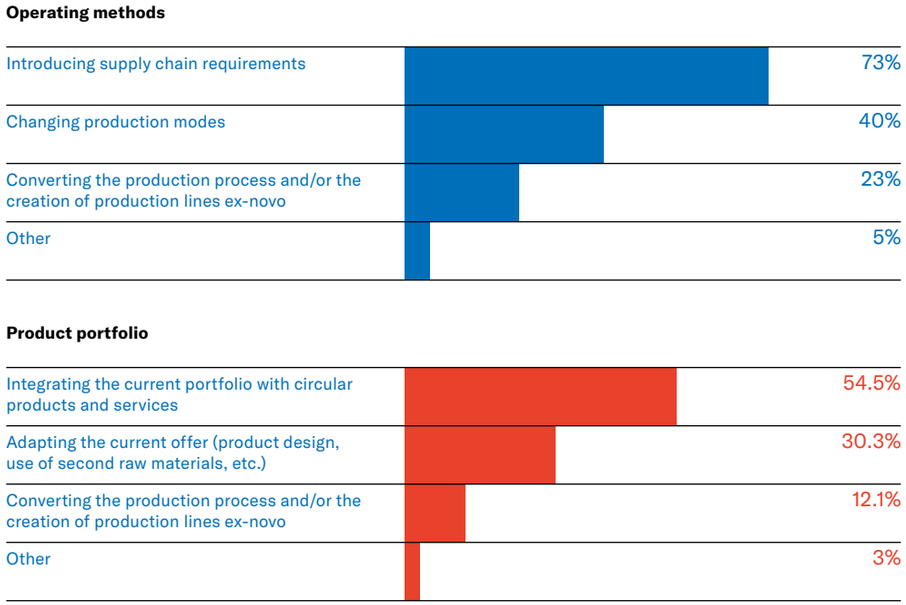


Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

63. European companies – including SMEs – have invested for the transition from a linear to a circular model, that also involved changes in the production processes. However, survey respondents declare that their companies have undertaken mostly **non-pervasive interventions**. For example, when asked about the operating methods adopted to guarantee Circular Economy models, **73%** of respondents stated that new requirements had been introduced in the supply chain, such as the use of recycled materials, increased use of renewable energy, management of expired materials and increased transparency and traceability along the value chain. To the same question, only **40%** replied that they had changed production modes and only **23%** said they had converted processes or created new production lines. This result holds especially for SMEs, where the percentage of respondends declaring that new requirements had been introduced in the supply chain rose to **95%**, highlighting their particular difficulty in undertaking major changes in their business models to meet Circular Economy requirements.

64. The risk aversion of companies towards Circular Economy can also be seen in the changes made to the supplier portfolio. In this case, the most frequent action for the transition to circular models is to integrate what they offer with circular products and services (**55%** of responses). These products and services are typically characterized by new design, greater multifunctionality and an extended lifespan. Also in this case, a lower percetange of companies have undertaken more pervasive interventions, such as the adaptation of the current offer (**30%**) and full conversion of the portfolio (**only 5%**). It therefore seems that European companies have not completely internalized the concept of circularity in the design and production of products and services they offer, preferring the inclusion of specific elements of sustainability rather than the rethinking of their business model or the design of their products/services. This is also evident looking at their opinion on the future perspective of their offer model: **46.7%** of respondents intend to adapt their offer models in order to recover value from product disposal. This could indicate a widespread tendency to associate Circular Economy with waste management practices, which is the only field of Circular Economy that has been subject to regulation and standard definition.

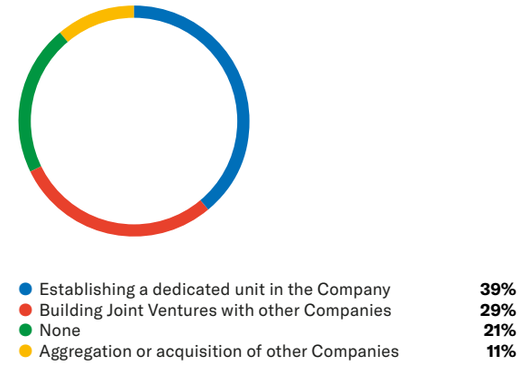
FIG 28 **Top: Response to the question "What operating methods does your company plan to develop to offer products and/or solutions for Circular Economy?", 2020** (% values – multiple choices allowed)
Bottom: Response to the question "With reference to your company's product portfolio, what prospects do you see for the immediate future related to Circular Economy?", 2020 (% values)



Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

65. In terms of organizational structure, it is worth mentioning that **39%** of European companies have established a **unit dedicated to Circular Economy**, while **29%** of them have built joint ventures with other companies in order to acquire additional expertise on Circular Economy.

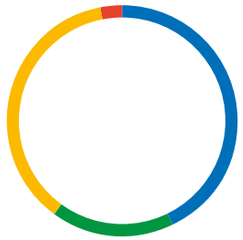
FIG 29 **Response to the question "What organizational changes has your company carried out (or intends carrying out) for the development and/or marketing of products, solutions and operating models for Circular Economy?", 2020** (% values)



Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

66. Evidences described above show that companies are entering the world of Circular Economy, albeit only through non-pervasive interventions on business models. For this reason, it is not surprising that about **60%** of business leaders consider their company ready to adopt Circular Economy models (**43%** of companies are already active in Circular Economy while **17%** judge themselves ready to convert to circular models). On the other hand, **37%** of business leaders think that their companies are partially unprepared to adopt changes for Circular Economy.

FIG 30 **Response to the question "Overall, how do you judge your company's level of preparation to develop and succeed in converting towards circular models?", 2020** (% values)



60%
of European companies are already active in Circular Economy or are ready to enter the industry

Already active	43%
Ready	17%
Partially unprepared	37%
Do not know	3%

Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

67. However, most European business leaders **judge their countries unprepared** to face the Circular Economy challenge. Focusing on Italy and Spain, respectively, **62%** and **69%** of respondents think their country is not ready for Circular Economy, compared to an EU average of 75%. Moreover, **77%** of Italian and **84%** of Spanish business leaders consider the level of information provided to companies related to the challenges and opportunities associated with Circular Economy to be low. Looking at Romania, however, the percentages are much higher: **90%** of respondents judge their country unprepared to face Circular Economy challenge and **93%** of them consider the level of information provided to companies to be low. As far as European SMEs are concerned, the percentage of business leaders who consider the level of information received on the challenges and opportunites associated with Circular Economy to be low, rises to **95%**.

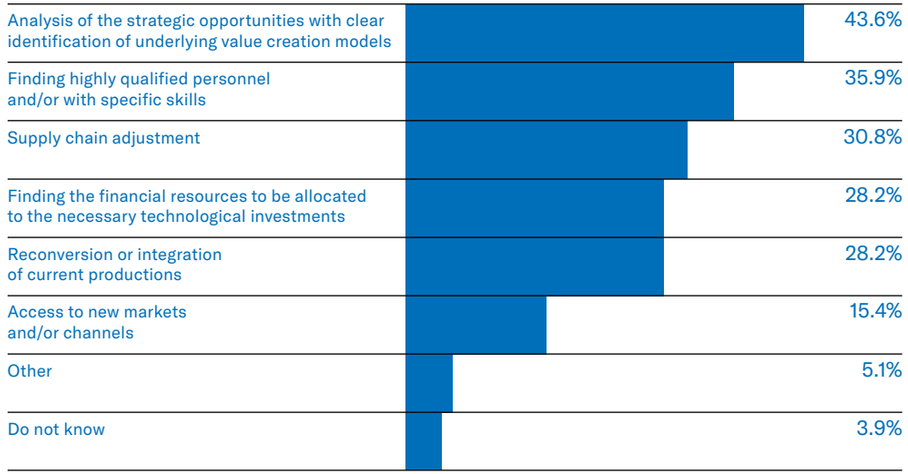
FIG 31 **Response to the question "How do you consider the level of information provided to companies related to the challenges and opportunities associated to Circular Economy?" in Italy, Spain and the rest of the EU, 2020** (% values)

High	23%	High	16%	High	11%
Low	77%	Low	84%	Low	89%

N.B.: There is no detailed breakdown for Romania due to the limited number of responses from Romanian participants to this survey question.
Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

68. The level of unpreparedness of the surrounding ecosystem also affects the obstacles perceived by business leaders to the development of Circular Economy. In fact, according to European business leaders, **uncertainty about value creation** (**43.6%** of responses) and **lack of skills** (**35.9%**) are the first two stumbling blocks to the development of Circular Economy in Europe. In Italy, 46.1% of respondents think that companies face the skill gap as a first obstacle to the deployment of Circular Economy models. The required **changes to the production chain** are also perceived by about **31%** of respondents as an obstacle to Circular Economy in Europe. Also because of their nature, for **55%** of European SMEs the most urgent area of intervention for the transition to Circular Economy is the access to new markets and/or new channels. These fears have in common some recurring micro-factors: uncertainty about access to financial resources and return on investment, lack of adequate university courses and skills both within the company and along the supply chain, and inadequate information on regulatory measures.

FIG 32 **Response to the question "What are the most urgent areas of action for your company to encourage the transition to circular models?", 2020**
(% values - multiple choices allowed)



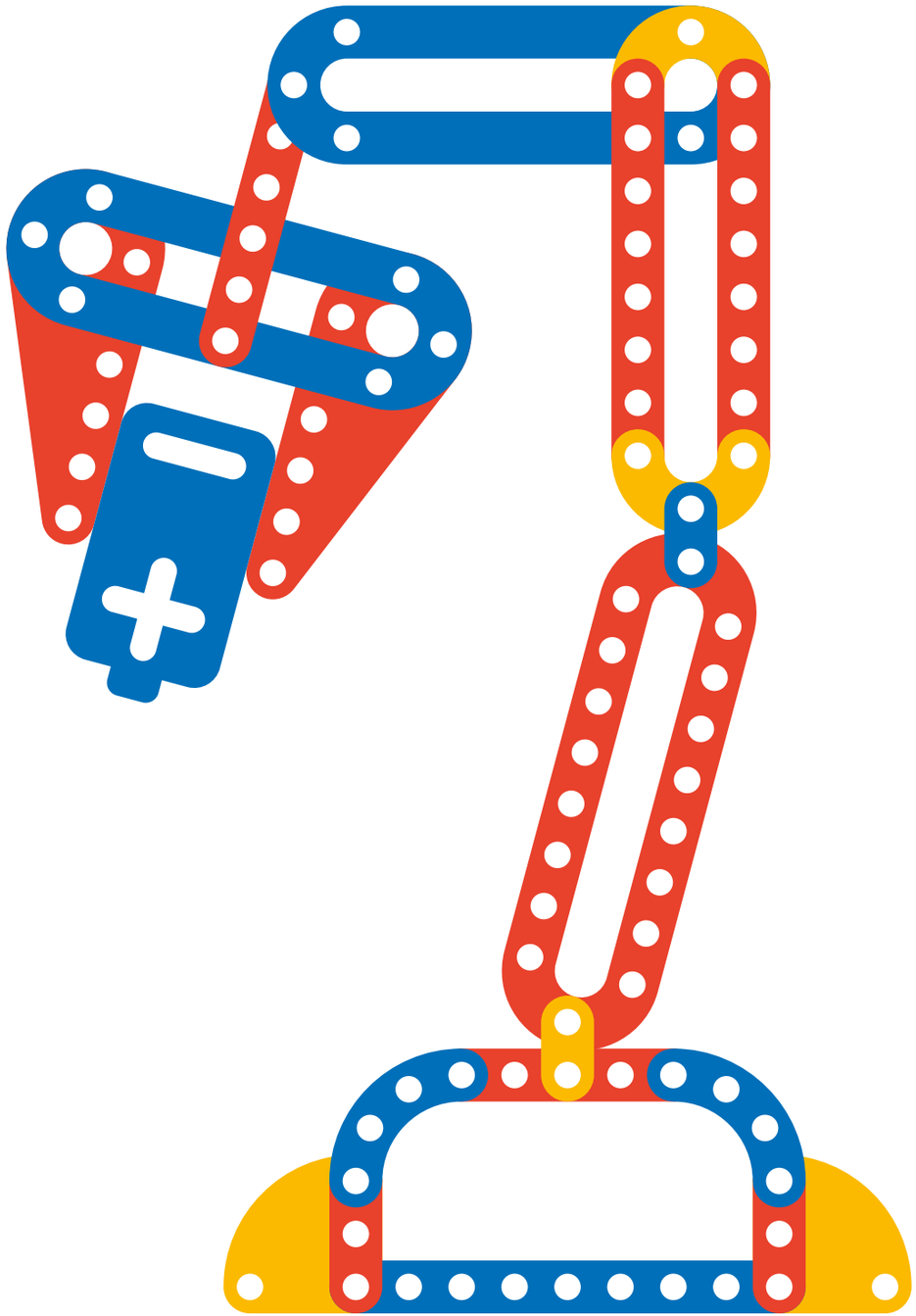
Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

69. Finally, the policy proposals that companies intend to request from national and European institutions were examined in depth. In both Italy and Spain, **facilitating access to finance and promoting investment** is the first action proposed by companies (**92%** and **89%** of respondents, respectively) followed immediately by clarifying the **meaning and the metric of "being circular"** (**52%** and **58%**). Reversing the order, these two actions are also the two priorities to be brought to the attention of national and European institutions according to business leaders operating in the rest of Europe. In third place among the action priorities for all the European areas considered, there is the **stimulus to demand**, probably linked to the fact that today's consumer is still considered to pay little attention to the aspects of sustainability and Circular Economy, because these products and services are still perceived as a niche, usually characterized by a higher price. Finally, it is worth observing how support for education and research in Circular Economy is regarded as the last action to be required from institutions in order of priority, although the lack of skills was indicated as one of the major obstacles to the development of Circular Economy in Europe.

FIG 33 **Response to the question "What measures does your company require from institutions (national and European) in order to foster Circular Economy?" in Italy, Spain and the rest of the EU, 2020**
(% values – multiple choices allowed)

	Italy		Spain		Rest of the EU	
Facilitating access to finance and promoting investment	**92%**	**1°**	**89%**	**1°**	**52%**	**2°**
Clarifying the meaning and the metric of "being circular"	**52%**	**2°**	**58%**	**2°**	**63%**	**1°**
Stimulating demand	32%		38%		49%	
Simplifying regulation	32%		30%		31%	
Reorganizing industrial supply chain, also internationally	28%		27%		38%	
Sustaining education and research in Circular Economy	20%		18%		10%	

N.B.: There is no detailed breakdown of Romania's policy proposals due to the limited number of responses from Romanian participants to this survey question.
Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.



Part 2

An innovative assessment model for socio-economic and environmental benefits of Circular Economy in the European Union, with a focus on Italy, Romania, and Spain

Key messagges

1

A **first-of-its-kind assessment model** of Circular Economy **economic**, **social and environmental benefits** has been devised. The model focuses on the European Union as a whole (EU27+UK) and on three countries of interest: Italy, Romania and Spain. The reference time-frame spans five years, from 2014 to 2018.

2

The methodological framework for the assessment of economic and social impacts of Circular Economy entails the creation of a complete panel database (**more than 8,500 observations**), **Principal Components Analysis** to identify **the ten key indicators of Circular Economy** and the estimation of the final effects through **Ordinary Least Square (OLS) Fixed-Effects regression** model.

3

Circular Economy is correlated to around **€27** to **€29** billion in Italy in 2018 (**1%-2%** of the annual GDP), from **€10** to **€12** billion in Romania (**5%-6%** of the current GDP), between **€33** and **€35** billion in Spain (**2%-3%** of GDP) and around 300-350 billion Euros of GDP in the EU27+UK (**2%-3%** of the current GDP).

4

Considering the mean value of the model output confidence range, Circular Economy is associated with the **employment** of approximately **200,000** jobs in Italy in 2018, around **5,000-40,000** individuals in Romania, while in Spain the overall effect ranges slightly in excess of approximately **350,000** employees. Overall, in the European Union, the shift from a linear to a circular paradigm is associated to almost **2.5 million jobs** in 2018.

5

As far as **investment** is concerned, Circular Economy is correlated in 2018 to about **8-9** billion Euros in Italy, **1-2** billion Euros in Romania, around **9-11** billion Euros in Spain and **90-110** billion Euros in the European Union (EU27+UK).

6

Circular Economy is associated also with an increase in **labour productivity: 560-590** Euros per employee per year in Italy (0.8%- 0.9% of current labor productivity), around **1,210-1,270** Euros per employee in Romania (5%-6% of current labour productivity), around **640-670** Euros per employee in Spain. In the EU, the circular paradigm resulted in **570- 940** Euros per employee, with an impact on the current value of 1%-2%.

7

The transition towards a circular development model can generate several **environmental benefits**, associated with the use of secondary materials instead of primary materials and the reduction of GHG emissions mainly connected with both the reduction of use of virgin raw material per se and the increase in the share of renewables in energy production.

8

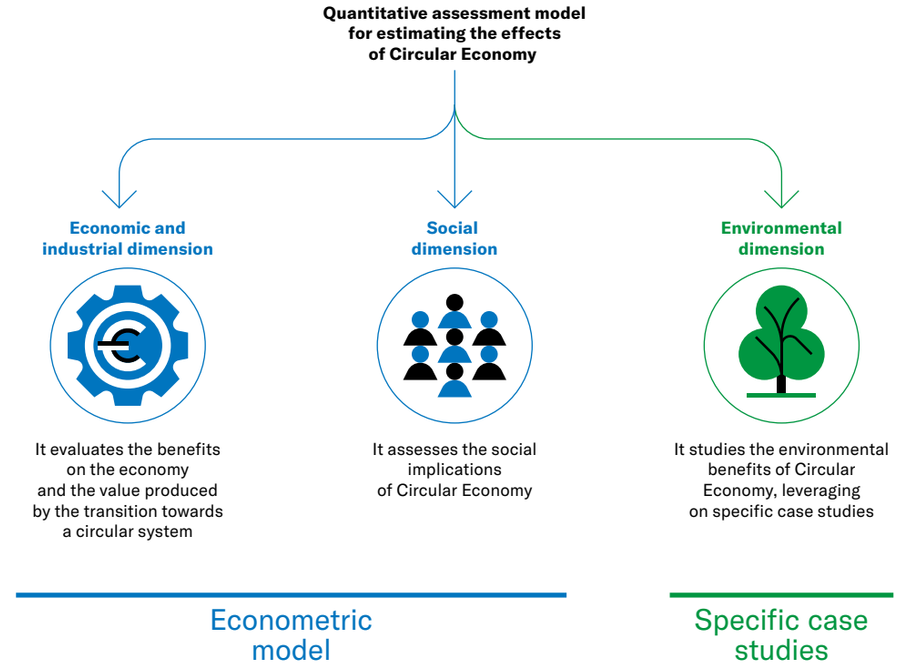
In addition, circular solutions can positively affect the environment, by extending the useful life of products and services and/or increasing their intensity of use. The extension of the useful life of vehicle batteries, circular smart meters, re-use and reparability of white goods and the spread of sustainable mobility are concrete examples of this important aspect.

1. The relevance gained by Circular Economy within the current policy debate at European and national levels, is making increasingly important to understand the **socio-economic effects** associated to the adoption of a circular paradigm in the economy and society. The **quantitative assessment** of the socio-economic benefits of Circular Economy is essential to guide the European policymakers' agenda.

2. With this purpose, a first-of-its-kind assessment model of Circular Economy impacts has been devised. The model focuses on the **European Union** as a whole (plus the United Kingdom) and on three countries of interest: **Italy, Romania and Spain**. The reference time-frame spans five years, from 2014 to 2018. From a methodological point of view, the model is based on a **macro approach**, combining a set of Key Performance Indicators (KPIs) of the Circular Economy Scoreboard with a series of variables related to the macroeconomic structure of each single country.

3. The main objective of the model is to assess the impacts, on different dimensions and levels, associated to a transition from a linear to a circular development model. Specifically, the model embeds both the **increase** in the **positive externalities** (dealing with the economic and industrial dimensions and with the social dimension) and the **reduction** in the **negative externalities** (dealing with the environmental dimension). For the economic, industrial and social dimensions, the final impacts are analyzed by leveraging on **advanced econometric techniques** in order to trace an indication of the quantitative relationships between the Key Performance Indicators (KPIs) most connected to Circular Economy and the main macroeconomic variables of each single country. For the environmental dimension, the analysis has been separated from the econometric model and has been examined in depth using a different methodology that leverages specific **case studies** and "**what-if**" analysis, performed along the four Circular Economy pillars.

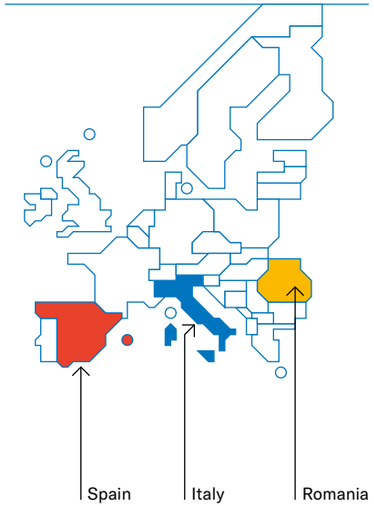
FIG 1 **Objects and methodological framework of the quantitative assessment model for estimating the impacts of Circular Economy**



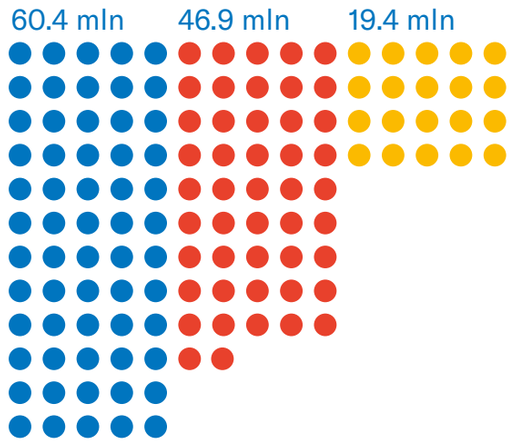
Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

4. The focus on Italy, Romania and Spain has been extracted from a wide socio-economic analysis of all EU27+UK countries across several dimensions, with a focus on the economic and industrial context and societal megatrends. Combining economic and societal features, it emerges that Italy, Romania and Spain are representative of **three different contexts and levels of economic and social development** within the European Union. Italy holds the highest GDP per capita (29,600 Euros per capita in 2018), followed by Spain (26,500 Euros per capita) and Romania (11,400 Euros per capita). In terms of industrial structure, Spain relies more on a service-oriented economy, while Italy has a strong manufacturing tradition, characterized by an intense presence of small and medium enterprises. Romania also has a strong manufacturing component with a significant share of employment in sectors with a high level of GHG emissions. In addition, Spain has a strong commitment towards renewable energy sources, with the aim of achieving a 100% share of renewable energy in electricity generation by 2050 (34% in 2030).

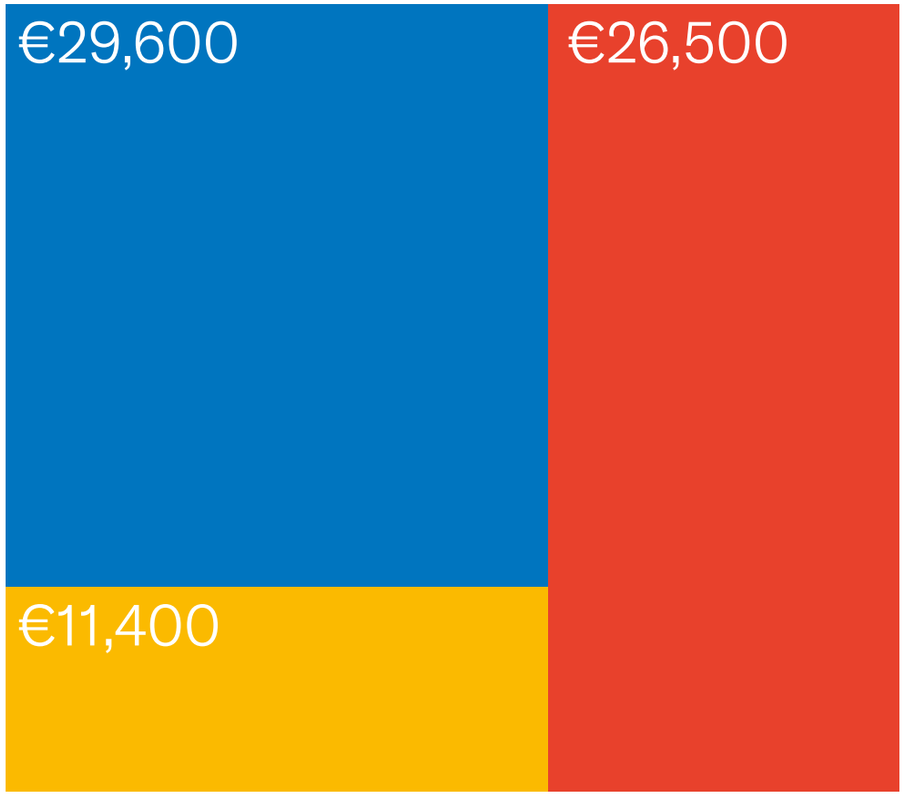
FIG 2 Key Facts&Figures on the economic and societal context for Italy, Romania, and Spain 2019



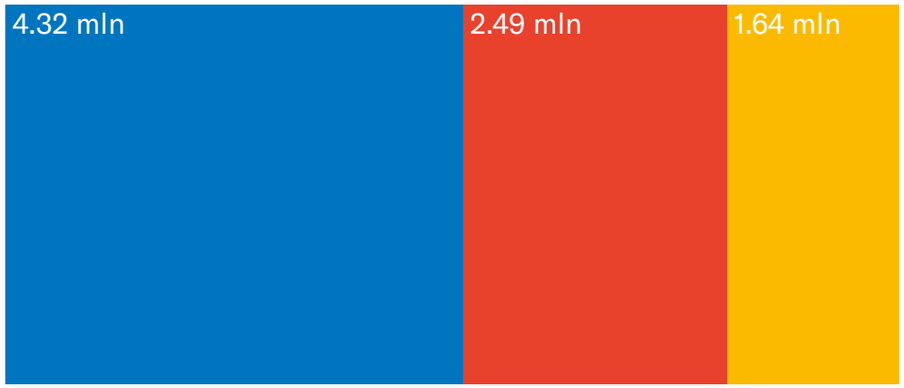
Inhabitants



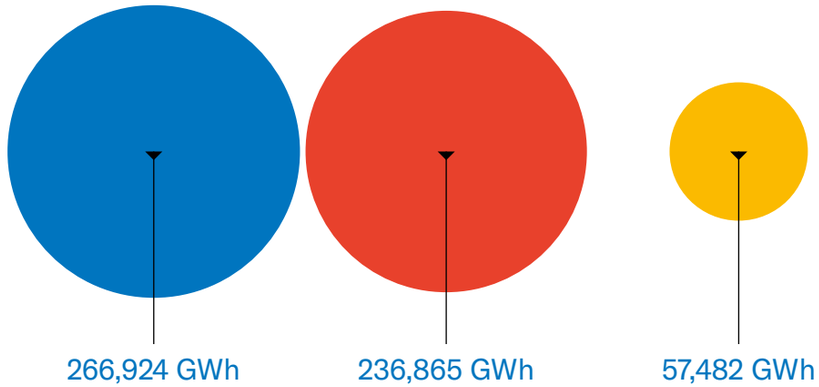
Per-capita GDP



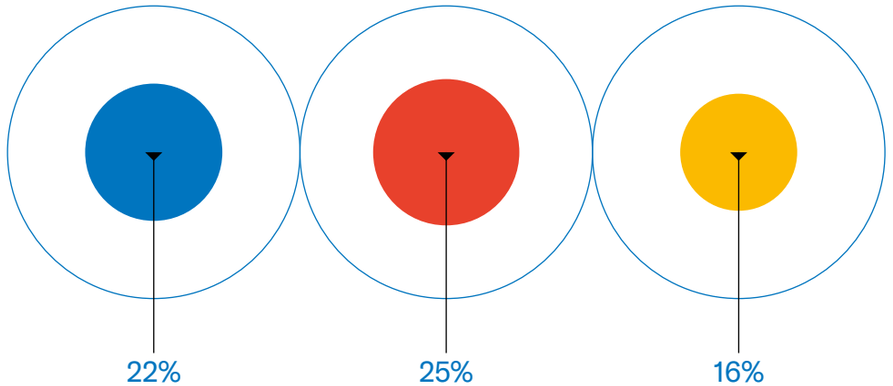
Manufacturing employees



Electricity Production



Electricity share in final consumption



Source: The European House – Ambrosetti and Enel Foundation elaboration on Eurostat data, 2020.

2.1 The economic and social impacts of Circular Economy

2.1.1 Methodological framework of the impact assessment model for economic, industrial and social dimensions

Please refer to **Part 1** of the study for a detailed explanation of the main metrics associated to Circular Economy

5. The starting point of the econometric model is the in-depth analysis of the issues regarding the quantitative estimation of Circular Economy features and impacts. As already mentioned, given the breadth of the Circular Economy phenomenon (it encompasses the economy and society as a whole), providing a complete and comprehensive view of the transition towards a circular development model is probably impossible. This issue also stems from the lack of a specific Circular Economy framework and definition. As a consequence, the absence of both a specific perimeter and of a set of internationally recognized standard indicators, makes it often necessary to recur to approximate indicators to quantitatively assess and explain Circular Economy.

6. The approach framework for the assessment of economic, industrial and social impacts of Circular Economy follows **5 methodological steps**:

1. Creating a complete and comprehensive **panel database** with **more than 8,500 observations**.
2. Selecting the **dependent variables** (output variables measuring the economic, industrial and social dimensions) and the possible **independent variables** (input variables used to capture the phenomenon of Circular Economy).
3. Performing **Principal Component Analysis (PCA)**[1] to identify the most relevant indicators of Circular Economy.
4. Exploiting the results of the Principal Components Analysis to isolate the most relevant indicators to build a **subset of the Circular Economy Scoreboard** to be used as an independent variable in the model.
5. Assessing the **impacts** of Circular Economy on the economic and social variables of interest.

FIG 3 Methodological steps of the quantitative assessment model for estimating the economic, industrial, and social impacts of Circular Economy

Step 1 Building the database	Creating a complete and comprehensive **panel database** with more than 8,500 observations
↳ **Step 2** Specifying the dependent and independent variables	Selecting the **dependent variable** and the possible **independent variables** to be included in the model for measuring Circular Economy (i.e., 23 KPIs of the Circular Economy Scoreboard)
↳ **Step 3** Performing Principal Components Analysis	Performing **Principal Component Analysis** (PCA) to identify the most relevant indicators of Circular Economy
↳ **Step 4** Building a subset of KPIs for Circular Economy	Exploiting the results of the PCA to isolate the **most relevant KPIs** in order to build a subset of the Circular Economy Scoreboard to be used as an **independent variable** in the model
↳ **Step 5** Assessing the impacts of Circular Economy	Assessing the **impacts of Circular Economy on the economic** and **social** variables

Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

7. As a first step, leveraging on Circular Economy Scoreboard data, a panel database was created. It includes:

- All the **23 Key Performance Indicators (KPIs)** of the Circular Economy Scoreboard.
- **7 output variables** (dependent variables), related to economy and society as a whole.
- **30 macroeconomic variables** used for normalizing Key Performance Indicators (KPIs) and as control variables[2].

The panel database is composed of **more than 8,500 observations** and all the variables are observed in a **historical trend of 5 years** (2014-2018).

Please refer to **Part 1** of the study for a detailed explanation of the Circular Economy Scoreboard.

1 The Principal Component Analysis is a statistical method for reducing data with many dimensions by projecting the data with fewer dimensions using linear combinations of the variables, namely the principal components. The Principal Component represent the directions of the data that explain a maximal amount of variance.

2 The 30 macroeconomic variables considered are: Unemployment rate, Youth unemployment rate, Real public consumption expenditure, Consumer price index, Household saving rates, Gross national saving, General government primary balance, Value added of manufacturing on total economic activity, Value added of services on total economic activity, Value added of agriculture on total economic activity, Total tax rate, Short-term interest rates, Long-term interest rates, Exports of goods and services, Imports of goods and services, Balance of payments, Current account balances, Household wealth, Household indebtedness, Household consumption, House price index, Maastricht definition of general government gross public debt, Money base, Population, Immigration rate, Education level, Investment in Research & Development, Public spending on health, Public spending on social security and Human Capital Index.

8. As a second step, variables to be included in the impact assessment model have been clearly stated. First of all, a preliminary theoretical partition has to be devised:

- **Dependent variable**, namely output variable whose value depends on that of another variable. It responds to the change in the independent variable.
- **Independent variable**, which is a variable that operates like a controlled input. Specifically, it acts as the factor that the researcher purposely changes or controls in order to measure the effects of a change in its value on the dependent variable of interest.

9. In the quantitative assessment model, the **dependent variables** are considered to be explanatory with respect to the final output the model is intended to estimate. Specifically, the dependent variables included in the impact assessment model identified for the economic/industrial dimension and for the social dimension, respectively, are:

Economic and industrial dimension:

- Gross Domestic Product (current prices, millions of Euros).
- Employment (total employment domestic concept in all NACE activities, thousands of people).
- Investment (Gross Fixed Capital Formation, current prices millions of Euros).
- Productivity (Gross Domestic Product per employee, Euros per worker).

Social dimension:

- Gross Domestic Product per capita (Euros per capita).
- Income of top/bottom 20% of population (Income quintile share ratio of disposable income, the ratio of total income received by the 20% of the population with the highest income—top quintile—to that received by the 20% of the population with the lowest income—lowest quintile).
- People at poverty risk (Percentage of people with equivalized disposable income[3] below the risk-of-poverty threshold, meaning 60% of the national median equivalized disposable income).

10. When it comes to the **independent variables**, additional considerations have to be taken into account. The rationale underpinning the selection of the variables to include in the Circular Economy Scoreboard presented in Part 1 meets a specific need to be as inclusive as possible, to be able to analyze the phenomenon of Circular Economy from a **360° perspective**. On the contrary, when selecting the variables to include in the econometric model with the aim of tracing a causal relationship, the logic must be different.

In fact, the inclusion of all the 23 Circular Economy Scoreboard's KPIs could generate issues leading to misinterpretation of the final results:

- Two or more variables could **explain the same phenomena** behind Circular Economy, resulting in disproportionately high correlations among variables.
- One or more variables could be **nested in other variables**, resulting in disproportionately high correlations among variables.
- One or more variables could present significant **missing values**. This issue is also present in the Circular Economy Scoreboard. However, given the fact that the econometric model methodology relies on panel data, the presence of missing data leads to an unbalanced setting, with some drawbacks in the estimation strategy.

11. To partially overcome these issues, **Principal Component Analysis (PCA)** was performed. PCA refers to the process by which principal components are computed and the subsequent components are used in understanding the data. This methodology is used when dealing with a large set of correlated variables, making it possible to summarize this set with a smaller number of representative variables that collectively explain most of the variability in the original set.

12. The analysis consists of **four methodological steps**:

1. Defining the **correlation matrix** of all the variables included in the database (only the 23 variables included in the Circular Economy Scoreboard). The Principal Component Analysis was performed on the correlation matrix to find a scaled and more balanced representation of the components.
2. Estimating the **principal components of the correlation matrix**[4] by defining the eigenvalues and the corresponding eigenvectors. The "new variables" (i.e., principal components) are uncorrelated among themselves and most of the information within the initial variables is squeezed or compressed into the first components.
3. Selecting the principal components able to **best explain the total variance** (in this case the first principal components, able to explain around 65% of the total variance).
4. Performing a **varimax rotation** of the axes. The rotation is a technique to maximize the variance shared among items to better represent how data correlate with each principal component.

3 The equivalised disposable income is the total income of a household, after tax and other deductions, that is available for spending or saving, divided by the number of household members converted into equalised adults; household members are equalised or made equivalent by weighting each according to their age, using the so-called modified OECD equivalence scale.

4 Performing the PCA on the correlation matrix is a useful tool to balance the different units in which the variables are measured. Alternatively, before computing the correlation matrix, it is possible to standardize the range of the initial variables.

13. Once the principal components of the Circular Economy database have been defined, it is possible to isolate the variables that **best explain the variance of the Circular Economy database**. This approach is performed by eliminating the redundant and unnecessary KPIs and it is based on **two simultaneous methodological steps**:

1. Analyzing the correlation matrix to find KPIs that could be **over-represented** (e.g., more variables representing the same phenomenon or which are nested in other variables).
2. Analyzing the results of the PCA to find the **most relevant KPIs** in explaining the variance of the Circular Economy database.

14. From these two methodological steps, it was possible to define a subset of Key Performance Indicators (KPIs) from the 23 variables comprising the Circular Economy Scoreboard. Each variable in this subset was weighted by its respective correlation with the first principal component (e.g., the first principal components loadings), to create a **subset of the Circular Economy Scoreboard** to be used as an **independent variable** in the impact assessment model.

15. As emerging from the Principal Component Analysis (PCA), the **ten variables** that best explain the variance of the Circular Economy database are:

1. **Circular material use rate**, which measures the share of material recovered and fed back into the economy - thus saving extraction of primary raw materials - in overall material use (percentage of total material use).
2. **Resource productivity** (Euros per tonne of material consumption).
3. **Share of total organic area in total utilized agricultural area** (percentage).
4. **Industrial waste treated by recycling** (percentage on total industrial waste generated).
5. **Municipal waste treated by recycling** (percentage on total municipal waste generated).
6. **Share of energy from renewables** (percentage of final energy consumption).
7. **Load factor** – used as a proxy of logistics efficiency (tonne per km/vehicles per km).
8. **Value added of retail sale of second-hand goods** (Euros per capita).
9. **Individuals using any website or app to arrange an accommodation from another individual** (percentage)[5].
10. **Individuals using dedicated websites or apps to arrange a transport service from another individual** (percentage)[6].

16. Once defined the subset of the Circular Economy Scoreboard—composed of the ten most relevant variables in explaining the Circular Economy database, weighted by their first principal components loadings—the regression model has been specified. For this purpose, an **Ordinary Least Square (OLS) Fixed-Effects (FE) regression model** has been selected. Specifically, the model relies on the following regression

$$Y_{it}=\beta_1 \chi_{it}+\beta_2 \theta_{it}+ \alpha_i+\varepsilon_{it}$$

where Y_{it} is the dependent variable for each country *i* at time *t*; β_1 is the coefficient for the independent variable χ_{it} estimating the effect of Circular Economy on the dependent variable Y_{it}; χ_{it} represents the independent variable for each country i at time t; β_2 is the coefficient for the control variable θ_{it} estimating its effect on the dependent variable Y_{it}; θ_{it} represents the control variables for each country *i* at time *t*; α_i is the coefficient estimating the fixed-effects for each country *i*; and ε_{it} is the error term.

17. The Ordinary Least Square (OLS) Fixed Effects (FE) regression model is a linear model appropriate for the **control of variables that cannot be observed** or **to measure time-invariant characteristics** of the observations, such as cultural factors or differences in socio-economic structure across countries. The fixed-effects coefficients allow to account for country heterogeneity and to control for, or partial out, the effects of time-invariant variables with time-invariant effects.

18. Moving from the results of the regression model, it is possible to isolate the **Circular Economy Coefficients (CECs)**. The impact assessment model was constructed to obtain a set of coefficients specific to each macroeconomic variable (all the dependent variables already specified), for the European Union and for each focus country (Italy, Romania and Spain). The CECs are represented by the β_i **coefficients** in the linear regression model reported above. They estimate how much of Y_{it} changes, all else being equal, when χ_{it} increases by one unit. Specifically, the interpretation is how much of the dependent variable Y_{it} is supported and can be attributed to the one-unit variation of the independent variable χ_{it}. In the assessment model, the estimation of the final Circular Economy Coefficients (CECs) follows **three methodological steps**:

1. Identifying the actual variation, across the 2014-2018 period, of the 10 most relevant indicators of Circular Economy (this is the subset of the Circular Economy Scoreboard identified using the PCA technique) for the European Union and for the three paradigmatic countries (Italy, Romania and Spain).
2. Adapting each CEC to the actual 5-year variation of the subset of the Circular Economy Scoreboard.
3. Diving the CEC by time period of reference (5 years, from 2014 to 2018) in order to find an average yearly basis value to estimate the actual annual impacts of the Circular Economy on the positive externalities (economic, industrial and social dimensions).

5 It is used as a proxy for accommodation sharing.
6 It is used as a proxy for sharing mobility.

19. Finally, to correctly take into account the approximation implied in each regression, it is necessary to evaluate a confidence interval for the results. Indeed, a **confidence interval** gives an estimated range of values which is likely to include an unknown population parameter. In this sense, for each CEC, a confidence interval was introduced building a likelihood range around the discrete value estimated by the model. Therefore, the CECs can be represented by a range of plausible values, defined by a ceiling value and a bottom value, including all values that provide a given likelihood, specifically 95%.

2.1.2 The results of the impact assessment model on the economic, industrial and social dimensions

20. As far as the economic and industrial dimension is concerned, all the variables considered present **statistically significant results** (albeit with different magnitudes) and **positive impacts**. This means that **Circular Economy appear to be positively correlated to all the variables related to economic and industrial dimensions**. Instead, when it comes to the social dimensions, the results are various in terms of statistical significance. In coherence with the results for Gross Domestic Product in the economic and industrial dimension, Gross Domestic Product per capita shows a positive impact and statistical significance. Yet, income inequality and people at risk of poverty do not show statistical significance. This does not provide evidence that Circular Economy does not have an effect on the variables, but it primarily indicates that it is still not possible with the data currently available and considering the current level of development of Circular Economy to conclude that the results are consistent and solid with a certain probability (e.g., 95%).

The social benefits of the "product-as-a-service" model

The **"product-as-a-service" business model** can offer temporary access to products rather than just selling them. Such models can also serve more customers with a smaller stock of products. While such business models are not always new, they can now be significantly optimised through **smart technology, increasing convenience** and **keeping much better track of the product's condition**. Under these conditions, they can bring positive social benefits.
As an example, top-quality washing machines would be affordable to **most households**, **even the low-income ones**, if they were provided through a "product-as-a-service" model, rather than sold, with customers saving around one third on the washing cost.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Ellen MacArthur data, 2020.

FIG 4 Synthetic view of the quantitative assessment model results for the economic, industrial and social dimensions

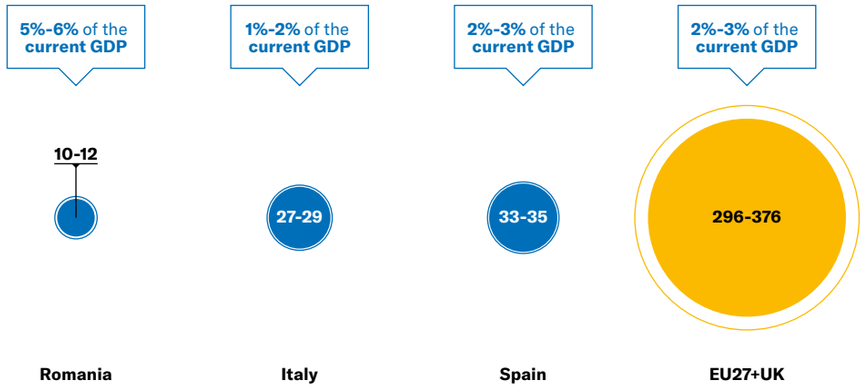
		Italy	Romania	Spain	EU27+UK
Economic and industrial dimension	Gross Domestic Product	●●	●●●	●●●	●●
	Employment	●●●	●	●●●	●●●
	Investments	●●	●	●●	●●
	Labour productivity	●	●●●	●●●	●
Social dimension	GDP per capita	●●	●●●	●●●	●●
	Income inequality	●	●	●	●
	People at risk of poverty	●	●	●	●

● Statistically not significant
● Statistically significant (p-value<0.05)
●● Statistically highly significant (p-value<0.01)
●●● Statistically very highly significant (p-value<0.01)

Source: The European House – Ambrosetti and Enel Foundation on Circular Economy online survey, 2020.

21. Focusing on Gross Domestic Product, Circular Economy amounted to **27-29 billion Euros** in Italy in 2018, reaching **1%-2%** of current Gross Domestic Product. In Romania it has been estimated that Circular Economy sustained **10-12 billion Euros** in 2018, meaning a value of **5%-6%** on current national Gross Domestic Product. A correlation effect has been observed for Spain, where the model estimated a relationship of **33-35 billion** Euros, equal to **2%-3%** of Gross Domestic Product. Focusing on the European Union as whole and United Kingdom (EU27+UK), Circular Economy enabled **296-376 billion Euros** annually, the equivalent of **2%-3%** of communal Gross Domestic Product.

FIG 5 **Annual relationship between Circular Economy and Gross Domestic Product in EU27+UK and in Italy, Romania and Spain, 2018**
(billion Euros)



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

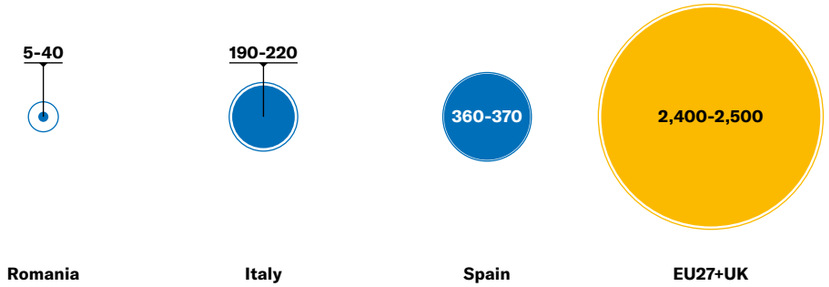
22. In terms of employment, in Italy the adoption of circular paradigm translated into **190,000-220,000 employees** in 2018. Romania presents the **lowest results for employment**, in terms of both statistical significance and magnitude. For this country, Circular Economy enabled the employment of **5,000-40,000 individuals** in 2018, while in Spain the overall effect ranges from **360,000-370,000 employees** in the same year. Finally, in the **European Union**, the adoption of Circular Economy practices is associated to a minimum of **2.4 million** to a maximum of **2.5 million employees**.

Sizing of employment results of Circular Economy in Italy and in the European Union

Looking at the results for Italy, it is worth noting that, on a five-year basis (2014-2018), employment associated to Circular Economy could be quantified as around **25%** of the employment in the manufacturing sector. For scale, this number is equivalent to **80%** of the employment in the construction sector or to around **1.2 times** the employment in agriculture.
With respect to the results for the EU27+UK, considering the results on a five-year basis (2014-2018), employment associated with Circular Economy in the European Union is **greater than the employment of 22 European countries** in 2018 and around **50%** of the Italian employment in the same year.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Eurostat data, 2020.

FIG 6 **Annual relationship between Circular Economy and employment in EU27+UK and in Italy, Romania and Spain, 2018**
(thousands of employees)



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

The employment consequence of adopting Circular Economy practices: a literature review

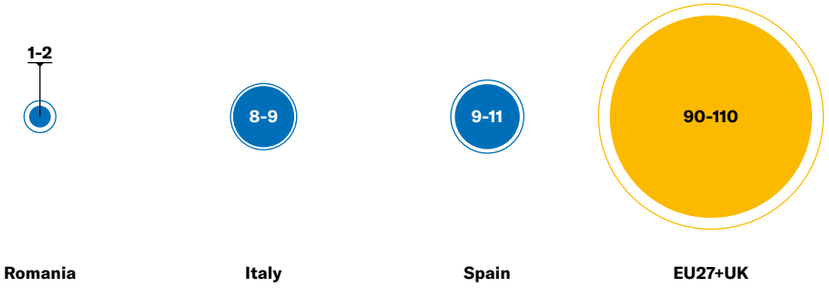
There is growing body of work, even if still limited, trying to quantify the employment benefits of the Circular Economy transition. Looking at 15 among the most influential studies on the topic, the literature review suggests that the employment gains of resource efficient and Circular Economy policies range between **0 and 2%**, with some studies predicting **employment gains up to 7% at 2030**. The scenario setting among the studies reviewed varies widely, but in general, most simulations deal with **material taxes** aimed at reducing virgin material consumption and increasing resource efficiency.

In some simulations, the generated tax revenues are redistributed to reduce distortionary labour taxes, which is commonly referred to as an **environmental tax reform**. In such scenarios, the positive employment effect is found to be stronger by around **2 percentage points**.

Source: The European House – Ambrosetti and Enel Foundation elaboration on OECD data, 2020.

23. As far as investment is concerned, Circular Economy resulted in **8-9 billion Euros** (2.6%-2.8% of the current private investments in 2018) in Italy in 2018. In Romania the circular paradigm enabled investment for **1-2 billion Euros** (2.2%-3.4% of the current private investments) in 2018 and in Spain for **9-11 billion Euros** (3.8%-4.6% of the current private investments in 2018). In the European Union (EU27+UK), Circular Economy made **90-110 billion Euros** of investment possible (2.9%-3.4% of the current private investments in 2018).

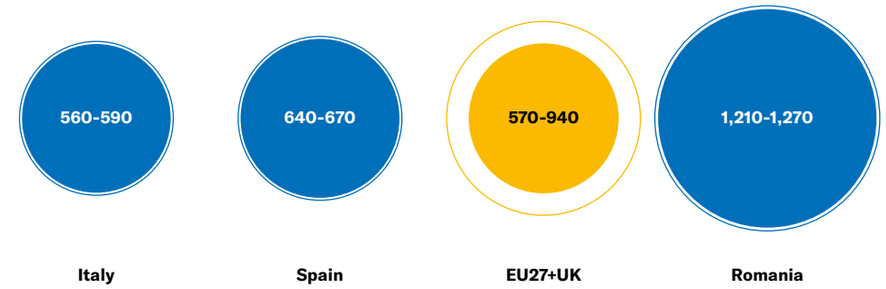
FIG 7 **Annual relationship between Circular Economy and investment in EU27+UK and countries of interest, 2018** (billion Euros)



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

24. Considering labor productivity, Circular Economy resulted in **560-590 Euros per employee in Italy**, the equivalent of **0.8%-0.9%** of current annual labor productivity in 2018. This effect is quite impressive considering that Italy is a country where labor productivity has been stable over the last 30 years. Contrary to the results for employment, the most impacted country is Romania. In this case, Circular Economy amounted to **1,210-1,270 Euros per employee**, corresponding to 5%-6% of current annual labor productivity. Focusing on Spain, a similar consideration as for Italy can be made, Circular Economy resulted in **640-670 Euros per employee**, the equivalent of 1%-2% of current annual labor productivity. The European Union presents limited statistical significance, implying a wider range of results: the circular paradigm resulted in **570-940 Euros per employee**, with an impact on the current annual value of 1%-2%.

FIG 8 **Annual relationship between Circular Economy and labor productivity in EU27+UK and countries of interest, 2018**
(Euros per employee)



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

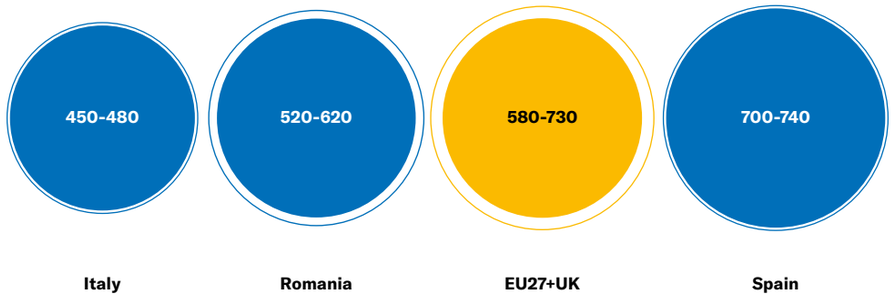
25. Finally, Circular Economy contributed to creating **450-480 Euros per capita** in 2018 in **Italy**. In **Romania**, Gross Domestic Product per capita enabled by Circular Economy was **520-620 Euros** per capita in 2018, while in the **European Union** it was around **580-730 Euros** per capita. **Spain** is the country with the highest expected impact, where Gross Domestic Product per capita resulting from the shift to the circular paradigm is between **700-740 Euros per capita**.

Comparison of the results for Gross Domestic Product per capita in Italy

In 2018, Italian households spent, on average, €462 a month for food and beverage products. Looking at these results, it is interesting to note how Circular Economy has enabled an annual amount equal or greater to the Italian average monthly spending on food and beverages.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Istat data, 2020.

FIG 9 **Annual relationship between Circular Economy and Gross Domestic Product per capita in EU27+UK and countries of interest, 2018**
(Euros per capita)



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

26. Analyzing the results of the quantitative assessment model for the economic, industrial and social dimensions implies several considerations. In fact, the value added of the quantitative model framework is to include **heterogeneity across countries** in socio-economic benefits. The results for the economic, industrial and social variables differ according both to the **specific level of development of Circular Economy** in the country at stake and the **specific economic and social structure**.

Interpreting the assessment model results: the different pathways towards the Circular Economy paradigm

The results shown for Gross Domestic Product are consistent with Circular Economy Scoreboard results and the relative positioning of the three countries (Italy, Romania and Spain) on the Circular Economy pillars, even with respect to other European Union countries. In fact, it is plausible that the lower the positioning within the Circular Economy Scoreboard, the more the impact of its marginal increase on Gross Domestic Product. For this reason, it is not surprising that among the three paradigmatic countries considered, Romania is the one with the highest impact on Gross Domestic Product, since it is also the country having the largest improvement in the Circular Economy Scoreboard between 2014 and 2018.
In addition, some results can be read in combination, shedding light on the pathway towards the Circular Economy paradigm. The relationship among variables can also be inferred from the results, looking simultaneously to the final results on Gross Domestic Product, employment and labor productivity (in terms of percentage with respect to the same reference variables and not in absolute terms). Reading the results together helps to find a possible interpretation on whether Gross Domestic Product is explained, among other things, through an increase in employment, labor productivity or a mix of the other two variables.
For Italy, given an impact of 1%-2% on Gross Domestic Product, there is evidence of an impact of 0.5%-1% on employment and 0.5%-1% on labor productivity. For Spain, the impact of 2%-3% on Gross Domestic Product is absorbed by 1.5%-2% in employment and 0.5%-1% in labor productivity. In Romania, the effect on Gross Domestic Product of 5%-6% is almost entirely due to labor productivity (4.5%-5.5%). The European Union overall presents results similar to the Italian case: an impact of 2%-3% on Gross Domestic Product is explained by 1%-1.5% in employment and 1%-1.5% in labor productivity.
Starting from these considerations, it is possible to **trace a path regarding the possible evolution of Circular Economy** in the European Union and the countries of interest. Reading the results of the assessment model in relation to the positioning of the three countries within the Circular Economy Scoreboard, it could be inferred that, in the process of shifting from a linear to a circular world, a country starts by **rendering more efficient the existing industrial chains** and then, gradually, by **creating ex novo value chains directly connected to Circular Economy**. Romania, the country lagging more behind with respect to the other focus countries, has not created industrial chains ex novo, but rather it has embarked on paradigm change through reconverting existing industrial chains and increasing labor productivity. This fact could also be explained by the Romanian economic structure, more manufacturing oriented, rendering more difficult for the economic system to create new value chains from scratch. The opposite is true for Spain, the most advanced country in terms of positioning in the Circular Economy Scoreboard among the countries considered, and a country with a very well-developed service sector.

Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

2.2 The environmental impacts of Circular Economy

2.2.1 Methodological framework of the impact assessment model for environmental dimensions

27. The impact of Circular Economy on the environmental dimension follows a specific methodology, different from the one used for the economic, industrial and social dimensions. In fact, assessment analysis for the environmental dimension leverages on specific **case studies**, "**what-if**" and **literature analyses** along the four Circular Economy pillars (Sustainable inputs, End-of-life, Extension of useful life and Increase of the intensity of use). The rationale underpinning this different approach, coherent with the existing literature on the topic, is that environmental variables change slowly over time. As a consequence, the econometric model specified above would not be able to detect the effect of Circular Economy—which is at a very early stage in many European Union countries—on this dimension.

28. The assessment of the environmental impacts of Circular Economy is comprised of **five methodological steps**:

1. Definition of the **perimeter of analysis of the impact of Circular Economy** on the environmental dimension, considering the impacts on all four pillars of the circular paradigm.
2. Definition of the **ways in which Circular Economy can affect the environmental dimension** along its four pillars, clustering them according to the channel underpinning the benefits they could bring to the environment.
3. Definition of how to **quantitively estimate the benefits of Circular Economy** pillars on the environmental dimension.
4. **Estimation of the environmental benefits** accruing from the shift from a linear to a circular paradigm.
5. Analysis of a **specific case study** of a specific value chain (e.g. **circular mobility**) that could result in environmental benefits along all four Circular Economy pillars.

FIG 10 Methodological steps of the assessment model for the environmental dimension

1	Definition of the **perimeter of analysis** of the impact of Circular Economy on the environmental dimension
↳ 2	Definition of the ways in which Circular Economy can affect the environmental dimension **along its four pillars**
↳ 3	Definition of **how to quantitively estimate** the benefits of Circular Economy pillars on the environmental dimension
↳ 4	**Estimate the environmental benefits** brought by the shift from a linear to a circular paradigm
↳ 5	Analysis of a specific **case study** of a specific value chain (**circular mobility**) that could bring environmental benefit along all the four Circular Economy pillars

Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

29. Analysis of the environmental impacts begins with the definition of the perimeter of possible benefits associated to Circular Economy. To assess the environmental benefits associated with a shift from a linear to a circular paradigm, it is necessary to consider all Circular Economy pillars, from Sustainable inputs to Increase of the intensity of use. For this purpose, the Circular Economy pillars have been clustered according to the channel underpinning the benefits they could bring to the environment. Specifically, the first two pillars (Sustainable inputs and End-of-life) deal with **how a product is manufactured in a circular way**, comprising the "**product cluster**". The other two pillars (Extension of useful life and Increase of the intensity of use) deal with **how the product or service is used** in a circular way, comprising the "**use cluster**".

30. The following distinction is relevant when taking into account how the Circular Economy pillars and clusters could have an impact on the environmental dimension. On the one hand, the pillars in the "product cluster" could benefit the environment through:

- **Secondary raw materials and recycling**, increasing the rate of recycling of materials and products and using recyclable waste (scrap materials) as productive inputs, to be reutilized and fed back into the economy.
- **Renewable energy sources**, increasing the penetration of renewables as energy inputs.

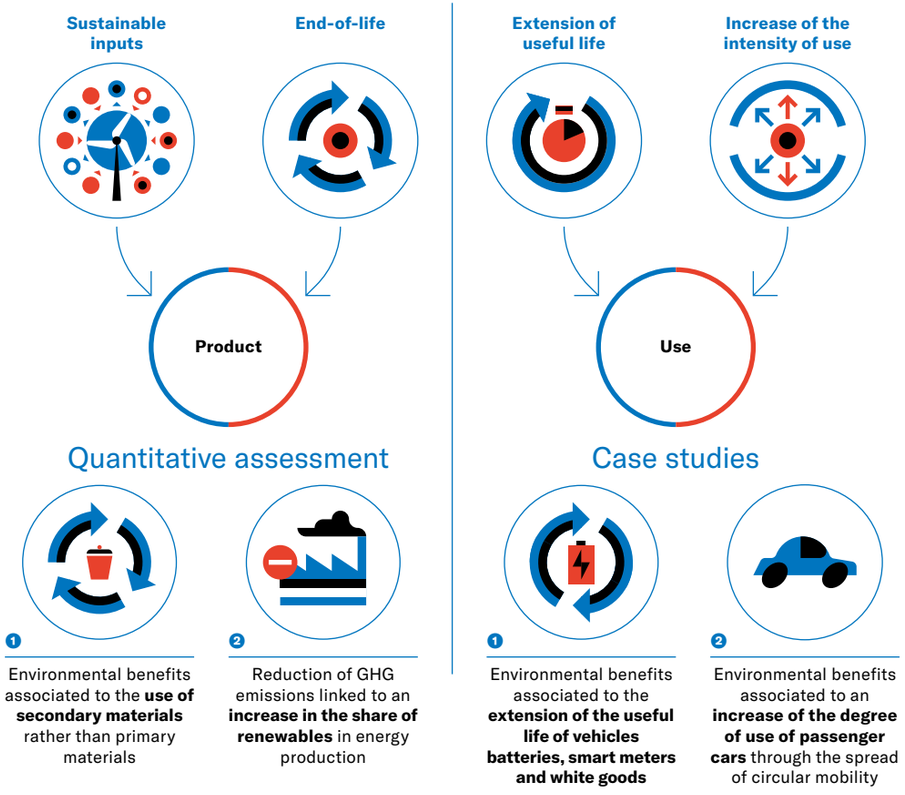
On the other hand, the pillars in the "use cluster" could benefit the environment through:

- **Useful life**, extending the useful life of products or services.
- **Usage**, increasing the use of products or services by a single user.
- **Users**, increasing the number of users of a single product or service.

The concept of "**circular by design**", meaning rethinking product design in a circular way at 360°, spans across all the Circular Economy pillars.

31. The environmental benefits deriving from the "**product cluster**" have been measured through a **quantitative assessment**, focusing on the environmental benefits associated with the use of secondary materials instead of primary materials and the reduction of GHG emissions linked to an increase in the share of renewables in energy production. As far as the "**use cluster**" is concerned, the environmental benefits have been presented via **specific case studies**, focusing on the environmental benefits associated with the Extension of the useful life of vehicle batteries, circular smart meters and white goods and those associated with an increase of the degree of use of passenger cars through the spread of circular mobility.

FIG 11 **Methodological framework used for assessing the environmental impacts along the different pillars of Circular Economy**



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

2.2.2 The impacts of Circular Economy on the environmental dimension

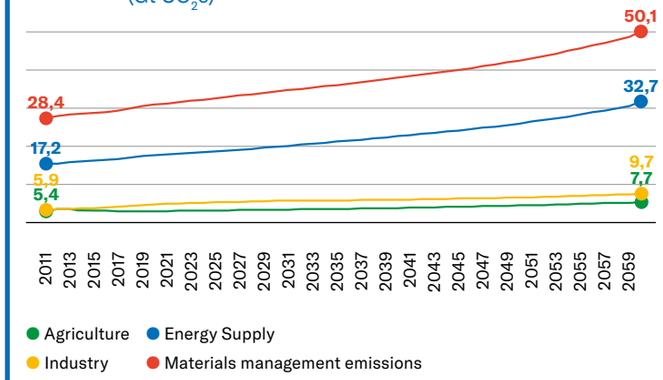
32. Starting from the "product cluster", the first focus is on the use of **secondary materials**. Secondary materials are the result of processing recyclable waste (scrap materials) into raw materials that can be re-used. Secondary materials may be complete substitutes for primary materials, or may only be used in lower-value applications[7]. The processing and use of secondary materials are driven by the availability of scrap materials and the cost-effectiveness of processing technologies using secondary materials input compared to primary materials. Most emissions are directly or indirectly linked to the use of materials and, more specifically, to "materials management". Materials management emissions mostly come from the combustion of fossil fuels for energy supply, but also include emissions from agriculture, emissions linked to the production of manufacturing goods and emissions from construction.

Materials management policies are pivotal in reducing the environmental impacts of materials use

Emissions related to materials management (agriculture, energy supply and industry) currently represent around **70%** of overall emissions and they are projected to increase from 30 Gt in 2017 to 49 Gt CO_2e in 2060.

This suggests that there is a significant opportunity to potentially reduce emissions through modification and expansion of materials management policies. In fact, reducing GHG emissions and other negative environmental externalities is strongly linked to policies for managing materials use. For example, reducing fossil fuel use directly contributes to lowering GHG emissions and reducing materials use.

FIG 12 **GHG emissions from materials management and projections to 2060, 2011-2060[E]**
(Gt CO_2e)



Source: The European House – Ambrosetti and Enel Foundation elaboration on OECD data, 2020.

7 This process is also known as "downcycling".

33. In this sense, the environmental impact of using secondary materials rather than primary materials has been reported[8]. First of all, the following **environmental dimensions** have been considered:

- **Acidification** as **corrosive impact** that pollutants such as Sulphur Dioxide (SO_2) and Nitrous Oxides (NOx) have on soil, groundwater, surface waters, biological organisms, ecosystems and materials (buildings). The impacts are measured as emissions of acidifying gases to the air (in kg SO_2-equivalents). These emissions are translated into an indicator 'deposition/acidification critical load', describing the fate and deposition of acidifying substances as Acidifying Potentials of different gases.
- **Climate change** as **anthropogenic emissions causing the temperature of the Earth surface to rise and leading to several impacts on the environment** (e.g. sea level rise, extreme weather events) and the economy (e.g. agriculture and ecosystem services). The impacts are measured as emissions of GHG to the air (in kg CO_2-equivalents). These emissions are translated into a category indicator 'infrared radiative forcing' using the 100-year global warming potential (GWP100) of different GHG.
- **Cumulative energy demand as energy footprint** (total energy use along the production chain of a material). The impacts are measured as energy use (in Joule). This energy use is summed into the category indicator 'cumulative energy demand' without any additional weighting of the different stages.
- **Eutrophication** as **potential impacts of excessively high levels of macronutrients** (such as nitrogen (N) and phosphorus (P)). Nutrient enrichment may cause **undesirable shift in species composition and elevated biomass production** in ecosystems and **it may affect sources suitable for drinking water**. The impacts are measured as emissions of nutrients to air, water and soil (in kg PO_4-equivalents). These emissions are translated into a category indicator 'deposition/N/P equivalents in biomass' using a stoichiometric procedure, which identifies the equivalence between N and P for both terrestrial and aquatic systems.
- **Freshwater aquatic ecotoxicity** as impacts of **toxic substances on species in freshwater aquatic ecosystems**. The impacts are measured as emissions of toxic substances to air, water and soil (in kg 1,4-dichlorobenzene equivalents). These emissions are translated into a category indicator 'predicted environmental concentration/predicted no-effect concentration' using Freshwater Aquatic Ecotoxicity Potentials (FAETP).
- **Human toxicity** as impacts of **toxic substances on species in freshwater aquatic ecosystems**. The impacts are measured as emissions of toxic substances to air, water and soil (in kg 1,4-dichlorobenzene equivalents). These emissions are translated into a category indicator 'predicted environmental concentration/predicted no-effect concentration' using Freshwater Aquatic Ecotoxicity Potentials (FAETP).
- **Land use** as land surface used to produce the resource (e.g., area occupied by a mine). This land is then temporarily unavailable for other uses, or for nature and ecosystems. The impacts are measured as land use (in m^2).
- **Photochemical oxidation** as **formation of reactive chemical compounds**, such as ozone by the action of sunlight on certain primary air pollutants, sometimes visible as smog. The impacts are measured as emissions of substances (VOC, CO) to air (in kg ethylene-equivalents). These emissions are translated into a category indicator 'tropospheric ozone formation' using the Photochemical Ozone Creation Potential (POCP) of different gases.
- **Terrestrial ecotoxicity** as **impacts of toxic substances on species in terrestrial ecosystems**. The impacts are measured as emissions of toxic substances to air, water and soil (in kg 1,4-dichlorobenzene equivalents). These emissions are translated into a category indicator 'predicted environmental concentration/predicted no-effect concentration' using the USES 2.0 model developed by RIVM, describing fate, exposure and effects of toxic substances into Terrestrial Ecotoxicity Potentials (TETP).

34. Taking into account the environmental impact assessment on the dimensions cited above results extremely relevant, since they deal with some of the most impacting damages for the environment. For example:

- **Acidification**: the environmental impacts of acidification are **one of the major contemporary environmental issues** globally. Indeed, the average marine acidity has been included in the 2030 Agenda for Sustainable Development, specifically in the Goal 14 "Life below Water". The acidity of the ocean has increased by 26% since the beginning of the industrial era.
- **Climate change**: it affects all regions around the world along different dimensions. Heavy rain and other extreme weather events are becoming more frequent. This can lead to floods and decreasing water quality, but also decreasing availability of water resources in some regions. Actually, **4 out of 5 Europeans are exposed to heat waves, flooding or rising sea levels**, but are often ill-equipped for adapting to climate change. Between 1980 and 2011 floods affected **more than 5.5 million people** and caused direct economic losses of **more than €90 billion**.
- **Cumulative energy demand**: in 2018, the energy sector was responsible for around **53%** of the overall European Union GHG emissions, split between **29%** of energy industries and **24%** of fuel combustion by energy users.
- **Eutrophication**: it is a serious environmental problem since it results in a deterioration of water quality and is **one of the major impediments to achieving the quality objectives established by the Water Framework Directive** (2000/60/EC) **at the European level**. It affects **54%** of Asian lakes, **53%** of those in Europe, **48%** of those in North America, **41%** of those in South America and **28%** of those in Africa.

8 The following analysis is reported from Organization for Economic Co-operation and Development, "*Global material resources outlook to 2060*" (2019).

35. Environmental impacts are associated with different parts of the life cycle of resource use: from extraction to processing and discarding as waste. In this regard, the direct and indirect environmental consequences of resource use along their life cycle stages have been reported for **six materials** (**aluminum, iron, copper, nickel, lead and zinc**)[9], through a normalized index that takes into account the different measures to estimate the environmental impacts in each dimension considered. The values refer to a global level and are not country-specific. In Figure 13, the difference in percentage points of the environmental impacts of primary and secondary use of materials for each dimension is reported. According to the analysis, primary production of copper and nickel has the highest impact per kilogram of produced metals for the selected environmental impacts. On average, the use of secondary nickel makes it possible to reduce the environmental impact by **96 percentage points** in 5 out of 8 dimensions considered, while the mean declines to around **89 percentage points** for copper. Secondary aluminum use seems to be effective in reducing the impacts on climate change and cumulative energy demand. These results must be seen jointly with the current domestic materials consumption of materials. In fact, consumption in absolute terms sheds light on the direction materials management policies must take.

FIG 13 **Environmental impacts per kg of selected materials on different dimensions for primary and secondary materials production and domestic material consumption, 2015** (normalized index value, max=100% and min=0% and million tonnes)

Material	Domestic material consumption (million tonnes)	Impact difference primary vs. secondary materials								
		Acidification	Climate change	Cumulative energy demand	Eutrophication	Freshwater aquatic ecotoxicity	Human toxicity	Land use	Photo-chemical oxidation	Terrestrial ecotoxicity
Aluminum	19.5	-29 p.p.	-58 p.p.	-60 p.p.	-2 p.p.	=	-38 p.p.	-21 p.p.	-5 p.p.	-1 p.p.
Iron	146.6	-6 p.p.	-7 p.p.	-5 p.p.	-1 p.p.	=	-6 p.p.	-6 p.p.	-1 p.p.	=
Copper	190.5	-26 p.p.	=	-21 p.p.	-98 p.p.	-98 p.p.	=	-91 p.p.	-82 p.p.	-73 p.p.
Nickel	22.1	-98 p.p.	-98 p.p.	-97 p.p.	-35 p.p.	=	-96 p.p.	-94 p.p.	-6 p.p.	-5 p.p.
Lead	3.4	-30 p.p.	-1 p.p.	-1 p.p.	=	=	-1 p.p.	-1 p.p.	=	=
Zinc	16.5	-30 p.p.	-1 p.p.	-1 p.p.	=	=	-1 p.p.	-1 p.p.	=	=

N.B.: The = sign stands for a negligible, yet positive, difference in percentage points between primary and secondary use of materials.
Source: The European House – Ambrosetti and Enel Foundation elaboration on OECD data, 2020.

9 Environmental impact assessment methodology utilizes the life-cycle analysis (LCA) of materials, in reference to cradle-to-gate impacts. Cradle-to-gate impacts cover the upstream portion of the life-cycle (extraction and processing).

36. The analysis is further enhanced by estimating the environmental benefits associated with **increasing the current rate of secondary materials use** in the European Union (EU27+UK). In fact, leveraging on the environmental impact normalized index and on the nine environmental dimensions presented above, the estimation methodology is comprised of **three steps**:

1. **The materials production** has been considered. Materials production estimates the amount of materials directly produced by an economy and is defined as the annual quantity of raw materials extracted and processed from the domestic territory. Due to the lack of data, the impacts are considered at the overall economy level and at the European Union level.
2. **The circular material use rate** has been taken into account. It measures, in percentage, the share of materials recovered and fed back into the economy—thus saving extraction of primary raw materials—in overall materials use. In this case, given the lack of data, only the materials category of mineral ores at European Union (EU27+UK) level was taken into account. The circular material use rate was regarded as a proxy of the secondary materials exploitation in the economy.
3. Finally, as "**what-if" analysis**, exploiting the estimation of environmental impacts connected to the use of primary and secondary materials, in terms of the reduction of the environmental impact, an **increase in 10 percentage point in the current circular material use rate** was estimated.

37. The underlying assumption is that materials production will remain constant with a perfect substitution between primary and secondary materials. In other words, the final impact on the environment was estimated considering the absolute value of the increase in the secondary materials considered and applying the gap between the environmental impacts between primary and secondary materials use. The new marginal reduction in environmental impact was compared to the scenario of a lack of increase in the circular materials use rate. For any environmental dimension, the impacts were considered only for the **two most impacting materials**, specifically those materials with the highest environmental impact associated with the use of primary materials.

FIG 14 **Environmental impact reduction due to an increase of 1 percentage point in the circular materials use rate at European Union level, 2018** (% values)

Acidification		Climate change		Cumulative energy demand		Eutrophication		Freshwater aquatic ecotoxicity	
Nickel	Lead	Nickel	Aluminium	Nickel	Aluminium	Copper	Nickel	Copper	Lead
-13.1%	-9.5%	-13.1%	-12.7%	-13.0%	-12.6%	-13.1%	-13.4%	-13.1%	-12.2%

Land use		Photochemical oxidation		Terrestrial ecotoxicity		Human toxicity	
Copper	Nickel	Copper	Nickel	Copper	Nickel	Nickel	Aluminium
-12.2%	-13.2%	-11.0%	-13.4%	-9.8%	-13.4%	-12.9%	-13.0%

Source: The European House – Ambrosetti and Enel Foundation elaboration on OECD data, 2020.

Focus on plastic: recycled plastic reduces the carbon footprint of packaging

More than half of all goods in Europe are packaged in plastic. On average, 29 kg per person each year. Out of the 57 million tonnes of plastics produced in Europe annually, **39%** is packaging. For this reason, plastic waste represents a significant cost. In today's system, **95%** of the material value in plastic packaging—**$80-$120 billion annually**—is lost to the global economy after a brief first use. There is an open debate in the literature on the environmental benefits of recycling plastics. It has been shown that **recycling 1 tonne of plastic** could reduce emissions by **1.1-3.0 tonnes of CO_2e** compared to producing the same tonne of plastics from virgin fossil feedstock. If one considers an **85% recycled polyethylene terephthalate (PET) food tray**, it is possible to provide GHG emissions saving through a detailed life-cycle assessment. In fact, GHG emissions were studied at each stage of the life-cycle and options for reductions were identified. The carbon footprint of **1kg of PET tray** is around **1.54 kg/CO_2e**. However, if the tray were made of **100% virgin PET**, the total carbon footprint would be of **3.75 kg/CO_2e** for 1kg of PET tray. If the tray were made of **100% recycled materials**, carbon footprint would be reduced by **24% in terms of GHG emissions**, for a total of **1.15 kg/CO_2e** for 1kg of PET tray. If all the current plastics used were 100% recycled, **Italy** would be able to reduce of **59.8% the kg/CO_2e in its production**, while in **Europe** the reduction would be of **57.9%**. Finally, some positive impacts were also found for a number of bio-based plastics. It seems these can have a negative emissions potential, with -2.2 kg CO_2e per kg of bio-based polyethylene (PE) produced, compared to 1.8 kg CO_2e per kg of fossil-based PE produced.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Dormer, A., Finn, D. P., Ward, P., et al., "Carbon footprint analysis in plastics Manufacturing" (2013) and

38 An increase of 10 percentage points in the circular materials use rate for the two most impacting materials for each dimension leads to an environmental impact reduction varying in relation to the normalized index value underpinning the specific materials. It is worth noting that nickel, one of the most damaging materials, almost always has the highest impact reduction, around **-13.1%** on average.

39. For the Climate change dimension, the indicator considered is the GHG emissions (kg Co_2e). The analysis takes into account the differential effect on GHG emissions of the production of primary material versus the production of secondary material. Indeed, taking into account 4 materials (iron, aluminum, zinc and lead), average reduction of GHG emission per kg of materials produced is **73.5%**, with a peak of **94.6%** for aluminum. An increase of 10 percentage points in the circular materials use of the 4 materials considered, could bring a reduction in the GHG emission related to their production of **15.6%** for aluminum, **14.1%** for iron, **16.7%** for lead and **13.7%** for zinc.

FIG 15 **GHG emissions reduction for the selected materials due to an increase of 10 percentage points in the circular material use rate at European Union level, 2018** (% values and tonnes of CO_2e)

Aluminium	Iron	Lead	Zinc
-15.6% (-507,772)	-14.1% (-9,097,246)	-16.7% (-35,549)	-13.7% (-148,999)

Source: The European House – Ambrosetti and Enel Foundation elaboration on E. Van der Voet et al., "Environmental Implications of Future Demand Scenarios for Metals: Methodology and Application to the Case of Seven Major Metals", 2018 and Eurostat data, 2020.

40. In 2018, the energy sector was responsible for around **53% of the overall European Union GHG emissions**, split between 29% of energy industries and 24% of fuel combustion by energy users. Therefore, when analyzing the effect of Circular Economy on the environment, the energy dimensions cannot be excluded, specifically the increase of the renewable energy sources penetration in energy production. For this purpose, a "what-if" analysis was performed that estimated the **GHG emissions savings** of an increase of 1 percentage point in the share of renewables.

41. The "what-if" analysis is composed of **three methodological steps**:

1. For the energy sector, the corresponding direct **emissions factors associated with the energy production by sources** were identified. The emission factors relate the quantity of a pollutant emitted to a unit of activity (e.g., kg fossil CO_2 per tonne of material reprocessed). Emission factors for different GHGs are usually aggregated and expressed as CO_2e per activity unit. The emission factors for the different energy sources were identified after carefully analyzing the available literature (emission factors of renewables were set to 0).
2. The **share of renewables** in gross available energy in 2018 were considered.
3. Finally, as "**what-if**" **analysis**, the GHG emissions avoided due to an increase in the share of renewables were estimated by applying the emission factors to the TJ of renewable energy and other energy sources. An additional analysis has been added, including a scenario of alignment to the best European performer in share of renewable energy production.

42. The final results for the renewables will depend on the energy mix of the country involved and, as a consequence, on the energy source that the renewables penetration will substitute. In this sense, it is possible to consider **three different scenarios of substitution of the energy mix**:

1. **100% coal** substitution.
2. **50% coal** substitution and **50% natural gas** substitution.
3. **100% natural gas** substitution.

FIG 16 **GHG emission avoided due to an increase of 1 percentage point in the share of renewables in primary energy production in three different scenarios, 2018**
(million tonnes CO_2e and % vs. current GHG emissions of energy sector)

	Italy	Romania	Spain	EU27+UK
100% coal substitution	**-6.3** (-1.8%)	**-1.3** (-1.6%)	**-5.4** (-2.1%)	**-72.6** (-2.2%)
50% coal substitution and 50% natural gas substitution	**-5.0** (-1.5%)	**-1.1** (-1.4%)	**-4.3** (-1.7%)	**-57.8** (-1.8%)
100% natural gas substitution	**-3.7** (-1.2%)	**-0.75** (-1.0%)	**-3.2** (-1.3%)	**-42.9** (-1.3%)

Source: The European House – Ambrosetti and Enel Foundation elaboration on Ispra and IRENA data, 2020.

43. Assuming a 100% coal substitution with 1 percentage point increase in renewables, Italy presents a GHG reduction of **6.3 million tonnes of CO_2e** (126 if Italy reaches the best performer in EU), equivalent to **-1.8%** of the current energy sector GHG emissions, the highest decrease in absolute terms among the 3 selected countries. The result is impressive if compared to the GHG emissions of the Italian capital and other areas: 6.3 million tonnes CO_2e of GHG reduction are equivalent to around 50% of the annual GHG emissions in the city of Rome and around 25% of the annual GHG emission in the province of Milan. Clearly, the energy mix is an important variable guiding the results. Assuming 50% coal substitution and 50% natural gas substitution, the results decrease to **-5.0 million tonnes CO_2e** of GHG reduction (-100 reaching the best EU performer), equivalent to **-1.5%** of the current energy sector GHG emissions and to **-3.7 million tonnes CO_2e** of GHG reduction (-74 reaching the best EU performer), equivalent to **-1.2%** of the current energy sector GHG emissions, with a 100% natural gas substitution. The spread in results is due to the fact that natural gas has a lower emission factor than coal.

44. When it comes to the "use cluster", a positive impact on the environment is presented by promoting a second life or the promotion of repair and reuse practices of some highly raw-material-intensive goods. For this purpose, some examples are illustrated:

1. **Second-life of batteries**.
2. **White goods**.
3. **Circular smart meters**.
4. **Dismissed power plants**.

45. The commercialization of electrified vehicles, including battery, hybrid and plug-in hybrid electric vehicles (BEV, HEV, PHEV) is forecast to increase worldwide in coming years in response to global concerns about CO_2 emissions, air quality in urban areas and energy security, thus favoring energy transition towards electrification. This, in turn, has led to rapidly-increasing demand for electric batteries. This will also translate into an increase of waste batteries after reaching first use End-of-life in vehicles. Closing the loop for batteries would allow a cut of **51% of the environmental impact** of their manufacturing process. End-of-life batteries are no longer suitable for their original purpose, yet they maintain a 70-80% capacity and could be used for other applications before recycling. To extend the useful life of batteries, an option is to use "**second life batteries**" as energy grid storage, back-up systems and small scale electricity production storage.

The "second use" of electric vehicles batteries in the European Union framework

Even though the term "**second use**" is not currently defined in the Batteries Directive, nor in any of the various Waste Directives, the second-use of electric vehicle batteries is aligned with both the **waste management hierarchy** (i.e., prevent, preparation for re-use, recycle, other recovery, disposal) as established by the **Waste Framework Directive 2008/98/EC** (EU, 2008) and the 2015 **Circular Economy action plan** of the European Commission, especially concerning actions on lifetime and improved raw materials flows.
In fact, this option for electric vehicle batteries can maintain added value in products for as long as possible and minimizes waste. Resources are kept within the economy when a product has reached the end of its life, so that they can be productively used again and therefore create further value.

Source: The European House – Ambrosetti and Enel Foundation elaboration on European Commission data, 2020.

46. For circular smart meters, in 2017 Enel started the replacement of **first-generation smart meters** with the new, second generation smart meter. Once removed, old meters are disassembled and the materials—plastic and various metal and electronic components—are suitably processed and destined to **further use in the production of second raw materials**. Manufacturing one circular smart meter emits **6% less CO_2** and produces **122 g less waste** with respect to traditional meters.

Benefits of the circular by design approach

6%
Less emissions of CO_2

122g
Less waste than the traditional one

Waste avoiding by numbers

10 million
second generation smart meters

1,200
tons of plastic waste avoided

8,000
tons of virgin plastic saved

70,000
tons of CO_2 less

Circular smart meter

Enel has started in 2017 the replacement of first-generation smart meters with the new, second generation ones. The replacement plan is a clear example of adoption of Circular Economy. The old meters, removed from the field, are disassembled and the materials – plastic, various metal and electronic components – are suitably processed and destined to further use in the production of second raw materials. In particular, the plastic (polycarbonate) recovered from the old meters can be regenerated and used to build the new "Circular Smart Meter".

This result is the combined outcome of several elements.

First of all, not only the new meter will be manufactured with both recycled and recyclable material, but also the old meter was far-sightedly manufactured mostly using recyclable materials, according to the best practices available at the time of manufacturing. The evolution of material selection and separation process allowed to actually recycle and reuse those materials, capitalizing on this design choice.

Second, the cooperation with Valcart, an Italian waste management company, allows to rely on a highly efficient, full automatic material separation technology which doesn't require expensive and inefficient pre-manipulation of the discarded meters. The decommissioned meters are brought to the recycling facility and crushed into chips smaller than 1cm^2. The chips are selected and separated by type, color and physical features, by using advanced optical and material recognition technologies. Plastic, copper, ferrous metals and electronics components are therefore separated and destined to further use either directly or after a process known as "regeneration".

Third, and probably most important, the new smart meter is evolving thanks to the adoption of a "circular by design" approach, allowing for efficient use of resources, process optimization and compliance with all the stringent technical and performance requirements.

The design process of "circular" smart meter required several testing and certification steps, guaranteeing the suitability of the recycled material first, and the perfect compliance with the technical requirements and relevant standards. With respect to performance of the regenerated plastic and reliability in time, more than 50 complex tests at accredited laboratories have been carried out and several conformities of the "circular" smart meter have been evaluated.

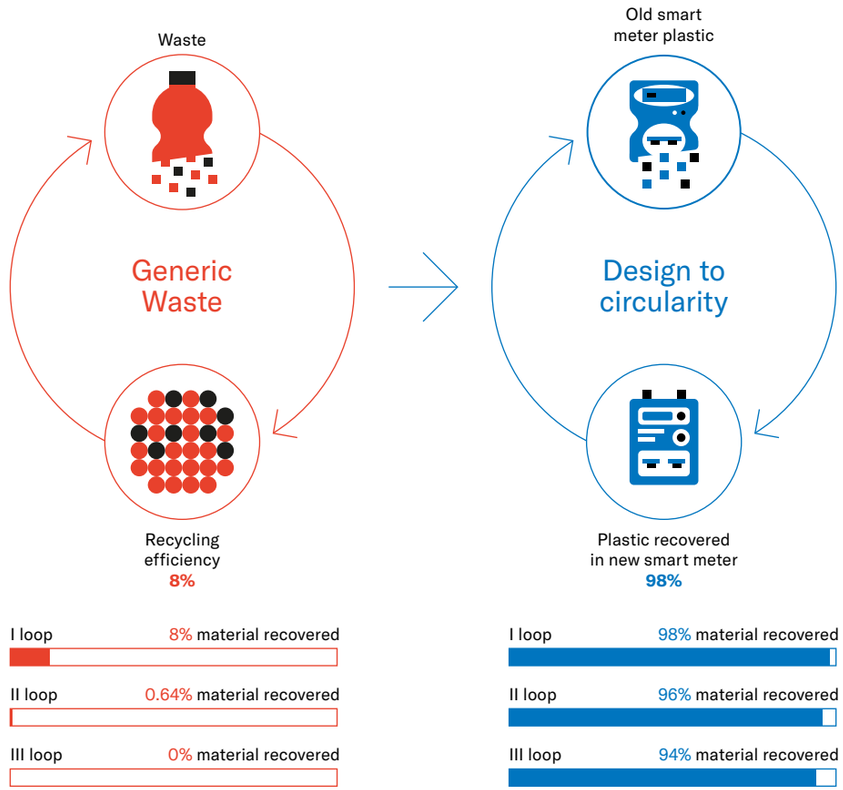
A first 30,000 unit batch manufactured with recycled material will soon be delivered and will help to identify further optimization of the overall process, according to a continuous improvement approach.

Valcart is an italian company expert in the sector of disposal and recycling of waste. Valcart buys dismissed smart meters and separates the plastic components which are provided another partner company OCHI in order to be regenerated and made ready for a new use.

The benefits of this approach have been evaluated adopting a Life Cycle Assessment methodology, which compared the environmental impact of the circular smart meter and those of a meter made using virgin materials only.

Benefits

The results of the assessment show that the manufacturing of one circular smart meter emits 6% less CO_2 and produces 122 g less wastes (virgin plastic) with respect to the traditional one. Moreover, the specific regeneration process of the plastic from old smart meters is optimized applying the "circular by design" approach, and has an efficiency of almost 98%. This is a really important achievement compared to the low value of material recovery (e.g. 8%)[10] for generic plastic waste. Such low value creates a relevant systemic impact. In fact, even if 100% of plastic is sent to recycle in the first life cycle, the actual material recovery is still around 8%. Under the same assumption, in the second life cycle only 8% of the original 8% is recovered, meaning just 0.64% of the original material. In the third cycle the amount of original material recovered is already negligible. Instead, in the specific case of the circular smart meter, assuming a period of three lifecycles, a 98% material recovery rate for each cycle translates into an actual material recovery of about an impressive 94%.



10 Retaining value in the Swedish materials system, Material Economics, 2020.

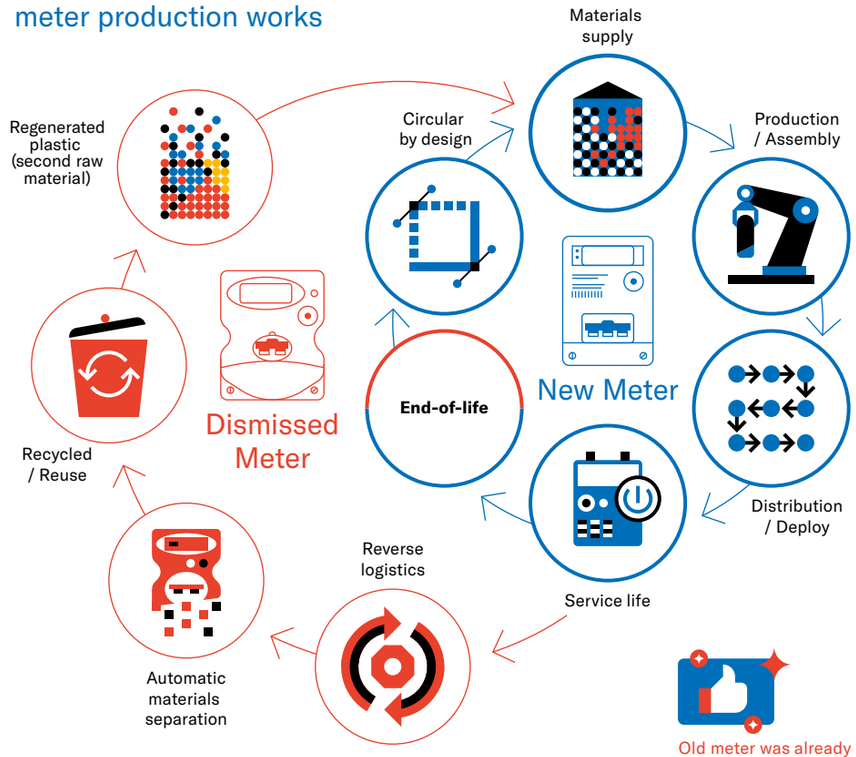
The use of recycled plastic also allows for a 5% reduction of the energy footprint by fossil fuels (Abiotic Depletion Potential of Fossil Fuels ADPF) required for the overall manufacturing process with respect to the utilization of virgin plastic.

These data show that the use of recycled plastic is not only less impactful in terms of CO_2 emissions but also less energy-intensive than that related to the use of virgin plastic.

Considering the amount of meters to be replaced, the impact of these saving is huge. Just the manufacturing of 10 million circular smart meters will allow to avoid wasting 1,200 tons of plastic, to save 8,000 tons of virgin plastic - an amount enough to build about 1.4 million plastic chairs - and will avoid the emission of 70,000 tons of CO_2eq, equal to about the yearly emission of 52,000 diesel cars[11].

Source: The European House – Ambrosetti and Enel Foundation elaboration on various sources, 2020.

How the circular smart meter production works



11 Diesel D segment Euro VI car 120g/km declared emissions, average mileage in Italy 11,200 km. Source Quattroruote.

The extension of useful life of buldings: the experience of the customs warehouse network

The energy transition is changing the way electric energy is produced and used. Energy efficiency, renewables and technology are driving the transformation of the entire power sector, starting from traditional power generation units.

In this context, Enel is committed to recover and enhance the end value of power stations that completed their primary lifecycle and function, by promoting conversion projects that respect the peculiarity of the territories where these facilities are located, according to a Circular Economy approach capable to enhance economic, occupational, social and environmental sustainability.

Some areas and structures belonging to Enel, located in the proximity of strategic infrastructures like harbors, airports and freight villages, have been identified as suitable for the development of the "network depositi doganali" (custom warehouse network) project.

The project aims at creating a network of custom warehouses through the total or partial repurposing of some areas, transforming them in logistic hubs. The activities of the hub will include not only container consolidation and deconsolidation but also high value added inward processing.

The construction of these custom warehouses will allow to reuse valuable assets located in highly attractive areas for the logistic business, reducing soil consumption and favoring reuse of materials and structures.

The initial phase of the projects will include the startup of two pilot sites located in the La Spezia and Livorno power stations.

This projects aims at capturing a part of the container flow in transit across the Mediterranean and that, because of the lack of suitable infrastructures, currently continues its travel towards northern Europe for custom clearance and rerouting towards the final destinations.

The repurposing of existing structures, according to Circular Economy principles, will bring remarkable benefits to the environment, thanks to the extension of useful life of the areas, to the economy, thanks to the valorization of existing competences and assets, and to the society, through the creation of new jobs.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Enel data, 2020.

Energy capacity of wind turbines

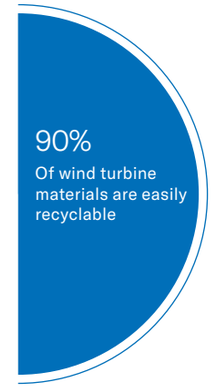
1,400 GW

Wind energy installed capacity in 2019

+540 GW

Wind offshore capacity by 2025

Recycling the wind turbines



The wind turbines blades recycling challenge

The blades are made of composit materials which are very difficult to recycle

Call for **solutions**

130 proposals

To identify the best available methods to recycle or reuse the materials of wind turbine blades

A Circular Economy challenge: recycling the blades of wind turbines

Wind energy has experienced exponential growth in the last decade. Installed capacity broke the 1,400 GW threshold in 2019, and keeps growing with thousands wind turbines installed every year worldwide. Forecasts suggest that this trend will go on for many more years. According to Bloomberg NEF NEO 2019 about 540 GW additional wind onshore capacity is expected to be online by 2025. This trend will keep wind energy at the forefront of renewable energy generation, with a 19% share of global RES growth in the next 5 years.

The average useful life of a wind turbine is about 20 years. After this period, the mechanical and structural properties of the turbines decay below a critical threshold. In some cases refurbishments allow to extend their lifetime for a few more years, while in other cases, the only option left is dismantling and substitution.

It is clear that an appropriate management of the inevitable end-of-life of these equipment is fundamental to further reduce the overall environmental impact of this technology. In fact, although wind energy is - almost by definition - green and environmentally friendly, players like Enel Green Power are committed to make it even more sustainable. While around 90% of the materials that make up a wind turbine (mainly metal parts) is easily recyclable, the blades are actually a challenge. Blades are in fact made of composite materials (like glass and carbon fibers) which are very difficult to recycle. To overcome this issue there are two possible strategies. First, the development of innovative recycling techniques allowing to process these materials. Second, the adoption of new materials, engineering and life cycle management solutions to increase the recyclability and reusability of the blades.

This is why Enel Green Power is searching for sustainable solutions based on reuse, recycling and on innovative options to give new life to the decommissioned blades.

This challenge requires to adopt a circular-by-design methodology, articulating it with a multidisciplinary and multi-sector approach. This allow to devise complex – and optimal – solutions integrating innovation both in technological development and in the creation of new business models and new life-cycle strategies. Different pathways seem to be opening up: starting from the design to reuse and recycling.

The study of new materials and new construction processes for the production of wind turbines certainly represents the most futuristic and innovative challenge, and probably it represents the maximum degree of sustainability attainable in the management of wind turbines.

Some interesting solutions are emerging in the field of composite materials. Lightweight, low density polymer compounds reinforced with natural fibers are attracting the interest of automakers, shipyards and real estate developers. Thermoplastic composite materials are also interesting because they are easily recyclable.

The path of reuse involves civil engineering and urban architecture. In fact, old wind turbines can be used for street furniture and similar artifacts. Depending on their size and characteristics, they may be suitable to build urban bridges, houses, and similar buildings.

Nevertheless, reuse is a valid strategy only for wind turbines at the end

of their first life. This requires to come up with innovative approaches to recycle blade material: glass or carbon fibers may find new applications in boating, sport equipment, and even in thermal and acoustic insulation for buildings. Moreover, blades could be used as inert materials to produce high performance conglomerates like asphalt and concrete.
Enel Green Power therefore decided to take the lead and systematically explore existing opportunities on this issue, launching two call for solution on the Enel crowdsourcing platform Open Innovability.
The first call was focused on the identification of the best available methods to recycle or reuse the materials of wind turbine blades. Out of 130 proposals received 18 solutions were selected. To demonstrate the technical feasibility of the solution, a set of proof-of-concept prototypes were implemented, from bricks manufactured by sintering and extruding used blade materials to pellets for thermal insulation of buildings and fillers for construction. The second call for solution was designed to further investigate the option to produce premium insulating materials for buildings. The call allowed so far to identify 11 EU and US based companies, active on various sectors and value chains. The objective of the cooperation with these companies, currently under development, is to assess the overall value chain and develop circular win-win business models that could allow to close the materials loop.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Enel data, 2020.

47. In Europe, **households own more washing machines than cars**. While washing machines are far more standardized than cars in both their physical dimensions and the amount of material they contain (typically 30 to 40kg of steel per machine), they vary substantially in price and lifetime. Although all washing machines have similar components, their longevity measured in washing cycles ranges from about **2,000 for entry-level machines to 10,000 for high-quality machines**. However, the trade-offs between high- and low-quality machines also have implications for material and energy consumption. Given similar material composition and production processes, replacing **five machines with a useful life of 2,000 washing cycles with with one 10,000-cycles machine** yields saves almost 180kg of steel and more than 2.5 tonnes of CO_2e.
Consumers declare they are willing to adopt Circular Economy practices related to **white goods**, but **they have very little incentive in actually doing so**. Consumers are in fact more likely to get their white goods repaired as long as they are still **under warranty**. Moreover, the choice between extending the useful life of a product and replacement with a new one depends on the price, representing another barrier to adoption.

48. The **sharing economy** has enjoyed remarkably rapid growth in recent years and seems set to scale new heights over the next decade. Some projections[12] put the sector's revenues at **$335 billion globally by 2025**, when in 2014 it was estimated to reach only **$15 billion**. The sharing economy is one aspect of Circular Economy and can have positive externalities on the environment by **increasing load factor of a product or service**. Urban density reduces emissions by enabling the sharing of carbon-intensive goods among households in a similar way as in a multi-person household. In fact, dense urban environments characterized by sharing consumption patterns drive per capita CO_2 emissions downward. It has been estimated that a shared passenger car has the potential to substitute from 4 to 13 personal cars. Taking into account potential increases in new car sales to car-sharing fleets and an increase in the degree of use of shared cars, CO_2 emissions could be reduced by roughly 40 to 140 kg per driver per year[13]. Considering for example that the estimated impact (in terms of CO_2 equivalent emission) for the production, maintenance and disposal of a car is of 5 tonnes CO_2e, the emission reduction of a shared car would be from 10 to 35 tonnes of CO_2e[14].This would entail a reduction from 66% to 87% of CO_2 emissions compared to the use of personal cars[15].

Circular mobility as an example of a sector embracing a circular paradigm at 360°

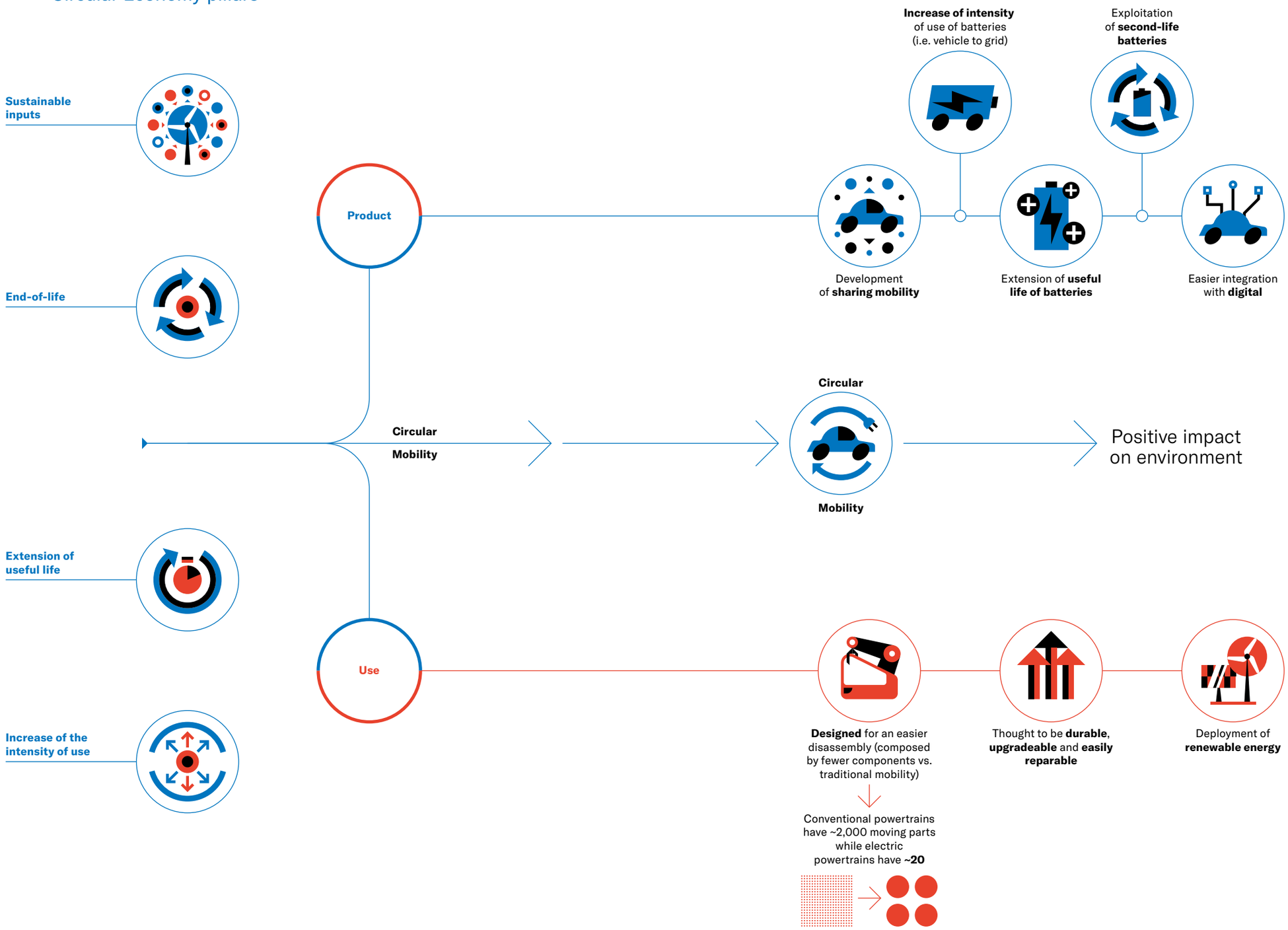
The Circular Economy paradigm requires understanding of the huge potential of **circular mobility** by investing to overcome today's barriers to its development in order to see the quality of the mobility system improve dramatically.
Circular mobility is an example of a sector that is able to **embrace the circular paradigm along all the four pillars** and to bring benefit to the environment.
On one hand, from a "product cluster" point of view, in circular mobility, vehicles are designed for easier disassembly and are conceived and built to be durable, upgradeable and easily reparable. Moreover, vehicles are built also to allow for higher deployment of renewable energy. As an example, conventional powertrains could have around 2,000 moving parts while electric powertrains around **20**.
On the other hand, from a "use cluster" perspective, circular mobility is set to permit easier integration with digital technologies and paradigm, implying a more linear development of the sharing economy.

Source: The European House – Ambrosetti and Enel Foundation elaboration various sources, 2020.

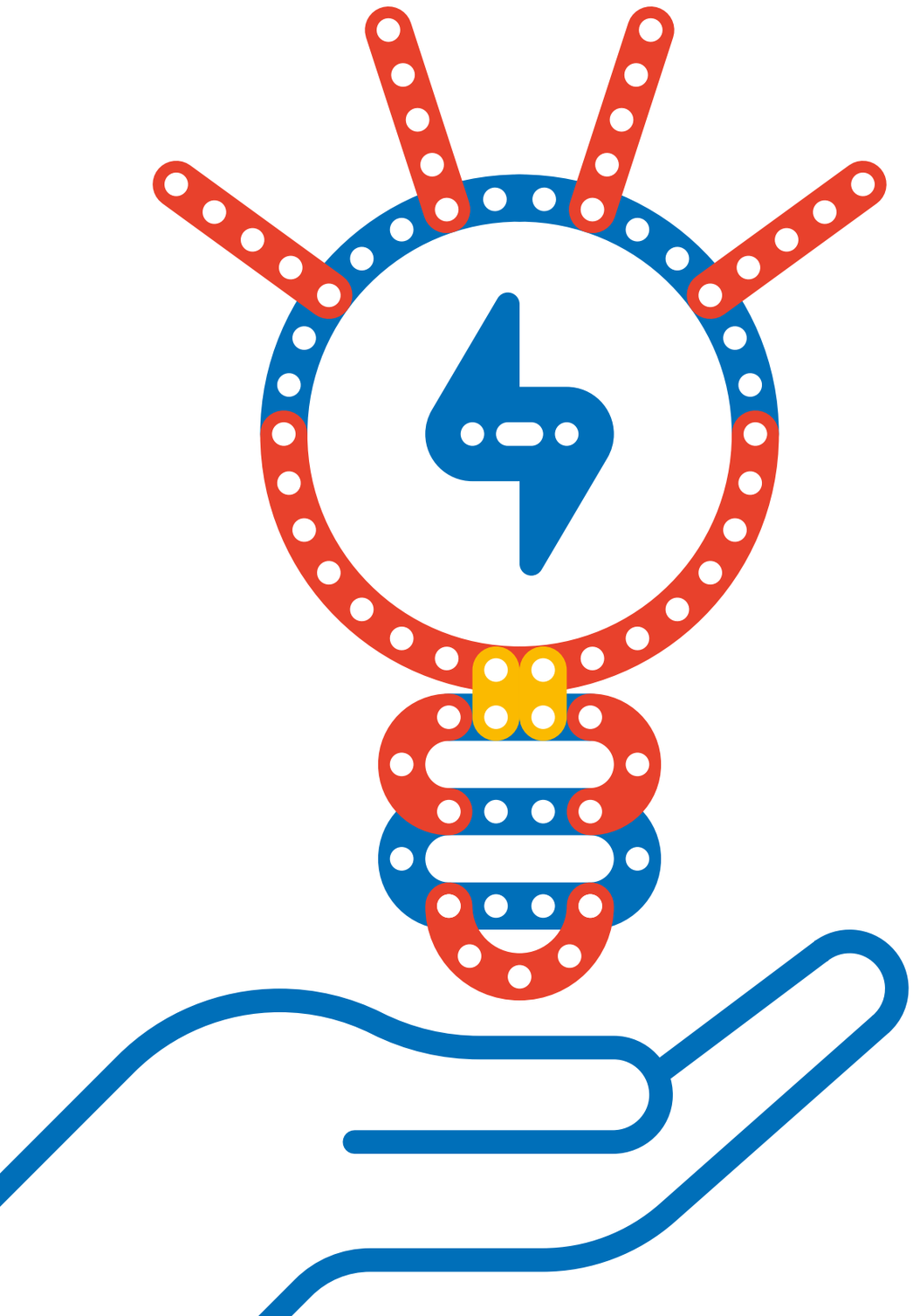
12 Source: Statista, 2019.
13 The CO_2 reduction estimate takes into account: the reduction of emissions attributable to the production, maintenance and disposal of a new car; the number of cars not produced; the average age of a car (thus calculating the average emission reduction per year); the average number of users using a shared car.

14 The reduction of 4 to 13 personal cars is offset partially (by around 35%) by the increase of the car-sharing fleets leading to final positive effect comparable to 3-8 cars.
15 The reduction in CO_2 emissions considers exclusively the effect of a decrease in the production, maintenance and disposal impact of cars attributable to 3-8 cars.

Fig17 Circular mobility and its environmental benefits along the four Circular Economy pillars



Source: The European House – Ambrosetti and Enel Foundation elaboration various sources,



Part 3

Policy proposals for successfully managing the transition from a linear to a circular world

Key messagges

The transition towards a Circular Economy has already brought **several economic**, social and **environmental benefits**. Nevertheless, to reap the full opportunities offered by the transition from a linear to a circular development model, some **outstanding issues** must be faced. In this sense, **10 areas of intervention**, entailing specific **policy actions**, have been identified to tackle the challenges related to circular transition and effectively reap its benefits.

1 **Defining National Strategies for EU Member States for a Circular Economic development**: setting comprehensive and ambitious strategies and roadmaps at national and at local level, with a strategic cross sectorial focus on Circular Economy, with measurable objectives to be achieved in a specific time frame.

2 **Redefining Circular Economy governance in order to support strategic and cross sectorial transition**: defining an effective governance, to include all the departments (both at national and at corporate level) avoiding that Circular Economy reach is limited to environmental department activities.

3 **Leveraging on legislation for enhancing circular transition**: enhancing the development of circular business models leveraging also on legislation.

4 **Levelling the playing field with linear solutions**: eliminating incentives to linear models or giving incentives to circular business models (e.g. reducing the taxation on circular factors, human labour first of all).

5 **Using finance as a leverage to promote Circular Economy Research & Development and best practices**: launching adequate financial instruments that can support companies' investments on Circular Economy model and promoting a circular public procurement that could also accelerate innovation.

6 **Addressing the lack of a clear definition and of comprehensive and homogenous metrics**: defining clear and homogeneous metrics to measure Circular Economy at macro and micro level.

7 **Turning waste-oriented business models into circular ones**: incentivizing circular by design approach, warranty time extension, making repair easier, creating financial incentives for reparability and ensure availability of information on durability and reparability.

8 **Promoting cross-cutting and coordination measures for all the sectors involved in the Circular Economy transition**: sustaining the creation of districts and clusters to maximize synergies at local, national and European level, creating an ecosystem for innovation by identifying some strategic sectors.

9 **Leveraging on Circular Economy as a framework to re-imagine cities and urban areas**: leveraging on cities and urban areas to promote the cooperation among different stakeholders and coordinating different contributions towards a more circular territory.

10 **Promoting culture and awareness on benefits associated to Circular Economy**: clarifying the value of Circular Economy, raising public awareness and promoting communication on Circular Economy benefits among consumers, promoting Circular Economy playbooks, addressing the issue of skill mismatch, implementing a “Circular Economy Apprenticeship Erasmus Program”, strengthening the commitment towards lifelong learning programs.

1. As shown by the assessment model in Part 2, the transition towards a Circular Economy can bring several economic, social and environmental benefits. However, to effectively reap the positive externalities of Circular Economy, it is necessary to further advance the shift from a linear to a circular development model. With this goal in mind, **10 policy matters, entailing specific policy actions**, have been identified.

1. Defining National Strategies for EU Member States for a Circular Economic development
2. Redefining Circular Economy governance in order to support strategic and cross sectorial transition
3. Leveraging on legislation for enhancing circular transition
4. Levelling the playing field with linear solutions
5. Using finance as a leverage to promote Circular Economy Research & Development and best practices
6. Addressing the lack of a clear definition and of comprehensive and homogenous metrics
7. Turning waste-oriented business models into circular ones
8. Promoting cross-cutting and coordinated measures for all the sectors involved in the Circular Economy transition
9. Leveraging on Circular Economy as a framework to reimagine cities and urban areas
10. Promoting culture and awareness on the benefits associated to Circular Economy

3.1 Defining National Strategies for EU Member States for a Circular Economic development

▼ Rationale

2. As described in Part 1, the recent European Green Deal and the related Circular Economy Action Plan set new and more challenging objectives for Europe with regard to the transition to Circular Economy models. However, Circular Economy development across the EU countries is characterized by a high degree of heterogeneity. Some countries, especially in Eastern Europe, are in an embryonic phase of transition and far from best performers like Finland (which established the first national roadmap towards Circular Economy in the world four years ago). As of today, many European countries still **lack a national, well-defined strategic roadmap** for transposing the European directives on Circular Economy at national level.

FIG 1 **The national transposition of European directives on Circular Economy**

Austria ●
First country to measure the circularity gap

Finland ●
Finnish roadmap to a Circular Economy (2016-2025)*
An update of the plan was released in 2019 to reform its economic model to ensure successful sustainability

France ●
French act of law against waste and for Circular Economy

Germany ●
Resource efficiency program for the sustainable use and conservation of national resources

Luxembourg ●
National waste and resource management plan

Greece ●
National Action Plan on Circular Economy

Italy ●
Declaration of intent with the Italian Green New Deal**

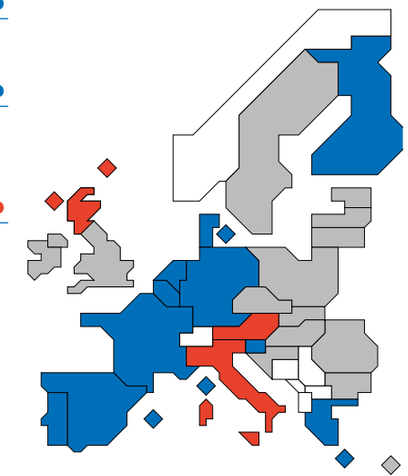
Netherlands ●
Circular Economy in the Netherlands by 2050

Portugal ●
Leading the transition: a Circular Economy Action plan for Portugal

Scotland ●
Circular Economy Strategy for Scotland

Slovenia ●
Roadmap towards the Circular Economy

Spain ●
España Circular 2030, a national strategy for Circular Economy in Spain until 2030



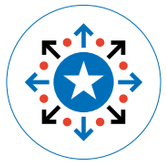
● National strategy ● Declaration of intent or regional activities ● Neither strategy nor regional activities

(*) It is the world's first national roadmap towards a Circular Economy

(**) The document "Verso un modello di Economia Circolare per l'Italia" was issued by the Italian Ministry of Environment and Ministry of Economic Development in 2017

Source: The European House – Ambrosetti and Enel Foundation elaboration on European Commission and European Circular Economy Stakeholder Platform, 2020.

Policy proposal →



Setting **clear and ambitious strategies** and **roadmaps** at national and at local level, with a strategic cross sectorial focus on Circular Economy, with measurable objectives to be achieved in a precise time frame.

3. The importance of the definition of a country vision and strategy on Circular Economy is of fundamental importance for the implementation of concrete actions in this perspective. Developing a vision - and a strategy for its implementation on a national basis - can, in fact, enable countries to:

- Give an **orientation on the short to medium term**, rationalizing existing initiatives.
- Define **challenging objectives** to be achieved over time horizons defined and shared by all the country's stakeholders.
- Encourage business leaders to **support actions** in a circular perspective.

3.2 Redefining Circular Economy governance in order to support strategic and cross sectorial transition

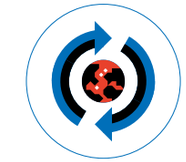
▼ Rationale

4. Circular Economy is a very complex concept that encompasses the whole economic system and society. Thus, the approach to Circular Economy has to be systemic and include all the different key areas, not being limited to environmental department but to involve also other departments (finance, economic development, industrial policy, etc.) involved in the transition with a clear definition of guidelines and reference bodies. Within this perspective, greater **collaboration between public and private players** across all economic and industrial sectors is considered necessary but there needs to be a single point of reference for both sectors that can coordinate activities and give guidance.

5. This aspect of collaboration among different players offers a challenge in terms of governance. In almost all the European countries considered, **regulation on Circular Economy is still decentralized and uncoordinated** among different Institutions and bodies inside company structure. It is fundamental that Circular Economy issues are managed not only by single agencies or offices, also because it is often mistakenly associated with environmental departments.

← Policy proposal

Defining an **effective governance**, to include all the departments (both at national and at corporate level) avoiding that Circular Economy reach is limited to environmental department activities.



6. To capture all the aspects and activities related to the transition from linear to circular models, a **cross-institutional approach** should be promoted, both at European and national levels, involving competences and/or professional figures related to all the relevant institutions and governmental bodies for Circular Economy. The definition of **clear governance** certainly also helps companies to have a **point of reference in terms of regulation and policy**, encouraging them to implement circular interventions in their business models.

3.3 Leveraging on legislation for enhancing circular transition

▼ Rationale

7. Circular Economy opportunities are currently prevented from legislative "silos", unclear regulations and undefined reference framework that have been built up in the past, focusing on traditional and linear models. New business models, new technologies, new opportunities require an **update of regulatory and legislative framework**.

8. Five business models can be identified for a more Circular Economy:

- **Circular supply models**, by replacing traditional material inputs derived from virgin resources with bio-based, renewable or recovered materials.
- **Resource recovery models**, which recycle waste into secondary raw materials, thereby diverting waste from final disposal while also displacing the extraction and processing of virgin natural resources.
- **Product life extension models**, that extend the use period of existing products, slow the flow of constituent materials through the economy and reduce the rate of resource extraction and waste generation.
- **Sharing models**, that facilitate the sharing of under-utilized products and can therefore reduce demand for new products and their embedded raw materials.
- **Product as a service models**, where services rather than products are marketed, improving incentives for green product design and more efficient product use, thereby promoting a more sparing use of natural resources.

9. Alternative business models are increasingly being adopted by European countries but, overall, the share of entities actually doing Circular Economy is still low and is typically linked to restricted economic niches. Moreover, to scale up the adoption of circular business models, it is important to align the choices of key stakeholders (customers and suppliers), so as to reshape the entire value chain. Thus, the **regulation framework** could play a pivotal role in anticipating the structural need of Circular Economy and incentivize business to adopt circular business models.

← Policy proposal

Enhancing the development of circular business models leveraging also on **legislation**.

10. Regulation should aim at implementing a legal framework that enables businesses and citizens to benefit from the advantages of the Circular Economy and to avoid unnecessary administrative burdens. Circular Economy legislation is future proof if it is **proactive** and **forward looking** and it is able to drive business leaders' choices towards decisions that meet the needs of Circular Economy.

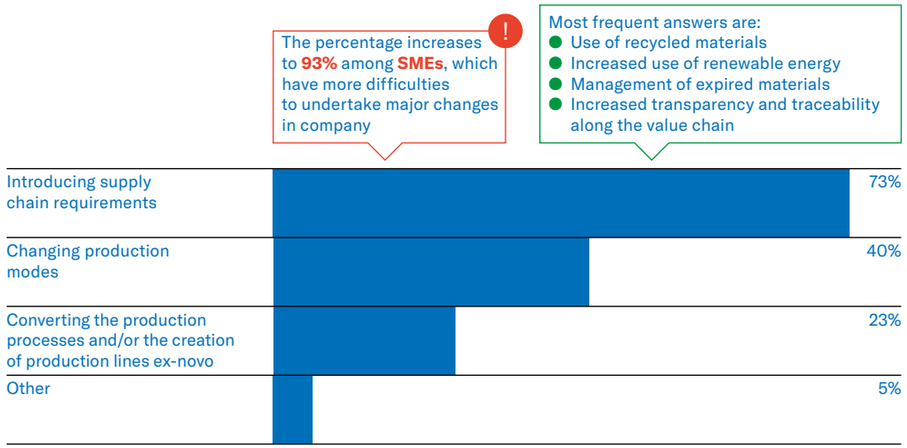
11. In other words, a "future proofed" approach on regulation and legislation entails the creation of a favourable context to accompany companies in the transformation of their business models. This purpose could be achieved by introducing a mandatory percentage shares of inputs used in production coming from recycling and renewables, allocating a certain share of companies' waste to the creation of secondary raw materials or by including targets for sharing mobility in municipal regulations. Following this approach, almost all the policy proposals and recommendations described in this chapter can be considered part of "future proof" legislation.

3.4 Levelling the playing field with linear solutions

▼ Rationale

12. European business leaders are reluctant to major changes in their business models. Also, a low diffusion of circular models emerges, as confirmed by the survey undertaken among European companies. In fact, when asked what operating methods they are willing to adopt to deploy Circular Economy, **73%** of companies answered "**introducing supply chain requirements**", while **40%** only replied "**changing production modes**". This suggest companies are not inclined to make relevant modification to their business models. This is even more evident among SMEs, where the percentage rises to **93%**. Moreover, the most frequent interventions are mainly related to the use of recycled materials and increased use of renewable energy, all requiring just small changes in business models, and partial implementation of the Circular Economy concept.

FIG 2 **Response to the question "What operating methods does your company plan to develop to offer products and/or solutions for Circular Economy?", 2020**
(% values, multiple choices allowed)



Source: The European House – Ambrosetti and Enel Foundation on Circular Economy online survey, 2020.

← Policy proposal

Eliminating incentives to linear models or giving **incentives** to circular business models (e.g. **reducing the taxation** on circular factors, human labour first of all).

13. Further to the definition of a clear governance and a regulatory level playing field, companies also need economic incentives. The survey shows that business leaders think that the most urgent area of intervention is to **promote access to financing** for companies willing to make a transition towards Circular Economy. It is necessary to assess existing public incentives and re-allocate those generating effects not in line with a Circular Economy. The extended responsibility of producers for the life-cycle—including the end-of-life—of products and the shared responsibility of all entities involved in consumption are important economic tools to guide the market towards circularity.

14. Therefore, a **re-balancing of the tax burden** is needed. A Circular Economy oriented tax scheme must, on one hand, discourage inefficient consumption of materials and energy; on the other, it must reduce the cost of labour and encourage the use of secondary raw materials.

3.5 Using finance as a leverage to promote Circular Economy Research & Development and best practices

▼ Rationale

15. Research and Development and technology advancements are two key enabling factors for the transition towards Circular Economy. The European Union is home to several major international industrial players, many high-tech small-medium firms and to world class research system. These are fundamental assets for the linear-to-circular transition. To enhance European companies R&D, it is of paramount importance to create innovative ways for fundraising, matching the peculiarities of research in the Circular Economy field (high level of initial investment, mid-/long-term returns, etc.) with the expectations of private investors.

16. The urge to access finance is clear from the survey results. Respondents identified facilitating access to finance and promoting investment as the **first most pressing intervention measure** in Italy (with **92%** of responses), in Spain (with **89%** of respondents) and no. 2 in the rest of the European Union (where **52%** of business leaders indicated this as their second choice).

← Policy proposal

- Launching adequate **financial instruments** that can support companies' investments on Circular Economy models.
- Promoting a **circular public procurement** that could also accelerate innovation.

17. As with the Social Impact Bond (SIB), Member States could launch appropriate **financial instruments** to sustain investment in Circular Economy related R&D and innovation activities. The recipient could be, for example, consortia grouping together key Circular Economy research players (i.e., universities, manufacturing companies, public administration, etc.). This combination of competences should guarantee coverage of all steps of the value chain, from research to implementation.

18. Investment and transformation of business models should be promoted not only in the private but also in the public sector. **Circular Public Procurement (CPP)** must play an important role in directing a significant part of public investment toward circular models. CPP can be defined as the process by which public authorities purchase works, goods or services that seek to contribute to renewable / closed energy and material loops within supply chains, while minimizing (and in the best case avoiding) negative environmental impact and waste creation across their whole life-cycle. For this, incisive and binding criteria need to be applied to public procurement. It is necessary to give guidelines, monitor the application of circularity criteria, assess the results and be able to carry out checks and, if necessary, provide corrective guidelines.

3.6 Addressing the lack of a clear definition and of comprehensive and homogenous metrics

▼ Rationale

19. There have been various attempts to define the phenomenon of Circular Economy starting from resource-oriented definitions, posing the emphasis on the need to create closed loops of materials flows and reducing the consumption of virgin resources and harmful environmental impacts. The focus of most definitions is on the reduction of resource extraction and of waste generation, thus limiting a comprehensive understanding of the phenomenon. Even if there have been attempts to go beyond the pure notion of management of materials resources and incorporate additional dimensions, often these have failed by **focusing on just a single dimension** (for example, energy or the materials dimension).

20. One frequently-cited definition that manages to embrace different aspects is the one provided by the Ellen MacArthur Foundation (2013) that defines Circular Economy as "*an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models*". Despite being very comprehensive, this definition **lacks the operational dimension** that would be needed to actually implement changes to promote the shift of the economic system from a linear to a circular one.

21. The urge to have an operational dimension of Circular Economy has also been pointed out by European business leaders. Respondents identified the clarification of the meaning and metric of "being circular" as the **second most pressing intervention measures** in Italy (with **52%** of responses), in Spain (with **58%** of respondents) and no. 1 in the rest of the European Union (where **63%** of business leaders indicated this as their first choice). The definition of operational standards and metrics for new Circular Economy models is of paramount importance to set effective policy instruments and avoid "green washing" effects.

Please refer to **Part 1.4** for a detailed analysis of the perception of the European business leaders towards Circular Economy.

FIG 3 **Response to the question "What intervention measures does your company require from institutions (national and European) in order to foster Circular Economy?" in Italy, Spain and the rest of the EU, 2020**
(% values - multiple choices allowed)

	Italy		Spain		Rest of the EU	
Facilitating access to finance and promoting investment	**92%**	**1°**	**89%**	**1°**	**52%**	**2°**
Clarifying the meaning and the metric of "being circular"	**52%**	**2°**	**58%**	**2°**	**63%**	**1°**
Stimulating demand	32%		38%		49%	
Simplifying regulation	32%		30%		31%	
Reorganizing industrial supply chain, also internationally	28%		27%		38%	
Sustaining education and research in Circular Economy	20%		18%		10%	

Source: The European House – Ambrosetti and Enel Foundation on Circular Economy online survey, 2020.

22. The lack of a clear definition of Circular Economy affects both the **financial sector**, with effects on the willingness of banks and financial institutions in investing in Circular Economy products and services, and **consumer behaviours**.

23. More specifically, from the investor perspective, the lack of understanding of what being circular means for companies affects willingness to invest in Circular Economic activities. Therefore, there are increasing difficulties associated with the creation of proper financial instruments able to support circular investment. The absence of a clear definition also determines the lack of metrics to measure who is actually carrying out Circular Economy activities. The urge to have accurate metrics and standards is of paramount importance in the banking sector, because it affects the willingness to grant corporate loans to support the investment needed for the transition. At the moment, the only available metrics are focused on the end-side of the Circular Economy value chain (e.g., waste and recycling) and this is also why the phenomenon of Circular Economy resembles often waste management.

24. From the consumer side, to promote more sustainable and circular consumption patterns, it is fundamental to introduce metrics and standards that are **understandable to the average consumer** (e.g., the carbon footprint is a very complicated measure that might be misinterpreted). In addition, the higher price associated to sustainable products represents an entry barrier for medium-low purchasing power consumers, especially if the reason for this price is not properly explained.

25. Similarly to the definition, Circular Economy metrics are still **mainly linked to the concepts of waste management and recycling**, which are the only fields for which clear and shared metrics have been developed. Even if various methodological alternatives to measure circularity exist, none of them is able to effectively capture the level of development of this phenomenon with an all-round view tackling all phases of the life-cycle. As a matter of fact, without clear metrics and standards, both at country (macro) level and at corporate (micro) level, the measurement and the understanding of the real economic value enabled by Circular Economy (e.g., new market opportunities) activities might be misinterpreted and fail to create proper stimulus to start the transition.

Policy proposal →

- Defining **clear, comprehensive and homogeneous metrics** to measure Circular Economy at macro and micro level.
- Enriching national and international **databases** with more data on macro and micro levels of development of Circular Economy.

26. The analysis of the existing micro and macro level Circular Economy indices pointed out some critical areas, such as the lack of a complete and homogenous representation of the phenomenon. This has to be tackled on both the macro level (national and European) and the micro level (corporate).

27. The Circular Economy Scoreboard is intended precisely to deal with the current incompleteness and provide a comprehensive picture of the phenomenon. The choice of the pillars and of the variables included in the Scoreboard was driven by the desire to be **as inclusive as possible** in representing the phenomenon of Circular Economy in its entirety.

28. The Circular Economy Scoreboard's pillars were identified starting from a literature review on the phenomenon that lacks, however, the operational and measurement aspects. These pillars were chosen to be **representative of the entire life-cycle of products and services**, capturing both the production side in the first two pillars (Sustainable inputs and End-of-life) and the consumption and usage side in the last two pillars (Extension of useful life and Increase of the intensity of use).

29. The Circular Economy Scoreboard aims at becoming a standard in the measurement of Circular Economy thanks to its all-round view and approach to the phenomenon at the macro level. However, it is important to note that the macro level results are the compound outcome of each initiative and practice carried out at the micro level, so it is fundamental to have the micro dimension monitored and measured as well. The effort to include Circular Economy at corporate level implies engagement in viable and sustainable business models. These business models have to be priority-driven and properly measured. Among the attempts to measure Circular Economy at corporate level, it is certainly worth mentioning the CirculAbility Model© developed by Enel which can be accessed by all companies and public bodies wishing to have an assessment of their degree of circularity in relation to a specific asset or product considered.

30. The methodological approach proposed by Enel brings together several aspects promoting an economic business model that fosters sustainable solutions (for example, considering the use of renewables and the use of recycled materials). The methodological approach for the measurement of circularity considers five pillars (Sustainable inputs, Life extension, Product as a service, Sharing platform and End-of-life).

31. The **micro** approach of Enel and the **macro** approach provided by the Circular Economy Scoreboard match at **pillar level**. This correspondence is key to provide a **uniform representation** of the phenomenon to a range of stakeholders, allowing both private and public actors to refer to a common scheme when defining the measurement parameters according to the specific needs of their business and sector of reference.

Please refer to **Part 1.3** for a more detailed explanation of the micro approach of the CirculAbility Model© and the macro approach of the Circular Economy Scoreboard.

32. Further to the definition of micro and macro level frameworks and metrics, it would be important to broaden the extent and detail of the **international databases available** relevant to this area. In particular, given the increasing importance of the phenomenon, it would be interesting and useful to have a **specific section of European and national databases dedicated to Circular Economy**.

33. This dedicated section could be added to the other relevant economic dimensions monitored regularly to provide a picture of the current level of Circular Economy in one country, as well as an understanding of the trend over time. This section would have to tackle the different aspects of Circular Economy in the economic system of a country representing the product life-cycle (i.e., starting from the pillars identified in the Circular Economy Scoreboard). It would be important to **enlarge and reinforce the availability of data** related to the intensity of use of products and services. This dimension is relevant because it captures new economic models (such as the sharing economy) that promote circularity. However, to date, the lack of proper and available data has led to the selection of enablers as proxies of this phenomenon.

34. To monitor companies' progress towards Circular Economy, "**circularity reports**" can be required from large companies. An option could be to include such reports in sustainability reports of companies and prepare them regularly as is done for financial reporting. Therefore, companies would also be able to communicate their level of circularity to European and national institutions, together with data related to their economic performance (i.e., value added, number of employees, and investment).

This additional reporting is not meant to create a further layer of complexity, but rather provide a **representation of the value entailed in circularity actions** that companies decide to engage in.

The adoption of a Circular Economy paradigm is not a simple endeavor. Although the general principles and framework are now essentially clear, the absence of well-defined international standards constitute one of the major difficulties. Notwithstanding that, various organizations and enterprises have recently mobilized to accelerate the adoption of this paradigm, starting to fill the existing gaps. As a result, it is possible to identify several initiatives borne not following regulations but in fact, anticipating them.

The "100 Italian Circular Economy stories" report by Enel and Fondazione Symbola sheds a light on this phenomenon in Italy. The examples illustrated in the report come from successful companies, research centers and non-profit organizations who pioneered the Circular Economy approach, delivering a vivid impression of how "Made in Italy" has already started to embed innovation and sustainability, also leveraging on the tradition of making the most out of the material resources scarcity affecting this country. These stories also represent an example to follow for others. A similar publication has been published from Finnish Sitra. It is interesting to notice that both Sitra and Enel independently adopted the same pillars in addressing circularity. Some companies and organizations have not only started to implement Circular Economy but also to share their experience, publishing handbooks and frameworks or adopting specific and transparent metrics that can be used by their customers to identify what product or service could improve their circularity. The "Circular Design Guide" by the Ellen MacArthur Foundation and Ideo, the "Circular Design Workbook" by Nike, the "Circular Business Models for Chemical Companies" and the "Circular Economy Business Models for Manufacturing Industry" by the Finnish Sitra, or the "CirculAbility Model©", published by Enel already in 2017 as a paradigmatic model on how to implement Circular Economy metrics (https://corporate.enel.it/en/circular-economy-sustainable-future/performance-indicators), are good examples of this growing trend.

Enel, with his subsidiary Enel X, has also started to adopt specific methodologies and metrics derived by the CirculAbility Model© and applicable for commercial purposes. These methods and metrics are certified by an independent institution (RINA) and allow to calculate a "circularity score" for various actors like companies and public administration institutions. In particular the tools developed are the Circular Economy Corporate Index, the Circular Energy Site Score and the Circular Economy City Score. The score can be used as a diagnostic tool and allows to select the best technical solutions to improve the circularity level of the customer.

Source: The European House – Ambrosetti and Enel Foundation elaboration on Enel, Finnish Sitra, Ellen MacArthur Foundation, Nike and RINA, 2020.

For further information on Enel CirculAbility Model© please refer to

3.7 Turning waste-oriented business models into circular ones

▼ Rationale

35. To-date, European consumers are generally favourable to Circular Economy but actual engagement is rather low. While a majority of European consumers repair products (**64%**), a substantial share has no experience in renting/leasing or buying second-hand products (**90%**). A reason for this low engagement in Circular Economy practices could be that consumers lack information regarding **product durability** and **reparability**, as well as the **lack of sufficiently developed markets** (e.g., for second-hand products, renting, leasing or sharing services etc.).

FIG 4 **Agreement with statements on general Circular Economy-related behaviors in the EU27+UK, 2018**
(% of respondents)

Circular Economy related behaviours	Strongly disagree	Tend to disagree	Tend to agree	Strongly agree
I always keep things I own for a long time	0.8%	5.8%	51.7%	41.7%
I always recycle my unwanted possessions	3.4%	18.8%	52.0%	25.8%
I usually repair my possessions if they break	7.4%	29.1%	52.7%	10.8%
Sometimes I buy second-hand products	31.1%	40.5%	23.8%	4.6%
I always buy the newest electronic goods and gadgets	15.2%	39.6%	37.1%	8.2%

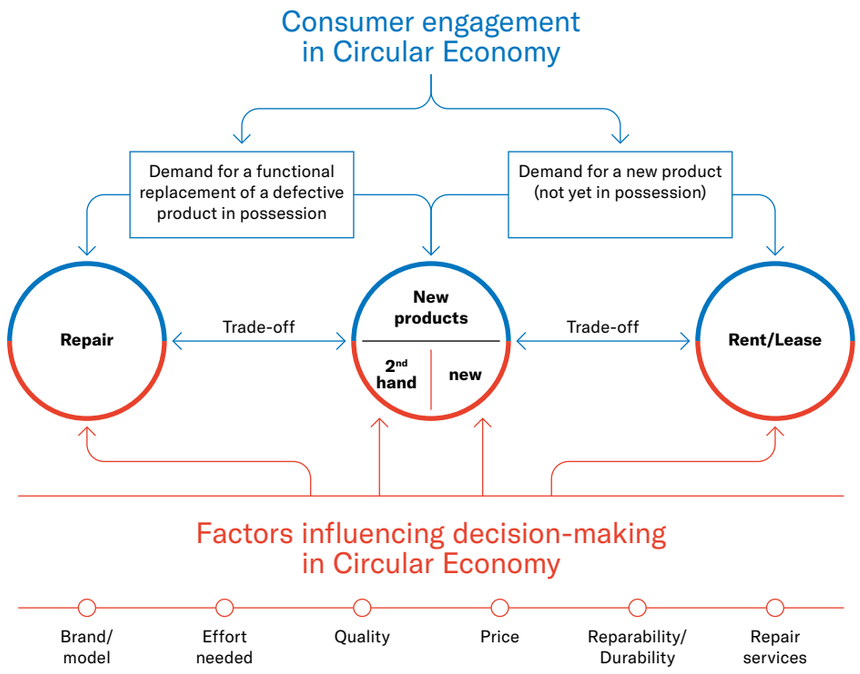
Source: The European House – Ambrosetti and Enel Foundation elaboration on European Commission data, 2020.

36. Much more effort is needed to foster the adoption of Circular Economy-related behaviours. From a consumer perspective, actions that extend the lifetime of products include purchasing more durable products, repairing products when broken and giving products a second life by selling them in the second-hand market. Increasing the utilization rate of products can also be achieved through renting/leasing models. Renting or leasing is especially useful for products that people only use occasionally. These options are presented in the figure below for two types of consumer demand:

- Demand for a **functional replacement**, or equivalent, for a product the consumer already owns (but is defective).
- Demand for a **new product** that they do not yet possess.

The options for the first type are repair or replacement with a new or second-hand product. The second type can only be satisfied by a new or used product (in ownership) or through rental/leasing.

FIG 5 **Factors influencing consumer Circular Economy behaviours**



Source: The European House – Ambrosetti and Enel Foundation elaboration, 2020.

37. There is evidence that the provision of **detailed product information** can be highly effective in shifting purchasing decisions towards products with greater durability and reparability. Furthermore, repair decisions are easily disrupted if arranging repair requires effort. These evidences indicate that there is a **large potential to close the gap between consumer willingness to engage and actual engagement**[1].

← Policy proposal

- Incentivize circular by design approach.
- Incentivize **warranty time extension** against breakage to reduce the frequency of purchase.
- **Making repair easier** by:
  - Making essential components in a product **replaceable by consumers** (often a product needs to be replaced or sent for professional repair if an essential component such as, for example, the battery, an LED light or a motor, becomes defective).
  - Including **repair instructions** for minor defects in user manuals.
  - Ensuring the **availability of spare parts** in the longer run, requiring companies to provide spare parts for a certain period of time (and also even after the product has been discontinued from the market).
- Creating financial incentives for reparability and durability, by introducing **tax reductions** or **exemptions** for durable goods, leasing/renting services, and repair services. This could also include incentives for companies to provide spare parts for products for a set period of time after production has been discontinued.
- Ensuring availability of **information on durability and reparability** at the point of sale by exploring the possibility of integrating durability and reparability information into existing **product labels** (e.g., icons indicating expected lifetimes or durability commitments).

For further information to the study "Behavioural Study on Consumers' Engagement in the Circular Economy" please refer to

38. Products often needs to be replaced or sent for professional repair if a simple yet essential component (e.g. battery, motor) fails. **Making essential components replaceable** by consumers is a potential solution. This would give consumers the option to replace, for example, a battery or another "easy-to-replace" component, and create more incentive for consumers to repair. Moreover, it would likely also stimulate the demand for repairs by professionals (manufacturers and independent repair services). This is because consumers already have a high willingness to have products repaired by third parties, but some difficulty in determining whether products can be repaired at all. Such uncertainty could be reduced by designing products so that they are more evidently built to be repaired.

1 Please refer to the study "Behavioural Study on Consumers' Engagement in the Circular Economy", European Commission, 2018. (https://ec.europa.eu/info/sites/info/files/ec_circular_economy_final_report_0.pdf).

The European Directive on batteries and accumulators

Directive 2006/66/EC on Batteries and Accumulators already contains requirements on the removal of batteries for certain electrical and electronic equipment. A similar requirement for batteries, as well as other components, could be applied to products more widely. This could potentially be done in the context of implementing existing legislation (for example the implementing regulations under the Ecodesign Directive).

Source: The European House – Ambrosetti and Enel Foundation elaboration on European Commission data, 2020.

39. Manufacturers could **include instructions on how to self-repair minor product breakdowns** in user manuals. Industry-led guidance and best practice could encourage manufacturers to provide this information to consumers. Repair instructions should be considered only for minor repairs that do not require specific skills or qualifications (also because it would open up issues of liability in the event of accidents). An alternative that could be considered is the provision of such a requirement within existing regulations and legislation. This option would make it mandatory for manufacturers to provide self-repair guidance for certain products and breakdown issues.

40. The availability of spare parts is essential for products to be repaired. Spare parts for older products are often difficult to find, in particular when that product is no longer in production. One option policy makers could investigate is the possibility of requiring companies to **provide spare parts for a certain period of time** (and also even after the product has been discontinued), as in the automotive sector. For example, a similar legal obligation has been introduced in France, where a decree requires producers to provide information about the time period for which spare parts will be available.

41. Potential cost savings were found to be a key determinant of consumer engagement in Circular Economy. Therefore, **financial incentives** that encourage the production and consumption of durable products, product repair and the leasing or renting of products, have the potential to promote the use of these behaviours by both manufacturers and consumers. However, further research would be required to confirm that there is sufficient price sensitivity in consumers for such stimuli to be effective.

42. Possible financial incentives include (but are not limited to) **tax reductions** or **exemptions for durable goods**, leasing/renting services and repair services. This could also include incentives for companies to provide spare parts for products for a set period time after production has been discontinued (see previous recommendation). An example of a tax scheme was introduced in Sweden in 2017. This scheme introduced a lower VAT rate for repair services and is known as the “repair bonus”.

43. The **provision of information on product durability** can encourage consumers to purchase more durable products. The study also highlighted that consumers have high levels of trust in manufacturer guarantees and are more likely to attempt a repair if a product is still under guarantee. Policy makers could explore the idea of encouraging manufacturers to offer a repair service to consumers throughout the technical lifetime of a product. Offering such services might increase product sales prices. If this were the case, manufacturers who offer this extended repair service may find it useful to point this out prominently. This way and in line with the experiment findings, manufacturers who offer extended repair services might see consumer willingness to pay for their products increase. Manufacturers who do not offer such services might benefit from offering lower prices and could be attractive for consumers who do not value reparability. Such transparency could contribute to having a level playing field among manufacturers.

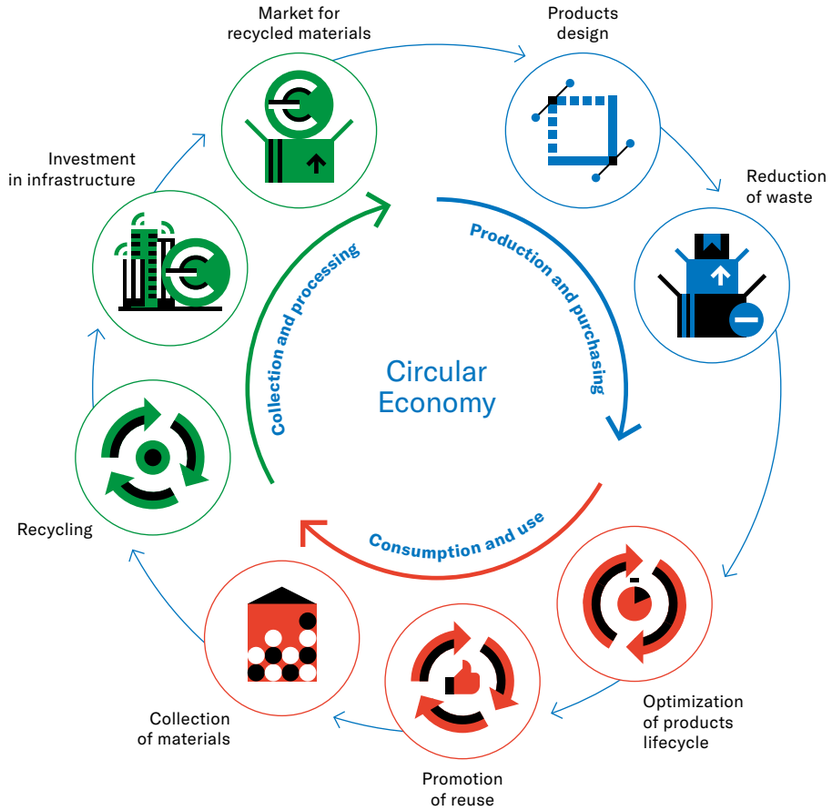
44. The provision of easier access to repair across a product’s technical lifespan may reduce consumer effort when it comes to product repair, as well as their uncertainty regarding whether repair would be possible at all, thereby encouraging more repairs. Exploring the possibility of **integrating durability and reparability information into existing product labels** (e.g., icons indicating expected lifetimes or durability commitments) could also encourage consumers to adopt more circular behaviours.

3.8 Promoting cross-cutting and coordinated measures for all the sectors involved in the Circular Economy transition

▼ Rationale

45. Circular Economy processes can involve all the value chain steps of any product or service sector: sourcing, manufacturing, distribution, use, resource efficiency and recycling. The challenge of closing materials loops and regenerating natural assets gets more difficult as the supply chains get longer and more complex. While more localized production has already established part of its business model on local circular supply chains, it is important to consider the issue of global division of labour, specialization and economies of scale. Circular Economy must hold its promise not merely to the village economy, but also to a **globalized economy**.

FIG 6 **Circular Economy impacts on all the value chain steps of any product or service sector**



Source: The European House – Ambrosetti and Enel Foundation on various sources, 2020.

46. From this point of view, most of the global economy can be considered as a massive conveyer belt of materials, energy and pathogens from resource-rich countries to manufacturing powerhouses (e.g., China), and then on to destination markets in Europe and America where materials are deposited or—to a limited degree—recycled. It is clear that to set up supply chain management approaches that balance the forward and reverse loops from a global perspective requires the definition of win-win mechanisms among geographies that:

- Foster a more **conscious design of products** in the manufacturing countries (i.e., that use less materials and facilitate recycling).
- Stimulate **economically sustainable recycling in the consuming countries** (i.e., by leveraging on profitable outlet markets for secondary materials).

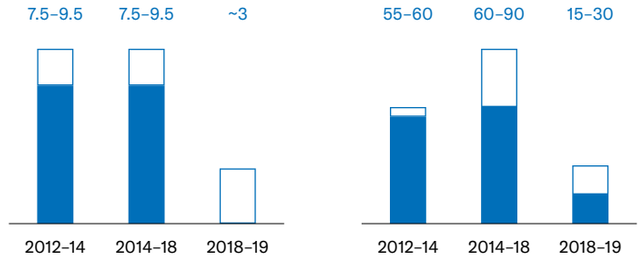
47. There are two main barriers to change: **geographic dispersion** and **complexity of materials**. The transition can begin once the pivotal points are identified and acted upon in a concerted effort—across companies and geographic areas, and along the supply chain.

- **Geographic dispersion**: even small appliances contain dozens, if not hundreds, of small components produced using multi-tier supplier networks, with dozens of sites spanning the entire globe. Globalization has raised the economic arbitrage of materials sourcing as a result of increasing global trade and shift of manufacturing from industrialized countries to emerging economies. All the opportunities based on Circular Economy as described in this report are based on the assumption that materials, component or product loops can be closed, both physically and in terms of quality, to create a balanced materials flow at a steady state. Closed regional and local loops are intuitively the most attractive as they are based on close proximity between points of production and use. Supply chain logistics can be organized at relatively low transport costs and without having to cross international borders with consistent regulation constraints. Closed global supply loops have been the rare exception so far and limited to high-value goods. On the commodity side, one industry-wide example of a balanced global materials flow between point of production and point of use is the global secondary fiber stream for paper production. This fiber stream is used in Asia to make packaging materials for export products because it is less expensive to use recovered, rather than virgin, fibers.
- **Materials complexity and quality**: in the attempt to pursue both perfomance and cost differentiation levers, companies have broadened the number of materials used in today's products. Materials complexity largely jeopardize the possibiliy of scaling up the Circular Economy. While tools and methods exist to create complex product formulations, it is still difficult to identify and separate materials, maintain quality and ensure purity (including non-toxicity). Other issues involve the purity quality of materials which are difficult to be guaranteed considering that products of different industries are collected and processed as one stream and could face multiple recycling cycles.

International case: Chinese Green Fence and paper industry

Historically, China is the main importer of recycled paper fiber and an essential commercial outlet for the sustainability of international recycling chains. Starting in 2018, the Chinese government imposed import restrictions, by defining stringent quality thresholds that are difficult to achieve by the current selection platforms.
The export limit is causing a situation of persistent overabundance of waste paper/cardboard on domestic markets, generating a sharp drop in sales prices with negative auction price situations. The higher resulting costs are intended to have a significant impact on the sustainability of the entire European recycling system.

FIG 7 **Left: Exported quantity of recycled paper fiber to China from European countries (EU27+ UK), 2012-2019** (billion tonnes)**.**
Right: Price differential in Italy for average MPS, 2012-2019 (Euros per tonne)



Source: The European House – Ambrosetti and Enel Foundation elaboration on European paper association data, 2020.

48. New production processes and new business models require **new dialog and collaboration between companies at different stages of the supply chain**. In order to create a full circular supply chain, companies will have to collaborate with other partners. This may require a shift since, generally, a competitive relation with suppliers is common, as based on downstream cost reduction. By contrast, circular business is much easier when all the players in a supply chain work together, because the added value is the joint process of assembling and disassembling. Depending on the sector and value chain in question, **the best opportunities for circular value chains may not always be found within the same value chain**. The best option may come from cooperation with players from an unrelated value chain that may have inputs as a waste stream or could use some waste streams as an input. Thus, implementing circularity is not just about looking forward and back, but possibly looking at neighbours in other sectors.

- Sustaining the creation of **districts and clusters** to maximize local, national and European synergies.
- Creating an **ecosystem for innovation** by identifying some strategic sectors (e.g. batteries, fashion, food, electric mobility, renewable energy – with particular attention on solar photovoltaics and wind – and smart grids).

49. Analysis of the complexity and heterogeneity of the factors to be mastered to set up efficient **circular value chains** highlights the need to support and foster coordination mechanisms along and across value chains. This must be taken into consideration whether evaluations are taking place on a local scale or broader actions are being evaluated on a global level. Logically, the global case differs substantially in the degree of complexity and type of actors to be involved.

50. At the local level the approaches should promote the formation of clusters around leading companies capable of taking advantage of the on-site production of recycled materials as input to their production. These approaches can, and in many cases must, foresee the **involvement of public sector players** (or dealers) in charge of managing the waste cycle, since the collection and selection models can largely influence the quality and competitiveness of the material collected and its subsequent reuse. Moreover, in the absence of proactivity from the manufacturing ecosystem, public authorities should themselves **promote forums for discussion** by leveraging on the creation of potential development drivers at local level which, in turn, avoid negative impact on the pocketbooks of the general public.

51. Such collaborative approaches at the level of local supply chains must necessarily be established even in cases where the local production environment does not allow direct re-use of secondary raw materials. In these cases, it is essential that the **collection and selection chain** (which in most cases is fragmented) is structured in such a way as to **guarantee the production of quality secondary raw materials suitable for marketing on international markets**, taking into account the associated logistics needs and costs. In fact, increasingly in the near future, developing markets, such as China or Indonesia, will give rise to regulatory barriers to prevent the import of low-quality recycled materials to limit their negative externalities. In that scenario, many of the well-oiled recycling mechanisms in western countries could face a drastic crisis as occurred in the paper industry during 2019.

52. When these discussions involve **global value chains**, the focus must be shifted to the ability to define common frameworks between governments. In this sense, the role of international collaboration organizations is fundamental to ensure commitment in promoting the most extensive adoption of:

- Product standardization protocols.
- Quality requirements.
- Trade rules and control protocols.

Furthermore, joint actions should aim at identifying cross-incentives between producer and consumer countries in order to:

- Encourage **sustainable product design** that involves the use of recycled raw materials and facilitates the subsequent recycling of materials and components.
- Support **recycling chains** in consumer countries by ensuring stable outlet markets for the treated materials.

These types of international discussions should leverage, on one hand, on the proactivity of governments and, on the other, should revise a more active involvement of large multinationals within which both supply chain needs and know-how are concentrated.

53. When talking about new business areas or **new types of production**, especially when more mature manufacturing ecosystems are looking for repositioning levers, it is essential to accompany the development of the new industry within a circular logic. The opportunity to establish **new circular supply chains** is, in fact, facilitated when it comes to creating new supply chains rather than transforming existing ones. Furthermore, in a logic of competitiveness, the definition of circular value chains can be a key differentiation lever, especially in the long term. At these stages, it is of paramount importance to push for advanced research and innovation in close cooperation with companies. Furthermore, this innovation can be fostered by cross-contamination and cross-collaboration among industries since different supply chains can be arranged consecutively in terms of material or component usages. The upfront definition of an end-to-end supply chain could also help single companies in identifying an increasing number of business adjacencies to be explored thanks to downstream material and product flows.

54. Energy transition is an outstanding example of a sector facing **profound transformation**, and in which western countries could largely benefit from Circular Economy models. Energy transition can, in fact, lead to **new technological opportunities** related to the foreseen decarbonization of the entire energy value chain (generation, distribution and end-uses), starting from the expected increase in electric technologies (e-mobility, digitalization, distributed generation, renewable sources, etc.). In light of these changes, research and innovation is a strategic issue because it allows, on one hand, the development of new technologies to be used as inputs for launching new types of manufactured products and, on the other, to identify innovative solutions to meet sustainability goals. The European Union hosts important international industrial players, small specialized and high-quality companies and highly-qualified research systems that can be even more competitive in meeting technology revolution challenges. Thus, the European Union must aim at **positioning itself as a leader in a number of cutting-edge technologies** which represent breakthroughs for the future.

An example of a cross-sectorial initiative for the circular transition in Italy: Circular Economy Alliance

The Alliance for the Circular Economy was launched in 2017 through the signing of a "**Manifesto**" with Made in Italy companies, leaders in various production sectors. Over the years, interest in this initiative has grown progressively, with an increasing participation in the number of companies and sectors represented. To date, the alliance counts 19 companies from 10 sectors, united by the desire to increasingly encourage the development of circular business models.
The aim of the Alliance is to guide an overall **evolution of the production context in a circular perspective** that enhances the **peculiarities of Made in Italy**, focusing on innovation, encouraging the sharing of experiences and best practices and promoting a constant comparison with the entire ecosystem.
The principles that guide the Alliance are the Circular Economy as a driver for innovation for the country, the paradigm shift in production systems, the enhancement of Made in Italy, the support to SMEs to produce sustainable innovation and the support to supply chains in view of internalization.
The Alliance presented a Position Paper in 2018 in which it proposed a roadmap for the country, focusing primarily on the need to act on Governance and Regulatory Instruments. The Paper then identified some priorities for action, such as simplification of the regulatory system to promote the reuse of resources, support for sustainable innovation, definition of measurement systems and KPIs, communication and awareness raising.
An updated version of the Position Paper is expected to be published in the last quarter of 2020.

Source: The European House – Ambrosetti and Enel Foundation on Circular Economy Alliance, 2020

3.9 Leveraging on Circular Economy as a framework to reimagine cities and urban areas

▼ Rationale

55. Cities and urban areas are the engines of the global economy. In cities people consume **75%** of our natural resources, produce **50%** of global waste and their activities are responsible for **80%** of global greenhouse gas emissions. Cities are the place where education, business, finance and innovation are concentrated and thus they can play a leading role in disseminating best practises in the country they belong to.

56. Cities (and in particular large cities) are a crucial area where a substantial part of the challenges - but also opportunities - related to the new paradigms of the Circular Economy are played out. These are elements that "cut" the economy and society across the board: the choices for mobility, those of urbanization, those on consumption models, up to those for inclusion and peripheries, find in the urban environment the context where to develop policies, collaborative models and good practices to be disseminated and implemented, for the benefit of citizens and businesses. These are essential choices, which can imprint new trajectories of development on which to implement the challenge of innovation and change, according to paths able to meet the needs dictated by the Circular Economy.

← Policy proposal

Leveraging on **cities and urban areas** to promote the cooperation among different stakeholders and coordinating different contributions towards a more circular territory.

57. Applying **Circular Economy** in cities and territories implies rethinking several activities related to them:

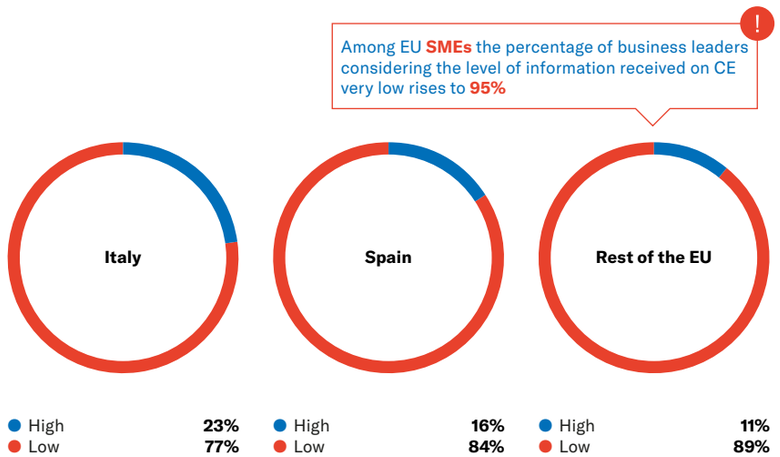
- **Planning**: in cities better air quality can be guaranteed by promoting the use of shared or green mobility and public transport. This could also generate savings in terms of occupied land (e.g. parking spaces) that can be used for parks or other business and commercial activities. The layout and design of cities also changes the way materials and products move around them. Instead of throwing materials 'away' to landfill or incineration, a new distributed system of resource management, nutrient flows, and reverse logistics makes the return, sorting, and reuse of products possible.
- **Designing**: infrastructure, vehicles, buildings, and products should be designed to be durable, adaptable, modular, and easy to maintain and repurpose. In the Circular Economy approach, materials used in cities are non-harmful and can be composted, recycled, and reused, while renewable energy powers cities.
- **Accessing**: in circular cities people get the things they need (e.g. space, products, transport) in a new way. This can be possible through sharing rather than owning or through product-as-a-service contracts. Modular designs allow for the reconfiguration of buildings and vehicles as needs change.
- **Operating and maintaining**: in circular cities products are no longer used just once but are repaired, recycled and reused by citizens, retailers and companies (e.g. vehicles and infrastructure, energy, water). This new approach makes cities more thriving, liveable, and resilient.

3.10 Promoting culture and awareness on the benefits associated to Circular Economy

▼ Rationale

58. The lack of knowledge about the benefits of Circular Economy has been identified as one of the barriers to the implementation of Circular Economy practices among European companies. **77%** of Italian and **84%** of Spanish business leaders consider the level of information provided to companies related to the challenges and opportunities associated with Circular Economy to be low and the percentage increases to **89%** for the rest of the European Union. As far as European SMEs are concerned, the percentage of business leaders who consider the level of information received on the challenges and opportunites associated with Circular Economy to be low, rises to **95%**.

FIG 8 **Response to the question "How do you consider the level of information provided to companies related to the challenges and opportunities associated to Circular Economy?" in Italy, Spain and the rest of the EU, 2020** (% values)



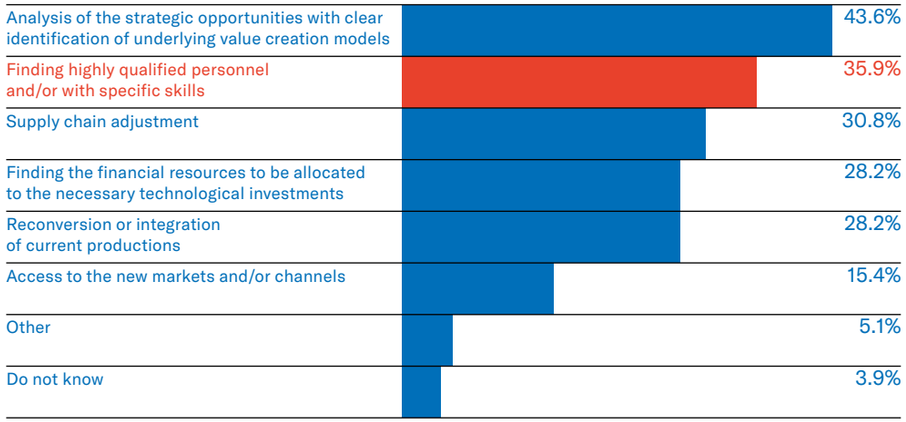
Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

59. In addition to the lack of information, there is the **skill mismatch** issue in Circular Economy field. Generally speaking, skill mismatch is still a pervasive concept, including in European countries. In Italy, around **6%** of workers is under-skilled while **20%** is underqualified. Despite the low average level of skill proficiency, skill surpluses are also present, reflecting the low demand for skills in the country. Over-skilled (11.7%) and over-qualified (18.2%) workers represent a substantial part of the Italian workforce. In addition, around 36.5% of workers are working in fields that are unrelated to their studies. Spain presents 41.2% of qualification mismatch among workers, with a 21.2% of underqualification and 20% of overqualification. Among the three selected countries, Romania holds the highest rate of field-of-study mismatch (39.2%).

60. The Circular Economy offers the next progressive step in the economic paradigm, taking over from the current linear "take-make-waste" economy by seeking to extract the maximum value from resources in use and keep materials in circulation for as long as possible through processes such as reuse, repair, remanufacture and recycling. The transition from a linear to a circular production process is expected to be labor intensive. The reuse and recycling of materials requires more occupation and more complex processes, resource sorting and the cleaning of components in the refurbishment of products. Therefore, Circular Economy is expected to create demand for different combinations of skills and ways of working.

61. However, the labor market and the educational system seem to be struggling to accommodate the circular transition. Around **36%** of European business leaders thinks that **skill mismatch is the no. 2 obstacle to the development of Circular Economy** in the European Union (second to analysis of strategic opportunity). This sentiment is even stronger at national levels. In **Italy** and **Spain**, business leaders consider the **skill gap to be the no. 1 obstacle to the deployment of Circular Economy** in their respective countries (**46.1%** in Italy and **41.9%** in Spain).

FIG 9 **Response to the question "What are the most urgent areas of action for your company to encourage the transition to circular models?" for European Union business leaders, 2020**
(% values - multiple choices allowed)

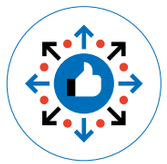


Source: The European House – Ambrosetti and Enel Foundation Circular Economy online survey, 2020.

62. More specifically, the **most recurrent difficulties** reported by respondents in this field were:

- **Lack of dedicated training courses** in current training curricula.
- Problems with **skills conversion for senior workers** in the company.

Policy proposal →



- **Clarifying the value** of Circular Economy by:
  - Raising public awareness and promoting communication on Circular Economy benefits among consumers.
  - Promoting the use of Circular Economy playbooks.
- Addressing the issue of **skill mismatch** by:
  - Implementing a "Circular Economy Apprenticeship Erasmus Program".
  - Strengthening the governmental and companies' commitment towards lifelong learning programs.
  - Creating a Network of Universities for Circular Economy at European level.
  - Promoting Circular Economy behaviors among students starting from the primary and secondary school.

63. It is crucial to inform companies and citizens about the benefits of taking action to spur the transition towards a circular development model. In fact, the second policy proposal aims at promoting measures to support and inform companies and citizens to **raise awareness of the advantages associated with Circular Economy**.

64. A **national communications campaign** to inform the public about the advantages of all circular products and services and highlight their contribution to economic and social development and to the environment should be launched. The campaign would communicate the environmental and economic gains resulting from a higher adoption of Circular Economy practices, thus enhancing individual social responsibility, as well as interest in Circular Economy solutions.

65. Also due to the lack of clear and comprehensive metrics, European companies may have difficulties in knowing how to operationally transform their business models into circular models. Once governance has been identified and rewarding incentives promoted for Circular Economy companies, it is necessary to give them an overview of the tools and technologies that can be used. For this purpose, the realization and dissemination of a **Circular Economy playbook** should be promoted, as a set of tools for encouraging the transformation to sustainable business, showing the opportunities and benefits of Circular Economy and demonstrating, with practical examples, how to implement circular business models and what kind of capabilities, skills and technologies are needed for this. The content of the playbook should take inspiration from the one launched for Finnish manufacturing companies.

The Circular Economy playbook for Finnish SMEs

The Finnish Innovation Fund Sitra has drafted a playbook aimed at giving advice and ideas to manufacturing companies in Finland on how they can adopt circular business models.
The playbook is focused on the four most important sectors for the Finnish economy (machinery and equipment, marine, energy and transportation) and promotes Circular Economy as a requirement for increasing company competitiveness.
The playbook calls for action by:

- Describing the rationale for why Circular Economy is relevant.
- Identifying circular business models with the highest potential value per sub-sector.
- Outlining required organizational and operational changes.
- Providing a blueprint of a transformation process for companies to achieve circular advantage.

In particular, the playbook provides companies with a specific set of tools that helps them to make the transition towards circular models.
Among the tools are:

- Business model development toolkit: set of exercises for identifying inefficiencies and customer pain points, assessing relevance of circular business models, and prioritizing them.
- Business model canvas: template for crystalizing circular business models.
- Value case tool: calculating high-level business cases for circular business models.

- Capability maturity assessment: tool for assessing a company's maturity in circular capabilities.
- Technology maturity assessment: tool for assessing a company's maturity in technologies enabling Circular Economy.
- Culture gap analysis: tool for analysing how circular a company culture is.
- Ecosystem partner identification: tool for identifying ecosystem partners to support a circular business idea.
- Funding requirement analysis: tool for reflecting on funding requirements and required activities to secure funding for a circular idea.
- Roadmap development: tool to support companies in planning a circular transformation process.

Source: The European House - Ambrosetti and Enel Foundation elaboration on Sitra, "Circular Economy business models for the manufacturing industry. Circular Economy Playbook for Finnish SMEs", 2020.

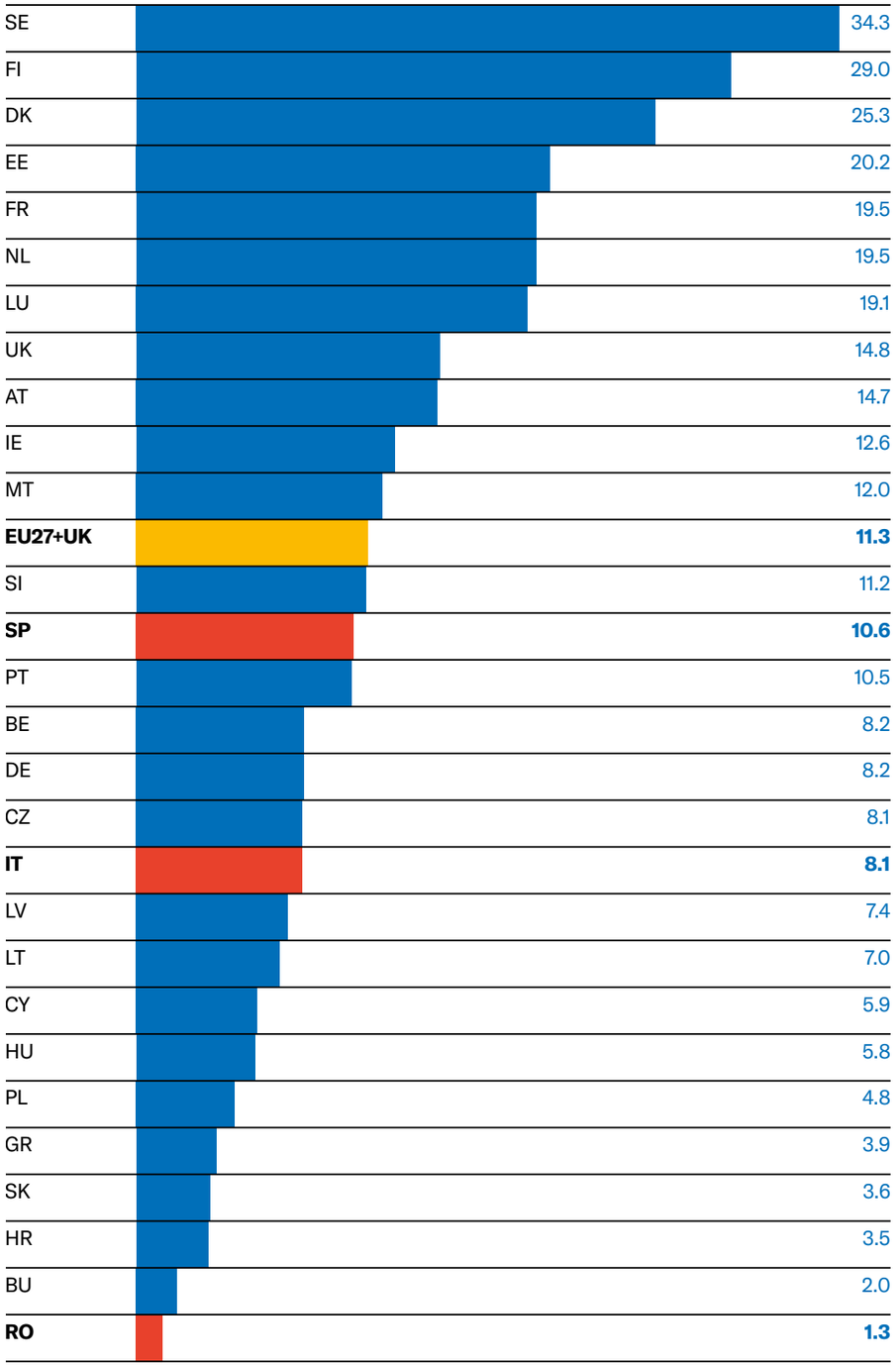
66. Circular Economy skills and knowledge are needed in **different areas** of public administration and in business—in chemistry, legislation, business activities, behavioural sciences, construction and food production. The list is potentially limitless, since it covers all areas of human activity. Shifting from a linear to a circular paradigm is a complex process. For this reason, **education** will play a key role in converting the global society into a circular one. People and companies have to be supported in learning about Circular Economy and its benefits, focusing on interdisciplinary, project-based and participatory approaches. The aim is to help people understand how they can influence the complex systems around them and to train workers for the new skills required by the new paradigm, to reduce or fill the skill gap.

67. The **European Apprenticeship Erasmus Program**, with its focus on skills development for employability and active citizenship, is a central element of the European Commission's strategies. Since it began in the 1987-88 academic year, the Erasmus program has provided over **4 million European students** with the opportunity to go abroad and study at a higher education institution or train in a company. With a budget of almost **€2.8 billion**, in 2018 the program allowed **853,000** people to study, train or volunteer abroad, with 95,000 organizations involved and 2,500 projects implemented. Moreover, the Erasmus program is also an opportunity to gain experience in the job market, supporting vocational education and training. In 2018, more than 170,000 learners and staff trained abroad.

68. For this reason, as a part of the European program, a "**Circular Economy Apprenticeship Erasmus Program**" could be introduced. The objective would be to increase the mobility of apprentices and trainees in **sectors that are relevant to successfully manage the transition from linear to circular development models** (e.g., white goods, energy sector, etc.). This would also have the advantage of encouraging young people to prepare for the jobs of the future, which will help reduce youth unemployment in Europe. In fact, a study on the impact of the European Union's Erasmus student exchange program shows that graduates with international experience perform much better on the job market. They are half as likely to experience long-term unemployment compared with those who have not studied nor trained abroad and, five years after graduation, their unemployment rate is 23% lower.

69. Moreover, another important aspect of Circular Economy education and skilling is to impact on the way people and workers think. In this sense, one important tool in the hands of governments and companies is **lifelong learning**. Lifelong learning encompasses all learning activities undertaken throughout life with the aim of improving knowledge, skills and competencies within personal-, civic-, social- or employment-related perspectives. For both companies and governments, strengthening the commitment to lifelong learning programs is becoming extremely important because it can help to promote cultural changes among workers, also through the engagement of companies to set the highest job quality standard. Increasing the commitment towards lifelong learning becomes even more important if one considers the current adult participation in learning. The latest results from the European Union labour force survey show that in 2019 the participation rate in the European Union stood at **11.3%**, 0.2 percentage points above the rate for 2018. Looking at the national levels, all the three countries considered hold an adult participation in learning rate below the European average, with Romania closing the ranks with a rate of only 1.3%.

FIG 10 **Adult participation in lifelong learning programs, 2019** (% of population aged 25 to 64)



Source: The European House – Ambrosetti and Enel Foundation on Eurostat data, 2020.

70. From an educational standpoint, building an **integrated system** designed to implement Circular Economy concepts at European and national level is pivotal. This policy aims at creating a **Network of Universities for Circular Economy** at a European level for the promotion of Circular Economy courses within national university systems, thereby strengthening Circular Economy skills and competencies. By showcasing Circular Economy-related teaching and research, the network aims at enabling collaborative ventures and knowledge in academia to promote an exchange of skills and information with policy makers and the business world.

71. However, in order to permeate Circular Economy within society, it could be necessary to **teach Circular Economy at all educational levels**. To render everyone a Circular Economy professional capable of applying circular solutions at work and in their everyday lives, this policy aims at promoting **Circular Economy behaviors among students starting from the primary and secondary school levels**, for instance through the distribution of a "**Circular Economy kit**", containing didactic materials for teachers to be used during social studies classes. The end-goal is to support the emergence of knowledge suitable to understanding Circular Economy basics, modeling skills and how to employ circular practices in everyday decision-making.

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Circular Economy Scoreboard Glossary

Sustainable inputs

Circular material use rate: share of material recovered and fed back into the economy, thus reducing the need for primary raw materials. It aims at measuring the circularity of materials.
(% values)
Source: Eurostat

Resource productivity: quantity of output goods obtained through the expenditure of a unit of input resource. In this specific case, resource productivity measures the economic value generated per tonne of material consumed in a certain country or group of countries.
(Euros per tonne of material consumption)
Source: Eurostat

Share of total organic area in total utilized agricultural area: share of agricultural areas fully or partially converted to organic farming. Organic farming is characterized by close attention to the use of agricultural inputs, and so the indicator is a good proxy of the circular use of inputs in agriculture.
(% of total utilized agricultural area)
Source: Eurostat

Water productivity: economic value obtained using a unit resource of water extracted. It aims at measuring the efficiency of water use.
(Euros per cubic meter of water extracted)
Source: European Environment Agency

Energy intensity: amount of oil equivalent used for the generation of a unit of GDP. It aims at evaluating the efficiency of an industrial system in creating value added with a given energy input. This is a reverse indicator: the higher the energy intensity, the less efficient the system.
(Tonnes of Oil Equivalent (TOE) per thousand Euros)
Source: Eurostat

Share of energy from renewable energy sources: percentage of final energy consumption from renewable sources.
(% values of final energy consumption)
Source: Eurostat

Final energy consumption by renewable energy sources in transport: percentage of final energy consumption from renewable energy sources in the transport sector.
(% values of final energy consumption)
Source: Eurostat

Final energy consumption of electricity in the manufacturing sector: percentage of final energy consumption attributable to electricity in the manufacturing sector (excluding mining and quarrying and construction sectors). It aims at measuring the electrification of the manufacturing sector.
(% values of final energy consumption)
Source: Eurostat

Final energy consumption of electricity in households: percentage of final energy consumption attributable to electricity in households. It aims at measuring the electrification of households.
(% values of final energy consumption)
Source: Eurostat

End-of-life

Packaging waste recycled: share of packaging that is sent to recycling. It aims at estimating the efficiency of management of packaging end-of-life[1].
(% values of total packaging generated)
Source: Eurostat

Total generation of waste per Gross Domestic Product unit: ratio of waste generated to GDP. It aims at measuring the efficiency of an industrial system to generate value with a limited production of waste. This is a reverse indicator: the higher the generation of waste per GDP unit, the less efficient the system.
(Kilograms per million Euros)
Source: Eurostat

Industrial waste treated by recycling: share of industrial waste sent to recycling[1]. It aims at estimating the efficiency of industrial waste management.
(% value of total industrial waste generated)
Source: Eurostat

Municipal waste treated by recycling: share of municipal waste sent to recycling[1]. Recycling includes material recycling, composting and anaerobic digestion. Municipal waste consists mostly of waste generated by households but may also include similar waste generated by small businesses and public institutions and collected by the municipality. It aims at estimating the efficiency of municipal waste management.
(% value of total industrial waste generated)
Source: Eurostat

1 It is worth noting that the indication of the amount of recovered material actually fed back into the economy is not generally available.

Patents related to recycling and secondary raw materials per employee in Circular Economy sectors: number of patents related to recycling and secondary raw materials divided by the number of workers in the sector. The attribution of patents to recycling and secondary raw materials is based on relevant codes in the Cooperative Patent Classification. The term 'patents' refers to patent families, which include all documents relevant to a distinct invention thus preventing multiple counting. The number of employees in Circular Economy sectors measures the employment in recycling, repair, reuse and leasing sectors. It aims at measuring the level of efficiency of these sectors.
(Patents per employee)
Source: Eurostat

Sewage sludge treated and disposed of in agriculture or used as compost: share of sewage sludge that is disposed of in agriculture or used as compost. It aims at measuring how efficiently end-of-life sludge is treated.
(% value of sewage sludge produced)
Source: Eurostat

Extension of useful life

End-of-life vehicles recovered and reused: tonne of end-of-life vehicles recovered and reused divided by the total tonne of end-of-life vehicle waste generated. End-of-life vehicles include all their components and materials. It aims at measuring the efficiency in the extension of the useful life of end-of-life vehicles and their components.
(% value of total mass of end-of-life vehicle waste)
Source: Eurostat

Load factor: ratio of the average load to total vehicle freight capacity expressed in terms of vehicle kilometres. It is calculated as the total tonnes per kilometre divided by the vehicles per kilometre. It aims at measuring the efficiency of the logistics system in terms of extension of the useful life of a service.
(Tonne per km/vehicle per km)
Source: Eurostat

Value Added of retail sale of second-hand goods: value added at factor cost of retail of second-hand goods in store divided by the population. Retail of second-hand goods in stores includes retail sale of second-hand books, retail sale of other second-hand goods, retail sale of antiques and activities of auction houses. The aim of the indicator is to monitor the consumption patterns that favour the extension of the useful life of products.
(Euro per capita)
Source: Eurostat

Employment in repair and reuse sectors: number of people employed in recycling, repair, reuse and leasing sectors divided by the total employment of a country. It aims at measuring the level of the development of the country in these specific sectors.
(% values on total employment)
Source: Eurostat

Increase of the intensity of use

Because of the lack of specific indicators, this pillar considers the enabling factors that would allow the diffusion of the sharing economy and of product as a service approach.

Individuals using any website or app to arrange accommodations from another individual: number of people that exploit sharing economy services to arrange accommodations.
(% values. Source)
Source: Eurostat

Individuals using a dedicated website or app to arrange transport service from another individual: number of people that exploit sharing economy services to arrange transport.
(% values)
Source: Eurostat

Collective transport as a total of passenger transport: share of buses and trains on total inland passenger transport per kilometre. It aims at measuring the availability of a service that permits an increase in the degree of use of transport means and a reduction in the use of single passenger cars in circulation.
(% value of total inland passenger per kilometer)
Source: Eurostat

Individuals using the Internet: percentage of the population aged between 16 and 74 that has used the Internet in the last 12 months. It is a proxy for the diffusion of the sharing economy and of Circular Economy consumption patterns, as Internet use is a key enabling factor.
(% value of individuals aged 16 to 74 in the last 12 months)
Source: Eurostat

Countries ISO 3166-1 alpha-2 codes

Austria		AT
Belgium		BE
Bulgaria		BG
Croatia		HR
Cyprus		CY
Czech Republic		CZ
Denmark		DK
Estonia		EE
Finland		FI
France		FR
Germany		DE
Greece		GR
Hungary		HU
Ireland		IE

Italy		**IT**
Latvia		LV
Lithuania		LT
Luxembourg		LU
Malta		MT
Netherlands		NL
Poland		PL
Portugal		PT
Romania		**RO**
Slovakia		SK
Slovenia		SI
Spain		**ES**
Sweden		SE
United Kingdom		UK

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Part 1

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