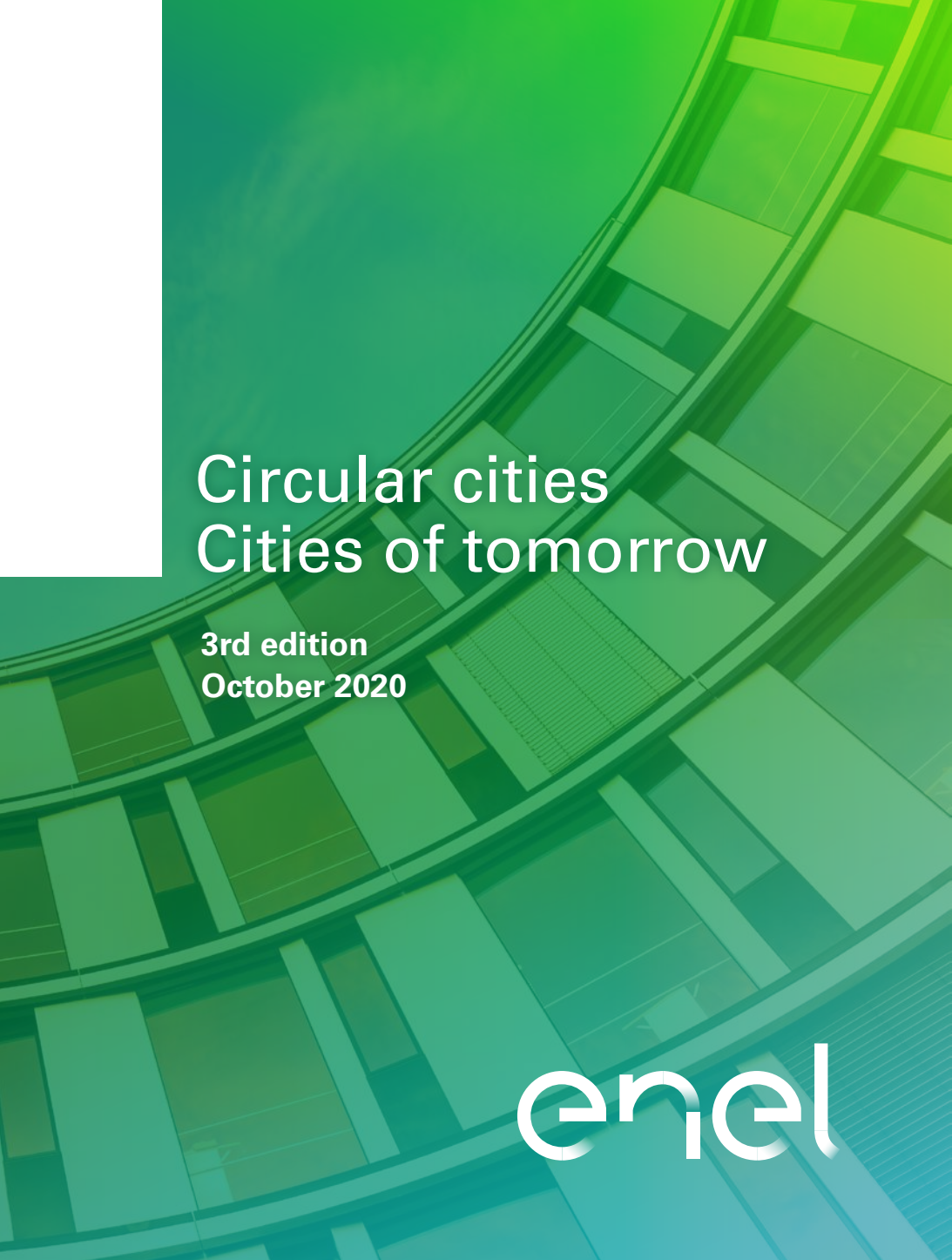


A low-angle, upward-looking shot of a modern, circular building interior. The structure features multiple levels with large glass windows and white structural elements, creating a sense of height and openness. The sky is visible through the top of the circular opening.

Circular cities Cities of tomorrow

3rd edition
October 2020

A green circular pattern composed of various shades of green, resembling a stylized map or a network of paths, overlaid on the right side of the image.

enel

Contents

Foreword / p 4 [↗](#)

Introduction to the third edition / p 7 [↗](#)

1. Circular cities: what is the status? / p 9 [↗](#)

- 1.1 A holistic approach
- 1.2 The circular economy vision
- 1.3 Governance

2. Realising the circular transformation / p 15 [↗](#)

- 2.1 Definition and scope
of the circular economy
- 2.2 A circular economy strategy
- 2.3 Where should
the control room be?
- 2.4 Planning: top-down or bottom-up?
- 2.5 Stakeholder engagement:
the public-private collaboration
- 2.6 Metrics and objectives
- 2.7 The role of innovation
- 2.8 Awareness and participation

3. The benefits / p 23 [↗](#)

- 3.1 Cities' circular recovery after
Covid-19
 - Futur Food Institute
 - Intesa Sanpaolo
 - Arup
- 3.2 Impacts on competitiveness
- 3.3 Environmental impacts
- 3.4 Social impacts

4. Conclusions / p 36 [↗](#)

Focus. Best practices from around the world / p 39 [↗](#)

São Paulo
Santiago de Chile
Bogotá
Montevideo
Boston
Pittsburgh

“What is the city but the people?”

Shakespeare, *Coriolanus*, Act III, Scene I



Foreword

It is within cities that our civilisation pulsates with life and evolves. Cities all differ in their architecture, culture and historical background, but were all created from our ancestors' impulse to gather and form communities. Be they small provincial villages or an agglomeration of glistening skyscrapers, they are the human habitat *par excellence* and, along with us, they change over time to protect the communities that inhabit them, to rise again when struck by catastrophe, to indulge changes in our lifestyle and in technological evolution.

Confirming the continued relevance of the "city paradigm", urbanisation has sharply accelerated in recent years: cities today are home to over half of the world's population and generate more than 80% of global economic output as well as the majority of pollutant emissions. Inevitably, cities are also where global trends release built-up tension: from demographic and migratory issues to the growing demand for energy and the damaging effects of climate change.



Michele Crisostomo
Chairman of the Enel Group

The Covid-19 emergency has demonstrated the inextricable link between cities and the social vitality that shapes and inspires them. Squares and streets, suddenly voided of their community, became urban coordinates of archaeological sites before their time. Being forced to stay at home confined us to a sort of resident nomadism in which, to protect the community, we had to negate all its manifestations, as if we were living, within our closest family units (couple, family, etc.), in the middle of the desert but with no way to move.

Even in this dramatic situation, cities gave us some indication of how they need to evolve in order for the communities that live in them not only to better prepare to face a health emergency but, more in general, to initiate evolutionary change.

If a city is destroyed by fire or an earthquake, it will probably be rebuilt with fire-resistant materials or according to anti-seismic criteria. So cities have to emerge from the pandemic on a different footing. During the emergency, cities became networks, connections, services, assistance, solidarity. Pollution emerged as a risk factor, also from a health perspective. As resident nomads, with the invisible enemy on our doorstep, we became more aware of how important it is to improve the quality of our cities – which, once again, returned to being the anthropological and physical context for a new idea of development.

In looking to sketch out this new idea of development, there is absolutely no way we can exclude sustainability. Only by evolving sustainably will our cities be able to renew their essential purpose to develop and protect communities. This is why it is essential to promote economic competitiveness, social inclusion and respect for the environment, considering these objectives not as alternatives or opposites but as synergistic elements, in a vision that brings innovation and sustainability together – and which is most effectively expressed in the circular economy.

Thus, the transition towards more circular models for living and producing is the best solution to the growing problems in the cities of today, and an essential step to avoid even greater economic and social imbalances in those of tomorrow.

We are convinced that in order to meet such a huge challenge, and more than ever to recover from the recent health emergency, we need to engage with all stakeholders: institutions, companies and citizens. We can count on a huge range of available technologies, innovative business models and significant investment capacity, but none of this will be of any use unless everyone embraces common objectives and fully commits to their achievement.

For Enel, defining a coherent, long-term vision for the *city of the future*, as a framework for the contribution we can make, is a strategic priority and a constant commitment. To this end, we have worked for years to turn the circular city concept into a reality. To do so, wherever Enel is present, we are in constant dialogue with the ecosystem around us, not just collaborating with the industrial supply chain but opening up to a wider vision that facilitates continuous exchange with institutions, associations, startups, research centres and universities.

We are convinced that breaking down cultural and industrial barriers, removing red tape and trying to find, through dialogue, possible synergies between different sectors are key to bringing about an effective model for circular cities and a level of wellbeing that's genuinely shared and enjoyed by everyone. With everyone's commitment we can build a better future for our cities as well as a fairer and more resilient society.

Introduction to the third edition

When we published the first edition of this position paper, at the beginning of 2018, the circular city model wasn't the subject of much debate. In recent years, circular economy as a theme has recorded remarkable development, in terms of both definition and importance, while at the same time its potential has become increasingly evident, also for the cities of tomorrow. However, the journey has still only just begun.

Our intention was to contribute to the development of this vision for the future. To do so, we started from the goal of bringing together economic development, environmental sustainability and social inclusion. To achieve such an objective, it is not sufficient to approach the issue from a purely technological perspective: it must be tackled holistically, taking into consideration all the sectors and elements that together constitute a city. This also means including many aspects that fall outside the specific activities of a utility company, which however, by its very nature, utilises a cross-sector approach and collaborates with all stakeholders. In this sense, this need for a holistic vision is fully in line with our mission. Furthermore, many of our business activities

already impact cities directly, contributing to the economic, social and environmental development of various local areas; the circular approach described in the following pages is capable of significantly increasing these positive effects.

Having focused the first edition on technologies and the second, in 2019, on circular business models, in this third edition we want to explore another key aspect for the transition towards circularity: the public-private collaboration and its crucial role in implementing a circular economy at city level. What can institutions, companies and citizens do to make the urban context in which they live and work more circular? What contribution can each of them make and what benefits can their collaboration bring?

Many of the necessary conditions for circularity are now within reach: in many areas the technologies required to bring this transition to fruition are available and competitive, and there are numerous solid business cases and interested financial players. To accelerate the process, a key element is therefore the collaboration between institutions, companies and citizens. To explore this relationship, in the first part of this document we look at some of the major enablers that can ensure this collaboration is fruitful: governance, strategy and metrics. In the second part, we present and analyse concrete cases from around the world which we believe stand as exemplars of the direction that is to be taken, to ensure that cities can truly transform.

The global Covid-19 health emergency, with its tragic humanitarian impact and its social and economic consequences, exploded while we were drafting this document, and further reinforced questions about the current development model and the need to revisit it. Whilst the challenge involves sustainable development in its widest possible sense, dealing with the economic model is part of the general equation. How the circular economy can be part of the solution, to reduce the risks of an unsustainable development model, and what role it can play in the rebuilding phase are fundamental questions we must pose to conceive the cities of tomorrow. Although it is too early to fully understand the consequences of the current pandemic, these aspects must still unavoidably be taken into consideration.

Once again, for this third edition we asked the institutions, organisations and companies who share our commitment to the cities of tomorrow to make a brief contribution related to their areas of expertise. Such contributions do not represent an endorsement, by them, of the entire document, the responsibility for which rests solely with Enel.



1. Circular cities: what is the status?

Circular cities: what is the status?

As highlighted in the second edition, cities are currently facing increasingly critical challenges and the awareness of these issues is growing. In this context, the circular economy represents the solution for redesigning the cities of tomorrow.

The extent of the phenomenon is best demonstrated through data: the world's consumption of raw materials saw a 12-fold increase between 1900 and 2015, and is expected to double again by 2050; furthermore, cities consume approximately two thirds of all energy and are responsible for a similar share of emissions¹.

The challenges that cities now face are diverse in nature: economic (competitiveness and employment),

environmental (air, water and soil pollution and waste management) and social (marginalisation, inequalities and disintegration of the social fabric). These are interconnected issues that are difficult to tackle with isolated actions: they require a systemic approach, tying in with the vision of city one is looking to achieve.

We believe that to do so there are a number of important steps that need to be taken in terms of governance, strategy and lines of action.

Indeed, when faced with these difficult challenges, cities have a series of opportunities and strengths that can potentially make them key players in the transition towards circularity. Indeed, the sense of physical community that exists within cities facilitates people's engagement in political change, compared to the regional or national level: decision-makers are closer to the interested parties and the impacts choices have are more directly felt.

We are already witnessing numerous city initiatives from around the world that are based around the circular economy concept. Each addresses the matter in a particular way – based on the priorities, context and evaluations made by local decision-makers on how best to tackle the sedimentation of centuries of decisions and the economic models which have favoured linear models for the past decades.

In Europe, in particular, it is worth mentioning the importance given by the EU's recent Circular Economy Action Plan² to the role of cities and local territories in implementing the transition towards a circular economy model. The purpose of the circular economy is to reformulate the economic model, and cities, as the place where the majority of the population lives and where the majority of resources are

¹ World Economic Forum, *Circular Economy in Cities. Evolving the Model for a Sustainable Urban Future*, 2018.

² European Commission, *Circular Economy Action Plan*, 2020.

consumed, have a key role to play. The solutions developed within cities have a direct and potentially key bearing on utilisation and consumption, as well as on reuse and value recovery.

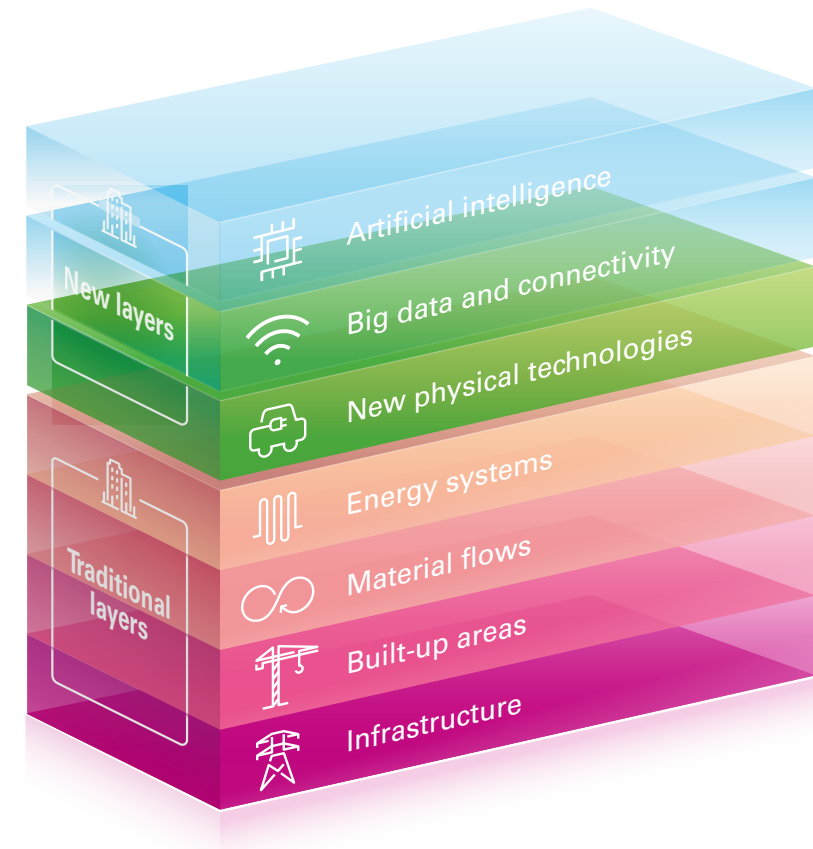
However, cities' approach to the circular economy, aimed predominantly at resolving local issues, must be viewed within the much wider context of possible systemic impacts; cities are an integral part of their regional and global fabric, so any improvements at their level have the potential to generate further impacts on a wider scale. More generally, cities are where the strong interconnection between people enables continuous innovation and idea generation: they therefore represent an accelerator in which new models can be constantly tested, combined and improved.

The concept of circular city emerged after (and, in some ways, stemmed from) that of smart city. While labels are not always clear enough to make a sharp distinction between the two, in Enel's vision the shift from smart cities to circular cities requires

moving away from a point of view that is mainly focused on new technologies and their benefits, to one where technology continues to play an important role but is integrated into a holistic vision with economic competitiveness, environmental sustainability and social inclusion goals.

1.1 A holistic approach

When considering their circular transformation, we must see cities themselves in all their dimensions and with respect to the overlap between traditional and new layers, linked to new technologies, digitalisation and the Internet of Things (IoT). Although, operationally speaking, we will focus on specific priorities, an overarching vision that evaluates the benefits and impacts that are generated³ is necessary.



³ Enel, *Circular cities. Cities of tomorrow*, second edition, October 2019.

Until a few years ago, the expression “circular economy” was often only mentioned in reference to the waste sector

1.2 The circular economy vision

Until a few years ago, the expression “circular economy” was often only mentioned in reference to the waste sector, whilst today it is commonly understood to mean *a substantial reappraisal of the economic model in its entirety, starting from the initial phases (see paragraph 2.1, Definition and scope of the circular economy).*

The classic representation of the five pillars of the circular economy includes:



Sustainable inputs

Inputs from renewable sources, reuse, recycling



Increased product life

Through modular design, predictive maintenance, etc.



Sharing

Shared use



Product as a service

Providing customers with a service rather than a product



End of life

Recovering value via upcycling, reuse and recycling



When scaled up, this transformation, in addition to the obvious economic and environmental benefits, can also lead to the creation of new jobs and services

To generate an impact on the final part of the value chain, it is still necessary to start with the earlier phases and systematically analyse where we can increase *flow circularity*. When scaled up, this transformation, in addition to the obvious economic and environmental benefits, can also lead to the creation of new jobs in sectors such as manufacturing, reuse, repairs and services – activities which generally call for close proximity with clients, and can therefore represent a further opportunity for development at the local level.



1.3 Governance

Governance, together with strategy and lines of action, is an essential hinge in implementing a transition towards the circular economy. Designing a model that makes it possible to manage and lead this change is crucial, from strategy definition to implementation. Indeed, different models generate different impacts on the decision-making processes and on actions, and they influence, to varying degrees, how decisions are carried out⁴.

The fact that public-private collaboration and open (i.e. transparent and participative) governance can enhance the effectiveness of economic models emerges recurrently. This is explored in further detail in the following section.

Governance, together with strategy and lines of action, is an essential hinge in implementing a transition towards the circular economy



⁴ Kate Raworth, *Creating City Portraits: A Methodological Guide from the Thriving Cities Initiative*, July 2020.



2. Realising the circular transformation

Realising the circular transformation

2.

Many local institutions from across the world are currently grappling with the implementation of measures to bring about an effective transition towards a circular economy model. The solutions and approaches adopted can differ significantly: such differences are due in part to the specific situations and in part to different definitions and visions of the circular economy. Realising a transformation of this magnitude requires a multitude of conditions, all of which need to be analysed in an integrated manner since they are insufficient taken one by one. The challenge is also to combine a new, radical vision in the medium term with a series of precise, specific and incremental initiatives. To do this, a systematic, shared approach is needed

to progressively break up – in terms of time and space and through a series of intermediate steps – a wide and long-term vision into a sequence of targeted actions.

2.1 Definition and scope of the circular economy

The first step is to define what we mean by “circular economy”. In some cases, you start with specific areas (often the first sector concerned is waste or water), to then gradually expand the approach. In other cases, you start from a wider, more strategic vision.

Despite there being a variety of different paths to take depending on the contingent situations, the starting point must be the definition of a circular economy vision that encompasses the entire urban context: this enables an effective transformation, towards a situation where the interests of both citizens and stakeholders converge (the cities of Amsterdam⁵ and Paris⁶ provide excellent examples of this).



Paris, a fine example of the circular economy in an urban setting.

⁵ To find out more

⁶ To find out more

The circular economy cannot be identified with a specific sector or a single phase of the value chain, because it represents an overall vision and is an approach to reappraising the entire economic model.

If the objective is indeed transformative, whichever sector you start from, the approach must inevitably encompass the entire value chain: to have an impact on the issue of waste management and to achieve noteworthy results, you cannot merely intervene at the final recycling phase, but must go all the way back to the design and production phases. Similarly, to reduce the consumption of materials and energy from non-renewable sources, on the one hand it is necessary to target the resources used, moving from non-renewable to renewable sources or to recycled inputs, and on the other hand it is essential to promote reuse, sharing or Product-as-a-Service models.

2.2 A circular economy strategy

Since effective action is not possible unless the issue is tackled in a systemic and structured way, a circular economy strategy requires an approach that includes:

- an overview of the sectors and areas that make up the urban context and an assessment, as far as is possible, of flow levels;
- an understanding of which sectors are the priority for intervention activities;
- the definition of the objectives to be achieved in the medium-long term.

Defining a clear strategy and objective creates a general framework that supports the commitment and collaboration of all the parties involved and, as we will see later, is necessary to ensure all stakeholders are engaged.

An ambitious medium- and long-term vision is essential to generate the right level of engagement from all interested parties, whilst stable leadership is fundamental for the coherent implementation of the strategy.

From this standpoint, Paris and Amsterdam are once again outstanding examples of well-developed plans that incorporate these two requirements.



The circular economy represents an overall vision and is an approach to reappraising the entire economic model

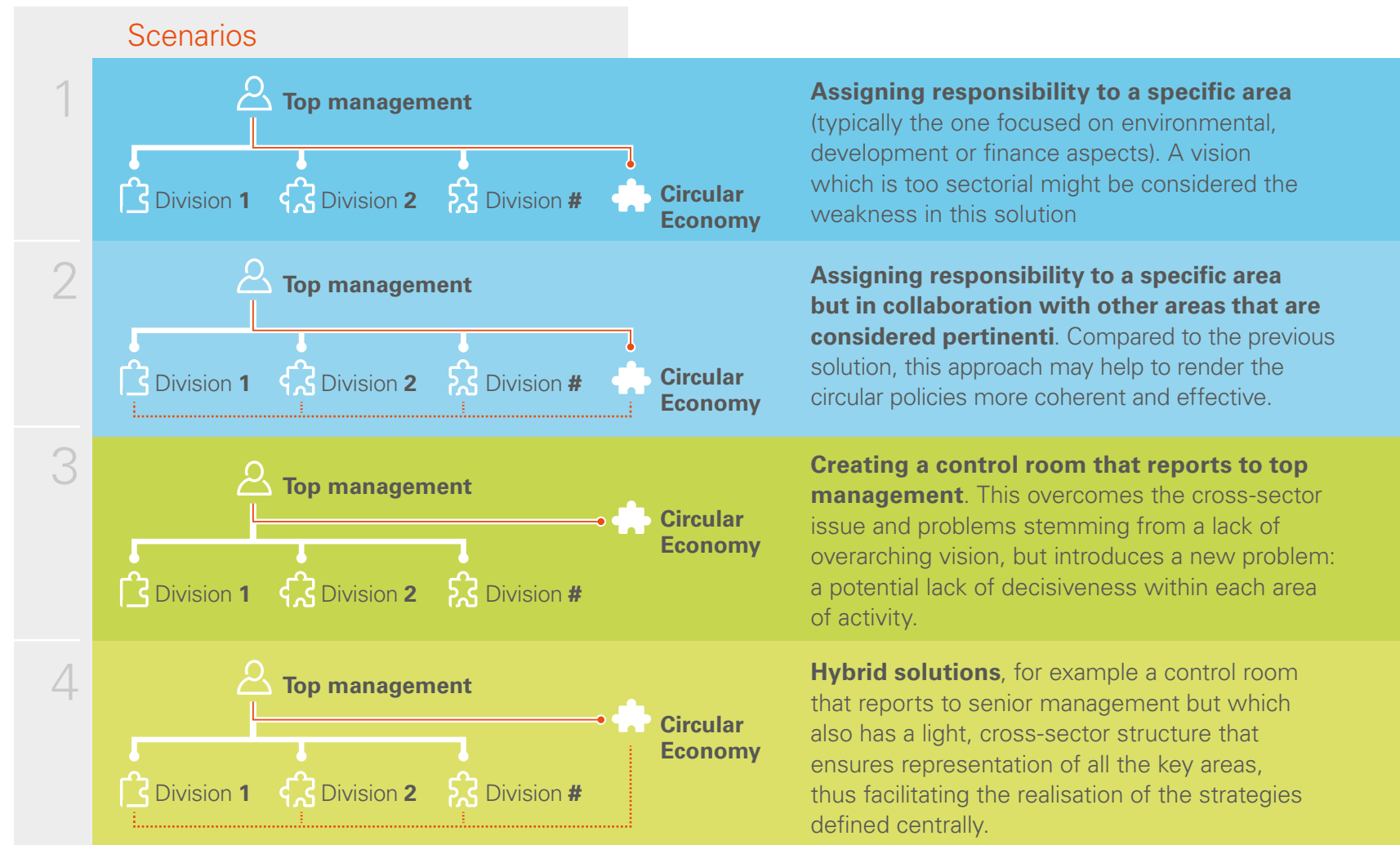
⁷ Circle Economy, *The Role of Municipal Policy in the Circular Economy*, 2020.

2.3 Where should the control room be?

As of today, the question regarding where best to locate the management of the circular economy is still up for debate within all sectors: institutional, corporate, academic, etc.

The crux of the problem is that the circular economy represents a cross-sector approach, so assigning responsibility for it to a specific sector significantly limits its range of operation and, as a consequence, its effectiveness. There are many different possible solutions, each with its own strengths and weaknesses.

There are many different possible solutions, each with its own strengths and weaknesses



2.4 Planning: top-down or bottom-up?

The circular economy may be conceptually developed according to two different guidelines: there are the more systemic projects which must be developed “top down” and there are many projects, relating to more specific solutions, that can be developed “bottom up”.

For this reason, having broad participation in strategy definition and maintaining engagement also during the implementation phase is beneficial, as it increases the potential associated with both the above-mentioned lines of action. In addition, there are many levers that allow entities to intervene in support of the transition towards the circular economy.

At national government level, for example, one can envisage a regulatory framework that enables or supports the implementation of innovative solutions – the so-called *future-proof legislation* – and which regulates opportunities; for

example, requiring one sector’s waste to be used by another sector as material input, support for the repairs sector or the use of renewable sources.

Furthermore, other intervention levers can have both a national and a local reach. A typical example is Green Public Procurement – and its evolution into Circular Public Procurement –, an initiative which pushes the supply chain towards the achievement of circularity objectives⁸ by establishing certain criteria for the assignment of public procurement contracts. This type of initiative can also have systemic effects: on the one hand there is an impact on the entire chain of sub-contractors, and on the other hand synergy may be created with similar proposals being implemented by companies. These are instruments that have the potential to become an essential driving force to promote the transition and facilitate innovation.

Another key lever might be the involvement of startups in identifying specific solutions, which can later be

scaled up through Circular Procurement. Finally, there are specific intervention models at the local level: linked to the identification of lines of action and of the main projects to be implemented in the area, they can also serve as accelerators by supporting the transition and actions implemented by citizens and companies to foster circularity.

To go back to a broader view and to implement the vision of circularity on a larger scale, local efforts must be integrated and included in a more general collaborative framework, taking advantage of the collaboration between institutions, the private sector, universities, research centres and citizens⁹.

 Broad participation in strategy definition

⁸ To find out more

⁹ Ellen MacArthur Foundation, *Cities and Circular Economy for Food*, 2019.
Ellen MacArthur Foundation, *Cities in the Circular Economy: The Role of Digital Technology*, 2017.

2.5 Stakeholder engagement: the public-private collaboration

Given that the circular economy concept itself is linked to the identification of synergies and closed loops between sectors, it is vital to effectively engage all stakeholders.

Amongst them, central and local public authorities and institutions are particularly important, because the concept of circular city does not end with the technological modernisation of infrastructure alone: it demands a complete redesign of all the phases and activities inherent in the urbanisation process. The creation of digital infrastructure and new technologies facilitate more transparent and interactive city planning and management mechanisms, in which the participation of citizens plays an increasingly important role, both in the ascending phases (definition of policies and incentive mechanisms) and in the descending phases (expressing consensus on planning or redesigning the city in a circular sense, as well as on its functioning).

However, the circular model goes way beyond the simple operational transparency guaranteed by digital technologies to citizens and companies, and also tends to help to reshape the public-private relationship, taking it from an initial level of openness to one of collaboration and co-creation that is more mature and informed, focused on innovation and sustainability. Projects centred on electric car sharing or consumers choosing energy from renewable sources, for example, do not stem exclusively from companies' offerings, but require the existence of conditions that not only do not prevent citizens from pursuing a shift towards new models based on reuse and recycling, but, where possible, actively incentivise them to fully embrace this evolution.

Based on this rationale, the public-private collaboration is no longer one of the many enabling factors for a model of more sustainable development and more inclusive growth. Instead, it has become an essential cornerstone of the circular paradigm, allowing the

horizontal subsidiarity within the urban context, as well as the foundation for the development of business solutions designed to improve the quality of life in the cities of tomorrow.

For the public administration it is about superseding an organisational and management model that is typically vertical, opting for an approach that allows for horizontal interaction with various parties, public and private, during the planning and management of state-of-the-art services. This greatly accelerates the evolution of the urban system towards *distributed governance*¹⁰, which is more effective in terms of facilitating the city's circular development and encouraging contributions from all stakeholders, and especially companies.

¹⁰ The term "distributed governance" was coined by Stephen Goldsmith and Neil Kleiman in *A New City O/S: The Power of Open, Collaborative, And Distributed Governance*, Ash Center Series, Innovative Governance in the 21st Century, Brookings Institution Press, Washington, 2017.

Because levels of intervention activities can vary significantly, it is necessary to find solutions that allow for all stakeholders to be engaged in a coherent project whilst simultaneously giving everyone a sufficient amount of freedom.

The collaboration of different stakeholders is essential in the pursuit of more ambitious objectives; furthermore, given the closeness between policy makers, companies and citizens at city level, it can be another useful factor in driving the transition. For example, local administrations can encourage circular companies by providing them with incentives or by removing subsidies that favour the consumption of energy from non-renewable sources, or even by defining clear roadmaps towards circularity. In turn, companies can test new circular business models and facilitate skills adjustments. Finally, citizens can also contribute by changing their consumption habits and behaviours¹¹.

2.6 Metrics and objectives

Metrics are as important as they are complex. Given that goals can be set and improved upon only if they are measurable, metrics cannot be a secondary aspect but must instead be an integral part of the strategy. Indicators must be selected so they are coherent and functional to the strategic objectives and must represent their progress, so as to ensure that the achievement of the targets associated to them leads to the attainment of the objectives themselves.

Many indicators can be associated with different aspects of the circular economy, but a one-size-fits-all approach does not exist. What matters is that the totality of the monitored values represents a genuine decoupling of economic activity from the consumption of energy from non-renewable sources: adopting values and indicators that are scarcely relevant, or even incorrect, can lead to choices that take you away from the circular economy rather than towards it. Furthermore, whilst a final indicator associated

with emissions exists for the issue of decarbonisation, a single indicator for the circular economy does not exist: in line with the definition of circular economy as *the decoupling of economic activities from the consumption of energy from non-renewable sources*, a variety of values must be analysed relating to both the cycle's input, design and closure phases and the mode of use.

With respect to including metrics in the overall strategy, there are a number of possible approaches that are increasingly structured depending on the level of ambition and engagement:

- go ahead with the first phase without recourse to a metrics system, waiting until the following phase before doing so;
- identify one or at least a few high-level indicators, which may be considered representative in the context;
- adopt a structured metrics system since the beginning.

¹¹ World Economic Forum, *Circular Economy in Cities*, op. cit. (see footnote 1, page 10).

Whichever approach is adopted, if a metrics system is identified, it is always useful to define one or more short- and medium-term objectives, in order to then monitor their progress and, above all, to identify any necessary corrections and define the next steps in the strategy.

Metrics are a central aspect in the transition towards the circular economy on which Enel has placed significant attention right from the outset. Indeed, in 2017 Enel developed and published a theoretical reference model that contributed to advancements on the subject on the international level and, more recently, has defined applicative models that also focus on the urban context¹².

2.7 The role of innovation

Innovation is the engine of the circular economy: this transition cannot be achieved simply by optimising the existing model, and instead requires careful rethinking of its every facet. This includes the technological, organisational and business model aspects, in addition to any specific solutions that call traditional consumption attitudes into question. Some of these aspects develop at a national or international level, whilst others have a more local dimension but must still be seen under the light of open innovation.

Let's not forget, the leading role played by companies in circular innovation has also recently been highlighted by the European Commission in its Circular Economy Action Plan¹³. Promoting and supporting innovation, with the goal of identifying new ideas and solutions to tackle and solve cities' problems and challenges, is one of the key drivers to encourage this transition.

2.8 Awareness and participation

The critical environmental protection issues that have arisen in recent years are now well known, from the climate crisis to pollution to waste disposal. However, there is often a lack of shared understanding regarding the approaches and solutions that need to be implemented. In this context, the circular economy risks being perceived as a concept that is evocative, but vague.

For this reason, supporting and facilitating wider awareness of the issues relating to circularity, in terms of both the problems and the potential solutions entailed, is crucial to build consensus regarding the commitment required and to create a context in which everyone can actively collaborate and make a contribution.

¹² Enel, *CirculAbility Model*, 2017.

¹³ See footnote 2, page 10.



3. The benefits

3.

The benefits

3.1 Cities' circular recovery after Covid-19

The explosion of the pandemic at the beginning of 2020 had a significant and immediate impact on city life, and its consequences will continue to be felt in the medium and long term.

Recent events have helped to consolidate people's awareness – which was already growing prior to the pandemic – of the need to transition towards a sustainable model, but also introduced new aspects that will have to be taken into consideration in the future. The early months of the year were peculiar because they took us beyond abstract reflection: most of the world's population suddenly faced daily reality in

a completely different context, as if some sort of experiment was being conducted on a global scale (unfortunately, with tragic events reminding us of how serious everything really was).

Three issues, in particular, emerged clearly.

1. Transition towards a sustainable economic model

The need to transition towards a sustainable development model, one that is compatible with the planet's environmental limits, clearly emerged as the only possible solution, in the medium term – to prevent, as far as is possible, new major disasters (pandemics, effects of global warming, etc.) – as well as in the short term, to limit the negative impacts of cataclysms that are already inevitable¹⁴.

As regards the medium term, without going into detail as to the origins of the current pandemic, there is wide consensus¹⁵ on the fact that destabilisation of the planet's



environmental equilibria, from the climate emergency to the destruction of ecosystems, contributes to causing these kinds of phenomena. The dramatic consequences of a pandemic of this type increase our awareness of the potential impacts linked, for example, to the effects of climate change.

¹⁴ C40 Mayors' Agenda for a Green and Just Recovery, July 2020.

¹⁵ There is an endless number of scientific studies attesting to this. David Quammen's *Spillover: Animal Infections and the Next Human Pandemic* (W. W. Norton & Company, New York 2012) provides an informative, highly readable report on this subject.

As for the short term, however, the extension and fragmentation of logistical chains, together with the systemic insecurity that was generated, have underlined the lack of resilience inherent in the current economic model. A different model, one that is less dependent on imported fossil fuels, goods and products and that is more based around local supply cycles and chains, renewable sources, the recovery of end-of-life asset value and so on, would guarantee increased resilience and adaptability.

Moreover, from the point of view of a utility company looking at consumer behaviour during the coronavirus pandemic, it is obvious and almost goes without saying that consumers spent more time at home, changing their purchasing habits and behaviours in response to their new needs. First and foremost, people became more aware of different aspects: their domestic energy consumption; their need to monitor such consumption to limit costs, also by seeking out energy-efficient solutions, flexible and eco-friendly plans for day-to-

day energy use; and the digital solutions available to manage any difficulties – including financial ones – arising from the economic crisis caused by the health emergency.

2. Cities as engines for development

The lockdown to which the vast majority of the world was subject gave rise to new considerations regarding physical interaction thanks to digitalisation, the management of living and working spaces, and the use of means of transport.

These considerations also included, more generally, the role of the city and its evolution. The possibility to work remotely, together with the desire for larger green areas and the (already in-progress) reappraisal of the “megacity” concept, have led to discussions on different solutions: from “sprawling cities,” i.e. cities covering a wide area with suburbs made up of single, distinct residential dwellings, to the more radical idea of completely doing away with physical nearness altogether.

With respect to this last point, it is worth remembering that, historically, cities were the context where human civilisation developed thanks to the continuous exchange of ideas and knowledge, the creation of initiatives and opportunities, and constant innovation. It is important to remember that all this was made possible thanks to the physical proximity between people, enabling constant dialogue and interaction. However, unsustainable development models combined with rapid urbanisation have, slowly but surely, created and intensified certain conflicts: considering the importance of physical nearness for human interaction, there are problems related to low quality of life and the impacts of negative environmental, economic and social factors.

This conflict can also be found in the sprawled city model: the need for people to distance themselves from the city centre – so as to enjoy larger open areas and live in a more habitable context – contrasts, from a number of perspectives, with issues relating to a lower quality of life (travelling distances and times)

Historically, cities were the context where human civilisation developed thanks to the continuous exchange of ideas and knowledge, the creation of initiatives and opportunities, and constant innovation

and to impacts that are environmental (increased emissions resulting from extra travelling and heating/cooling homes that are more isolated and larger on average), administrative (management of services for a more widely dispersed city and related costs) and social (reduction or absence of the social fabric required for human interaction).

While obviously not conclusive thus far, these considerations highlight the existence of needs that do not go as far as pushing for the city concept to be superseded but do require its reappraisal. The benefits connected with the opportunities presented by the urban dimension must be balanced with quality of life in terms of work-life balance (digitalisation plays a key role from this standpoint), environmental health and the creation of a social fabric. On the one hand these opposing forces guarantee the city its key role, but on the other they push for a return to a dimension that is more conducive to liveability in its broadest sense.

In this context, rethinking mobility and buildings will be crucial both for cities' life and for the environmental impact they will generate on a global scale. This is the direction taken by various cities (such as Paris and Amsterdam) that have made circularity the cornerstone of their transition. There are many and various different possible solutions and policies, but a particularly interesting initiative has been conceived and developed in Paris: the so-called *Ville du quart d'heure* (Fifteen-minute City), based on the concept of reorganising urban areas to improve conditions for both people and the environment¹⁶.

3. Flexibility and liveability

Given these emerging considerations, it seems plausible that public spaces will become, by necessity, more versatile and flexible, but also healthier and greener. It is clear we need compact areas where services are easily accessible, a more flexible use of buildings (to avoid gatherings) and a reduction in daily commutes to work.



In this period, but also in the future, the modularity and adaptability of private and public buildings will become fundamental, structural features: the evolution of work methods will require a careful reappraisal of how spaces are managed.

Moreover, resilience will undoubtedly be one of the most important elements to relaunch cities and breathe new life into their economies after the pandemic. Change will take shape in different ways, depending on the specific solutions implemented to contrast the spread of infection: from the types of materials used to the design of technologies such as heating, ventilation and air conditioning (HVAC) systems. Circular cities, and even more so circular districts, will be capable of greater resilience also in terms of resources and their use, closing the loop

¹⁶ Developed by Carlos Moreno, professor of architecture at the Sorbonne in Paris, and embraced by many cities in post-Covid times and by C40 (c40.org), the Fifteen-minute City initiative proposes a model where people can satisfy all their daily urban needs, from work to leisure, within fifteen minutes by bicycle or on foot.

at the local level and avoiding some of the difficulties faced in these months, during which the lockdown plunged the procurement systems of entire supply chains into deep crisis.

The challenges relating to mobility, a key issue for cities in terms of both emissions and traffic, will not be met simply by reducing commuting through digitalisation. A first important step, which is rapidly evolving, is the shift towards adopting electric means of transport (both private and public) and the development of the related infrastructure, in addition to increasingly widespread incentives to micromobility¹⁷.

Public transport in particular, which was also heavily impacted by the recent Covid-19 crisis, can rely on many alternative options – from rail transport to electric buses to electric mobility within Mobility-as-a-Service or sharing models – and it will play a central role in reducing congestion in city centres.

¹⁷ To find out more

FOCUS

Covid-19: new scenarios for some sectors



During the Covid-19 health emergency, shortcomings in the food supply system clearly arose in all phases of the supply chain. The need to radically review these systems, using a holistic and systemic approach, is now inescapable. The impacts of the coronavirus pandemic on the food supply systems can be grouped into three main areas: domestic, urban and agricultural. Starting with the domestic area, first and foremost we witnessed a

dramatic shift in consumer behaviour after a long period in which at least the world's wealthier regions spent their money on convenience, accumulation and the pleasure of eating, with no consideration for the unsustainability of production models. The pandemic forced the global population back to Maslow's hierarchy of needs: food as an essential good, with local and nutritious ingredients, became the new norm. Kitchens have been rediscovered as an important place where families prepare and share meals, revive the human interactions that we had almost forgotten due to the frenzy of daily life, and reconnect with each other through food. Especially after the pandemic, the kitchen of the future will be increasingly regenerative: it will be a place where ingredients are chosen to further sustainable food choices and used responsibly to reduce waste. With respect to the urban area, redesigning cities' food systems means reshaping habits while still guaranteeing the food purchased



The kitchen of the future will be increasingly regenerative: it will be a place where ingredients are chosen to further sustainable food choices and used responsibly to reduce waste



Incentives and the so-called “pop-up cycle lanes” (which are temporary routes that serve as “safety lanes”) have emerged as one of the first emergency measures adopted in various European cities

by citizens and consumers is safe. Local food banks, vertical farming and closer ties between urban centres and their hinterland are just a few examples of the solutions being developed. The pandemic also hit canteens and restaurants, while data in the Nielsen report (regarding the 2020 Spring Festival in China) point to the flexibility and resilience of the retail sector. Figures are similar in Italy: local shops and the growing collaboration with digital platforms provide communities with essential points of reference. Finally, regarding agriculture, the prolonged lockdown provided the world with an opportunity to relearn

the value of food and to reconnect with those who produce, distribute and process it, as well as with the people they share it with. The pandemic shone a light on the dysfunctions in the current food supply chain (harvesting, transport, distribution and storage): waste and losses increased, putting the security and work of farming businesses at risk as well as compromising food quality. This obvious lack of resilience and flexibility in the supply chain underlines the need for a deep analysis of the food sector, calling for a radical shift – away from centralised systems towards disintermediation, decentralisation and direct

relationships between farmers and final consumers. A shift that can only occur with the support of a profound change in mentality.

INTESA  SANPAOLO

The drastic and dramatic change currently underway, as a result of the coronavirus, has triggered many transformations.

We have understood that it is beneficial to change positioning and business model during this phase. Although this is a period of growth for certain sectors – particularly the food, digital, delivery, health and telecommunications sectors – many others are suffering greatly: think of tourism and events, automotive (and therefore fuel production and distribution), culture and leisure, catering and manufacturing, as well as sectors providing products and services to companies.

Public transport, short-term car hire and car sharing all saw drops of 60% to 90%, with a bleak outlook for the long term if targeted support is not put in place. However, micromobility sharing, with priority road lanes, could provide a way to meet user demands: for example, incentives and the so-called “pop-up cycle lanes” (which are temporary routes that serve as “safety lanes”) have emerged as one of the first emergency measures adopted in various European cities.

During this period, working from home (remote working) has quickly become more widespread in companies and public administrations, giving rise to a number of critical issues: from the availability of remote work devices and suitable network infrastructure to the repurposing of domestic spaces to enable the coexistence of various work and study activities within the family



The retail sector – after a sharp drop in in-store sales – has seized the opportunity to digitalise their relationship with clients, reaching out to them via e-commerce

context, to managers' ability to supervise and assess their teams' work remotely.

If, on the one hand, local shops' revenue has grown much more quickly compared to large supermarkets, on the other hand the retail sector – after a sharp drop in in-store sales – has seized

the opportunity to digitalise their relationship with clients, reaching out to them via e-commerce.

To support Italy's recovery, Intesa Sanpaolo has prepared a series of concrete measures to accelerate and facilitate the transition of families and companies out of the emergency phase and into the relaunch and recovery. In addition to extending lines of credit and providing government-backed loans, the Group's initiatives include providing a total of 50 billion euro of credit for the country and 10 billion euro dedicated to the Programma Sviluppo Filiera (Supply Chain Development Programme). We also continue to support innovative startups, some of which are involved in sectors and business models that are driving a substantial transformation in response to the pandemic.

This crisis represents an opportunity to drive innovation, and in order

to facilitate the recovery we have supported a number of startups, which we believe are developing solutions that will be important to meet the challenges we mentioned. We have selected and supported two we consider to be particularly interesting for the world of work.

BEACONFORCE offers a digital solution that uses an algorithm to analyse employees' motivation and engagement on a daily basis.

YOBS is a remote recruiting platform based on artificial intelligence, a support tool for HR offices to screen and select applicants and create teams.

During these months we have also worked with six innovative startups in the retail sector.

MEDIATE has developed a small, motorised robotic trolley that performs home deliveries autonomously.

UQUIDO offers augmented reality, Internet of Things and artificial intelligence solutions to improve customer experience in the retail sector, both in person and remotely.

SISTEM-EVO provides software for setting up intelligent chatbots that can digitally respond to customers.

ULISSE has invented a device that is able, through computer vision, to track customers' movements inside a shop and regulate accesses in order to comply with physical distancing protocols.

ZEROGREY/KOOOMO is a digital platform that strives to become a one-stop-shop by enabling access to a multitude of global marketplaces.

QBIT is a platform that uses virtual, augmented and mixed reality to transport customers into a 3D e-shop.

The idea of “adaptive reuse” must prevail over demolition and new construction in order to satisfy the market’s demand for different uses

During this phase, some entrepreneurs need to reposition their business, understand how to shift towards the sectors that can best tackle the crisis and maintain a good level of competitiveness, or transform their activity in an innovative way. The pandemic emergency must be seen as a transformation spiral that will never take us back to what was normal previously but will instead give us the opportunity to discover new dimensions for development.

ARUP

The current Covid-19 pandemic has forced all sectors, including the urban construction sector, to reassess their situation. In this context, Arup opened a conversation, among others, with StopWaste, a public agency that is supporting Alameda county, in California, in its transition towards a

circular economy. Alameda comprises 14 cities located in the eastern region of the San Francisco Bay Area and is one of the few members of the Ellen MacArthur Foundation’s network of circular cities that represents small local governments. StopWaste focuses on energy, water and all types of waste, including conventional solid urban waste.

The emergency made it all the more evident to the agency that buildings need to be able to “adapt” and be reused for different purposes. For example, converting empty parking facilities and office spaces (now vacant as a result of remote working) to residential use can help to alleviate the critical need for new housing in the San Francisco area. These resources are often located in urban centres close to communication routes and other services, thus reducing the demand for additional infrastructure to reach less built-up areas that are further away.

Arup is supporting StopWaste in creating a checklist for the evaluation of the potential additional effort the conversion activities may require and of the necessary measures to encourage such activities. In the meantime, the county of Alameda has understood that the presence of a well-consolidated network of in-city areas could provide a suitable response to the need to repurpose buildings during periods of crisis.

As far back as 2018, StopWaste identified local administrations as leaders in the transition towards a circular built environment, providing planning, permits, financial incentives and training for owners and developers. This led to the development, jointly with Arup, of a primer for local administrations: *Circular Economy in the Built Environment: Opportunities for Local Governments*¹⁸. Focusing on a very localised scale (single buildings), the document by StopWaste and Arup presents the increase in use and

occupation, both for existing and new buildings, as a priority. The idea of “adaptive reuse” must prevail over demolition and new construction in order to satisfy the market’s demand for different uses. Where possible, vacant houses should be completely transferred to sites where there is a demand for them, and new buildings should be designed to be flexible and adaptable, so that they can be used for different purposes in both the short and the long term.

¹⁸ To find out more

3.2 Impacts on competitiveness

Creating new job opportunities, supporting the development of new companies and attracting larger investments are the challenges that cities are currently facing and that will be crucial for their development in the coming years. The overall economic transition is hitting many companies also within the urban fabric. A complete assessment of the economic potential of the circular economy is yet to be carried out, but the general underlying principle is well understood and shared: by focusing on maintaining the value of materials and resources, improving the use of renewable sources and fostering strong interest for innovation, the circular economy could generate economic opportunities for large corporations, small companies and individual entrepreneurs alike.

Economic opportunities derive, in particular, from the use of new renewable and electrical technologies, a new approach to designing assets that

focuses on maximising their potential, and the adoption of new business models like sharing and Product-as-a-Service (see paragraph 1.2, The circular economy vision) to offer citizens solutions that are both more competitive from an economic standpoint and environmentally sustainable. Essentially, circular economy solutions should base their competitiveness **on the following key drivers**.

Focusing on maintaining the value of materials and resources, improving the use of renewable sources and fostering strong interest for innovation, the circular economy could generate economic opportunities



Transition to more competitive sources for energy and materials, for example by supporting the adoption of renewable energy sources.



Products designed to extend their useful life and easily recover their end-of-life value.



Reuse of materials and products that are otherwise wasted.



Best use of goods: many goods and products in cities are underexploited, from business buildings (offices and spaces used for work purposes or financial transactions) to vehicles to infrastructure. Although there are sporadic actions already in place, a systematic evaluation of the overall untapped potential would lead to further savings.

The impact on competitiveness may be seen on multiple levels.

1. Direct impact on administrations through Circular Procurement: managing contracts using a circular approach, i.e. introducing adjustment metrics and factors that guide long-term effects and management, promoting innovative solutions that ensure competitiveness.

2. Corporate investment: providing a clear vision and the necessary support to achieve a circular transition may attract private corporate initiatives that act as accelerators in creating a local ecosystem.

3. Startup and SME development: the creation and encouragement of an environment characterised by circular economy principles can help to foster new startup and SME initiatives, whilst cities can serve as incubators to support further expansion phases.

4. Citizen-led business initiatives: individual citizens might also identify other sectors that can generate value. Again, in

this case, the economic benefits deriving from the circular economy are not limited to a single sector, but span throughout the entire portfolio of initiatives that support each other. Therefore, the innovation process can be amplified through circular public contracts or corporate investments. To capture this value at city level, we must activate many different levers.

3.3 Environmental impacts

With respect to the environmental benefits generally associated with the circular economy, it is important to understand that the expected advantages cannot derive simply from recycling waste, but rather from completely overhauling the economic model, starting with its earliest phases. The aim is to decouple economic activities from the consumption of non-renewable resources: in other words, to ensure that all activities use renewable materials and energy, or completely reuse non-renewable resources, so as to – ideally – completely eliminate all impacts on the environment.

Recycling represents a step forward but is not enough. To generate benefits along the entire value chain, it is essential to start with the design phase.

Consumption of materials. In the urban context, this central aspect in the circular economy vision can result in a complete overhaul of material flows: the construction and food sectors provide particularly good examples in this sense, due to the large volumes of raw materials they consume and the waste they generate. Furthermore, it is important to note how strong the interconnections between sectors can be: this is perfectly illustrated by the fact that energy consumption is strongly influenced by the choices made in the construction industry.

Local and global emissions. Decarbonisation objectives must be achieved not only through renewable sources, electrification and improved energy efficiency, but also by including other sectors in the circular economy: recent studies estimate that 45% of

global emissions derive from how we produce and use products and how we produce food¹⁹. Furthermore, designing compact, flexible areas at city level makes it possible to reduce travelling time, noise, air pollution and energy consumption. Today, having understood the urgency of the situation, many cities have identified the concept of “zero emissions” as their most important commitment

Waste generation. The impact would be more immediate in this area, because goods at the end of their lifecycle would be reused or recycled in a kind of closed loop.

Pollution and health. Reducing waste, improving wastewater treatment and reducing water contamination and air pollution are all measures that generate positive impacts, for health and more. Even the redistribution of food to people in need, on top of reducing waste, has positive effects on health and pollution because the environmental impact deriving from food production and processing is reduced²⁰.

3.4 Social impacts

Although the circular economy’s most direct impact is on the environment, we can expect it to also have a positive impact from a social standpoint.

In general, an economic model based on the exploitation of natural, non-renewable resources, consumption and the generation of waste is characterised by a significant level of automation, long logistical chains for supplying materials and semi-finished products, and highly-concentrated energy consumption. The product, at the end of its useful life, constitutes a problem for disposal that can either be handled locally or further afield.

In contrast, a circular approach is more focused on maintaining the value of stock, closing loops and using renewable sources. This entails, from a design standpoint, a shift towards inputs that are at least partially local (renewable energy, reused materials, etc.), reduced production and extended product life

(repairing, maintenance, services), new business models (Product-as-a-Service) and, consequently, activities that close loops in the cycle (regeneration and recycling)²¹.

A special mention should also be made of sharing and reuse through selling: these models enable private citizens’ direct participation, and do not lead to job creation but are a way to supplement income.

It is worth noting that the 2020 pandemic had a significant negative impact on asset sharing initiatives (in particular sharing and Product-as-a-Service models) and on the sale of products between private individuals (reuse) because, as they require assets to be used by more than one person,

¹⁹ Ellen MacArthur Foundation, *Completing the Picture: How the Circular Economy Tackles Climate Change*, 2019.

²⁰ World Health Organization, *Circular Economy and Health: Opportunities and Risks*, 2018.

²¹ Circle Economy, *Jobs and Skills in the Circular Economy*, 2020.

they indeed require some form of direct interaction. We must therefore take into consideration the fact that any continuation of social distancing measures will have an impact on the development of these business models.

In addition, the assessment of the overall impact must consider the numerous cross-sector interactions encouraged by the circular economy approach, including various jobs that enable circularity – such as the design of new products consistent with the circular approach, activities that are actually circular in nature, like remanufacturing, and activities that are indirectly linked to the circular economy, such as those tied to reverse logistics²².

Although quantifying the impact of the circular economy on the job market is not possible yet, the dynamic of creating new “green” jobs, together with the gradual reduction of those production sectors that are characterised by intensive resource use and the requalification of existing works, will probably lead to a rise in employment, albeit somewhat modest.

ROUGH ESTIMATE OF THE IMPACT OF THE CIRCULAR ECONOMY ON EMPLOYMENT

		GLOBAL BASE	VS.	LOCAL BASE	OVERALL IMPACT ON EMPLOYMENT	EXAMPLES
Production	 Design					Shift of focus
	 Input					RES/Local loops
	 Production					Less demand for new goods
Use	 Life extension					Repair/Maintenance
	 Sharing*					Part time share
	 PaaS					Services
Close the loop	 Reuse*					Second life
	 Remanufacture					Reverse logistic/Remanufacturing
	 Recycle					Reverse logistic/Remanufacturing

 No impact
  Slightly negative impact
  Very negative impact
 Slightly positive impact
  Moderately positive impact
  Positive impact

* More than job, income opportunity

It is worth mentioning that, however, recent studies associate the most encouraging results in this sense with the adoption of a gradual increase in tax on materials and – leveraging these new revenue streams – a reduction in labour taxation²³.

²² Circle Economy, *Launch of the Circular Jobs Initiative*, 2020.

²³ OECD, *Labour Market Consequences of a Transition to a Circular Economy*, 2020.

This transition therefore creates new challenges and opens up choices, at both national and local levels, that can be summarised as follows.



Taxation

The fiscal lever helps to guide economic choices. For example, increasing taxation on the use of non-renewable resources and the generation of waste, with a simultaneous reduction in labour taxation, would accelerate the transition towards circular solutions based on renewable materials and energy or on maintenance, repair activities and services (ultimately this would mean elevating and supporting human labour, recognising it as the renewable resource *par excellence*²⁴).

This triggers further systemic considerations: for example, a possible tax on work performed by robots similar to the one applied to human labour. Then there is the issue of fiscal incentives, another lever that could be used to promote the use of renewable sources and activities to extend products' useful life (such as repairs) or to regenerate end-of-life products (such as remanufacturing).



Training

With certain old sectors being substituted by new ones, we must create new skills and support workers during the transition phase, with education and training programmes.



Business ecosystems

Since, as mentioned above, innovation has a key role in the circular economy, investment can facilitate the creation of new startups and SMEs, a local production sector characterised by a high concentration of industrial companies, mostly small and medium-sized, and highly specialised production. This can lead to a virtuous circle between research facilities, companies and public and private funding, which is essential for cities' resilience and development, and could stem from spontaneous networks or could be supported through local tax incentives.

²⁴ Walter R. Stahel, *The Circular Economy. A User's Guide*, Routledge, New York 2019.



4. Conclusions

Conclusions

4.

Having analysed in previous editions the technologies, circular business models and wide range of competitive solutions available today, this third edition of our position paper focuses on a more complex and multi-faceted aspect. In particular, we focus on how to implement cities' circular transformation through collaboration between stakeholders and public-private collaboration.

Using the kind of tools that can be expected from government intervention, institutions have a key role in stimulating this potential; from strategy definition to drawing a shared roadmap, or from regulatory and financial levers (for example, Circular Procurement) to training and activities to support innovation.

This central role played by institutions will become even clearer in light of the recent pandemic, because overhauling the city model requires a shared and participatory vision, so as to enable all parties to collaborate with other government bodies at the local, regional and national level. Without this vision, opportunities might be wasted or come to fruition in a way that is incoherent or fragmented. This is why the many initiatives that exist, around the world, to coordinate different cities' efforts for sustainability and the circular economy are so important: they demonstrate how each city is not a separate reality, but a different application of a common vision, whose impacts have global relevance and scope. As big as they might be, thanks to their local dimension and specific characteristics, cities are contexts where people feel a sense of belonging and may have a more direct impact; therefore, they are an essential hinge in solving the global challenges that await us.

Cities will also continue to be, each with its particular characteristics, places of congregation, culture and development,

identifying as cultural hubs or commercial and production centres depending on the case. At the same time they will change the way they operate, evolving in ways that cannot possibly be analysed without considering the main trends outlined in this document: from urbanisation to digitalisation to climate change.

As is outlined in the final section of this paper, which highlights best practices around the world, this dynamic is starting to clearly come through, paving the way for new projects that no longer appear as single incoherent initiatives, but as stages in a transition towards a circular city model, tiles in a mosaic where we catch a glimpse of the ambition to redesign the city through key sectors such as mobility, construction, urban planning, food and waste.

Of course this is no single, one-size-fits-all approach: the common vision is moulded in each case to suit the local characteristics and conditions. The objective is to combine the opportunities offered by the city with environmental

sustainability (at the global and local level) and social interconnection, as a fundamental prerequisite for improving urban liveability.

Understanding the causes, impacts and consequences of the current pandemic will be at the centre of activities for the coming months, as well as a key element to consider in any subsequent conclusion. When facing a new issue as vast and complex as this, it is impossible to cover the subject in its entirety. Nevertheless, we believe it is still important to periodically share our

thoughts and ideas regarding circular cities, taking it as an opportunity to consolidate and reflect upon what has been achieved and as a starting point for further development.

For years, Enel's commitment has been to contribute, through its business activities, to the transition towards a sustainable economic business model, and to do so openly by collaborating with all stakeholders and with those who share our vision. Everything we are doing, and will do, for the cities of tomorrow is an essential part of this commitment.



What we are doing now
– and what we will do – for
the cities of tomorrow is
a fundamental part of our
commitment to contribute
to the transition towards
sustainable economic
development



Focus

Best practices from
around the world

Best practices from around the world

The European Commission's adoption of the Circular Economy Action Plan in 2020, and the role conferred to cities and regions with respect to this new approach, have been, without doubt, among the most significant drivers for the implementation of the circular economy at the European level. The strong calling for circularity expressed by European cities like Amsterdam²⁵ and Paris²⁶ is a benchmark for many other urban centres.

Around the world, there has been a lively debate on the subject of the circular economy, not limited to Europe. For this reason, with the aim of exploring the public-private contribution in implementing circular strategies and projects at the urban level, we now take a detailed look at what has been happening recently in some cities in North and South America, starting with those where Enel is carrying out projects that are hugely significant in terms of their impact.

²⁵ To find out more

²⁶ To find out more



São Paulo

Its territory's considerable size, high level of biodiversity and particular cultural and socio-economic context make Brazil an interesting testing ground for circular dynamics and models, where single initiatives can trigger a multitude of effects.

To this end, we have decided to analyse what is happening in São Paulo, also through the eyes of two of our partners: Intesa Sanpaolo and the Future Food Institute. In studying projects such as Urban Futurability, led by Enel and focused on areas like infrastructure and digitalisation as well as two different aspects on the issue of food, we look at the different levels involved in creating a circular city



Urban Futurability in the Vila Olímpia district

Developing a new approach to the city forms the foundation of Enel's Urban Futurability project, a state-of-the-art solution to digitalise the network, reshape the energy sector and create value for cities and their inhabitants.

Launched in 2019 in Vila Olímpia, São Paulo's financial district where tens of thousands of people live and work every day, the project will become fully operational in a couple of years. Based on the electricity network, one of the principal and most widespread urban infrastructures, projects such as Urban Futurability can contribute to creating the

city of the future by combining innovative technologies, which improve the network's resilience and automation with stakeholder engagement in what can be regarded as a genuine natural laboratory for co-designing and developing new circular services.

The project involves the use of entirely innovative industry-4.0 solutions, including around 50 initiatives that introduce Brazil to new technologies (from predictive maintenance to hyperreality for maintenance activities and on-the-ground training, and from smart metering to artificial intelligence for safety) and new services that will impact on asset management and daily work activities.

Centred around stakeholder engagement and the pillars of the circular economy, Urban Futurability will enable the creation of cities which are more liveable, resilient, and able to adapt to the effects of climate change, in line with the objectives set out by the United Nations in the 2030 Agenda.

The circular approach

Urban Futurability is allowing for the re-examination of the "business as usual" way, and for the integration of circularity into the production process right from the initial design phase.

For example, the replacement of 4.8 kilometres of overhead lines with underground cables was carried out via a sustainable worksite model, which improves the sustainability performance and the reuse of materials such as water and soil deriving from digging activities. Ways in which concrete might be substituted with polymers recycled from plastic waste (either purchased or deriving from Enel waste) are also currently being tested, in order to reduce environmental impact and resource consumption whilst ensuring savings and investing in safety at the same time.

Regarding process revision activities, a new and sustainable process has been established for tree cutting



Regarding process revision activities, a new and sustainable process has been established for tree cutting which, amongst other things, utilises a new circular supply chain (suppliers, NGOs, startups, universities and other associations) to transform the waste from cutting into new products

which, amongst other things, utilises a new circular supply chain (suppliers, NGOs, startups, universities and other associations) to transform the waste from cutting into new products. In addition to circular solutions such as biomass and composting, the new process is also exploring additional open-loop



solutions on the one hand – like getting local craftsmen to create products using leaves and branches (thus promoting local growth) – and closed-loop solutions on the other.

A contribution to global decarbonisation and electrification objectives is also being made through the implementation of new business models. A good example of this are e-mobility initiatives that influence a fundamental aspect of people's lives and their relationship with the surrounding environment. In the Vila Olímpia area, 10 electric vehicle charging stations and 1

electric bike sharing and charging station are due to be installed, strengthening the circular business model of sharing. An electric bus (e-bus) line will run in the area, improving the way in which people move around.

The project will also include smart traffic lights to improve traffic flows, reduce time spent in traffic within the area and reduce emissions. Enel will be installing Smart Lighting on streets to make the area safer, more modern, efficient and attractive: the system is completely digital and can be remotely managed in real-time by the

Municipality, enabling quicker responses to any problems that might occur.

Taking into consideration the importance of connectivity for the operational dynamics of a circular city, Wi-Fi internet connection points will be installed. In addition, 5G speed tests are also planned to facilitate the exchange of information within the area.

Network Digital Twin®, a new virtual network model, is creating an open data platform in Vila Olímpia to encourage the local interested parties to contribute to and potentially co-finance new solutions (urban planning, safety, etc.) based on infrastructure data. Approximately 70 stakeholders have already participated in co-creating a list of possible services that could generate value for both businesses and citizens. Thus, from an urban context with advanced smart services (from mobility to street lighting) we shift towards the information city: where real-time data teach cities how to think and, within the industry 4.0 and energy 4.0 frameworks, enable them to improve

In the Vila Olímpia area, 10 electric vehicle charging stations and 1 electric bike sharing and charging station are due to be installed

person-data interactions so as to foster efficiency, resilience and sustainability whilst simultaneously placing the final user front and centre.

Financing

Significant results, such as those expected from implementing this project, necessarily require the contribution and collaboration of all the involved parties. The finance package includes the investment from Enel as well as public funds for innovation and local development provided by ANEEL, the Brazilian Electricity Regulatory Agency, totalling 25 million euro. Financial sustainability is expected to be achieved within a five-year time horizon, enabled by cost savings intrinsically generated through the project and by the economic value deriving from the new models and services.

Economic, environmental and social impacts

Urban Futurability is an ambitious project striving to transform a megacity district into a more sustainable reality, taking advantage of circular economy concepts and state-of-the-art technologies as an engine for generating added value for the city and its citizens.

Positive impacts are expected for everybody living in the area, going way beyond the 100,000 São Paulo residents who are Enel customers. This number is expected to grow throughout the city, and extend beyond its borders. Indeed, a more resilient electricity grid means a better-quality supply and – taking advantage, through artificial intelligence, of real-time understanding of the resource situation and predictive maintenance – a subsequent mitigation of environmental risks resulting from extreme weather, fires, floods, etc. Digitalising and remote controlling activities can effectively aid in reducing environmental impacts, carbon dioxide emissions and noise pollution.

The data platform is a gateway for the future sharing of information: making a vast array of data available, obtained through the IoT, sensors, and careful 3D infrastructure mapping, Urban Futurability can generate job opportunities through the creation of a new ecosystem of startups, suppliers and other companies.

Following the pandemic emergency, the project is also exploring how to support São Paulo's recovery by looking to utilise solutions offered by the circular economy. Starting, for example, from regenerating waste such as cables and plastic to make new equipment, or from the new circular supply chain revolving around urban tree cutting, Urban Futurability is also exploring possible new solutions, including temporary ones, to foster a new value chain around regeneration.

INTESA SANPAOLO

The circular food system: an enabler for food security and an engine for the local economy

The region around São Paulo is facing significant challenges as a result of the wide disparities that exist within the city.

The food system is increasingly considered as a key vector for economic, social and environmental development. A thriving food and restaurant industry and the high capacity for innovation of its many research institutes, universities and companies, among other things, suggest that São Paulo is in a unique position to develop a regional distributed and inclusive food system

based on the three principles of the circular economy, as underlined by the Ellen MacArthur Foundation in 2018 in its report *Cities and Circular Economy for Food*²⁷:

1. **source food grown regeneratively, and locally where appropriate;**
2. **make the most of food;**
3. **design and market healthier food products.**

The city of São Paulo is surrounded by the metropolitan region of São Paulo, which includes important industrial hubs as well as residential areas,



The city promotes regenerative farming practices in compliance with the FAO's principles for agroecology

farmland and indigenous vegetation (which covers 37% of the metropolitan area, despite high urbanisation rates).

Food production is mainly concentrated in the southern and eastern areas of the city, which are considered "rural" and represent approximately 30% of the urban territory. This is the area where an agroecology movement has been progressively expanding, with the support of city and state initiatives.

Evidence of this phenomenon can be seen in the Parelheiros food

production district, towards the far south of the city, where farmers moving over to agroecology methods benefit from the technical support offered by eco-friendly farming companies, as well as from the first public procurement contracts issued as part of the city's school meals programme.

The city promotes regenerative farming practices in compliance with the FAO's principles for agroecology,

²⁷ To consult the report



Agroecology involves an integrated approach aimed at designing food systems that optimise the interactions between plants, animals, people and the environment

such as biodiversity, efficiency, resilience, food culture and traditions, and responsible governance.

Agroecology involves an integrated approach aimed at designing food

systems that optimise the interactions between plants, animals, people and the environment, taking into consideration the social aspects that must be tackled in order to achieve a sustainable and fair solution.

The farmers in São Paulo who are already applying (or switching to) regenerative practices are supported by a number of initiatives. The following are some of the most notable.

Ecological farming companies.

Two centres located in São Paulo's main food production areas offer specialised assistance to local farmers switching from conventional farming methods to agroecology. They manage greenhouses which produce seedlings that help to improve soil health during the transition process and provide refrigerated storage to support the logistics process.

Special fund to support the environment and sustainable development. A specific fund is

dedicated to supporting civil society projects aimed at improving the city's natural environment. It has already assigned millions of Brazilian reais to agroecology initiatives.

Agroecology transition

certificates. The state and city of São Paulo have signed a best agroenvironmental practice protocol to encourage regenerative agriculture around the city's water resource protection areas. Under this agreement, certificates are issued to identify farmers switching to agroecology production methods, both at direct points of sale and in government procurement processes, thus making the global transition more financially sustainable.

School meals programme. The city has included specific objectives to introduce food products from family-managed farms and from the local, agroecological supply chain into the public procurement process

for school meals. In 2015, 1,747 family-managed farms benefited from food procurement contracts with the city of São Paulo totalling 2 million dollars in value; since then, new offers for local and organic farming and for agroecology have been guaranteed. The programme's implementation plan envisages all procurements for public school meals being 100% organic or from agroecology by 2026.

In conclusion, local and regenerative food production is starting to play a more central role in the city of São Paulo's agenda, acting as an enabler for nutritional safety and an engine for the local economy as well as for social and environmental development in rural areas.



The circular food system: resilience and reduction of inequalities

In terms of governance, the close interdependence between energy and food systems must not be underestimated. Irrigation and the use of chemical products for farming, but also the harvesting, processing and transport of food, all depend on energy. To waste food, therefore, is one of the most obvious ways to waste precious natural resources: a model that is costly and simply unsustainable.

It is of paramount importance to analyse the link between energy and

food in cities, which will be the most relevant places to model new food systems with a view to improving the future. Indeed, considering by 2050 we expect 80% of all food will be consumed in cities, the latter are ideally positioned to leverage their huge buying power to redesign food systems so they become more resilient to external shocks whilst regenerating the environment they rely on.

Given its potential for innovation, thriving food and restaurant scene

and strategic position, the city of São Paulo offers great examples of circular city projects.

Indeed, in this context, by leveraging its power as a major public investor, São Paulo procures food from local farms to serve up to 2.3 million meals per day to public school pupils. During the Covid-19 lockdown and school closures, the Municipality quickly redirected these food supplies to a system of food banks, which gave out food baskets to more than 1 million families around the city.

Banco de Alimentos is an NGO, operating in São Paulo since 1998. With a vision that goes way beyond simple food waste reduction, it follows three main pillars for action to counterbalance food inequalities through reallocation, education and awareness. The particularly innovative aspect of its approach is the urban collection of food, drawn from excess supplies in food companies and supermarkets and



During the Covid-19 lockdown and school closures, the Municipality quickly redirected these food supplies to a system of food banks, which gave out food baskets to more than 1 million families around the city.

from social institutions feeding the communities that are most in need. The fact that collection and distribution are completed within the same day ensures the food – while deemed unsuitable for sale – still maintains its nutritional value and properties.

Every day, Banco de Alimentos reaches more than 20,000 people. In addition, through dedicated food education courses, it provides training to social institutions (to prepare meals that maximise food's nutritional value, in appropriate portions for recipients) as well as to companies and schools, to increase awareness regarding the value of food.

A similar approach is followed by Mesa Brasil Sesc, a national network of food banks sharing Banco de Alimentos's same objective, to reduce hunger and food waste. The work is organised, also in this case, on a collaborative basis. It all starts with food donors offering their excess food supplies; in return, they can benefit from tax breaks and reduced food disposal costs, in addition to an improvement in terms of brand image tied to their active engagement in social and environmental causes. Once collected and transported to the Mesa Brasil facilities, food is packaged and stored to provide additional nutrition for those affected by food vulnerability.

Therefore, this represents an institutional collective effort to improve quality of life and social inclusion, starting from food security and nutritional safety. The Mesa Brasil network has managed to create a multidisciplinary web of connections, extending out from the central role of the collective effort and shared educational projects. Its presence within every single Brazilian state is ensured by multidisciplinary teams which combine and link together the organisation's four principal areas of interest: food security, social assistance, multi-company partnerships and partnerships with social institutions.

An institutional collective effort to improve quality of life and social inclusion, starting from food security and nutritional safety

Santiago de Chile

On 6 May 2020, the Chilean Minister of the Environment, Carolina Schmidt, launched the work of the strategic committee for the creation of a circular economy roadmap, an initiative led by the Eurochile Foundation to bring this new economic model to fruition in the country by 2040²⁸.

“Going from a linear to a circular economy requires a change of model and a huge shift in the ways we produce and consume. For this reason, we have decided to lead the creation of a roadmap, inviting a cross-sector group of organisations to help us to define concrete objectives for making Chile a circular country”, explained Schmidt²⁹.

A strategic committee made up of 25 representatives from the public

sector, private sector (unions and trade associations), the academic world and NGOs, in addition to national experts in this field, will define the development plan’s final structure. The implementation of this strategy is anchored on the collaboration between the various parties involved who, through innovation, have already commenced activities focused on relevant technological areas, with dedicated human capital, high private participation and balanced governance, thus helping to facilitate local development.

Public transport with electric buses

Mobility is one of the pillars underpinning the transition towards circularity in Chilean regions and cities and contributes to achieving the objective of carbon neutrality by 2050.

In 2018, an alliance between Enel, Metbus and BYD introduced the first 100 electric buses into Santiago de Chile’s public transport network. The following year, with the integration of more vehicles



²⁸ To find out more

²⁹ To find out more

in the metropolitan region, Chile became the first country in Latin America to implement a sustainable electric corridor where a total of 285 zero-emission buses are currently running. These vehicles use innovative technology to provide a high level of passenger comfort, Wi-Fi connectivity, chargers for smartphones and air conditioning. Above all, they are zero-impact in terms of polluting emissions and offer a more cost-effective alternative operationally, since running them costs 60% less than conventional diesel buses.

The results achieved by this initiative have been so remarkable that the Chilean authorities immediately included electric buses as part of the requirement for tendering processes, in order to gradually renew public transport contracts.

The success of this collaboration was also underlined by Hector Moya, director of Metbus, when he said the project “has made it possible to obtain something unthinkable for public transport. In the customer satisfaction survey carried

out by the Ministry of Transport and Telecommunications (MTT), the service provided by the route operated using electric buses achieved a score of 6.4 out of 7” – much higher than the score customers gave the traditional service in 2017 and 2018 (4.9 and 4.8 respectively). “In countries like Chile, the sector in which electric mobility will consolidate more quickly will indeed be public passenger transport,” Moya continued, “because existing contracts are expiring and approximately 4,000 buses have already come to the end of their useful life, and will soon have to be updated”.

Electroruta de Chile

In January 2020, Enel announced the Electroruta de Chile plan, involving an investment of 13 million euro to install 1,200 recharging points all over Chile by 2024.

It is estimated that by 2025 there will be approximately 82,000 electric vehicles in the country, so the early installation of



An investment of 13 million euro to install 1,200 recharging points all over Chile by 2024

charging stations will enable the company to support such a transition and become the market leader for recharge services. Every city in Chile with more than 50,000 inhabitants will have at least one charging station, in addition to those positioned along the road network, which will be no further than 100 kilometres apart. Thus, Enel will guarantee 5,000 kilometres of coverage – surpassing the entire length of continental Chile (4,270 kilometres). In parallel, user interaction will be designed and fine-tuned to improve their



experience: using an app, clients will be able to find the closest charging stations, check for availability, book and pay for the recharging.

In implementing this programme, Enel can count on successful examples such as the alliance developed with the local administration of Las Condes (a municipality in the metropolitan region of Santiago de Chile), which in 2018 waived local taxes on the installation of 8 charging stations on its public roads.

Nueva Cordova Building

Santiago de Chile is an example of innovation and circularity in the urban context also thanks to a distributed generation system created using photovoltaic panels, installed on the façade and roof of the Nueva Córdoba building (in Las Condes). The addition of the photovoltaic modules into the building's façade will guarantee the building's energy self-sufficiency, thus reducing operational costs, and

will also provide green energy to recharge electric cars and bicycles, helping to fight climate change and to decontaminate the city.

The project includes the design, equipment supply, installation and set up of an on-grid photovoltaic generation system, with an installed capacity of 186.30 kWp.

Replacement of wood burning stoves

Air pollution is a serious problem in Santiago de Chile, with pollutant levels above the stipulated limits for many days during the year. A traditional wood-burning stove, for example, produces emissions equivalent to 5 diesel-powered buses. Hence the importance of the project to replace wood-burning stoves with air conditioning equipment, involving a variety of parties: companies exceeding emission limits must present an environmental compensation project, while families

The addition of the photovoltaic modules into the building's façade will guarantee the building's energy self-sufficiency, thus reducing operational costs, and will also provide green energy to recharge electric cars and bicycles

can voluntarily join the programme, which is coordinated through the local municipalities. The latter schedule an inspection by a qualified technician to evaluate the feasibility of installing an inverter air conditioning unit; if possible, the system is installed and the family receives training on how to best use the equipment so as to maximise energy efficiency. Finally, the wood-burning stove is collected for dismantling, and its components are recycled and put to new use to create other products.

From the beginning of the project in 2017 to the end of 2019, a total of 5,261 stoves were replaced throughout Chile, amounting to 17,098 tonnes fewer carbon dioxide emissions and 105.22 tonnes fewer PM 2.5.

Santiago 2041

Since 2010 Enel Chile, in collaboration with the faculty of Architecture and City Planning at the Universidad del Desarrollo (University for Development)

and Siemens, has been organising Santiago 2041, one of the main forums for city planning issues at the national level, based on the idea of inviting citizens to consider and discuss the kind of city they desire. The objective is to give them the opportunity to discuss, with authorities and opinion leaders, the public policies that the capital will implement to celebrate the five-hundredth anniversary of its foundation in 2041. The central themes of Santiago 2041

are: the response to natural disasters, emerging technologies for the real-time management of the city's biggest challenges, the role of Municipalities and projects that contribute to cities' sustainability. The event represents an additional example of collaboration between stakeholders and institutions to build a path towards circularity.



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Bogotá

Colombia, and specifically its capital Bogotá, is also becoming one of South America's leading lights in the implementation of the circular economy. Having a national circular economy strategy approved was key to guiding the country in this direction, with the goal of combining environmental protection with economic growth.

In 2018, the Colombian government, via the Ministry of Environment and Sustainable Development, published its *Estrategia Nacional de Economía Circular*³⁰, a plan whose aim is to analyse the use of resources (the so-called "urban metabolism") and to improve the efficiency of production processes. In addition, particularly for Bogotá, the 2020-2024 District Development Plan³¹ defines

a "green growth" strategy with the main objective of achieving environmental sustainability, facilitated by innovation and the circular economy.

Fenicia

In Bogotá's urban plan, the Triángulo de Fenicia – a densely populated area at the heart of the city, with great variations in living conditions and significant problems of inequality, where the city's historical centre (La Candelaria) and university area converge – was singled out as the focus for an urban redevelopment strategy. Thus the Plan Parcial Triángulo Fenicia³² was launched, led by one of the area's key players, the Universidad de los Andes, which promotes the Proyecto Progres Fenicia³³ to develop an array of social, environmental and economic management activities (construction of 67,000 square meters of commercial area, hotels and offices; 25,500 square meters of residential area; 3,500 square meters of renovated public facilities; 900 new houses).



³⁰ To find out more

³¹ *Plan de Desarrollo Distrital Bogotá 2020-2024.*

³² *Plan Parcial de Renovación Urbana Triángulo de Fenicia.*

³³ *Proyecto Progres Fenicia.*

Enel will invest over 5 million euro during the 2020-2024 five-year period

In this context, in collaboration with the Universidad de los Andes, Enel defined this area's potential to implement a highly digitalised circular city model anchored on technological innovation. To bring this project to fruition, Enel will invest over 5 million euro during the 2020-2024 five-year period. The project, based on smart grids, follows circular economy criteria and the principles for creating shared value between the company and the stakeholders involved.



A simplified representation of this complex project includes:

- **Network modernisation:** remote monitoring and control.
- **Network digitalisation:** electricity infrastructure modelling and digitalisation.
- **Internet of things:** sensors for the electricity infrastructure and the management of information.
- **Advanced Measurement Infrastructure (AMI):** energy telemetry and remote network management.
- **Human Machine Interfaces (HMI):** augmented and virtual reality to simplify and safely conduct many activities.
- **Telecommunications**
- **Living lab:** a space for discussion, innovation and the development of implemented technologies.
- **Distributed Energy Resources (DER):** solar panels and slow/fast charging stations.

Thanks to a structured plan for urban redevelopment, electricity infrastructure modernisation and technological innovation to generate value and improve citizens' quality of life, this project has the potential to quickly put Bogotá on the road towards becoming a circular city.

This is a vision also shared by the Universidad de los Andes, which has underlined how “the smart, circular and sustainable city of the Triángulo de Fenicia project aims to contribute to the wellbeing of the community, as well as to strengthen the role of the University as a beacon in Latin America. Indeed, the Proyecto Progres Fenicia will contribute to a better use of communal areas in buildings, improve their environmental and waste management, contribute to the safety of public areas and generate new insights into the subject of energy efficiency and generation from renewable sources. The sustainability of the project will also be reflected in other aspects: redevelopment work, for example,



Enel also contributes to individual means of transport, through the promotion, sale and installation of charging systems for private and public electric cars, in high-influx private and public locations around the city

will be managed so as to reduce environmental and social impacts to a minimum, promoting the recycling and reuse of materials and offering new opportunities to local residents. The objective is to create a living laboratory, a collaborative, open platform for innovation, an immersive environment for experimentation to create a shared value ecosystem.”

Electric mobility

The Municipality of Bogotá’s general mobility plan³⁴ puts forth a “hierarchical” public transport scheme , which includes a synergy between high-capacity passenger transport systems (articulated buses

³⁴ Plan Maestro de Movilidad de Bogotá.

³⁵ Esquema de Transporte Público Jerarquizado.

and underground trains) and medium-capacity systems (buses). Both high- and medium-capacity systems include electric mobility solutions supported by Enel, thus making the company a strategic ally of the Bogotá Municipality for the city's circular development. But Enel also contributes to individual means of transport, through the promotion, sale and installation of charging systems for private and public electric cars, in high-influx private and public locations around the city, thus facilitating the introduction of more electric vehicles into the country.

Electricity supply for Bogotá's first underground line

The organisation of the current project to develop an underground system in Bogotá started in 2016³⁶, when the national and local governments, led respectively by president Juan Manuel Santos and mayor Enrique Peñalosa, decided to create Bogotá's first underground line.

To implement the Primera Línea del Metro de Bogotá (PLMB) project, which



forms part of the general mobility plan, Peñalosa requested the development of an electricity infrastructure to enable its construction and operation. The following activities are planned: the construction of 3 new substations, the displacement

of high-voltage networks at 7 crossing points with the PLMB viaduct and, finally, the displacement of secondary networks,

³⁶ An interesting chronicle regarding Bogotá's underground system.

for which Enel will invest in excess of 80 million euro over a 6-year period.

Taking into consideration the project's size, a regulatory framework and clear roles were defined at the institutional level: from the responsibility of public institutions and public service companies for financing and executing the transport infrastructure projects, to the definition of the above-mentioned PLMB by the mayor of Bogotá, to the creation of a company to manage the budget and coordinate the companies entrusted with carrying out the work, including the building consortium, Enel and other public service companies.

The scale of this project, along with its impact on the functioning, development and dynamism of the city of Bogotá, make it one of the largest infrastructural challenges ever faced by both Enel and the Colombian municipality.

Electric vehicle recharging infrastructure

In the context of mass public transport, buses play a key role in Bogotá's general mobility plan, because they are an integral part of the medium-capacity public transport system. To this end, Enel developed an infrastructure project to charge public buses, which is essential for the growth of e-mobility due to the long distances covered every day by each bus (over 250 km).

The objective of this project is to establish, by the second half of 2020, 4 electroterminals (electric bus charging areas) for Bogotá's integrated public transport system, in which a total of 477 electric buses will operate – making the Colombian capital's fleet of electric buses the biggest in Latin America. Enel's overall investment in this project will total 35 million euro.

These 477 electric buses will operate within three large municipalities (Fontibón, Suba and Usme) where the electroterminals will be installed, each



with an installed capacity of 8-10 MVA, with an energy consumption close to 40 GWh per year, resulting in approximately 40,000 tonnes fewer carbon dioxide emissions per year. Indeed, this type of project promotes decarbonisation in the transport sector, as well as improves the air quality in cities and, as a direct consequence, residents' quality of life.

Finally, passengers will see improvements in terms of comfort on board the vehicles: a reduction in vibration, noise and, as already mentioned, harmful pollutants.

A total of 477 electric buses will operate – making the Colombian capital's fleet of electric buses the biggest in Latin America

Montevideo

*Circular economy and resilience, by Arup,
Global Resilient Cities Network and the Intendancy of Montevideo*

In recent years, Arup and the Global Resilient Cities Network have explored the various ways in which the circular economy can support, enable and improve cities' resilience. Results show that the circular economy can contribute to reducing unemployment by creating, through closed, regenerative loops, new business opportunities, supporting social cohesion with shared access to goods and services and creating shorter, less complex supply chains, which are less susceptible to external shocks. In summary, the fact that the circular economy is distributive and diversified by nature helps to build a city that is more resilient to shocks and stress.

The project described below shows how Montevideo's local administration has worked hard to adopt circular economy

strategies with a view to making the capital of Uruguay more resilient.

The analysis revealed the city was facing many challenges, including social and regional inequality, aging infrastructure, coastal flooding and vacant housing. At the same time, it was observed that Uruguay as a whole has much higher domestic material consumption (a production-side measure of the use of materials within an economy) and a household solid waste generation rate compared to neighbouring countries suggesting a consumption based economy.

To guide the collaboration between different municipal departments, four areas for cross-sector collaboration were identified to help to achieve the city's resilience objectives.

1



Materials

Reduce the pressure on the waste management system by adopting a cradle-to-cradle approach to extend resources' lifecycle and prevent waste production.

2



Buildings

Reverse the constant expansion of unauthorised construction, by using existing empty or underused buildings instead of adding new ones.

3



Transport

Increase the capacity of the existing transport system by improving public service, implementing shared transport systems and encouraging active mobility options.

4



Water

Mitigate flood risks through adaptive, nature-based measures.

In the following section, we showcase some of the priority initiatives identified within each area of analysis.

Reuse and repair hubs

In Montevideo less than 2% of the solid urban waste goes to landfill via the waste collection system. Reuse and repair centres could contribute to further avoiding disposal of waste in the landfill, to extending the useful life of clothing and small electrical and electronic devices, to finding new users for unwanted items, and to offering work opportunities to citizens with experience in traditional professions.

The proposal is for reuse and repair hubs to be strategically located within the more densely populated areas. These hubs could be managed locally by private individuals or by a newly created cooperative, a social organisation or by the city itself. The initial funding could be allocated by the city on the basis of the job or waste reduction opportunities

that are created. Support policies, quality certifications, tax reductions on repaired goods and online activities were identified as possible enablers to facilitate successful implementation.

such as for municipal services, community services, retail and co-working spaces. Such initiatives would also be a solution to the uncontrolled expansion of the city's suburbs. They would encourage



Meanwhile spaces

The empty, unused areas in Montevideo have been estimated to be worth over 10.5 million US dollars. Meanwhile spaces could be exploited financially and utilised for new permanent or temporary uses,

companies to return to more central locations and create job opportunities in both the short and the medium term. A key factor is the incorporation of spaces owned by the local administration and of digital platforms that can match the available spaces to demand.

Public transport rental

The city's public transport system was inefficient and obsolete. A leasing or performance-based procurement model for a new fleet of hybrid, electric or hydrogen-powered buses would reduce the total expenditure related to those assets and allow the local administration to invest in modernising other means of transport.

The local administration (via the urban mobility department) would clearly be the most interested party in such scheme, but the private transport supplier and the national government could collaborate to implement a pilot project.

Sustainable drainage system networks

Sustainable drainage systems can improve rainwater drainage, increase an area's biodiversity and offer better interaction between blue and green

infrastructures; they also contribute to managing the growing flood risks and to reducing pressure on the conventional drainage system. The combination of existing drainage systems (green roofs and rain collection barrels) with new sustainable ones (bioswales, i.e. drainage canals with vegetation, and rain gardens) can create a solid network of sustainable drainage systems within Montevideo.

The administration should engage landowners, by highlighting the benefits of these systems and developing new infrastructure together with them on their plots of land. The administration's support would consist of identifying the flood risk areas, delimiting the plots to be earmarked for the development of sustainable drainage systems, and promoting development. Engagement with landowners, residents, companies and other stakeholders in the identified flood-risk areas would require building sufficient consensus around the activity.



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Progress thus far

Arup's support has enabled the local administration in Montevideo to better understand the meaning of the circular economy, how it can be implemented within the city, and the key role it can play in making the city more resilient. One of the most important recommendations of this strategy was to develop a more holistic circular economy strategy for the city.

The attention attracted by the above-mentioned activities contributed to securing financing to further explore the implementation of three of the four initiatives identified through Ciudad Vieja Circular³⁷, a pilot project in the city's historical centre, which encompassed the following activities:

- Mapping all the reuse and repair centres in the area. A digital hub will contribute to creating connections between people and the mapped organisations.
- Reclaiming empty buildings throughout the city. Structures could be renovated and then repurposed for a variety of social uses, such as rented council housing, social housing, day shelters for the homeless and community centres for minorities' activities. The reuse is intended to be permanent, not temporary.
- Construction of new small-scale rain gardens around the city. A feasibility assessment is also being carried out for large-scale, natural solutions such as wetlands along waterways. Preliminary projects to consider aspects relating to biodiversity, ecosystem services, and quality of water have also been developed. Before choosing which projects are to be implemented, costs will be calculated.
- Planning a new initiative aimed at facilitating the reduction of waste generated by the food and hospitality sectors. The initiative will be encouraged via incentives, training and skills development, to integrate the principles of circularity via new business models.

Beyond the individual activities and projects, the main success factor is commitment from the local administration to adopt a circular economy approach, with the objective of making the city resilient.

Indeed, as declared by the Montevideo Intendancy: "A resilient city is open to innovation and is capable of recognising alternative ways of utilising resources in pursuit of its objectives. Montevideo is exploring the possibilities offered by circular economy principles to achieve a different kind of development. It has set out a roadmap to incorporate these circular economy principles, with the goal of obtaining a territorial system which is regenerative right from the design phase".

A resilient city is open to innovation and is capable of recognising alternative ways of utilising resources in pursuit of its objectives

³⁷ For further details

Boston

Boston is leading the way on energy efficiency in the United States: in 2013, mayor Marty Walsh made it one of the first six cities to commit to C40's Deadline 2020 project.³⁸ Furthermore, the city was recently included in the list of the ten most walkable cities in the country.³⁹ Through the Climate Action Plan, with its objective to achieve carbon neutrality by 2050, and an agenda to reach the zero-waste goal, the mayor's team has committed to the vision of a sustainable, circular future. As a key public institution within the city, the University of Massachusetts Boston (UMass Boston) is doing its part.

These objectives pose a significant challenge to the Commonwealth of Massachusetts' main energy consumers:

being exposed to elevated electricity costs over time. Energy storage is seen as the optimal solution, since it allows users to store electricity to use in periods when relying on the network would be much more expensive. UMass Boston believes that this solution will lead to cost reductions and to alignment with the plan set out by the city and the campus to achieve ambitious sustainability goals.

UMass Boston has therefore integrated a 1 MW photovoltaic system on the top of a parking garage, with a 500 kW / 2 MWh lithium-ion battery energy storage system, which will allow the campus to generate clean energy as well as to store and consume excess energy on demand, thus reducing its reliance on the grid during periods when energy tariffs are higher. Equipped with Enel's DER optimisation software, the storage system will also enable the campus to earn revenue through regional demand response programmes, and to qualify for incentives through the Solar Massachusetts Renewable Target (SMART) programme.



Furthermore, the project includes the installation of 11 smart, electric vehicle charging stations: an infrastructure that is useful to both the university and the city, in the context of a reduction in traffic and associated emissions. The stations are designed to avoid recharging during periods when the high demand on the grid would determine higher overall expenditure and, potentially, emissions. Finally, thanks to the partnership with Enel, the university has financed the entire project on the basis of its expected value, thus avoiding high initial installation and hardware costs.

Boston is leading the way on energy efficiency

³⁸ To find out more

³⁹ To find out more

Pittsburgh

During the first half of the 20th century, Pittsburgh, Pennsylvania was home to a huge industrial production sector; with half of all US steel produced there, it was nicknamed “Steel City.” Pittsburgh today has changed completely, and is now set on facilitating a just transition towards a sustainable future.

In 2013, the urban planning commission analysed the area’s energy flows to identify opportunities for increased efficiency and to plan the future of energy generation and use. The analysis highlighted the inefficiencies in the conventional system (40% loss during the generation phase, 20% during the distribution phase and 5-7% at the point of consumption). Reducing system losses and losses within



single buildings was central to the development of the Pittsburgh Climate Action Plan, which strives to cut consumption by up to 50% to create 2030 Districts and use district heating, microgrids (as a tool for improving efficiency and as a way of integrating renewable energy) and solutions such as sensors and monitors.

The City of Pittsburgh’s collaboration with the US Department of Energy and the Danish Ministry of Energy, as well as its partnership with other companies and with the Pittsburgh Energy Innovation Center, has led to the formation of the Ecoinnovation District of Pittsburgh. This is an initiative that combines environmental sustainability and innovation

⁴⁰ The 2030 Districts Network (2030districts.org) is an initiative currently involving 20 cities in the United States that are committed to combining environmental sustainability with economic growth. For Pittsburgh, visit

This strategic approach led to the collaboration with the United States Department of Energy (Sandia National Labs and National Energy Technology Lab) and with the Danish Ministry of Energy, in addition to a partnership with other companies and the Energy Innovation Center in Pittsburgh. This collaboration between the private sector, political institutions and the academic world has enabled the creation of Pittsburgh's Ecoinnovation District, an initiative that brings together environmental sustainability and innovation. The Ecoinnovation District is living proof that redevelopment can improve the environment, support residents' needs and increase entrepreneurship and job growth.

Grant Ervin, the city of Pittsburgh's Chief Resilience Officer, underlined the importance of public-private collaboration: "Creating a just transition is possible when all partners have a seat at the table. In Pittsburgh, we used R&D to understand our energy system and promote an ecosystem that includes

public and private partners, as well as the community, in identifying the strategic actions necessary to design and create a 21st-century energy grid".

All this has led to the creation of the Western Pennsylvania Energy Consortium (WPEC), which aggregates the electricity demand from 29 different governmental areas, represents 154 million MWh of annual electricity consumption at approximately 365 locations and offers year-on-year price stability, guaranteeing members certainty in their annual costs. The WPEC Energy Board is working with Enel to create a so-called "PJM subaccount" with a model for sharing and aggregating demand, enabling the WPEC to manage the portfolio so as to supply exclusively renewable energy on behalf of its members.

Mayor Bill Peduto summarised the benefits of the new agreement: "The city will be meeting its renewable electricity goals for its facilities for the next year – a critical milestone from our climate action plan created in 2018

[...]. Equally important, the extension is both environmentally friendly while also reducing energy costs for our Consortium members, demonstrating that good environmental and economic decisions can go hand in hand".

The 2030 Agenda objectives are set out in the Pittsburgh Climate Action Plan and include various commitments towards achieving city circularity, such as the zero-waste objective, a 50% reduction in emissions throughout the city, the supply of 100% renewable energy for the city's activities, the creation of a task force of electric vehicles and the use of a fleet which does not use fossil fuels.

For further information
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