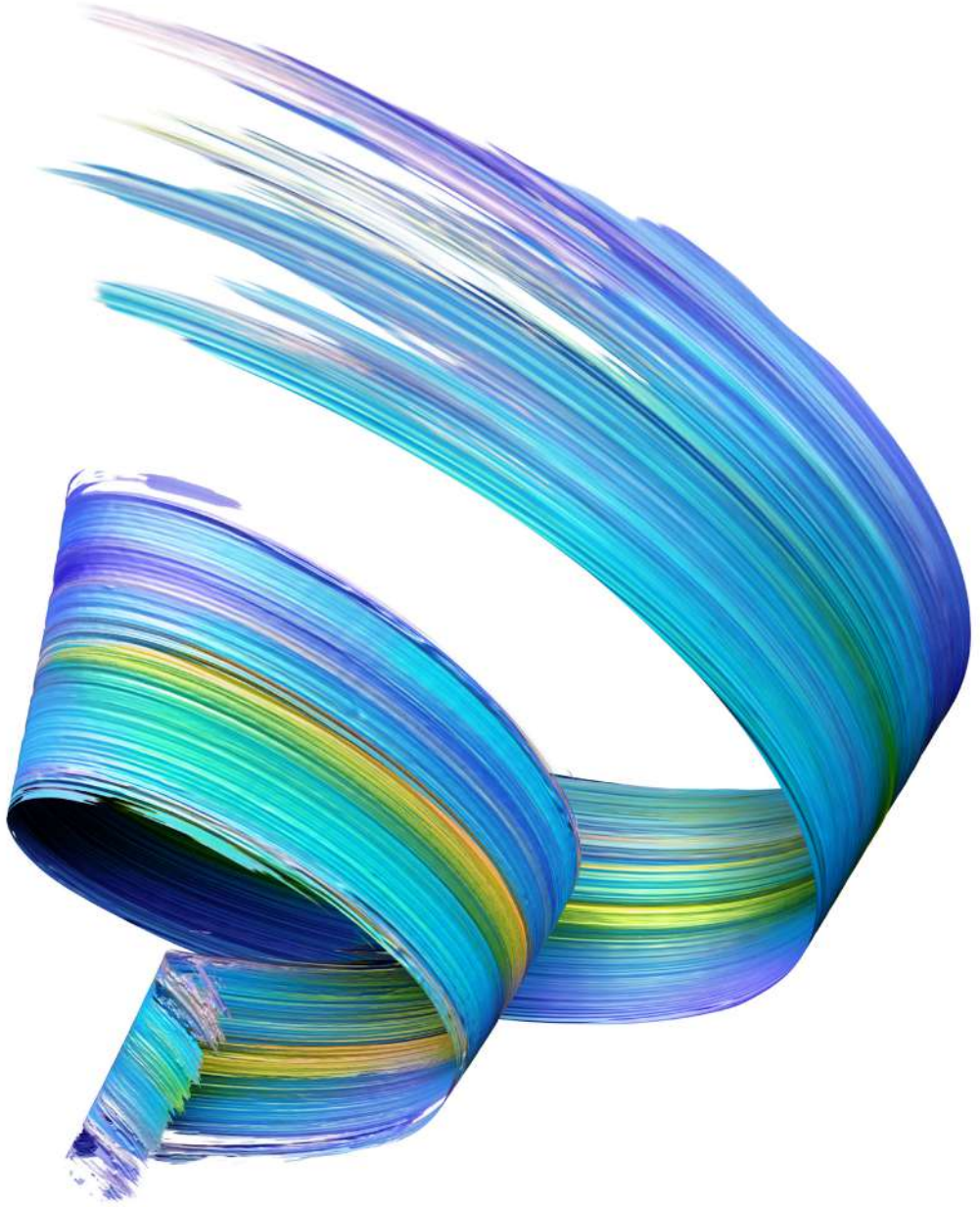

Transitioning to a Circular Economy: *Opportunities for Recovery, Resiliency and Regeneration*

Enel North America – USA & Canada
March 2021

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Forward

A time of change...

Change is certain. The result uncertain. Uncertainty spells risk for some, opportunity for others.

In the last twelve months we have all seen remarkable upheaval in our norms and routines, an overdue focus on the problems of social injustice and, likely, a shift in our expectations of the future, even if just for a moment. Unsettling. But change is also necessary if we are to evolve and develop as a society and a species. As we increasingly move to an urban-focused global population, the demands of city infrastructure and systems to support us become strained, and their capacity is being outpaced by our demand for electricity, water, data and food. But more significant is the demand for products and waste removal. This is exerting significant stress on our natural resources that we are depleting at an alarming rate.

One of the fundamental tenets of a circular economy is the switching of energy sources from combustion of fuels to renewables, driven by an equitable, environmental and financially stable return on investment. The pursuit of alternatives is also fraught with paths that can point towards solutions that create societal inequities. Making a choice of respecting our planetary boundaries should not come at the expense of vulnerable communities, yet we often see options to a better path laid out as an unattainable financial choice. This is where we must consider applying our vast collective intellect to create the change.

In this publication, Enel reaffirms and shares its commitment to circularity and outlines a vision based around the principles of a Circular Economy in North America. It is compiled to deal not with the easy, low hanging fruit of repetition but to embrace a collaborative model for an energy business, to do something different, with better outcomes, for all.

Tom Kennedy
Principal, Americas Circular Economy Leader, Arup

Cole Roberts
Americas Energy Business Leader, Arup

Letter from the North America CEO

2020 was a year of tremendous challenges. The coronavirus pandemic disrupted nearly every aspect of our daily lives. We saw that racial injustice is still harming communities in North America and across the globe. Political tensions in the United States tested the core of our democratic principles. And extreme weather caused billions of dollars of damage. These circumstances have forced us to ask ourselves difficult questions. As a company, we have persevered and sharpened our focus – to do our work as safely as possible, to use our voice to speak out for what is right, to cherish the institutions of government that represent their constituents, and to build greater resiliency against natural disasters. All this while growing our business and making an important contribution to the progress of the energy transition. Against this backdrop, building a more circular economy feels more important than ever.

As the former head of Enel's Thermal Generation business line, overseeing power generation from traditional generation technologies, I know that the principles of a circular economy are tightly linked to the energy transition and are critically important both for Enel as a company and for our global community. I have seen firsthand the value a circular approach can provide, having stewarded the decommissioning of thousands of megawatts of thermal generation capacity. Transitioning to clean energy is necessary, but not enough by itself. We must also find new ways of creating value which are self-sustaining and circular. To this end, in 2015 Enel began working to transform former conventional power generation sites into new development opportunities for local communities through the Futur-e project. We are helping retrain workers with the skills they need to be successful in the new energy economy – another important step. But even more work is needed to ensure our business has sustainability at its core and is engaging in long-term circular solutions.

Leading Enel North America, a region within the Enel perimeter that is comprised of 100% renewable energy generation assets, Energy & Commodity Management and our dynamic Enel X business line, is an exciting change for me and is the perfect place to encourage greater circularity. As we begin 2021, we are pursuing further improvements in the field of circularity – not only in our projects and products from development to their end-of-life, but also in all of our operations and new life cycles. These improvements are necessary and will make us stronger. As you read the following pages, be assured that from the top-down, Enel is here to collaborate in achieving our purpose: Open Power for a brighter future. We empower sustainable progress. We embrace the transition to an inclusive circular economy and welcome the opportunity to share the burden of our collective challenges as well as address them head on with openness and innovation.

Enrico Viale
CEO, Enel North America, Inc.

Context

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In December 2020, Enel Group published its most recent position paper on the circular economy.[1] This Enel North America supplement complements and contextualizes the Group's position on circular economy as it relates to our regional business activities in the United States and Canada. It's important to recognize that the transition to a circular economy is largely contingent on geographic, socioeconomic and regulatory parameters; as such, it becomes increasingly relevant to adjust the lens with which one views these systems in order to gain the proper focus. Whereas the Ellen MacArthur Foundation (EMF) defined the three primary principles of a circular economy to be: designing out waste and pollution, keeping products and materials in use, and regenerating natural systems; these macro-principles allow for greater contextualization and translation into business models, implementation and measurement approaches.[2]

In 2018, Enel Group defined its **Five Pillars of the Circular Economy** to further add clarity on how our business seeks to transform our operating models to transition to a circular approach (next page).

While Circular Inputs and New Life Cycles can represent material or biological inflows and outflows related to a good, product or service, the remaining three pillars represent business models which help to promote and transition towards a more circular approach. This definition may be relevant to business stakeholders while still requiring further translation to reinforce the context and opportunity of moving from a linear to a circular system for citizens, government and society at-large.

In the 2020 Enel Group position paper, topics include a detailed analysis and explanation regarding the role of cities in transitioning to a circular economy; a digestible example of the interconnectedness of our systems within society. This was previously defined at great length in Enel's 3rd edition of the paper, *Cities of Tomorrow*, published in September 2020.[3] Whereas that document placed detailed emphasis on the role of oversight and governance in transitioning to a circular economy, providing innovative case studies across North and South America of how cities are addressing the transition to a circular economy; the Group's later published position paper further speaks to other relevant topics such as design for circularity, value chains, and the roles of finance, innovation and ecosystems to foster a circular economy.

[1] https://www.enel.com/company/our-commitment/circular-economy/circular-economy-position-paper

[2] https://www.ellenmacarthurfoundation.org/circular-economy/concept

[3] https://www.enel.com/media/explore/search-news/news/2020/09/circular-cities-position-paper

Enel Group's five pillars of the circular economy include:

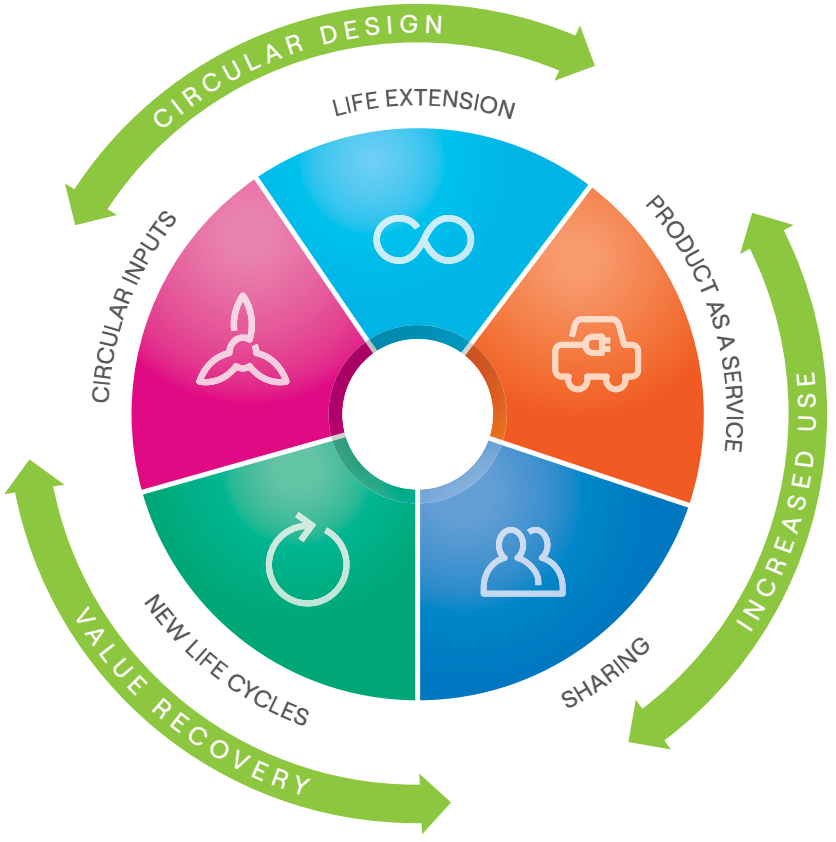
Circular inputs: production and use models based on inputs from renewables or from previous lifecycles (reuse and recycle).

Life extension: an approach to the planning and management of an asset or a product that intends to extend its useful life, for example, through modular design, simplification of repairs and predictive maintenance.

Product-as-a-Service (PaaS): a business model in which the client acquires a service for a limited amount of time, while the company retains its ownership of the product, thereby maximizing both the use factor and its useful life.

Sharing: shared management systems accessed by multiple users of products, goods or services.

New life cycles: in synergy with the other principles, all the solutions that aim to preserve the value of a good at the end of its lifecycle through reuse, regeneration, upcycling or recycling.



Enel in North America: what we do

Enel North America, Inc. is comprised of three of Enel Group's Global Business Lines:

- Enel Green Power
- Enel X
- Energy & Commodity Management

Enel Green Power functions as an Independent Power Producer, or IPP, with 100% of our US and Canadian power generation assets providing renewable energy to utilities and Commercial and Industrial (C&I) customers. Enel X provides smart value-added services and solutions dedicated to enabling sustainable outcomes and a transition to circularity for our customers through decarbonization, digitization and electrification. Lastly, our Energy & Commodity Management division is an active facilitator in energy markets as a broker/trader of energy commodities and associated Energy Attribute Certificates (EACs).

Our presence in the United States and Canada uniquely positions us for the transition to a circular economy, by both posing challenges we seek to address as an active member of the communities where we live and work, as well as with corresponding opportunities for collaboration and innovation in addressing those challenges. As a producer of renewable energy as well as other products and services to enable our customers on their sustainability journey, we are finding tremendous value in the development of a sustainable and circular ecosystem at all stages of our value chain. We believe that working across industries and stages of the value chain is critical for successful collaboration in solving how to transition to a circular economy.

As a result, the reader may first question why a power producer or energy services provider is addressing issues such as a fragmented recycling infrastructure, the need for stronger policy positions related to Environmental Product Declarations (EPDs), or even what role social equity plays in the energy transition for a provider of utility bill management (UBM) software solutions. However, the answer is more straightforward than one might think: the interconnected relationships within nature and our environment are just like those within the business community. Butterflies pollinate plant life which provides ecosystem services to crops, just as one company's supplier is another company's customer, receiving services that in turn ultimately yield a product, good or service for the next.

Now, what if that land with native vegetation, pollinators or crops was also producing renewable energy, while simultaneously providing the previously mentioned ecosystem services and associated work opportunities? More on that to come in the following sections. However, it is because of this interconnectedness that local, state, regional and national policy and governance is a central point of consideration when discussing the transition to a circular economy.

Policy Overview

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It would seem the term "circular economy" remains either widely unknown or underutilized (perhaps both) for many in the United States and Canada. Certainly, when considering the wide scale adoption of circular economy policies across the globe, government leaders in North America seem to be lagging considerably when compared to the nations of the European Union.[4] In Canada, impacts of climate change and actions to support "clean growth" largely overshadows the concept of "circular economy." Nevertheless, government-driven actions, both at the federal and provincial level, appear to be taking shape in recent years.

And while the United States (and to a lesser degree Canada) lacks the comprehensive and cross border policy framework and ambition of the EU, many piecemeal examples that in some way address circularity challenges can be found at the local, state, provincial or regional level. In the Bloomberg New Energy Finance (BNEF) October 2020 update of its *Circular Economy Policy Database*, BNEF identified some 950 policies either announced, in the legislative process or in force in the United States and an additional 164 in Canada.

Viewing the BNEF data from the US and Canada paints a picture of the fragmented or piecemeal approach to policies on circularity, which is in part due to the geographic expansiveness of both countries but also the disjointed policies, governance and infrastructure in place. This can pose challenges for consumers, but also challenges and opportunities for producers, value chains and industries as a whole.

Challenges and opportunities in the US

The US is lagging its international peers in setting a national circular economy plan and putting the legislation in place to execute it. In 2020, several bills were introduced, but few made significant progress. Without broad support from affected corporations and a unified government with common objectives, a national circular economy plan is unlikely to

Summary of BNEF Circular Economy Policy Database (October 2020)

Of the initiatives in the US only five were at the national/federal level (whereas Canada had 11), while 163 in the US were at the state level with the remainder within a city or municipality. Furthermore, once you remove initiatives associated with banning of plastic bags and straws, the total number in the US drops nearly 40% from 950 to 590. In Canada, the bulk of the policies rest at the provincial level, however in both the US and Canada regulations appear to be focused primarily on plastics, waste and recycling.[5]

[4] Source: BloombergNEF

[5] Source: BloombergNEF

materialize, but there remain opportunities to enact smaller, more modest proposals.

The federal government is trying to use its buying power to support the circular economy as it relates to energy, albeit modestly. For example, in accordance with the Energy Policy Act of 2005, each fiscal year the federal government must consume at least 7.5 percent of its total electricity from renewable sources.[8] In contrast to city-level emissions reductions targets, this isn't ambitious or focused enough to advance the circularity agenda.

There are many parallels with clean energy's regional fragmentation and that of the recycling industry, as it relates to infrastructure, policies, and a lack of consistency across geographic boundaries. Given that renewable energy components (i.e. wind turbine blades and PV panels) face increasing scrutiny from communities based on their prospects for waste disposition, how can the energy industry collaborate with waste/recycling entities to improve both systems' respective (if not related) policies? Material recovery/recycling facilities (MRFs) for material "waste" are vastly different from Regional Transmission Organizations (RTOs) or Independent System Operators (ISOs) for energy, however the convoluted structure of these systems, which are vital to the infrastructure that may enable the circular transition, need to be addressed.

Challenges and opportunities in Canada

Canada's recent climate actions have the country on track to deliver the largest emissions reduction in its history. Driven by scientific analysis, the Federal Government of Canada established its net-zero emissions target by 2050.[9] Net-zero means that all emissions produced are absorbed through plants and trees or buried through carbon-capture technology. While there is no enforcement mechanism, the goal mandates the government to evaluate its progress every five years; the government is also required to issue a concrete plan to achieve the next target during each evaluation. This net-zero emissions target secures Canada's position as a leader

Spotlight: Ellen MacArthur Foundation

On an annual basis, the US Congress appropriates federal funding for agency grant and loan programs that support the circular economy. For example, the US Department of Energy selected the Golisano Institute for Sustainability (GIS) at the Rochester Institute of Technology (RIT), part of the EMF's Pioneer University network, as part of its Manufacturing USA initiative,[6] to lead its new Reducing Embodied-Energy and Decreasing Emissions (REMADE) Institute.[7] The project will see a national coalition of leading universities and companies forge new clean energy initiatives, deemed critical in keeping the US manufacturing industry competitive. The EMF is a REMADE partner organization. The REMADE Institute will focus its efforts on driving down the cost of technologies essential to the reuse, recycle and remanufacture of materials such as metals, fibers, polymers and electronic waste.

[6] See, https://www.manufacturingusa.com/

[7] See, https://remadeinstitute.org/

[8] Also called the renewable energy requirement. See, https://www.energy.gov/eere/femp/federal-agency-use-renewable-electric-energy

[9] https://www.canada.ca/en/environment-climate-change/news/2020/11/government-of-canada-charts-course-for-clean-growth-by-introducing-bill-to-legislate-net-zero-emissions-by-2050.html

in emissions reduction through technology while curbing emissions from heavy industries, such as oil and gas, manufacturing, public transportation and others.

Established in 2019, Canada's Infrastructure Bank is mandated to issue $50 billion (CAD) to support clean growth and emissions reduction initiatives.[10]

The Pandemic: circular economy setback, and accelerator

2020 kicked off what the United Nations and many others have called, the "Decade of Action" for nations and society as a whole to make meaningful progress in curbing global greenhouse gas (GHG) emissions, to curb the adverse effects of anthropomorphic climate change and global warming, and to achieve the UN's Sustainable Development Goals (SDGs).[12]

Ontario

The Province of Ontario also aims to achieve its emissions reduction goal through the transition into a circular economy.[11] To support this shift, Ontario passed the Waste-Free Ontario Act, 2016. It enacted two acts: The Resource Recovery and Circular Economy Act, 2016, and the Waste Diversion Transition Act, 2016. Under the new legislation, the province is moving toward a circular economy framework by establishing a producer responsibility regime. Combined with new and existing tools, such as those under the Environmental Protection Act, the province is setting a strong foundation to transform the way Ontarians think about waste.

Through regulations, the government will establish outcomes-based requirements that producers of goods and services will have to meet, such as reduction, reuse and recycling targets, service standards and promotion and education requirements. This outcomes-based approach supports competition and provides opportunities for businesses to compete in an open and fair marketplace. Producers have a range of options in deciding how they will comply with regulatory requirements. A producer may choose to fulfill its obligations individually by finding innovative ways to reduce material use, develop reusable products, or manage materials at their end-of-life by recycling and reintegrating them into the economy without disposal.

[10] https://cib-bic.ca/en/about-us/mission-and-mandate/

[11] https://www.ontario.ca/page/strategy-waste-free-ontario-building-circular-economy

[12] https://www.un.org/sustainabledevelopment/decade-of-action/

Then, before the first quarter of the year had passed – the world as we knew it – stopped.

The novel coronavirus COVID-19 pandemic is forcing significant reflection on our notions of normal, resilient and sustainable. With global travel and commerce effectively coming to a screeching halt, workers resigned to furlough, layoffs or working remotely from home while also tending to familial duties; society has been forced to take a long, hard look at our previous assumptions and models for work, for our personal and social lives; environment, health and safety; as well as our approach to and management of economic models in practice.

Early safety measures taken, along with assumptions made by many, surfaced several concerns that the pandemic would effectively block, or even reverse progress made towards circularity. For example, many plastic bag and single use product bans were halted or lifted. Businesses were compelled to provide single use-only items for concern of surface contamination spreading the virus. Business models that considered sharing or Product-as-a-Service as a primary feature were also looked at wearily for the same reasons. However, as society learned more about the nature of the virus, how it spreads and how to effectively control it, opportunities surfaced when looking towards recovery; and the now familiar phrase, "build back better," began to proliferate.

After over a year of shifting (and incongruent) policies on social interaction, distancing and the ability for public business and spaces to function as was before, the United States in particular still seeks a new, post-pandemic equilibrium. However, some trends that took hold in the first peak periods of the pandemic appear to have demonstrated valid approaches for the medium and perhaps long term. Moreover, a reduction of physical contact between people highlighted the value of digitization, particularly for the need to increase effective utilization for unified communication and collaboration platforms, i.e. remote working and learning coupled with increased time at home has highlighted the need for greater access to broadband infrastructure and digital tools to complete daily tasks.

Other opportunities that may move us forward towards a safer and more resilient circular economy include the greater use of local supply chains. While it will require capacity building and mapping of material sources and processes, this holds promise to push for closing material cycles locally, then expand to increase use of recycled materials and ultimately renewable materials and energy sources in a smaller stretching value chain that continues to loop. Government could also provide incentives for reuse-reduce models, Product-as-a-Service models, similar to those found in the EU, that potentially reduce our addition to consumption. It is clear the need for cross-sectoral solutions, which ultimately can yield more opportunities for producers, suppliers and customers, creating more resilient value chains and better decoupling resource extraction from the environment with economic growth.

In the short term the pandemic forced us to slow our reuse of materials because of the potential contagion risk, but companies such as TerraCycle's Loop are addressing concerns through innovation in design and reverse logistics that is seeing adoption of their offering by major brands internationally.[13] We would hope to see more of this through direct government subsidies or sustainable financing.

Inclusivity, equity, and the circular economy

In 2018, Enel announced its "Pledge for a Just Transition to Decent Jobs" in the renewable energy sector.[14] We believe that leaning-in to promote just transition principles for the circular economy will result in the identification of opportunities that not only "design out" waste and stimulate innovation, but will also enable inclusive business practices and maintain open dialogues with stakeholders and supply chains that address environmental and social justice imperatives. These core principles are further reinforced by the Universal Values of the United Nations 2030 Agenda for Sustainable Development (SDGs) to leave no one behind.

Summarized within in a notable research paper published in April 2020, *Promoting a Just Transition to an Inclusive Circular Economy*, author Patrick Schröder writes:

"As the links between the environmental issues of climate change, overconsumption of resources and waste generation, and social issues of inequality and the future of work become increasingly obvious, the urgency to connect environmental with social justice is gaining in significance. The language of 'just transition' – a transition that ensures environmental sustainability, decent work, social inclusion and poverty eradication – has started to penetrate debates and research on sustainability policy, particularly in the contexts of climate change and low-carbon energy transition.[15]"

[13] https://loopstore.com/

[14] https://bteam.org/our-thinking/news/just-transition-pledge/

[15] https://www.chathamhouse.org/sites/default/files/2020-04-01-inclusive-circular-economy-schroder.pdf

Enel North America and the Enel Group's Open Power Vision[16] recognizes its responsibility to drive the energy transition from fossil fuels to renewables, and also its duty to ensure a just energy transition that is accessible to all. We believe Enel North America has a platform and therefore a duty to speak up and act, particularly now on the intersection of racial justice, environmental justice, community empowerment, and diversity and inclusion in the clean energy industries. Sustainable energy and climate action are inadequate if they do not put racial justice and environmental justice at their core. And it is important that we take action to help dismantle the systems that perpetuate harm against communities of color. We are doing this every day as we work to transform our business towards circularity in a manner that is inclusive and equitable.

PYXERA Global

Partner Spotlight: What is an Inclusive Circular Economy?

In PYXERA Global's pursuit of convening and enabling local circular economy ecosystems, inclusivity means:

1. listening first and continuously,
2. never making assumptions,
3. relying on the experience and expertise of partners both local and global,
4. consistently level-setting with the local community (and changing course if necessary), and
5. prioritizing and engaging the most vulnerable and marginalized group(s) in the local community ecosystem to spearhead the circular transition.

[16] https://www.enel.com/company/about-us/vision

Recovery: 2021 and Beyond

5

With the trials and challenges faced in 2020, many of which continue into 2021, and others that have far too long existed; how do we focus as a society – be it community, government, industry or business – on recovery? Enel North America seeks to outline aspects of consideration which are aligned with the Group's vision, mission and purpose; but further contextualized for the United States and Canada.

Economy

We now know that the traditional take-make-waste model that defined most (if not all) of the 20th century is outdated; wasteful, if not dangerous, and fundamentally unsustainable. A concerted effort is being made in academic realms to "decouple" economic growth and the extraction, use and waste of resources. And if the pandemic proved anything, it is that our most vital resources are the personal connections that make our social and economic systems function.

A nation or region's economy is inextricably linked to its governance and policy. At present, it can be said that in lieu of comprehensive policy or governance strategy for the circular transition, innovation has stepped in along with corporate commitments to sustainability and the SDGs. Under new national leadership, we have already seen the US reaffirming past commitments to the Paris Accord and halt select fossil fuel development projects, along with promotion of renewables and a commitment to invest in resiliency and infrastructure; all of which leads to job creation, improved public health and with hope, concrete progress in the transition to circularity.

The special role of cities

Much attention has been given to the role of city systems in the wake of the pandemic, as well as their role in helping the transition to a circular economy. Enel's 3rd edition of the *Cities of Tomorrow* position paper identifies the key points in the discussion as well as several case studies on models for circular cities. City governments in North America seem to have been slightly slower out of the gate than their European counterparts in defining a comprehensive strategy, as seen in the Policy Overview section of this paper.

While a number of cities have sought to tackle the challenges, comprehensive approaches and policy frameworks are still in the early stages of development. Commitments to combating climate change have grown substantially in recent years: 17 cities in the US and Canada have joined the C40 Cities network,[17] and nearly 25% of cities included in the CDP Cities program *2019 City-wide Emissions dataset*, collected by CDP and Local Governments for Sustainability (ICLEI), were from the US and Canada.[18] But doubts remain on progress, as a Brookings Institution report found that only 45 of the largest 100 cities in the US have emissions reduction goals and plans to address them.[19]

If the path to circularity starts with design, using circular and renewable inputs, there is much work to be done, with plenty of opportunity. Following are examples of cities and regions working to develop comprehensive approaches towards the transition.

[17] https://www.c40.org/cities

[18] https://data.cdp.net/Emissions/2019-City-wide-Emissions/542d-zyj8

[19] https://www.brookings.edu/research/pledges-and-progress-steps-toward-greenhouse-gas-emissions-reductions-in-the-100-largest-cities-across-the-united-states/

Partner Spotlight: University of Pittsburgh Center for Sustainable Business: In November, the University of Pittsburgh's Center for Sustainable Business published the *"Marshall Plan for Middle America Roadmap."* The work provides a detailed analysis of how the Appalachia and Ohio River Valley region of the United States could be transformed into a more equitable and sustainable beacon for Middle America, by aggregating some $1.24T USD of capital across the region over the next 30 years. The study, underwritten by the Enel Foundation (which also provided scientific support), found that a blend of financing through Federal investment, ESG-related mechanisms and corporate incentives could drive not only an upgrade to more resilient infrastructure, but also foster a just transition with electrification and decarbonization leading to a circular economy. It offers a set of 10 policy actions to go along with a myriad of science-backed evidence confirming the environmental gains that can be achieved as well as economic growth and job creation should the Plan be adopted. It also provides case studies from across the four-state region examined, ranging from municipal solar arrays and electric vehicle charging infrastructure upgrades to pension divestment strategies to remove investments from fossil fuels.[20]

[20] https://www.sustainablebusiness.pitt.edu/research/marshall-plan-middle-america

Partner Spotlight: Arup and the New York Circular City Initiative: The New York Circular City Initiative, convened by law firm Freshfields Bruckhaus Deringer, brought together representatives from city government, business and civil society to form a group with unique influence on the future direction of New York. The group's vision is to create the first truly circular urban economy, one that would drive job creation and growth to elevate New York City as a global beacon for sustainability. Cities are the perfect incubator for circularity because of the rapid rise of urban populations. They consume 78 percent of the world's energy and produce 60 percent of its emissions. If sustainable cities can emerge, they would have a disproportionate impact on humanity's environmental footprint. The research concentrated on and assessed the 10 levers with the greatest potential to create circularity in New York by analyzing its impact on jobs, economic growth and the environment. Through this work they identified an approach that could create over 11,000 new jobs across the income spectrum, deliver over $11B USD in economic benefits and reduce waste to zero.[21]

[21] For more information, visit: www.circularnyc.org

Partner Spotlight: Circular Chicago Coalition: To foster the vast potential that a circular city can ignite – addressing the simultaneous crises of economic inequality and excess waste that are gripping American cities – a multi-sector coalition of leading organizations have united to launch the Circular Chicago Coalition (CCC). The CCC's vision is to provide the knowledge, convening power, and investment to incubate and scale an inclusive circular Chicago. The collective power amassed through the participation and alignment of key stakeholders at the local, state, and national levels across these three sectors would serve to push forward a circular agenda that prioritizes economic, environmental, political, and social leverage points for change. CCC members include PYXERA Global, Enel North America, Rheaply, Metabolic, Closed Loop Partners, Plant Chicago, and Volans.

For Enel North America, the energy transition must be just and equitable, therefore we must consider and include those members of society that are traditionally disadvantaged or marginalized and execute on strategies to be inclusive. We are proud to be contributing to the CCC as a partner from the energy sector dedicated to the coalition's goals and objectives and commit to reporting on both challenges and solutions encountered along the way.

Evolving business models

Changes to traditional business models are an imperative for companies, industries and the economy to transition into a circular model, and that innovation will be a differentiating factor for successful early movers and adopters. Enel views sustainability and innovation as intrinsically linked as we pursue a transition to circularity. Designing products for modularity and reparability has the potential to unlock new job opportunities and secondary markets for goods. Product-as-a-Service business models are able to incent more durable goods while maintaining their value through service agreements and repurposing. The sharing economy helps to increase utilization and provide consumers the end result they seek from a product without the necessity of more extractive and resource depleting production of more products.

If the US and Canada are to effectively recover from the pandemic and design a more resilient and circular society, it is imperative for broader adoption of these principles. For Enel's part, this has been recognized through the development of our Open Innovability platform. Since its inception in 2017, our crowdsourcing platform has launched over 140 challenges and collected thousands of solutions from over 100 countries, awarding financial prizes and signing agreements with companies, startups, researchers and individuals. Several of the challenges are advancing digitization, addressing social inequality and applying circular economy principles to address challenges within our value chain. Furthermore, the United States and Canada are home to three of our Innovation Hubs, in Boston, San Francisco and Toronto. We work with venture capital funds, accelerators, incubators, universities, large industrial entities and government institutions in a constant search for startups and subject matter experts to collaborate in making traditional businesses more efficient and/or to generate industrial growth through new business models.[22]

Allocating capital to the circular transition

Financial institutions, supranational entities such as the EU and the UN, as well as nonprofits and NGOs working with corporates have already made efforts to better articulate the role of finance in transitioning us to a circular economy. In 2018 ABN AMRO, ING and Rabobank jointly published a set of Circular Economy Finance Guidelines. Within them was a practical set of core components regarding: (1) the use of investments, (2) process for project evaluation and selection, (3) management of investments, and (4) reporting.[23] Fast forward to 2020 and the Ellen MacArthur Foundation conservatively estimated that by the first half of the year there were 30 venture capital, private equity and private debt funds, a 10x increase since 2016, and that over $2B USD in assets were being managed through public equity funds with a circular economy focus.[24]

With the evident need for the transition now apparent to the financial world, one can expect to see further entrants to the market as well as the establishment of more defined

[23] https://www.ing.com/Newsroom/News/ABN-AMRO-ING-and-Rabobank-launch-finance-guidelines-for-circular-economy.htm

frameworks and metrics. For its part, Enel published its CirculAbility Model® for circular performance as an early contribution to the space in 2018. Since then, Enel has continued to push the discussion through collaboration and thought leadership.

For Enel Group's contribution, we remain an active member of the European Commission's Expert Group, *Support to Circular Economy Financing*. Again, we see European policymakers leading the way in addressing and implementing the circular economy, however the Group investment in the US and Canada is still driven by our global headquarters in Rome. Overall, the Group strategic plan released in 2020 includes a target to increase sustainable financing sources by 16% from 2020 – 2023, from 32% - 48%, and an additional 20%+ increase to over 70% by 2030.

In the United States and Canada, some of our largest contributions may be seen in the expanded investment and development of greater renewable energy generation, which increases circular inputs and reduces

The 2020 Enel Group position paper highlights four key enablers to demystify the concept of circularity in finance and overcome the barriers for implementation and acceleration:

- Development of financial know-how on the circular economy
- Creation of a "level playing field" with respect to the linear model
- Assessment of long-term impacts and related benefits of a circular model
- Enabling collaboration between different value chains

emissions within the region. We're also applying circular economy principles in some of our largest value chain investments such as battery energy storage systems (BESS), which enables greater production output and improves time-of-use matching from our renewable generation plants, as well as resiliency for the electrical grid.[25] This is also advancing the call for transparency through EPDs, which help maintain and improve material use through mechanisms that incent producers supporting a transition towards product circularity.

[25] https://www.enelgreenpower.com/media/news/2020/03/partner-selection-sustainability

The Path to Resiliency

Extreme weather events

The world's seven-warmest years have all occurred since 2014,[26] and in 2020 North America has seen a surge in extreme weather events and signs across the United States and Canada that the atmospheric and global impacts of climate change are not only very real but growing increasingly dangerous for society and our environment. The National Oceanic and Atmospheric Administration (NOAA) found in October of 2020 over 45% of the continental US was experiencing drought.[27] Through mid-December 2020, the United States saw about 57,000 wildfires, up more than 6,000 from the same time the previous year, and California alone had 5 of its 20 largest fires on record, losing 4.2 million acres to wildfires.[28] In parallel, the 2020 hurricane season started in May (as opposed to the traditional 01 June) with Tropical Storm Albert and has since produced 30 named storms and 13 hurricanes.[29]

In the, *"Canada's Changing Climate Report 2019"* issued by the government, a warming climate was deemed, "virtually certain" and over a period of more than 60 years average mean temperature rose 1.7^{0}C for the country as a whole and 2.3^{0}C in the north. The authors also placed a level of "high confidence" in future, daily extreme precipitation.[30]

In order to support a functional society that can withstand the impacts of extreme weather, more resilient energy systems and regenerative economies have become ever more imperative. Speeding and expanding the adoption of renewable energy while curtailing and decommissioning fossil fuel generation not only helps reduce GHG emissions and ceases further extraction of natural resources, it also allows for the adoption and implementation of distributed energy resources (DERs); coupled with battery energy storage systems (BESS) this enables a more resilient and sustainable energy system. This has the benefit of offering a more stable production supply chain for companies which may have otherwise been affected by extreme weather; should the grid experience a power outage one can still maintain operations with a well-designed DER microgrid solution. As referenced in the policy overview, this has

The independent, US-based nonprofit Council on Foreign Relations identified a $2T USD funding gap in required budget to adequately update infrastructure in the United States, and attributes costs up to $155B USD annually due to traffic congestion and air travel delays alone.[31]

[26] https://www.noaa.gov/climate

[27] https://www.noaa.gov/media-release/us-winter-outlook-cooler-north-warmer-south-with-ongoing-la-nina

[28] https://www.iii.org/fact-statistic/facts-statistics-wildfires

[29] https://www.nytimes.com/2020/11/16/us/hurricane-season-2020.html

[30] https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR_FULLREPORT-EN-FINAL.pdf

[31] https://www.cfr.org/backgrounder/state-us-infrastructure

the added benefit of promoting an inclusive, prosumer approach to the next generation model of societal energy production, management and consumption.

Fixing aging infrastructure

Compounding the risks associated with climate change and extreme weather, fragmented policy and outdated infrastructure in the United States poses a significant risk for society and the environment while also a challenge to the circular transition we so vitally must make. Advancement of decarbonizing the transportation sector remains a challenge due to the far-reaching nature of road travel in North America, with electrification currently somewhat confined to major urban centers. However, in 2018 the United States saw its one millionth EV take the road, with the Edison Electric Institute estimating growth to reach 18.7 million by 2030.[32] In order to support such decarbonization and electrification growth, a robust EV smart charging infrastructure needs to be deployed which is publicly accessible, thus not limiting adoption to only those who have the space for a private home charging unit.

The electrical grid is an expansive and complex patchwork of systems. The complexity is compounded by an interwoven tapestry of legislation and regulators that varies based on geography – be it local, state, regional or national. In order to address this, North America needs to consider the policy levers available and investment required to establish upgrades to:

1. Circular infrastructure for materials: MRFs to value chains and the associated transportation mechanisms to enable greater adoptions.
2. The electrical transmission, distribution and regulatory system: from interconnection issues to regulatory oversight, a comprehensive and forward-thinking approach is critical.
3. Coastal areas and islands: with population highly concentrated in vulnerable areas, a robust effort to protect against extreme weather and the associated losses.
4. Building electrification: moving away from fossil fuels to circular inputs.
5. Building use disclosure: property owners have a responsibility, and occupants a right to know, how their personal activities and responsibilities can impact our ability to achieve collective goals.

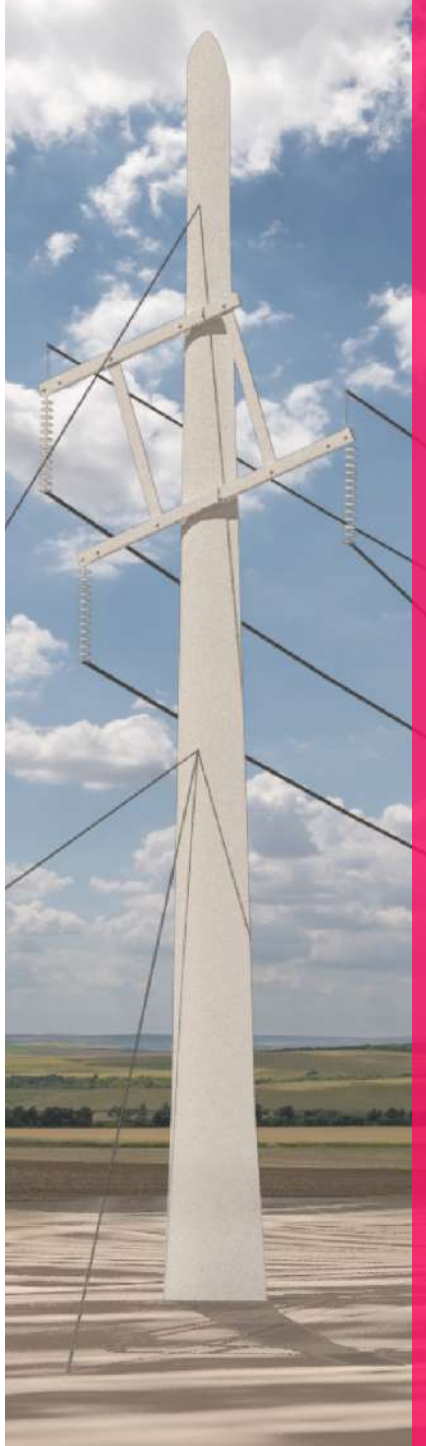
Rethinking value chains

When considering a resilient and circular future, attention must be paid to the function of the value chain for goods and services. In the traditional circular approach of looping materials – through life extension or new life cycles – so too should this approach be taken with suppliers of commodities or equipment. Given the uncertainty presented by extreme weather cases or global regulatory changes, it has become ever-more apparent that geographic concentration in companies' supply network can also be a vulnerability. To be exposed to volatility in all the extreme weather events across the globe, or regulatory changes that can have

[32] https://www.eei.org/resourcesandmedia/newsroom/Pages/Press%20Releases/EEI%20Celebrates%201%20Million%20Electric%20Vehicles%20on%20U-S-%20Roads.aspx

a deleterious effect on production, is to be overexposed. Rather, establishing distributed and increasingly localized loops for materials and goods becomes a mechanism for collaborative innovation that can also spur economic growth in a region.

Through Enel X, we're helping to address renewable inputs for businesses by guiding them on a path to 100% renewable energy procurement, while also enabling data management and emissions reporting that can then provide transparency on progress for both suppliers and customers. Distributed Energy Resource models (DER) using renewable energy and storage systems and electric mobility solutions advance electrification and decarbonization of the transportation sector, further supporting energy resiliency.



Enel Green Power North America is collaborating with researchers from the Re-Wind consortium[33] to progress the novel re-use application for wind turbine blades as electricity transmission poles. This second life application, known as the BladePole,[34] contributes both to company efforts related to circularity, as it avoids the disposal or down cycling of the highly engineered blades, as well as resiliency, providing Enel and ultimately the industry with an alternate construction method for critical infrastructure components, without the need for further resource extraction.

The Re-Wind research team, led by Georgia Tech Professors Larry Bank and Russell Gentry, has spent more than half a decade analyzing end of life options for wind blades, considering economic, environmental, and societal aspects of different approaches. Weighing these considerations, the team determined that focusing on structural re-use was the most environmentally efficient option. The team has made significant progress in evaluating the structural feasibility of the BladePole application. In the next stage of this work, Enel is providing financial support and turbine blades from the recently re-powered Smoky Hills Project in Kansas to the Re-Wind team for a half-scale demonstration and design validation of the BladePole. Capitalizing on the research expertise from Re-Wind and the industry experience and assets from Enel will enable advancement of this technology towards commercial scale demonstrations, positioning Enel closer towards its goal of a more circular, resilient future for wind power.

[33] For more information please visit: https://www.re-wind.info/

[34] To learn more about the BladePole please visit: https://bit.ly/3nCea9B

IMAGE CREDIT: RE-WIND NETWORK

Regeneration

7

Within corporate discussions of transitioning to a circular economy, one may form the opinion that, at present, regeneration of natural resources remains a largely overlooked principle of the circularity agenda. Whereas recycling and waste management, second life applications for materials or product components, or the banning of particular substances remains tangible and easily digestible for most; regeneration is yet another less tangible or otherwise obtuse and hard to grasp principle in the corporate context.

Thus, we seek to highlight this disparity in the current context, offering proper illumination to the subject in order to further the collective thought on the matter with hopes of advancing the discussion. By increasing the focus on the ability to retain material value and ultimately regenerate natural systems, we can shift our efforts towards creating the largest positive environmental and social impacts possible, rather than simply trying to reduce or minimize harms.

Ecosystems and extended value chain approaches

The previously offered parallel between business partners and environmental balance has grown to be more evident in the business lexicon, with increasing references paid to *ecosystem development*. The concept of a business ecosystem incorporates all aspects of the value chain, starting with the design phase of a product or asset straight through to its ability to see new lifecycles. It is through collaborative innovation that Enel believes this transformation will occur. Not just evidenced by our Open Innovability approach to problem solving, but also by engaging with suppliers and customers, as well as in some cases competitors, in a pre-competitive fashion. The challenges our society faces today, be it climate change or social equity, cannot be solved in a vacuum. As such, developing a business ecosystem across industries affords creativity, knowledge and best practice sharing, along with a joint commitment to achievement of goals.

Following are some examples of how this approach, both in nature and in business, is helping Enel improve our circularity while also transitioning from renewable energy to truly *sustainable* energy.

Improving the environmental impact of solar

With dozens of existing and future projects in over 30 countries, Enel facilities provide a unique opportunity to put practices into action, serving as a living laboratory to connect theories about the performance of the circular economy to empirical data from the field. Improving the environmental impact of our sites is a key mission of our Innovation group, working with commercial teams and a wide variety of stakeholders in the field to test key ideas that are then disseminated into common company practice.

Central to this effort is our work integrating agricultural practice into the development and construction of our photovoltaic plants, known as agrivoltaics. Projects in this field

started more than two years ago, with the integration of pollinator friendly ground cover at Enel's Aurora solar plant in Minnesota. Working with world-class experts from the National Renewable Energy Laboratory (NREL) and other institutions as part *the Innovative Site Preparation and Impact Reductions on the Environment* (InSPIRE) project,[35] pollinator-friendly native seed mixes were planted below the panels at the project, that provide not only important wildlife habitat, but also temperature and soil conditions that have the potential to support the continued health and viability of the PV technology. From 2020 forward, Enel, as part of its plan to grow its solar portfolio across the United States, is taking lessons learned from the project and extending them further, developing multi-use solar technologies wherever it builds projects, leveraging advancement in technology, practices and wide variety of geographic and temperature zones to make this unique activity a common practice, allowing the company to meet or exceed its sustainability goals. This also provides the ecological, community and naturally regenerative attributes that create shared value for all relevant stakeholders.

[35] https://www.nrel.gov/news/features/2019/beneath-solar-panels-the-seeds-of-opportunity-sprout.html

***Sustainable energy:* removing embodied carbon**

Another practice that supports regeneration is to examine how we can reduce the embodied emissions and potential ecotoxicity of our solar generation power plants. While renewable energy inherently supports our transition to a circular economy, we must still examine how to design out waste and pollution in the equipment we procure in

ARUP

"Arup, working in partnership with Enel, has developed a programmatic tool to assist in delivery of dual use solar – the practice of using the land for the production of solar energy while also taking measures to preserve natural capital and provide ecosystem services. The tool (currently at beta stage of development) is intended to inform decision makers and their project teams on dual use options and implications so that they can proactively decide their strategy at early stages and attain better outcomes – i.e., faster and better decisions.

At its core it uses a multi-criteria analysis to determine the preferred dual use application(s) on site. To do this, the project team "weights" value-based criteria and enters unique facts about the site (location, size, stage of development, contractual considerations, environmental context and design parameters). The tool then scores the differing options and produces a report that details out the actions that need to be implemented by the different team members to successfully advance the preferred option. In 2021, Arup and Enel seek to further develop the robustness of the tool, with plans for broader sharing and testing among the solar and environmental communities."

order to ever achieve a state of regeneration. Working with Arup, the embodied carbon and ecotoxicity of the four largest material streams of a photovoltaic plant were examined as a benchmark for current performance. Findings showed that while Enel is performing better than industry averages in respect to both embodied emissions and ecotoxicity, further consideration for the location of manufacturing facilities and technologies selected would allow for a more thorough incorporation of circular design principles. Even so, the environmental payback for utility scale solar-plus-storage deployments is evident and further dialogue among industry stakeholders should hone in on the findings to drive improvements.

MARIN CARBON PROJECT

Partner Spotlight: Arup and the Marin Carbon Project

The Marin Carbon Project (MCP) has pioneered efforts to enhance carbon sequestration in rangeland, agricultural, and forest soils through applied research, demonstration and implementation. The results of MCP's work and that of its collaborator, the Carbon Cycle Institute (CCI), has been to deepen the understanding of landowners and land managers role as stewards of soil health and enterprising leaders of carbon farming – to improve on-farm productivity, enhance ecosystem function, and address climate change. For over a decade the MCP has been working to advance the science of managed land circularity and "carbon farming". Among the outcomes is a heightened awareness that carbon markets combined with local policy incentives, community investment, and private sector value led participation are important collaborations to achieve sustainability and circularity. Arup was an inaugural sponsor of the MCP carbon credits and this partnership was borne of an interest to intersect urban and agrarian interests in the circularity of climate mitigation by recognizing the interrelationships and interdependencies of both.

Looking Ahead

As Enel North America executes on its business growth in 2021, we're committed to continuous improvement regarding how we as a company as well as a society as a whole can accelerate the transition to an inclusive circular economy in the United States and Canada.

From advancing circularity in cities and our involvement with the Circular Chicago Coalition, to developing our pipeline of over 1 GW of new renewable energy development that will further progress dual-land use models for renewables to help maintain and regenerate natural ecosystems, the time for circularity is now.

Collectively we're in need of recovery from the tumultuous events of events of 2020 and design a plan to build back better. For this, we must develop greater resiliency, in our communities, for our infrastructure and for the connections that bond our society. In our pursuit of this, we seek to regenerate natural systems – of the environment to combat climate change and global warming, and of society to heal our nations.

Join us in pursuit of Enel's mission: Open Power for a brighter future. We empower sustainable progress. We cannot do it alone, but all are welcome to be a part of this journey.

Acknowledgements

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Arup
For more information on Arup, please visit:
https://www.arup.com/

National Renewable Energy Laboratory (NREL)
For more information on NREL, please visit:
https://www.nrel.gov/

PYXERA Global
For more information on PYXERA Global, please visit:
https://www.pyxeraglobal.org/

Re-Wind Project
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