ERT

Towards an EU Action Plan for a Digitally Enabled Green Transition

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Contents

Foreword

Sustainability has become an imperative – for businesses, governments, and societies alike. Climate change and geopolitical tensions further emphasise the importance of accelerating Europe's green transition. The war in Ukraine and the energy crisis are our immediate priority, posing a challenge for the competitiveness of European industry and our economies. While the need to reduce the EU's dependency on Russian gas increases the urgency with which we must act, it also provides an important opportunity for new business models with the long-term aim of phasing out fossil fuels. Ultimately, our ability to reach our decarbonisation targets is inextricably linked to the success of our digitalisation efforts – meaning Europe must tackle the challenge of the twin transition.

This requires all stakeholders to work together – across value chains and national boundaries. Governments and business leaders must join forces to form policy and finance environments that encourage the green transition, formalise the energy strategy of companies, and support the deployment of renewable energy sources.

The key to fully embracing this opportunity is transparency – because we can't manage what we can't measure. By embedding sustainability metrics into business operations, organisations can access and act upon financial, social, and environmental data. Digital technologies can help us accurately measure emissions, share critical information with stakeholders, implement resource efficient strategies, and dematerialise and transform value chains. In this way, rather than seeing the two as mutually exclusive, we strengthen the link between sustainability and profitability. Transforming to a low-carbon, low-waste, low-inequality economy and leveraging sustainable finance not only represents a necessity to protect future generations – it is also a massive opportunity for future business success.

This paper builds on the belief that Europe's companies play an essential role in the green transition as they (must) deliver digital innovation to drive both Europe's sustainability ambitions and European competitiveness. In this paper, we highlight some of the cutting-edge innovations such as digital twins and business networks with which European companies across a wide range of sectors are already leading the way.

At the same time, the paper argues for a supportive policy environment at both the EU and Member State levels to facilitate the development and broad deployment of digital solutions that support the green transition. From consistent standards that enable data sharing and comparability to government investment in digital green skills and infrastructure, this paper identifies a number of ways in which policy can support Europe's companies in achieving the digitally enabled green transition.

Ultimately, European businesses that utilise digital technologies to fuel their green ambitions, enabled by supportive policies and frameworks, will accelerate not only their own competitiveness but also our transition to a more sustainable world.

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Executive summary

Key arguments

The European Round Table for Industry (ERT) use cases outlined in this paper make a simple but powerful point. They show how European companies utilise digital technologies to drive decarbonisation and wider environmental goals by reducing the carbon footprint and broader impacts of energy generation and industrial production. Summarised in this paper, and explained in detail in the appendix, the use cases show that digital technologies such as 5G, machine learning, artificial intelligence, green software design and digital twins[1] – as well as the greater collection, sharing and use of data – will be at the heart of a successful transition to a net-zero society and to a more efficient and circular economy. At the same time, digital technologies also play a critical role in driving the achievement of green goals in every other part of the value chain.

ERT has identified five significant trends in the application of digital technologies to the green transition:

- **Data sharing in trusted business networks** can drive transparency around the carbon footprint of business activities, and consequently emissions reduction throughout the supply chain.
- **Upgrading ICT infrastructure** boosts resource efficiency and is the basis for applications that can substitute for emission-generating activities.
- Digital technologies are critical for **sustainable transport management**, including enhanced traffic planning and the expansion of electric vehicle use.
- Digital technologies play an essential role in **managing the energy grid**, distributing energy resources and enhancing flexibility, whilst increasing the grid's hosting capacity with the necessary speed.
- **Digital twins** offer significant opportunities to improve efficiency (including waste and emissions reduction) thanks to simulation across many sectors.

There is a clear opportunity not only to use digital technologies to accelerate the green transition but also to ensure European competitiveness. European businesses which utilise digital technologies to fuel their green ambitions, enabled by a supportive policy environment, will remain at the forefront of competition globally. Indeed, digitally enabled green business models developed in Europe will be able to be exported globally. With this in mind, ERT has also identified four key issues to be addressed in order to support the rapid deployment of relevant technologies:

- A **lack of clear standards** in the areas of data interoperability, sustainability reporting and measuring the environmental impact of digital technologies slows down the expansion of business networks and reduces our ability to make data-informed green decisions and means that stakeholders are less informed regarding the environmental impact of technologies.
- The **EU sustainable finance taxonomy** does not adequately **incentivise investment** in the twin transition, due to the lack of acknowledgement of digital technologies.
- With our use of data set to continue to expand, and digital technologies forming an increasing part of our energy ecosystem, **robust cybersecurity** will need to stay at the front of policymakers' and business leaders' minds.
- Investment in **skills remains siloed** between digital and green skills of the European workforce, failing to prepare individuals to combine both skill sets.

1 A digital twin is a virtual representation of a physical object or process. This is distinct from the 'twin transition' which refers to the connections between the green and digital transformation agendas.

Call for action

To accelerate the positive trends and address the barriers to more rapid deployment of technology, ERT calls for an EU action plan for the twin transition with six core recommendations for EU policy, which are expanded into a set of actions for business and for EU policies in Section 3 of this paper:[2]

1. Collaboration in business networks should be further encouraged through research and innovation spending, by facilitating cross-industry platforms, and by ensuring that data is easy to find, accessible, interoperable and reusable.

2. The use of digital twins should be extended, including the establishment of an industrial platform to prove and promote the concept of using them to drive environmental benefits within and between companies, and by public authorities.

3. The development of harmonised standards should be fostered to enable a radical increase in the use of the technologies identified in this paper, streamline reporting requirements, and enable the measurement of 'greening of' and 'greening by' digital technologies.

4. The EU sustainable finance taxonomy should be revised to recognise fully the enabling role of digital alongside a review of the treatment of digital technologies in public procurement around decarbonisation.

5. Further support for the development of highly secure ICT infrastructure should be created, especially relating to the expansion of 5G, which will be essential for smart energy grids and the mobility sector.

6. A more integrated approach to education and training is essential to break down the silos between 'green' and 'digital' career paths, including by creating academic programmes which develop both skill sets simultaneously.

Across the EU action plan for the twin transition, ERT Member companies will share learnings and best practices from current industry models to contribute to the recommendations above. More specially, ERT Member companies will function as an incubator for the expansion of business networks and contribute to shaping and applying sustainability standards. This will include gathering and publishing data, where available, on the carbon impact of products along the entire supply chain as well as quantifying and reporting on the reduced environmental impact of digital solutions when standards are available. Companies led by Members of ERT will raise awareness of the importance of green coding among staff and suppliers and continue building relevant digital green skills. Finally, ERT Member companies will mirror the commitment by EU institutions and national governments to start prioritising environmental sustainability in ICT procurement.

2 Not in order of priority

Introduction

Europe's political leaders have set important ambitions for the transition that the EU economy and society must undergo during the coming decades. The EU and the Member States have agreed clear targets for making the industry more sustainable across both carbon emissions and materials use, and for developing and adopting innovative digital technologies by 2030.[3] The Russian invasion of Ukraine, and Europe's policy response to reduce energy dependency, has only increased the urgency of accelerating this transition, highlighting the existential importance of European technological capabilities, and of more diverse and sustainable energy supplies. However, the EU is still lacking a strategy for the twin transition and, in particular, how digital technology can enable and accelerate the green transition.

This paper sets out the potential benefits of linking the ambitions described as the 'twin transition' – achieving huge strides forward in digitalisation alongside achieving the decarbonisation and resource efficiency goals of the EU Green Deal – highlighting their interdependence in practical investment decisions. The paper attempts to build on existing regulation and efforts towards this end, for example the European Green Digital Coalition, considering ways to further harness and extend these frameworks in order to accelerate the twin transition.

With this paper, ERT would like to:

- Capture European companies' successes in applying digital solutions to the green transition,[4] supported by real-world use cases, and highlight remaining barriers to more rapid and widespread adoption of relevant technology;

- Set out the potentially transformational role that greater use of digital technology can play in the near-term, with concrete steps policymakers can take to unlock this potential.

Reviewing and comparing these use cases from companies led by Members of ERT, which represent a diverse set of investments and activities across sectors and industries, the commitment from businesses to innovate and invest in alignment with the twin transition is clear. Despite this decisive engagement from companies, we conclude that there is an opportunity for action at the European level to accelerate the twin transition by treating the green and digital agendas as mutually reinforcing objectives. This will require pursuing targeted reforms to the policy frameworks for data, ICT infrastructure, green software design, sustainable finance rules, energy markets and electricity grids. At the same time, it also means embracing and encouraging adoption of tools such as digital twins and the development of business networks that have demonstrated their value in industry. Ensuring a high level of cybersecurity and equipping the workforce with the needed dual skill-set to bridge the gap between digital and environmental expertise will be equally necessary.

It is clear from the use cases given in this paper and the lessons drawn from them, that two types of innovation are needed within the realm of digital sustainability: (a) 'greening of' digital innovations, where the hardware and software are 'green', meaning that they abide to resource efficient practices such as energy efficient coding and AI models; and (b) 'greening by' innovations, where digital technologies are used to drive sustainable outcomes along the entire value chain. While the greening of digital technology is already on the political agenda, the greening by digital innovation is still not fully understood. Thus, this paper focuses on the enabling role of digital technology on the green transition.

Embracing the role of digital technology in delivering green outcomes, diversifying energy supplies – and giving this political attention through initiatives such as RePower EU – supports European competitiveness and can help secure Europe's global leadership role.

3 See for example the Digital Compass , the Data Act , the Green Deal (including the Fit for 55 package, EU taxonomy and the recently released Circular Economy Package).

4 Here digital solutions include those that (i) drive direct environmental impact (for example virtual solutions such as telehealth, remote working) and also (ii) enable indirect environmental impact (for example the collection of data to create digital passports).

1. Identifying Europe's strengths in applying digital technologies to the green transition

Digitalisation is noted as one of the six key transformations needed to meet the UN Sustainable Development Goals .[5] Likewise, the most recent report by the International Panel on Climate Change (IPCC)[6] emphasised the positive contribution of digital technologies to decarbonisation. By fully harnessing the benefits of digitalisation, carbon emissions could be reduced by at least 20%, and resource use by up to 90%.[7] Providing that the energy and resource demands of digital technologies are managed and limited, especially in light of our ever-increasing computing power needs, the advantages of accelerating both the green and digital transitions in parallel is indisputable.

Key trends and technologies identified by ERT

The contributions of digital technologies to European industry can best be understood through five key trends:

- the collaboration across the value chain in business networks;
- upgraded ICT infrastructure;
- enhanced management of transport infrastructure;
- efficient management of the energy system; and
- harnessing digital twin technologies.

The role of business networks

In our volatile and highly complex world, cross-company collaboration in business networks plays a transformational role in making the green transition measurable and manageable. While becoming greener has become a business imperative, many companies continue to lack the transparency necessary throughout the supply chain to advance environmental goals. Bringing together companies in unified business networks which share data helps to create transparency throughout supply chains and enables businesses to manage 'green' lines in addition to top and bottom lines. The potential of business networks in accelerating the green transition is illustrated by the fact that, for many sectors, the majority of emissions are concentrated in the supply chain. For example, in vehicle manufacturing, more than 80% of emissions are from activities completed by companies further upstream or downstream. Likewise, within the healthcare sector, more than 70% of emissions come from the supply chain through production, transport and disposal of goods and services.[8]

Catena-X[9] is an example of the power of collaborative business-to-business (B2B) networks. Catena-X is an open, scalable network that ensures data exchanges between car manufacturers, suppliers, and ICT companies are secure. This enables peer-to-peer data exchange while ensuring data sovereignty between all companies involved in the automotive supply chain and lifecycle including OEMs, suppliers as well as recyclers. A further example is IDunion, a sharing infrastructure with built-in technology to enable verification and confidentiality-protection of shared data. This sharing of data in trusted and secure business networks enables participating companies to obtain critical insights to respond to any disruption in real time. Most importantly for the green transition, the traceability of data throughout the supply chain also helps to support circular economy objectives and enables companies to track and reduce the carbon footprint.

Given the concentration of emissions in supply chains, such networks will be extremely important in fuelling the green transition. By connecting the entire ecosystems of a sector, business networks like Catena-X or IDunion help to make supply chains more resource efficient, resilient, and sustainable. Other initiatives are also in progress to advance the data transparency of emissions embedded in supply chains. The World Business Council for Sustainable Development's (WBCSD)

5 United Nations, Sustainable Development Goals (SDGs) available here: Home | https://sdgs.un.org/#goal_section

6 International Panel on Climate Change (IPCC), Report available here: https://www.ipcc.ch/report/sixth-assessment-report-working-group-3/

7 UN-EP, digital transformation subprogramme found here: https://www.unep.org/explore-topics/technology/what-we-do/digital-transformation

8 Healthcare without Harm, Report available here: https://noharm-global.org/sites/default/files/documents-files/5961/HealthCaresClimateFootprint_092319.pdf

9 Catena-X, The gateway to a Digital Economy, available here: https://catena-x.net/en/

Value Chain Carbon Transparency Pathfinder[10] provides an interoperable standard for enhancing the visibility of emissions throughout supply chains. This is achieved by supporting the exchange of standardised emissions data through a growing, industry-agnostic, business network.

There are several conditions which will need to be met for the expansion of business networks. High speed telecommunications infrastructure like 5G, digital data platforms and innovative (green) software applications are essential for making collaborative business networks a reality.

The ability to share data at a scale and with a level of consistency that makes it accessible and interoperable is critical. Yet the lack of data interoperability remains a leading barrier to the expansion of business networks. It will therefore be essential to address the lack of common data standards and compatible formats. At the same time, data should be exchanged between businesses (as well as their stakeholders) only on a voluntary basis and with consistent levels of security, with companies participating in business networks able to ensure that they maintain full control over their sensitive business data

The Catena-X Automotive Business Network

Catena-X is envisioning a continuous data exchange for all contributors along the automotive value chain to foster innovation and solve key challenges on for instance sustainability and supply chain resilience. The goal is to establish a globally operating network based on European values.

Product Footprint Management

SAP's Product Footprint Management solution enables companies to calculate product footprints on a regular basis. It also helps companies to scale, considering the entire product lifecycle, as the calculated product footprints are integrated into operational end-to-end processes that include all relevant business users in each department.

IDunion

IDunion enables sharing of third-party certified verifiable information. It is already applied to the exchange of product carbon footprint. This sharing approach can also be applied to other ESG data which are relevant to manage sustainability in the supply chain.

Digital Product Passport

To achieve a circular economy, the first digital hurdle to overcome is to provide sufficient transparency by trustworthy, verifiable information about the product including provenance of the materials and recycling opportunities. The tool to achieve this is the Digital Product Passport.

Ellipse - Carbon Intelligence Platform

ENGIE Ellipse Zero Carbon Platform is the world's most comprehensive carbon intelligence platform. It enables businesses to measure carbon emissions today, design decarbonisation roadmaps for tomorrow, and confidently disclose progress. Delivering unparalleled visibility across Scopes 1, 2 and 3, ENGIE Ellipse offers a single source of truth to unlock carbon-first decision making across an organisation.

Gathering CO_2 Data Along the Value Chain (SiGREEN)

To help manufacturers determine their products' carbon footprint, Siemens has developed the SiGREEN application. SiGREEN enables companies to efficiently request, aggregate and share product carbon footprint data based on actual emission values and emissions quantified, along the value chains. Based on peer-to-peer communication, it is also an open industry solution for all sectors.

10 World Business Council for Sustainable Development, Report available here: https://www.wbcsd.org/Programs/Climate-and-Energy/Climate/SOS-1.5/Resources/Value-Chain-Carbon-Transparency-Pathfinder-Enabling-decarbonization-through-Scope-3-emissions-transparency

The power of upgraded ICT infrastructure

ICT infrastructure serves as a foundation for ensuring a digitally enabled green transition. It enables more efficient resource use, automation, education and operations, all of which are critical factors for achieving Europe's green goals.

High speed connectivity is a precondition for the digital innovations that drive the green transition throughout the economy. The connectivity provided by mobile technologies makes a significant, though rarely recognised, contribution to avoided emissions. Estimates from GSM Association found that the level of avoided emissions thanks to mobile communications technologies was ten times greater than the global carbon footprint of mobile networks themselves.[11] As illustrated by the use cases in this paper, fifth generation mobile networks (5G) in particular are powerful examples of how ICT infrastructure can support green objectives. 5G is a step change technology which presents unprecedented opportunities due to its high-capacity and low-latency characteristics. 5G also brings major improvements as regards the energy efficiency of mobile networks themselves. In terms of energy consumption per unit of traffic (W/Mbps), a joint test pilot of 5G deployments in Spain and Brazil, conducted by Ericsson and Telefónica in 2021, showed they were up to 90% more energy efficient than fourth generation networks (4G).[12] Accordingly, governments and regulators should facilitate the rollout of new generation networks, which will gradually replace legacy networks.

Significant gains in energy efficiency are also possible by running software on the cloud instead of on local servers. Cloud servers have been shown to reduce carbon emissions by up to 98%; they also require only ¼ of the servers meaning fewer materials are needed to deliver on the needed functionality,[13] helping to support the dematerialisation necessary for circularity. In addition to decisions over where to run software – both at a local level, but also within the cloud where decisions over where and when to run software are important – the energy consumption of applications can be reduced by up to 50% by selecting the most appropriate programming language for the task.[14]

A further technology which will be key to ensure a digitally enabled green transition is the development and expansion of high-performance computing (HPC). Using purpose built HPC clusters to carry out calculations relevant to data analysis, transfer and simulations is significantly more energy efficient than running the same processes on consumer devices. Moreover, HPC has the ability to support the research of problems which require the analysis of big data in order to make progress.

Two leading barriers remain in place when it comes to ensuring that the EU has the necessary ICT infrastructure in place for the twin transition. First, in terms of the expansion of 5G networks, the current regulatory framework stifles private investment. Second, and most relevant for the expansion of high-performance computing, whilst EU Research and Innovation programmes such as Horizon Europe, Digital Europe, and the Connecting Europe Facility have contributed to the development of Europe's ICT infrastructure, there remains a lack of funding for research and development. This funding is needed to support innovation and develop computing infrastructure to reach the cutting-edge. It will also be critical to ensure that high-performance computing is expanded, in particular to European SMEs.

At the same time, it is important to recognise the impact of the ICT sector on the environment and support EU efforts to better measure the energy and environmental footprint of the ICT industry. In particular, we acknowledge emissions caused by data centres. Greater transparency for the data centre industry has been driven by both the Energy Efficiency Directive (EED) and in the sustainable finance taxonomy. In addition, the EU Code of Conduct for Energy Efficiency in Data Centres (a voluntary mechanism) is a significant step forward. Concurrently, the data centre industry is making substantial progress in decarbonising its own operations, minimising energy consumption and setting ambitious decarbonisation goals. Nevertheless, it will be important for the twin transition to keep in mind the importance of decarbonising data centres.

11 GSMA, Report available here: https://www.gsma.com/newsroom/press-release/mobile-technologies-enabling-huge-carbon-reductions-in-response-to-climate-emergency/

12 Ericsson, Study available here: https://www.ericsson.com/en/blog/3/2021/1/achieving-sustainability-with-energy-efficiency-in-5g-networks

13 Study conducted by Microsoft and WSP, Report available here: https://www.wsp.com/en-GL/insights/microsoft-cloud-computing-environmental-benefit-study

14 Accenture, Report available here: https://www.accenture.com/_acnmedia/PDF-135/Accenture-Strategy-Green-Behind-Cloud-POV.pdf#zoom=40

Renewable Energy for Data Centres

TotalEnergies has signed in 2021 a strategic partnership with two major cloud providers for digital innovation and net-zero goals. The company provides more than 500MW of renewable electricity and batteries for its data centres and sustainable cloud services and works with both partners for co-innovation in digital solutions accelerating the energy transition.

The Smart Innovative Operations (SIO)

Air Liquide's Smart & Innovative Operations (SIO) programme leverages the power of data and digital technologies to optimise the energy consumption of oxygen, nitrogen and hydrogen plants, while contributing to improve their reliability. SIO demonstrates that digital technologies can enable the green transition, by improving efficiency and thus reducing the Carbon emissions of the Air Liquide Facilities.

Circular Economy

Deutsche Telekom is committed to become fully circular around technology and devices by 2030. The company introduces specific circular economy criteria into the sourcing process and sets up specific zero waste targets, along with additional measures. In particular, leasing, refurbishing and reusing existing equipment and devices significantly reduces the environmental impact in terms of manufacturing, raw material consumption and waste disposal.

Decarbonising Healthcare

Philips digital healthcare solutions can drive significant reduction of Scope 3 emissions through dematerialisation. Telehealth replaces physical with virtual solutions, helping to reduce carbon footprint per patient, while AI diagnostics can help to prevent unnecessary treatments and also improve utilisation rates of hardware.

Telecommuting

The provision of personal and business connections has enabled a shift in the behaviour of companies and employees, enhancing 'working from home' approaches while reducing the need for the employee to commute or travel. Telefónica has sought to quantify carbon emissions reductions thanks to the connections it provides, which in the case of telecommuting was around 20% based on fixed line connections and 15.3% for B2B mobile networks.

Green Data Centre and Sustainability

Eni's Green Data Centre houses HPC5, which is one of the most powerful supercomputers in the world. The Green Data Centre is a leader in Europe in terms of efficiency and carbon footprint, as confirmed by the indicator Power Usage Effectiveness - PUE of 1.166. By 2021, this translates into a lower energy consumption than the European average PUE of 15,380 MWh and an associated reduction in CO_2 emissions of 5,858 tonnes.

AI Optimises Power Savings for Mobile Networks

Artificial Intelligence (AI) can reduce CO_2 emissions and energy costs of telecommunication networks. AI predicts low traffic periods and shuts down idle resources. For instance, Nokia AVA AI energy management for mobile networks minimises energy waste for cooling (up to 70% less energy). Real-world experience shows that using AI brings overall energy savings for networks between 7% to 30%.

Digitally-enhanced transport infrastructure

Real time data is crucial to effectively manage public transport systems and is increasingly used to support road users to reduce their environmental impact. Most obviously, to ensure the successful expansion of electric vehicle use, private and fleet owners will require both digital services that guide where charging infrastructure is available and adaptive route planning tools that can support logistics management. In addition to supporting electric vehicle use, consistent and comprehensive data is crucial for both enhanced traffic planning as well as for functional refined and efficient energy grid steering (see below). This requires harmonised communication between different sub-systems as well as between the logistics and other societal systems. This data can also be further used to monitor the proportion of transportation that is zero-emissions, information which – if communicated to consumers in the right way – has the ability to drive greater ambition in supply chains to make the transition to zero-emission vehicles.

Digital Tools and Services for Route Planning and Charging

In an electrified transport system, digital services are key for guiding drivers to where charging infrastructure is available while adapted route planning tools support logistics planning.

5G Enabling Smart Ports

The Port of Livorno, handling 780,000 containers/year, have teamed up with Ericsson to use 5G networks and IoT solutions to optimise logistic operations. Reduced idle times for ships and transit time of goods help cut down emissions. These changes are expected to help the Port achieve 8% CO_2e reduction. In Europe, around 74% of goods enter or leave by sea, thus a wider adoption of 5G smart ports would have a huge environmental impact.

Smart energy grids

Digital technologies have an important role to play in helping Europe address its energy 'trilemma'. Having been brought into sharp focus by the Russo-Ukrainian war, the trilemma requires Europe to balance the need to boost security of energy supply, with maintaining competitive and affordable prices in the short-term, alongside delivering net-zero emissions by 2050.

Digital technologies are critical for the entire energy value chain, including energy generation, transmission, distribution, and storage, as well as in energy use by both industrial and household customers. Yet, under existing regulatory frameworks and tariffs the investment in digital technologies in electricity grids is not incentivised by governments to the same extent as investment in physical infrastructure. Instead, companies face barriers around capturing, sharing, and using the data that is critical for optimising the efficiency of our energy systems. Addressing these areas with greater urgency is therefore fundamental for pursuing the ambitions set out in the Green Deal and recently in the REPowerEU plan.

Digital technologies have the potential to enhance grid optimisation and flexibility through the roll-out of smart meter and grid technologies. They can improve both the integration of intermittent renewable energy sources and distributed energy resources, as well as the accuracy and consistency of network models. It is important to remember that flexibility must be provided to network operators by customers via market players. A growing number of heating systems that rely on heat pumps (approx. 3-4 MWh per annum) – as well as charging of electric vehicles (min. 4 MWh per annum) – will mean that the grid's peak load will increase threefold. A power grid that is intelligently designed for customers by integrating and managing distributed energy resources such as heat pumps (to enable flexible load shifting) or electric vehicles would require only up to a third of the physical expansion.[15]

Digital solutions are also critical on the demand-side by managing the efficiency of consumption from key sectors such as transport, buildings, connected services and smart quarters. In buildings, technologies such as Building Automation and Control Systems (BACS) enable monitoring, control and optimisation of building

15 Data from E.ON

energy and environmental performance. They also facilitate interaction with the energy grid, consumption prediction, management of energy storage, and generation from renewable sources. The rollout of BACS can provide net energy savings of 15% to 22% across the EU.[16] The technology can also bring returns 9 times higher than the investment[17] with a pay-back time of under 5 years.[18]

The expansion and digitalisation of grids will enable the electrification of transport to ensure that energy is in the right place at the right time. The harmonised implementation of zero emission zones across the Single Market would create a solid and significant demand for zero emission vehicles. Technologies such as energy management systems to control charging stations and keep residual peak loads low (including by bi-directional charging systems) can enable consumption to be managed locally. In addition, digital can also encourage the deployment of energy storage facilities through use in areas such as load balancing, ensuring an even load distribution.

Decarbonised Mobility

In the transport sector, the digital transition has a major role to play in decarbonising vehicles. With this in mind, Watèa by Michelin has developed solutions to ease the adoption of zero emission vehicles by fleets, by giving them information on the vehicle's range and infrastructure for example and providing them services to best optimise their journey. In that respect, data access, data sharing and data interoperability are key to make decarbonisation a reality.

Energy Grid Optimisation

The energy transition is facing challenges like the increasing number of distributed generation and consumption, making flexibility crucial for the energy grid optimisation. BeFlex, a Horizon Europe project led by Iberdrola, aims at increasing energy flexibility, enhancing cooperation among Distribution System Operators (DSOs) and Transmission System Operators (TSOs) and easing participation of all energy related actors.

Smart Energy (FLEXGRID)

The FLEXGRID programme implements around 40 "Smart energy" projects related to renewable energy production, energy efficiency and flexibility. The data management tool developed by Orange lets local actors have a better knowledge of and be able to optimise energy flows.

Ecological Corridor Management

ECM by E.ON aims to ensure the safety of overhead power lines while minimising the environmental impact of maintenance measures by making use of various digital solutions, e.g. satellite-based vegetation monitoring, AI for defect detection, drone inspection and digital data evaluation. A group-wide blueprint was launched for the ECM of 110 kV power lines, accompanied by a partnership with the United Nations Environment Programme (UNEP).

The contribution of digital twins

Digital twins offer enormous potential to accelerate the twin transition.[19] A digital twin is a virtual representation of a physical object or process, and therefore offers a way to integrate real-world objects and processes into the digital world. ICT integrates all data, simulation models, and other information from a physical object or process generated during engineering, commissioning, operation, and service. This information can then be provided to designers, engineers, operators, and service technicians across vertical domains. Digital twins have been shown to help reduce waste and emissions in processes such

16 CIRCABC, Task Report on Scoping available here: https://circabc.europa.eu/ui/group/1582d77c-d930-4c0d-b163-4f67e1d42f5b/library/1aff0783-fce8-4217-be69-581295f57fab/details

17 European Building Automation Controls Association, Guidelines available here: https://eubac.org/news/eu-bac-guidelines-for-the-transposition-of-the-revised-epbd/

18 Danfoss Building Efficiency, Newsletter available here: http://danfoss.ipapercms.dk/Danfoss/Newsletters/building-efficiency/optimizing-the-energy-use-of-tbs/?page=8

19 European Commission, European Digital Twin of the Ocean available here: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/restore-our-ocean-and-waters/european-digital-twin-ocean-european-dto_en

as testing and simulation, with twins often created before the physical product or system. The use of digital twins in modern sensor communication technology can also provide detailed operational insights to participating stakeholders in real time. This helps to reduce and even avoid emissions in multiple ways, for example by allowing predictive maintenance and reducing the travel needs of service engineers. Digital twins also serve as a foundation for connected, optimised and smart cities.

But whilst the intelligence and predictive capabilities made possible by digital twins have the ability to significantly reduce resources and energy use, this technology has only just begun to be harnessed by industry. One of the key reasons for this is the unresolved challenges which remain around the interoperability of data, an issue which largely lies beyond the scope of businesses to address if acting in isolation. More specifically, there is unexploited potential to use digital twins between businesses and other value chain stakeholders, where companies operating in an ecosystem could secure even greater benefits from making processes more sustainable as they collaborate across boundaries. Digital twins also have the potential to play a key role in supporting the advancement of measuring and reporting processes, including both standards for measuring different areas of the green transition as well as standards more narrowly focused on measuring the environmental footprint of products. These contributions multiply when companies and stakeholders collaborate across boundaries and throughout value chains, making entire supply chains more efficient, resilient and sustainable.

Destination Earth

The European Commission recently launched the "Destination Earth" initiative, which aims to develop a very accurate digital model of the Earth (a 'digital twin') to monitor and predict environmental change and human impact, past present and future. Leveraging decades of experience in space, Airbus and Leonardo support this initiative with their technical capabilities and stand ready to contribute further with their operational solutions.

QCem: Data and Machine Learning to Optimise Cement Production

Using historic production data and machine learning, Holcim is now able to forecast the future strength of cement and its quality accurately and in real-time at any point during the production process. This allows to adjust the parameters to minimise the use of raw materials and energy consumption and prevent over-processing. Where tested it led to 8% reduction in CO_2 emissions.

Digital Twin of Chemical Production SCOTT

BASF has developed a proprietary digital solution to efficiently calculate product-related cradle-to-grave carbon footprints (PCF) leveraging primary data. BASF's solution enables the company not only to provide accurate and granular PCFs for its sales portfolio, but also creates unparalleled transparency in what is driving greenhouse carbon emissions in its manufacturing footprint and raw material purchasing basket.

2. Barriers to be addressed for Europe's twin transition

Each use case and technological innovation highlighted in this paper is unique. There are, however, common elements to their conditions for success, as well as shared issues preventing their wider adoption and application. Some of these issues relate to European regulatory frameworks for sustainability reporting, access to interoperable data, the availability of necessary skills and the importance of robust cybersecurity. In the below paragraphs, the issues which Europe must address in order to enhance its digitally enabled green transition are explored.

Standardisation of data, sustainability reporting and the impact of digital technologies

One of the key cross-cutting issues to be addressed to support a digitally enabled green transition is the development of harmonised standards. Standards help support the interoperability of data, increase transparency, and encourage consumers, customers and wider stakeholders to understand the environmental impact of ICT and digital technologies. Meanwhile, once developed, the enforcement of these standards will be important in order to ensure a level playing field.

Insufficiently interoperable data

In a digitalised environment, technological developments including machine learning and artificial intelligence offer significant potential for more efficient production, distribution and use of resources. To be effective, these technologies require large and consistent data sets to be shared in real time. More broadly, across the use cases discussed in this paper, the volume, comparability, and accessibility of data (for example data relating to energy consumption or driver behaviour) are key to meaningfully contribute to green objectives, so that it can be processed and acted upon with data aggregation along the supply chain. Data consistency also helps to ensure trust and confidence in the value of individual data points.

As such, industry-driven efforts to establish commonly agreed digital standards to exchange information are crucial. As the use cases in this paper illustrate, work is already in progress to this effect, on both a European and global level. For example, the Pathfinder Network initiative of the WBCSD is working on the development of digital standards which takes into account data sovereignty, confidentiality, integrity, scalability, equality among participating organisations, and openness to allow all businesses and industry-focused data exchange platforms to connect to ultimately form one interoperable network. Likewise, in addition to supporting the traceability of information through supply chains (as discussed above in Section 1), Catena-X – based on the preliminary work of Gaia-X – provides a model for an open and collaborative data ecosystem.

Besides supporting areas such as artificial intelligence and machine learning, data interoperability is necessary for the expansion of business networks and the effectiveness of digital twins. Therefore, the work of initiatives to support data standards, coupled with a supportive policy environment, will be important for digital technologies to be as effective as possible in supporting Europe's green transition. The European Commission's efforts to facilitate Common European Data Spaces for the Green Deal and for Energy are important in this regard. The higher the level of data interoperability, the sooner and more successfully the digitally enabled green transition will be able to be realised.

Lack of harmonised standards for reporting sustainability information

Reporting standards have played an important role in rewarding companies that are prepared to demonstrate leadership by ensuring a level playing field and raising the bar for all. However, there are currently a multitude of standards for measuring different facets of sustainability. The number of reporting standards, and the lack of easy comparability between them, have created significant complexities for businesses. Most obviously, the administrative burden which this multitude of standards poses can detract from vital business activities such as innovation. Even more significantly, however, the lack of harmony in reporting sustainability information also reduces the effectiveness of digital technologies in analysing data, diminishing the ability of European businesses to make data-driven environmental decisions.

a) Disclosure standards

In the EU currently, the transparency of businesses is influenced by several disclosure standards. At the centre of disclosure policy in the EU is the upcoming Corporate Sustainability Reporting Directive (CSRD). At the same time, frameworks including the Taskforce on Climate-related Financial Disclosures (TCFD), and the International Sustainability Standards Board (ISSB) which is currently under development, continue to influence

corporate transparency on sustainability.

By ensuring greater consistency and comparability between the information which businesses are disclosing, there is potential to better utilise digital technologies to analyse the data. This in turn helps support stakeholders in drawing more accurate comparisons between entities (whether companies, investors, cities etc.) disclosing information regarding sustainability. The digitalisation of sustainability data in turn supports optimisation through data-driven decision making, leading to outcomes such as emissions reductions and more efficient material use.

On a more granular level, one of the most pressing areas of sustainability standards to be developed relates to information on emissions. Some of the most commonly used guidance adopted by businesses globally at present include the Greenhouse Gas Protocol, the Science Based Targets initiative and the ISO standards. The lack of harmonisation on standards relating to emissions not only creates complexities for businesses, but can also lead to unintended outcomes. In some cases, requirements for calculating emissions have been designed for one industry and then applied to another. This can hinder companies from accelerating the green transition, and can even be counterproductive by incentivising the wrong outcomes. As with sustainability standards more broadly, harmonisation and reduced duplication of standards relating to emissions will enable greater levels of comparability and digitalisation of data, thereby supporting the digitally enabled green transition.

b) Product standards

Standards for reporting sustainability information are required not only at a company and entity level, but also at a product level. Product-level disclosure looks at the environmental footprint of a given product which serves as a way of supporting greener decision-making with stakeholders. Addressing the issue of the environmental footprint of products is already a priority for the European Commission, most recently addressed by the Sustainable Products Initiative proposal[20] – released as part of the Circular Economy Package I – which proposes the introduction of a Digital Product Passport, and through planned changes to the EU Ecolabel.[21] When it comes to applying digital technologies to capture the environmental footprint of products, it is important to ensure comparability and to avoid differences in how the environmental footprint of products is measured. Greater levels of comparability between products and regions can be supported by ensuring that the measurements adhere to existing standards.

c) Standards for measuring the carbon footprint of digital technologies

To support the twin transition, we need to address not only the role of digital technologies in fuelling sustainability goals, but also the importance of ensuring that digital technologies are themselves energy and resource efficient. Standards to measure the environmental impact of digital technologies include measuring the impact of particular products. Consumers and customers have expressed a clear desire for information about the environmental footprint of digital products. This means there are benefits to be gained from expanding robust and clear measurement to inform both suppliers as well as consumers and customers regarding the environmental credentials of products placed on the market. A leading example of this is the Eco Rating Initiative methodology in the telecoms sector. As detailed in the use case below, and in the annex to this paper, the Eco Rating Initiative supports consumers and customers when deciding between mobile phone models by rating them on the basis of environmental issues such as durability, repairability and resource efficiency. This, in turn, also helps to incentivise producers to step up their sustainability efforts.

In addition, the green transition would benefit from more specialised standards in certain areas. For example, standards could help to define 'green coding', 'sustainable AI', as well as the carbon footprint of different softwares. Green coding refers to coding principles which ensure that the lowest number of processor instructions and as little memory space as possible are used in order to reduce the energy and material consumption of coding (and therefore the emissions associated with it). Tools are needed to help software developers make trade-offs between performance, energy efficiency and speed to market to better accelerate green-by-design in software. Likewise, sustainable AI refers to implementing green practices and creating impact throughout the AI lifecycle. More specifically, this means looking into measuring and reporting the impact of AI on sustainability and subsequently reducing the energy required for developing and deploying AI solutions. This necessitates careful balancing between model accuracy, fairness and sustainability. Standards

20 European Commission, Initiative available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en

21 Ibid.

could support both software and AI developers in doing this.

d) Standards for measuring the emissions avoided by digital technologies

In addition to addressing the carbon footprint of digital technologies, standards can help us to measure the enabling role of ICT on green ambitions. Digital technologies play a significant role in helping to reduce emissions, and numerous frameworks are under development to help us quantify this. For example, the International Telecommunication Union (ITU) is developing a methodology to measure the enablement effect of telecommunication networks, whilst the work of the European Green Digital Coalition (EGDC) is looking at standards alongside the Commission to measure the impact of digital solutions both in terms of abatement and own impact.

Smart grids

Finally, it would be remiss to discuss standards in the current political climate without noting the role of standardisation in supporting the energy transition. In particular, greater levels of standardisation will be required in the development of smart grids as part of the energy transition. Standards are needed to cover the communication needs of grid management, balancing and interfacing with new renewable energy sources, as well as for the complex interactions of the new distributed energy market. This standardisation should build on ongoing discussions such as on network codes. Standardisation efforts for smart grids will also be crucial for improving the grids' potential to effectively handle more renewable energy sources, as well as the transition to electric vehicles, and the integration of smart homes and buildings.

Cross-Industry Transparency on Greenhouse Gas Emissions

The World Business Council for Sustainable Development (WBCSD) is moving towards enabling confidential and secure exchange of granular, primary and verified product emissions data across organisations. An exchange of standardised data was realised by BASF, ENGIE, Solvay, SAP, Shell, Nestlé, Unilever and other WBCSD members using several interoperable technology solutions in the Pathfinder Network, providing an open, decentralised network infrastructure.

Open-es: An Open Community for the SDGs

Open-es is an alliance open to all industries committed to the sustainable development path, which offers a unique and free of charge one-stop comprehensive platform for stakeholders' engagement, measurement, collaboration and monitoring with reference to ESG performance and improvements.

Eco Rating initiative

The Eco Rating scheme evaluates the environmental performance of mobile phones across the entire life cycle. The initiative has been driven by a consortium of five European mobile operators: Deutsche Telekom, Orange, Telefónica, Telia Company and Vodafone. Launched in May 2021, the scheme supports consumers to make responsible purchasing decisions based on transparency sustainability criteria when buying mobile handsets.

Lack of acknowledgment of digital technologies in the sustainable finance taxonomy

A core area of EU leadership globally has been the establishment of a sustainable finance taxonomy. In order to tackle the risk of greenwashing, the taxonomy provides consistent definitions of which economic activities can be classified as sustainable and therefore aligned with the objectives of investors committed to sustainable investment strategies. It is one of the main levers for supporting investment into green activities and is complementary to various pieces of legislation such as the upcoming Corporate Sustainability Reporting Directive. However, since the Taxonomy Regulation[22] agreed in 2020 does not fully capture the role of digital in the green transition, it does not make its fullest possible

22 European Commission, Regulation available here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852

impact in redirecting capital towards sustainable activities.

Currently, there is only one section dedicated to digital as an enabler for greenhouse gas emission reductions,[23] with no potential, for example, to include the full impact of software and network connectivity as an enabling business activity. Thus, only a minor share of revenue, capex and opex of these technologies can be reported under the EU taxonomy's current framework. The existing text on ICT and digital technologies in the Annex to the Climate Delegated Act is currently overly basic and largely unclear, creating a significant degree of legal uncertainty within the digital sector regarding which economic activities are taxonomy eligible and, in particular, around the inclusion of telecom networks. The technical screening criteria are extremely strict, and thereby fail to recognise the value of digital in enabling climate change mitigation.

Indeed, the lack of acknowledgement of the role of digital in supporting the achievement of green goals is a permeating theme throughout the development of the EU's sustainable finance taxonomy. This includes at the level of the Taxonomy Regulation itself, but also as we look to future iterations and expansion of the taxonomy. Most recently, for example, the Platform on Sustainable Finance has decided to address in a separate taskforce the role of enabling digital technologies for the environment objectives; these activities were therefore not included in the Platform's final report[24] which was released at the end of March 2022. It is crucial that the taskforce on enabling technologies fully grasps the potential of digital technologies for the environment, by setting relevant criteria, such as avoiding a comparative and best in class approach that has proved to be very limitative under the Climate Delegated Act.

Robust cybersecurity

A key recurring theme in this paper relates to the importance of collaboration of market players in order to ensure a digitally enabled green transition in Europe. In addition to the need to share data which is interoperable, this creates a clear requirement for robust cybersecurity. In this sense, cybersecurity is a pre-condition for the twin transition, and an issue which must continue to be engaged with by both businesses and policymakers. Indeed, cybersecurity will be important not only for sharing information between businesses and along value chains, but also as green technologies become increasingly smart and digitalised themselves. This is especially apparent in our energy system, where strong cybersecurity will be crucial for protecting critical energy infrastructure. It is therefore necessary that the importance of integrating security into future investment plans, particularly for cross-company data platforms and within our energy system, is accounted for in the European policy environment. This will help to support the secure and resilient data-driven infrastructure needed for the green transition.

A skilled workforce

It is evident that there currently exists a skills gap to support the twin transition. We have plenty of individuals with advanced digital skills, and many people are developing strong environmental and green expertise. But there are few individuals who are able to bridge this skills gap and demonstrate expertise in both areas. One example of a prominent skills gap centres around green software design, with the Green Software Foundation working to plug this gap. Likewise, the increasing availability of relevant courses at European academic institutions and professional development programmes is welcome, but there are few examples of programmes which address the two issues in parallel, meaning policy and business processes risk continuing to develop in siloes.

Leonardo Labs

Leonardo has enhanced its innovation leadership with the Leonardo Labs,[25] technology incubators to drive long-term R&D and channel investment in cutting-edge technologies: the digital aspects necessary for the twin transition (AI, HPC, Quantum computing, coding) as well as other fields such as new materials and electrification. The Labs feed a continuous flow of talent, skills and competencies, by investing in the professional development of young researchers, as well as promoting a wide innovation ecosystem made of academia and industrial partners. To accelerate Labs' activities Leonardo leverages its own HPC davinci-1.[26]

23 European Commission, Regulation available here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R2139

24 European Commission, Report available here: https://ec.europa.eu/info/files/220330-sustainable-finance-platform-finance-report-remaining-environmental-objectives-taxonomy_en

25 More information is available here: https://www.leonardo.com/en/innovation-technology/leonardo-labs

26 More information available here: https://www.leonardo.com/en/innovation-technology/davinci-1

3. EU action plan for the twin transition

The use cases in this paper have demonstrated that industry and policymakers cannot operate in isolation: there are powerful positive feedback loops between infrastructure, the adoption of technology at the organisational level, and a supportive policy framework. This is reflected in the actions to which ERT Member companies are committing and in the recommendations to the EU institutions below. Together these can provide a powerful accelerant to Europe's twin transitions in the coming decades.

The urgency of action on the green transition, and the transformational contribution of digital technologies, calls for a more ambitious EU action plan for the twin transition, representing a partnership between the private and public sectors that can provide certainty for the long-term.

The conclusion of ERT is that this action plan should comprise 6 core steps to be taken by the EU, paired with 8 initial commitments from the industry.

i) Data-driven collaboration in business networks should be further encouraged through research and innovation spending, by facilitating cross-industry platforms, and by ensuring that data is findable, accessible, interoperable and reusable.

- EU R&I programmes should be leveraged to foster the creation of business networks for cross company collaboration on sustainability in strategic industries and within supply chains.
- A cross-industry platform should be established, facilitating the creation of shared models, principles, interoperability, and access to information that are key for the expansion of business networks. This platform should borrow learnings from successful examples like the WBCSD Pathfinder initiative, Catena-X and the IDunion network, and should be understood as the horizontal backbone to the growth of vertical sectors and ecosystems in the form of business networks. Core principles that should be reflected are maintenance of data sovereignty, inclusion of smaller players, common data formats, and technology neutrality.
- The European Commission should drive the development of the Common European Data Spaces for the Green Deal and for Energy in close cooperation with industry.

ERT Member companies commit to function as an incubator for the expansion of business networks, particularly by defining the priority ecosystems and by thinking beyond existing frameworks to make business networks more inclusive.

ii) The use of digital twins should be extended, including by the establishment of an industrial platform to prove and promote the concept of using them to drive environmental benefits within and between companies, and by public authorities.

- A digital twin industrial platform should be established to prove the concept and value of cross-sector and regional integration of digital twins. The platform can serve as a micro-site for driving innovation and pushing digital twins to their fullest potential, and be used to test ways to address present challenges with integrating digital twins such as with data sharing.
- Digital twin technology should be utilised in public procurement, for example through guidance on innovation procurement and application of the Most Economically Advantageous Tender (MEAT) principle.

ERT Member companies will increase the use of digital twin technologies for their products and operations and foster cooperation between businesses to drive its adoption across ecosystems.

iii) The development of harmonised standards should be fostered to enable a radical increase in the use of the technologies identified in this paper, streamline reporting requirements, and enable the measurement of 'greening of' and 'greening by' digital technologies.

- The standardisation of existing measurements and metrics of the environmental footprint of products should be facilitated. This can be achieved by providing a common set of rules and guidance that can translate across industries and be applied across different products. A high level of interoperability will simplify data exchange and comparison of environmental performance with digital technologies harnessed to capture this data, but should allow for industry specific adaptations to ensure the most relevant/suitable information is being captured and integrated along the supply chain.
- The development of standards to measure the environmental impact of digital technologies should be supported. This should include both the emissions avoided by utilising digital technologies (the enablement effect) as well as addressing the environmental impact of digital technologies themselves.
- A greater level of harmonisation should be ensured within sustainability disclosure standards. In terms of reporting standards, European Institutions should align with the equivalent international standards which are currently under development in order to seek harmonisation. A harmonised approach to sustainability reporting should be supported across the EU that is also consistent globally, based on international standards and industry-driven approaches. In particular, the work of the IFRS' ISSB should be recognised and incorporated by EU institutions when updating existing disclosure requirements.
- When it comes to the circular economy, the Commission should ensure that the Circular Economy Business Hub[27] provides a channel to integrate businesses into the existing process of harmonising and expanding standards and criteria for products. In this area, it is key that the Commission takes note and input of existing best practice developed by business and builds off and not away from what already exists.
- The power of data for managing the energy grid more efficiently should also serve as a prompt for reviewing the regime for customer consent to share consumption data, where this could drive significant advances in the move to electrification and distributed generation.

ERT Member companies will contribute to shaping sustainability standards and will integrate them into our corporate objectives and the ones of our affiliates globally.

Companies led by Members of ERT will gather and publish data, where available, on the carbon impact of our products along the entire supply chain.

They will quantify and report on the reduced environmental impact of digital solutions when standards are available.

27 European Commission, Communication available here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0140&qid=1649112555090.

The Proposal for Ecodesign for Sustainable Products Regulation allocates budget for a European circular business hub that will *"support the uptake of circular business models, channel information and services including awareness raising, cooperation, training and exchanges of best practices. It will build upon the expertise and service offer of existing EU actions, notably the European Circular Economy Stakeholder Platform, Enterprise Europe Network Sustainability Advisors and the network of European green tech clusters."*

iv) The EU sustainable finance taxonomy should be revised to fully recognise the role of digital technologies alongside fostering digital technologies in public procurement for decarbonisation.

- The Commission should provide clarity within the EU Taxonomy Regulation on the role of digital technologies to drive and enable the green transition. In the short term, the role of digital in accelerating progress towards the four remaining environmental objectives should be given prominence in the upcoming Delegated Act before the end of 2022.
- In the longer term, an improved definition should be provided in subsequent developments of the EU taxonomy which broaden the scope of possible "Data driven solutions enabling GHG emission reductions" that can be considered for inclusion, alongside simplified technical screening criteria.
- Best practices from the twin transition should be integrated into public procurement processes. This includes in ICT infrastructure procurement where all public ICT infrastructure – national or EU – should rely on green energy and be material efficient. Likewise, the environmental characteristics of devices should be prioritised in procurement decisions, whilst devices should be disposed of in a sustainable manner at the end of their lifecycle.
- EU funding decisions should be made in such a way to support the twin transition. For example, the European Commission should assess applications for EU funding in terms of which projects will support 'greening of' and 'greening by' digital innovations. This would contribute to breaking down historic silos between green and digital, and promote the application of digital technologies to increasing environmental sustainability. Likewise, in light of the ongoing energy crisis, investment in connected charging infrastructure and smart energy grids should also be encouraged to a greater extent. Given the electrification transformation, having the right charging infrastructure, expanded and digitalised efficient grids, digital solutions and enabling legal framework to secure dynamic availability of green energy at the right time and place will be crucial.

ERT Member companies will provide use cases and metrics, inter alia within the European Green Digital Coalition, to prove the impact of digital technology on the green transition, which in turn should facilitate its inclusion in the EU sustainable finance taxonomy regime.

v) Further support for the development of ICT as well as (other) critical infrastructure should be created, especially relating to the expansion of 5G, high-performance computing, support for robust cybersecurity, smart energy grids and the mobility sector

- Relating to 5G infrastructure, investment in the rollout of 5G networks should be expanded and joint usage of infrastructure and other forms of resource sharing – based on commercial agreements – supported. It is essential to set the conditions and the appropriate regulatory frameworks to accelerate 5G networks' rollout, both at national level and through private networks, and ensure legal certainty to incentivise investments. The extension of high capacity, resilient networks is a prerequisite to enable the development of new digital solutions for environmental sustainability.
- Meanwhile, access to high-performance computing has also to be expanded. The European Commission and the Member States should build on the progress made by the EuroHPC Joint Undertaking[28] and seek to broaden the availability of high-performance computing to European SMEs through the creation of a public-private platform. The platform should be premised on ensuring that green objectives are met at the same time.
- A voluntary guiding document for ICT industry, certifiers, and auditors should be created in order to help with the third-party verification of the implementation of the EU Code of Conduct for Energy Efficiency in Data Centres. When it comes to measurement and publishing of data in the Energy Efficiency Directive, careful consideration should be made when it comes to which type of data should be requested, as there is a risk some is either impossible to collect or commercially sensitive.
- The EU Member States and European Commission should support efforts for a coordinated European response to cyber threats, including through enhanced public-private cooperation. This should involve the swift establishment and effective operation of the Joint Cyber Unit and the European Cybersecurity Competence Centre's 'Cybersecurity Competence Community'.[29] The Community is a crucial element in enhancing, sharing and disseminating industry expertise in cybersecurity towards the shared goals of increasing Europe's cybersecurity capacity, resilience and ecosystem.

ERT Member companies will mirror the commitment of EU institutions and national governments to start prioritising environmental sustainability in ICT procurement.

We will also continue to invest in cybersecurity, collaborate with other companies to increase cybersecurity standards across supply chains and engage in public-private partnerships to analyse new cybersecurity threats and develop common mitigation strategies.

28 EuroHPC Joint Undertaking, available here: https://eurohpc-ju.europa.eu/.

29 European Cybersecurity Competence Centre and Network, available here: European Cybersecurity Competence Centre and Network (europa.eu).

vi) A more integrated approach to education and training is essential to break down the silos between 'green' and 'digital' career paths, including by creating academic programmes which develop both skill sets simultaneously.

- EU Member States should develop academic programmes, including integrated curricula and Technical Vocational, Education and Training (TVET) to support the development of individuals with combined digital and green skills. These programmes will help to support a mindset shift within businesses, to enable green and digital issues to be integrated into decision making, and to help bridge the gap between the two skills sets. This should apply at both an early stage in education as well as in upskilling the existing European workforce.

ERT Member companies will continue building relevant digital green skills, for example by partnering with other companies, universities and research institutes. We will foster the mindset shift, organisational structure and culture for all sustainable behaviour in the workforce, and greater understanding of the role of digital technologies to enable this. ERT Member companies will continue to support reskilling Europe's workforce through ERT's Reskilling 4 Employment[30] initiative. We will raise awareness of the importance of green coding among staff and suppliers.

Across the EU action plan for the twin transition, ERT Member companies will share learnings and best practice from current industry models to contribute towards the recommendations above.

30 More information available here: https://reskilling4employment.eu/en/

Annex

Catena-X

Catena-X aims at connecting companies across industries. An end-to-end data networking from small and medium-sized enterprises to OEMs will help to make important progress in the sustainability of automotive products and the resilience of supply chains. In this form, Catena-X is the first integrated, collaborative, open data ecosystem for the automotive industry of the future. It connects all players to end-to-end value chains – easier, more secure, and more independent than ever before. Catena-X is an open approach and provides the opportunity for other industries and ecosystems to be integrated. The pioneers of Catena-X are developing the technology for the open, cross-company system today. The claim is data sovereignty. Whoever makes data available retains control and decides individually who is involved in the data exchange, how, when, and where. Use cases for digital, end-to-end supply chains with secure, sovereign, and standardised data exchange are possible and will be implemented. Catena-X establishes a global network for the automotive industry based on European values. It secures new business opportunities and profitability for everyone – from SMEs to corporations. As a nucleus in the heart of Europe for a new, consistently joint activity, it enables the automotive industry to master global challenges and crises. Declared objectives are the climate-friendly and sustainable production and utilisation along the automotive value chain.

The following use cases are planned as part of the implementation of the Catena-X Automotive Network:

- Traceability of hardware and software components (compliance with supply chain law à "Lieferkettengesetz")
- Sustainability (proof of CO_2 footprint, compliance with social standards)
- Circular economy (enabler for re-use and recycle)
- Quality management (real time & collaborative quality management)
- Demand and capacity management (security of supply)
- Business partner database (master data service)
- Data and model-centric development and operations support (Digital Twin)
- Modular production (shared service)
- Manufacturing as a Service (Shared Service)
- Real-time control and simulation (Shared Service)

From a German and European perspective, Gaia-X is a prerequisite and enabler for the simple, efficient, sovereign and secure exchange of data and information in the automotive data economy. Thus, the Alliance will rely on Gaia-X, and depends in part on Gaia-X for its success.

European Green Digital Coalition

The European Green Digital Coalition is a group of companies committed to supporting the Green and Digital Transformation of the EU. The European Green Digital Coalition (EGDC) was formed by 26 CEOs of ICT companies who signed a Declaration to support the Green and Digital Transformation of the EU in 2021. They commit – among other things – to invest in the development and deployment of green digital solutions and to become climate neutral or net-zero no later than 2040. The main aim of the EGDC is to maximise the sustainability benefits of digitalisation. There is a need to define science-based methods to estimate the reduction and avoidance of greenhouse gas (GHG) emissions by specific ICT solutions in different sectors. The EGDC seeks to establish a more harmonised approach to calculate this Enablement Factor.

Eco Rating

Eco Rating was initially launched in June 2021 by Deutsche Telekom, Orange, Telefónica, Telia Company and Vodafone. It provides information on the environmental impact of producing, using, transporting, and disposing of smartphones and feature phones. The five original operators behind the initiative were joined by Proximus as they expanded their agreement to encourage operators worldwide to participate.

Using information provided by device manufacturers, each mobile phone handset is thoroughly assessed and given an overall Eco Rating score out of a maximum of 100 to signal the environmental performance of the device across its entire life cycle. Eco Rating applies a consistent evaluation methodology across 19 different criteria to highlight five key aspects of mobile device sustainability: durability, repairability, recyclability, climate efficiency and resource efficiency.

Eco Rating has three main goals: Firstly, to address the increasing consumer demand for environmental information about mobile devices, secondly, to raise awareness and transparency by creating a consistent way for consumers to identify and compare the most sustainable options, and lastly, to encourage and incentivise suppliers to reduce the environmental impact of their devices.

Today Eco Rating is available in around 28 countries and more than 200 phones by 16 vendors have been assessed.

Cross-industry Transparency on Greenhouse Gas Emissions

Taking climate action has moved to the top of the business agenda. Various industries react by setting strong self-imposed emission targets. However, there is no overarching infrastructure available to connect these individual efforts across the whole value chain and support the Greenhouse Gas Protocol (GHG) Scope 3 targets, i.e. calculation of CO_2 emission based on upstream supply chain data. Today, many enterprises develop dedicated solutions for their supply chains. Nevertheless, an interoperable and vendor-neutral approach to include the needed standards is currently missing.

Therefore, SAP and the World Business Council for Sustainable Development (WBCSD) are moving towards the confidential, trustful and secure exchange of granular, primary and verified product emissions data across organisations by testing the enablement of the global economy to share carbon footprints along global supply chains and across industries using such an interoperable, vendor-neutral data-sharing infrastructure – the Pathfinder Network. With the intention to create trust, this approach will enable businesses to have real insight into Supply Chain Carbon emissions and can empower citizens and businesses to make more responsible and sustainable decisions. Collaboration and Partnership in the Business Network on sustainability topics will allow participants to achieve their goals, and jointly make a positive impact on the environment. Therefore, this key is relevant to the digitally enabled green transition.

Together with other WBCSD members, they are developing the Pathfinder as an interoperable network allowing different technology solutions to connect and support peer-to-peer data exchange across value chains and industries to enable Scope 3 transparency.

IDunion

Sharing infrastructures that have built-in technology to enable verification and confidentiality-protection of shared data are emerging. One such infrastructure has been launched by IDunion, a European Cooperative Society (Societas Cooperative Europaea, S.C.E.).

IDunion enables sharing of third-party certified verifiable information, which is already applied to the exchange of product carbon footprint. This sharing approach can also be applied to other ESG data which are relevant to managing sustainability in the supply chain, especially because all kinds of environmental and social standards require certification. The technology of IDunion supports not only the digital exchange but also the revocation of certificates in case of incidents, so that the whole upstream chain is informed immediately.

The IDunion infrastructure provides the public identity information of participating supply chain entities needed to verify certificates' origin. The non-profit utility, open for organisations to participate, was initiated by companies like Bosch, Deutsche Bahn and Siemens.

The infrastructure is designed on the principles of data sovereignty, decentralised trust, privacy, and business confidentiality. No personal or confidential data is stored on the network itself – not even in the form of an integrity value. In order to protect privacy and confidentiality, data is stored on user's end devices or in the respective trust domains of the participating organisations. The communication takes place via encrypted end-to-end channels between individual participants.

Anyone can develop applications based on the IDunion network. The decentralised infrastructure ensures that there is no centralised revenue extraction as well as data and governance control. The nodes of the network, which are operated by different partners, are not only geographically distributed, but are also operated in different trust domains. This redundancy offers a high degree of availability and resiliency.

EU Digital Passport

To achieve a circular economy, the first digital hurdle to overcome is to provide sufficient transparency through trustworthy, verifiable information about the product, including provenance of the materials and recycling opportunities. The tool to achieve this is the Digital Product Passport (DPP). The product passport is considered for the first time in the new EU 'Battery

Regulation', expected to come into force from January 2026. It will cover all batteries with internal storage >2 kWh, and there is therefore a concrete need for action to design and implement a solution. That is why it was chosen to be the first use case for material passports in Catena-X. The idea is to create an electronic information exchange system for batteries. The information should be available through interoperable and easily accessible data services. The technical solution should provide full data sovereignty by decentralised data storage. The rules for data access are commonly determined for the ecosystem. The data should be verifiable by decentralised identity. The data quality should be ensured by audits. For the implementation of a product passport, the cooperation of the economic actors in the entire supply chain is necessary, therefore Catena-X is a great matrix for such an application.

DPPs will be the basis for new digital business models which will create additional value and incentivise all members of the ecosystem.

Air Liquide: Smart Innovative Operations (SIO)

Air Liquide's Smart Innovative Operations (SIO) is a worldwide programme which leverages data & digital technologies to improve the operations performance of Air Liquide facilities producing oxygen, nitrogen or hydrogen. Digital technologies such as predictive analytics and digital twins are used in remote SIO Optimisation Centres to improve the availability and efficiency of these facilities. Improving the availability of facilities avoids unproductive energy consumption and contributes together with the efficiency improvement to the carbon emissions reduction of the Air Liquide facilities. As such, SIO demonstrates that digital can enable the green transition.

SIO is addressing Air Liquide facilities and is a stepping stone for business networks leveraging digital twins with optimisations scope extended to external stakeholders.

Airbus: Destination Earth initiative

Destination Earth is the European Commission's flagship initiative that will consist of a cross-disciplinary collaboration between scientists, industry, European and national institutions, with the aim to develop a digital replica of the complex Earth system. This initiative exemplifies how the green transition can be digitally enabled. As an ambition, Destination Earth calls for succeeding with so-called lighthouse projects, smaller digital twins, that can demonstrate short-term results as well as long term benefit. The first digital twins use cases will be dealing with Extreme Natural Disasters and Climate Change Adaptation. These should not only consist of research projects, operational results can already be yielded based on existing technologies. Based on its combined satellite manufacturing capabilities, ensuring continuity as well as developing beyond the state of the art sensors, Airbus can equally contribute to a full Earth Observation portfolio ranging from the data required, to thematic services. Both are essential to support the development of a first global, very detailed model and representation of the Earth. In addition to the long term effort to fuel the expected predictive modelling capabilities foreseen by Destination Earth, Airbus equally underlines the importance of leveraging contributions from operational and vetted services that are already in place and used by numerous stakeholders; thus supporting the EC's Digital Twin vision with quick wins.

BASF: Digital Twin of Chemical Production SCOTT

Steering the reduction of greenhouse gas emissions towards net-zero requires gaining transparency with carbon footprints on product level (PCF). Consistent calculation standards and wide availability of primary PCF data along the value chain are essential preconditions to work towards that goal. With that purpose in mind, BASF has developed (a) a prescriptive and robust PCF calculation methodology enabling a high degree of comparability of results across the chemical & process industry and (b) a highly efficient and automated digital solution to perform PCF determination at scale. Only if industries follow the same methodology, PCF values will be comparable. BASF believes that its digital solution and methodology can help industries to create a level playing field and substantially enhance the availability of primary PCF data.

Following a cradle-to-gate approach, BASF's solution enables the company not only to provide accurate and granular PCFs for its sales portfolio, but also creates unparalleled transparency in what is driving greenhouse emissions in its manufacturing footprint and raw material purchasing basket. TÜV Rheinland has certified that BASF's method to calculate PCF is in line with the relevant international standards. To foster the availability of consistent and comparable PCF data, BASF has decided to bring its digital solution into the market via an ecosystem of licensing partnerships with software houses, which – in turn – are now capable to implement it at multiple interested manufacturers.

BASF: Predictive Modelling and Supercomputing

This use case is the prediction of the biodegradability of polymers based on computer models.

The biodegradation process of polymers is complex and based on the interaction of biology and chemistry. Biodegradable polymers are completely metabolised by microbes into CO_2, energy, water and biomass. The fundamentals of the biodegradation process are similar, whereas the conditions in the relevant environments such as compost, soil, marine, limnic or wastewater treatment plants vary significantly. Besides habitat-specific test methods under laboratory and field conditions, BASF has developed digital tools to predict the biodegradation of polymers for a specific chemistry in a specific habitat.

The predictive model developed gives an immediate simulated biodegradation value dependent on specific chemistry and environmental factors. This can be used alongside practical test results generated by time- and resource-intensive test methods, which for a single measurement can take years and cost several thousands of Euros. Additionally, the model makes use of high-volume supercomputer calculations to enable predictions for more complex structures compared to currently available tools.

The benefit of the predictive model is a reduction in the number of structures which are synthesized to identify lead candidates, combined with an accelerated development time for new biodegradable polymers for different end-of-life options. In addition, it enables a deeper understanding of the factors influencing biodegradability of polymers, advancing the development of biodegradable products enabling circular use of natural resources. It further allows the simulation of biodegradation and therefore has the potential to be used as a supportive tool for the registration of polymers (e.g. for substance information requirements).

Deutsche Telekom: Circular Economy

Deutsche Telekom has committed to striving for full circularity of technologies and devices by 2030. This complements Deutsche Telekom's goal of becoming fully climate neutral by 2040 (including Scope 3 emissions) and at the same time supports its zero waste strategy. In particular, leasing, refurbishing and reusing existing equipment and devices not only makes sense from a purely economic perspective, but also significantly reduces the environmental impact in terms of manufacturing, raw material consumption and waste disposal. As roughly 50% of Deutsche Telekom's Scope 3 emissions are supply chain related, DT has amended its procurement policy to better assess, rate, and decide on circular aspects when making purchasing and design decisions and continue working with manufacturers and OEMs towards more circular products, packaging and offerings.

E.ON: Ecological Corridor Management

In order to ensure the safety of distribution grids (overhead power lines, mid and high voltage) e.g. in forest areas, the vegetation on the grid corridors must be maintained. Ecological Corridor Management (ECM) aims to minimise the impact of maintenance measures. For that purpose, ECM makes use of various digital solutions, e.g. satellite-based vegetation monitoring, AI for defect detection, drone inspection and digital data evaluation.

These measures go hand in hand with the restoration of vegetation.

Against the background of digitalisation opportunities a Group-wide blueprint was launched for the ecological corridor management of 110 kV power lines. This is accompanied by a partnership between E.ON and the United Nations Environment Programme (UNEP).

Following the successful implementation of ECM in several E.ON regions, an E.ON team is now working on consistent company-wide implementation of ECM and its further developments.

By the end of the decade, E.ON will create valuable biotopes on 70,000 hectares under 13,000 km of its overhead powerlines, thus making a significant contribution to climate and species protection.

E.ON: Klima Navi

With the climate navigator, E.ON can help municipalities step by step to reach their climate goal. Every municipality, every office and every district will find their own current CO_2-balance sheet broken down by different sectors such as stationary energy, agriculture or transport.

On this basis, the municipality can develop its individual climate protection concept.

E.ON accompanies the customer throughout the entire process: From the preparation of an initial climate protection report to the implementation and monitoring of the success of climate protection

measures. In a first step the current status quo will be analysed: How high are the CO_2-emissions in the considered municipality and what causes them? Do they arise? Then the municipality can set realistic targets for sectors such as mobility, heat generation, etc.

The climate navigator shows the municipality which climate protection measures the customer could implement in the sectors. They can continuously monitor each planned individual measure with regard to the desired effect and readjust it if necessary.

E.ON ectogrid™

E.ON ectogrid™ is a closed grid with low temperatures where heat pumps and cooling machines in every building adjust the temperature according to need. E.ON ectocloud™ is the digital platform that handles and controls the energy system E.ON ectogrid™. With the help of cloud computing, AI and IoT technology, proprietary E.ON ectocloud™ boosts performance over the entire grid. In this process, each building sends excess heating or cooling to other buildings, depending on their needs. Through sharing, balancing, and storing energy in rotation, E.ON ectogrid™ efficiently uses all available energy flows before adding new energy. This drastically reduces energy consumption – and in turn costs and environmental impact. Using unique technology built on harnessing the power of low temperatures, distributed heat pumps, intermittent renewable energy and storage, E.ON ectogrid™ is the solution that can help us reach zero emission levels – in a city block, surrounding area or even an entire city.

E.ON: Quantum Computing in the Energy Sector

The energy transition means a massive restructuring of the energy system, which is becoming more and more complex and decentralised as the number of players increases. Together with a strategic partner from the ICT sector E.ON is working on several approaches to find solutions for the current challenges of the energy transition.

Key goals of quantum computing at E.ON to accelerate sustainability include:

(1) Quantum Predictive Maintenance: Prompt identification of technical issues and their origin is vital to improve the availability and the efficiency of assets such as Combined Heat and Power Plants. Quantum computing is able to condense the information from several hundreds of sensors into a single maintenance measure based on a prompt root cause analysis of potential failures or identified anomalous behaviours, and the evaluation of their criticality.

(2) P2P Trading Optimisation: With the introduction of the Clean Energy Package to reach the renewable generation targets, the role of the prosumer has increased over the years, creating opportunities for new markets at the distribution system level. This workstream suggests a decentralised peer-to-peer energy trading optimisation model to coordinate the bids and asks of the market participants which leverages quantum computing for faster runtime.

ENGIE: Ellipse - Carbon Intelligence Platform

ENGIE Ellipse is an end-to-end software purpose-built to accelerate a business's decarbonisation journey by drawing together expertise in carbon accounting, energy and sustainability management, supplier management and scenario modelling. ENGIE Ellipse brings several highly differentiated capabilities, including:

(1) AI-driven, data-rich GHG baseline from multiple dynamic data streams helps identify Scope 1, 2 and 3 emissions. Businesses can use custom APIs to draw this information from energy use (e.g. billing), supply data (e.g. energy spot prices) and contract data (e.g. supplier contracts);

(2) Integrated project, goal and target tracking links project performance to expected outcomes. Organisations can combine detail on a project like electric vehicle adoption or switching to electric heating with climate data to clearly show progress towards science-based targets. They can then compare outcomes with similar projects in peer organisations;

(3) Engineering-grade scenario modelling informs carbon first decision-making. ENGIE Ellipse enables businesses to identify projects to prioritise or reassess their entire approach. This can include comparing ROI by combining the impact on CO_2e carbon footprint with the evolution of the energy market and multiple other cost and effort factors. For example, businesses can determine if long-term investments could give them an edge, like building on-site renewable energy generation.

Eni: Green Data Centre and Sustainability

Eni's Green Data Centre in Ferrera Erbognone, in the province of Pavia (Italy), houses Eni's central processing IT systems for both management IT and Oil & Gas applications. It houses HPC5, inaugurated on 6 February 2020, and its predecessor HPC4, installed in 2018. HPC5 is one of the most powerful

supercomputers in the world. The Green Data Centre is a leader in Europe in terms of efficiency and carbon footprint, as confirmed by the universally recognised Standard Data Centre efficiency indicator (Power Usage Effectiveness - PUE) of 1.166. By 2021, this translates into a lower energy consumption than the European average PUE of 15,380 MWh and an associated reduction in CO_2 emissions of 5,858 tonnes.

In 2021, the supercomputing system was again used for research on COVID-19, both as part of the European project EXSCALATE4CoV, an acronym for EXaSCale smArt pLatform Against paThogEns, to identify the safest and most promising drugs to combat Coronavirus, and in collaboration with Pavia Hospital to study the body's immune response to the base virus and its variants.

Eni: Open-es – An Open Community for the Sustainable Development Goals

To achieve the objectives of sustainable development, it is essential that all the players in the productive ecosystem, from small and medium-sized enterprises to large industrial groups, financial institutions and sector associations, work together. For this reason, at the beginning of 2021, an open industrial partnership started by Eni, BCG and Google Cloud gave rise to Open-es, a systemic initiative available and designed for all companies and industrial sectors, which responds with concrete tools to the need to measure, improve, and share ESG performances.

Through the digital platform, all companies can measure their sustainability performance according to standard metrics and share their ESG profile with their customers and/or financial institutions. They can compare themselves with industry benchmarks, access customised development plans to identify priority actions to be implemented, quickly and easily obtain an initial version of their sustainability report and identify services and solutions to improve their ESG performance.

This strategic alliance for ecosystem sustainability represents a unique one-stop comprehensive ESG solution for stakeholders' sustainable development and monitoring. More than 6,500 companies from 78 countries and 65 different sectors have joined this community.

Ericsson: 5G Enabling Smart Ports

Ericsson, TIM and other partners have worked together to use 5G at the Port of Livorno, which handles 780,000 containers per year. 5G networks and IoT solutions are optimising logistic loading/unloading operations. This means minimising idle times for ships and the transit time of goods, which in turn helps to cut down on emissions. These changes will ultimately empower the Port of Livorno to drive innovation and sustainability actions with 5G, resulting in an expected 8% CO_2e reduction in just one terminal. In Europe alone, around 74% of goods enter or leave by sea, and so a wider adoption of 5G smart ports would have a substantial environmental impact.

Ericsson: Sustainable Self-Driving Trucks With 5G

Ericsson, Einride and Telia are putting 5G into motion at a DB Schenker logistics facility in Jönköping, Sweden. The goal is to power an all-electric, autonomous transport ecosystem that takes fleet management to the next level.

Ericsson´s 5G solution is providing high performance connectivity to Einride's T-pod – a driverless vehicle operating continuously at DB Schenker's facilities in Jönköping. Going forward, 5G provides the connectivity and reliability to safely introduce the T-pod onto public roads, paving the way for a 90% reduction in CO_2 emissions and the elimination of nitrogen oxide (NOx) emissions.

There is a paradigm shift going on in the transport industry. 5G, with its high-data speeds and ultra-low latency, will power a new world of autonomous vehicles. The high-capacity and low-latency characteristics of 5G will be cornerstones of future transport solutions. Einride's T-pod and autonomous transport system, powered by 5G, can potentially replace more than 60% of today's transport with a cost-competitive and sustainable alternative.

5G presents an opportunity for telecom operators to tap into new revenue streams emerging from the digitalisation of industries. An Ericsson report on 5G business potential shows a USD 619 billion revenue opportunity for telecom operators by 2026.

Ericsson, Deutsche Telekom: Driving Sustainable 5G Radio Site Operations

A successful trial on German mobile network operator Deutsche Telekom's (DT) 5G-enabled network could pave the way for major advances in sustainable mobile site operations with renewable energy. The joint Ericsson and DT initiative has transformed a live radio site to efficiently harness solar and wind energy while optimising power supply and demand.

A major goal of the Ericsson-DT partnership is to identify and validate energy efficiency and energy

cost-cutting solutions based on optimised energy consumption and control and increased usage of renewable energy sources.

The site – in the Bavarian municipality of Dittenheim – has been part-powered by energy from solar panels since the initiative began more than a year ago. The site currently has 12 sqm of solar modules. Now, Ericsson and DT experts have added a wind turbine, providing up to five kilowatts of additional power, as a second renewable energy power source.

The simultaneous integration of the two renewable energy sources means the site can theoretically be operated on a stand-alone basis without utilising its cable connection to the electrical power grid. If weather conditions allow, the solution can make a major contribution to powering the site.

The next project phase will see the development of additional functions for the efficient use of generated energy and storage capacities. Soon, the integration of additional energy sources such as fuel cells will replace the need for diesel generators, which are currently kept in reserve for emergencies.

Holcim: CemQ: Data and Machine Learning to Optimise Cement Production

The quality and strength of cement are traditionally measured through physical testing that can take up to one month. To compensate for this, operations have traditionally used a higher amount of raw materials and additives to ensure a consistently high-performing product. Today, by using historic production data and machine learning, the future strength of cement can be forecasted during the production process itself. This means it is possible to adjust parameters to prevent over-processing and reduce overall energy consumption.

CemQ is a digital technology that allows Holcim to adjust its production parameters in real-time based on predictions, minimises fluctuations and stabilises product quality. But more importantly, it minimises the use of CO_2 emitting components and reduces energy consumption, leading to the reduction of overall CO_2 emissions. It is currently deployed in 25 plants and Holcim is targeting 60 plant deployments by mid-2023.

This digital solution demonstrates how, by using big data and machine learning in our operational processes, we can reduce energy intensity and CO_2 (among other benefits). By way of example, Holcim's Volos plant in Greece was able to save 8% CO_2 by using this technology.

Iberdrola: Energy Grid Optimisation

The energy transition is facing challenges including the intermittency of renewable sources and the increasing amount of distributed generation and consumption in the networks, which leads to unpredictable load flows and increased complexity.

Flexibility will be crucial for energy grid optimisation, and prosumers' participation together with digitalisation are key factors in increasing flexibility in the electric system.

BeFlex, a Horizon Europe project led by Iberdrola, aims to increase energy system flexibility, enhance cooperation among Distribution System Operators (DSOs) and Transmission System Operators (TSOs) and enable participation of all energy-related actors through the validation and large-scale demonstration of:

- Adapted and proven cross-sectoral services
- Interoperable platforms for smart grids operation and the creation of required system architecture framework
- Creation of new business models providing additional value to meet consumers' needs in compliance with a stable regulatory

BeFlex will provide a multi-stakeholder approach that covers the whole value chain of energy systems and cross-sector related services: DSOs, TSOs, aggregators, R&D centres and Universities, industrial suppliers for smart grids technology providers and ICT developers.

Iberdrola will lead a consortium of 24 companies (among them 1 TSO, 5 DSOs, 5 Industry, and 5 R&D/ Universities), including 4 large-scale demonstrations with 11 pilots in 4 different countries (Spain, Sweden, France and Italy), where Iberdrola will also lead the Spanish pilots.

Leonardo: Leonardo Labs

Leonardo created a network of corporate laboratories – so-called Leonardo Labs. These are technology incubators driving long-term R&D and channelling corporate investment in cutting edge technologies, especially in the digital field (AI, HPC, Quantum computing, coding), creating competencies that can be applied to different business sectors. The Labs feed a continuous flow of talent, skills and competencies, investing in professional development of young researchers, promoting a wide innovation ecosystem made of academia actors and industrial partners. Indeed,

key pillars in driving sustainability-tied innovation are the joint Labs established with other key actors such as Solvay (on New Materials) and the Istituto italiano di tecnologia (IIT) (on Robotics). Moreover, to accelerate the Labs' activities Leonardo made its own HPC davinci-1 available. Such a combination of skills and innovation infrastructure makes it possible to develop those digital technology tools needed to drive the green transition (e.g. digital twins).

Leonardo: Cybersecurity Academy

Leonardo's Cyber & Security Academy enables institutions, companies and organisations responsible for critical infrastructure to train and certify their teams on security issues, at technological, regulatory, methodological and process levels. This provides the tools to promote a secure digital transition and contribute to the wider spread of a culture of security. The Academy is an advanced training centre that benefits from the experience gained by Leonardo in the physical and cyber protection of critical infrastructure in more than 150 countries worldwide and from continuous management of cyber threats in various strategic fields.

Immersive, modular training courses, adapted to operational needs, enable students to consolidate theoretical and practical skills in prevention, detection and management of cyber-physical security incidents already acquired through university courses, post-graduate Masters qualifications and specialised certifications. This is an approach that combines technological expertise with the enhancement of the 'human factor', which is crucial to increasing risk awareness: recognising the correct information and sharing it with all parties involved allows conflicts to be resolved more quickly.

Considering the twin transition, the Cyber & Security Academy is a key asset in creating those skills and competencies needed to safeguard the security and the resilience of infrastructure, a key element when considering – for example – the risks tied to the digital dimension of our energy grids.

Leonardo: Digital Twin of Helicopter

Digital twin-based simulators are adopted in Leonardo Helicopters Division to support specific certification activities, curtailing flight testing and therefore GHG emissions. The goal is to enlarge their role since they are efficient and powerful tools to evaluate failure cases which sometimes cannot even be achieved in flight tests. Simulators must be adequately representative of aircraft systems and flight dynamics – if so, they create strong benefits through: a) reduction of flight testing (20% estimated as a first step) and b) reduction in risks, costs, as well as on noise and CO_2 emission, a key driver in a hard to abate sector like aviation.

Leonardo: Virtual Training for Aircraft and Helicopters

Leonardo has developed an innovative training system that allows the substitution of around 50% to 60% of military pilot flight training hours. In the following years, it expects to accomplish 70% of fidelity. The technology behind those simulators includes a Live, Virtual and Constructive Simulation (LVC). Those technologies permit that simulators in the ground interact with the pilots in the air, during the same training missions, through augmented reality applications. Therefore, this complex technology creates a safety scenario avoiding accidents by aircraft collisions. Also, it improves the efficiency of the training, giving pilots the possibility to simulate situations that would be too costly or risky to simulate in reality. The International Flight Training school is a collaboration between Leonardo and the Italian Air force that has reduced actual flight hours through full mission simulators, providing 26,000 hours of virtual training and avoiding around 116,000 tonnes of CO_2 emissions since 2018. Those emissions are equivalent to the carbon sequestered annually by 817 acres of forest preserved by deforestation. The potential environmental emissions saved by digital reality technologies in the sector could be significant when we consider continuous pilot training requirements and a large amount of GHG emissions coming from this sector.

Leonardo: Digital Twin Earth

Digital twins are key enablers for a green transition, a feature that has still to be recognised by EU institutions. Facilitating the creation of standards, establishing cross-industry platforms, fostering dedicated public procurement, and exploring the establishment of a digital twin industrial cluster may accelerate the impact of this technology on the EU twin transition. Telespazio takes part in the Digital Twin Earth project thanks to its British branch Telespazio UK, who recently signed an agreement with ESA for the development of a Digital Twin Earth Precursor (DTEP), a technological demonstrator capable of increasing the comprehension of the local impact of the global-scale climate change. The solution to be devised by Telespazio UK will, for instance, measure the ground humidity and drought parameters impacting agriculture in Africa. The innovative Climate Explorer proposed by the Telespazio UK

team will use advanced Earth System Models, processed using High Performance Computing infrastructure and state-of-the-art data assimilation techniques with satellite Earth Observation (EO) data. Optimised model simulation outputs will be delivered via Machine Learning emulation to the end user through a cloud-based Interactive Data Portal.

Leonardo: IT and Computing Power

Leonardo leverages its sustainable path on its digital and data processing capabilities. As those are key elements in implementing a data driven sustainability and green transition, the company developed dedicated ESG KPIs on computing power and storage capacity. The KPIs are key in measuring the progress towards the tied Group sustainability targets: 1) increasing computing power by 40% per capita (by 2025) and 2) increasing storage capacity by 40% per capita (by 2025), both calculated as the number of flops (Floating Point Operations Per Second) and bytes in relation to employees in Italy.

Michelin: Decarbonised Mobility

The decarbonisation of transport, the second largest CO_2 emitter in Europe, will be possible only if users find a global economic balance in this transition. The additional economic cost of moving to zero-emission mobility is a reality of today and tomorrow. In that respect, Watèa develops vertical field services for professionals which allow them to save time by optimising delivery tours, avoiding theft, and notably easing access to parking facilities in urban areas. Most of these services require the implementation of telematics which collect data, but also data-sharing between stakeholders and go-through digital applications for the driver or fleet manager. It is a concrete example of how digital tools and data analysis facilitate the adoption of more environmentally-friendly mobility. In this context, digital services will directly increase efficiency, and thus reduce the additional cost of switching to green mobility, and indirectly improve the working conditions of users.

Nokia: ICT Optimised Microgrids

Nokia and Austrian telecom operator A1 provide a private wireless network for Siemens' microgrid deployed at its Austrian headquarters in Vienna. Smartly managed renewables within a microgrid are making an impact on many industrial applications by offering energy cost savings and supplying energy security to industrial campuses. Despite their size, microgrids are complex systems with many elements which need reliable connectivity because they integrate distributed energy sources such as solar cells and battery storage. Voltage levels across the grid are in a constant state of flux with load balancing and optimisation between different sources and loads requiring direct control.

Thanks to the Siemens microgrid controller, the photovoltaic power generation, the e-charging infrastructure, the battery storage and the private wireless network supplied by Nokia with A1, the Siemens Campus Microgrid has reduced carbon emissions by approximately 100 tons per year – while also reducing peak electricity usage.

Nokia: IoT Solutions for Wind Farms

Wind is essential to a carbon-neutral energy supply. Located in remote and often harsh environments, wind farms pose unique challenges to communications systems. Private Long-term Evolution (LTE) networks allow for a comprehensive IoT system, connecting teams both onshore and offshore with data reported from sensors installed in the wind turbine, including temperature, vibrations, humidity and current. This data is absolutely essential to monitor the wind turbine to prevent damage and to schedule preventive maintenance. Without an IoT network, monitoring the condition of these turbines is only possible through visual inspection.

In collaboration with nCentric, Nokia private LTE network solution has successfully been installed at several offshore wind farms enabling seamless communication between offshore platforms and teams on land. The ICT solution enables seamless communication and remote monitoring of the condition of wind turbines and as such contributes to carbon neutral energy supply. In situations where further visual inspection of the turbines is required, automated drones, connected over the private network, can fly over remote offshore locations that are otherwise unreachable or dangerous for workers.

Nokia: AI Optimises Power Savings for Mobile Networks

Mobile networks consume 2% of the world's electricity. AI can reduce CO_2 emissions and energy costs of mobile networks, with no negative impact on performance or end customer experience. Conventional energy-saving methods operate based on pre-defined static shutdown windows and are not able to handle complex savings scenarios. AI predicts low traffic periods and shuts down resources such as frequency carriers or even whole sites in case of overlapping coverage.

For instance, Nokia AVA AI energy management for mobile networks minimises energy waste for cooling (up to 70% less energy consumption for cooling) and other auxiliary components and the reduction of idle resources. AI-based solutions achieve two to five times more savings than non-AI systems that perform temporary shutdowns based on fixed schedules. Real-world experience shows that AI brings overall energy savings in networks from 7% to 30%. As a total-site, software-based solution, an AI system can be set up quickly to minimise all kinds of energy waste. It requires no large-scale deployments, network modernisation or architecture re-design, and has no hardware impact. Once the data pipeline is established and the system trained a bit, it acts as an overlay and uses available data to start saving energy right away.

Nokia: Digital Solutions for Increased Food Supply Productivity

Collaboration between Nokia and Vodafone Idea improves the livelihoods of 50,000 farmers in India through enhanced and sustainable agriculture practices. More than 400 sensors are deployed over 100,000 hectares of farmland including soil probes, weather stations, insect traps and crop cameras. Insights from the data improve soy and cotton crop yields, as well as reduce their impact on the environment (expected to yield water usage reduction of up to 40%).

Nokia partners with AeroFarms on connectivity, IoT and AI-enabled smart agriculture solutions to produce more food, more sustainably while using fewer resources. Cutting-edge networking, autonomous systems, and integrated machine vision and machine learning technologies are used to identify and track plant interactions at the most advanced levels. AeroFarms are global leaders in vertical farming with up to 390 times greater productivity per square foot annually, while using up to 95% less water and zero pesticides.

Another example is Nokia's dedicated 4G network with Virgin Media O2 to connect four 'factories of the future' of British Sugar. It allows automating the manufacturing process for sugar and other co-products. Part of this will be relying on AI to monitor operations in real time and predict maintenance and potential downtime in advance. This reduces disruption, cuts down on wastage and can deliver cost and energy savings – helping avoid unnecessary emissions.

Orange: Smart Energy (FLEXGRID)

FLEXGRID is a French regional programme for smart and optimised energy systems, based on a public-private partnership (involving local authorities, municipalities, and private companies). It aims to deploy, in the south-east French region 'Provence-Alpes-Côte d'Azur,' a set of Smart Grids equipment and technologies, making it possible to leverage data from smart energy networks in this region. This should enable many different local actors to provide new or better suited services (emergence of new economic models).

Orange, in partnership with ENGIE (French utility company for energy generation and distribution) provided a platform for energy data management. This platform enables local actors to monitor the electricity production and consumption rates in 5 territories (including some with a high presence of renewable energy and in particular, photovoltaic solar energy) and in the end, optimise or even control consumption in relation to production. Another key feature of this platform is to predict future needs, such as the demand for smart charging, based on the crossing of historical data and real-time data from network managers (ENEDIS, RTE) with meteorological information and charging station usage and connection data.

Philips: Decarbonising Healthcare With Digital Solutions

Healthcare systems account for over 4% of global CO_2 emissions and use 10% of all materials produced each year. Digitalisation offers tremendous opportunities to improve the delivery of care – from early detection and diagnosis to treatment and home care. It can expand access to quality care to underserved communities, while reducing the environmental footprint of the entire healthcare system. Examples of digital solutions include:

- Improved workflows and first-time right diagnosis – Philips Spectral CT 7500 demonstrates 34% reduction in time to diagnosis, 25% reduction in repeat scans and 30% reduction in follow-up scans. This helps hospitals to eliminate waste.

- Virtual care solutions – many hospitals visits can easily be done remotely and care can be shifted from resource-intensive clinical settings to networked, lower-cost settings and the home. Through adopting telehealth, a leading US customer was able to close 2 small clinics and reduce greenhouse gas emissions per given outpatient visit with 51%.

- Replacing specialised hardware-software features, enabling the use generic hardware (e.g. tablets), like Philips Lumify, that replaces the

need for an additional monitor, saving significant amounts of materials.

- Software improving utilisation rates of hardware – Philips PerformanceFlow helped 'Onze Lieve Vrouwe Gasthuis' (Dutch hospital) to reduce the use of 16 feeding pumps through monitoring real-time location and utilisation.

- Remote services – replacing onsite installations of Philips EMR TASY with remote services helped one customer in Brazil to reduce their CO_2 emissions by 15 tonnes, equivalent to driving one car around the whole world.

SAP: Product Footprint Management

SAP Product Footprint Management (PFM) focuses on product-centric and manufacturing companies and supports them with insight regarding the environmental impact of their products, for disclosure to business partners or for internal product and process optimisation, by minimising efforts with scalability, using real-time analytics, ensuring feedback integration for optimisation and creating a benefit from cross-network collaboration.

SAP PFM is relevant and necessary for the digitally-enabled green transition, because it allows companies to integrate their GHG emissions across the entire product lifecycle for clear carbon accounting and disclosures. CO_2 calculation happens bottom up and in real-time, while the analytics give actionable insights for product and process optimisation. Relevant information from the CO_2 calculation is returned to the respective end-to-end business process to ensure constant improvement. Alliances, partnerships and business networks allow collaboration and data exchange across the network.

SAP: Supply Chain Resilience

Modern supply chains face unprecedented challenges and are drawing an increased level of careful examination. Many regions are impacted by COVID and global political instability and have started to plan for recovery and look at supply chain reliability and risk. There is a clear trend towards more flexibility and multilevel sourcing guides in the era of resilient and sustainable supply chains. Resilient supply chains absorb uncertainty by staying flexible and changing to cope with the uncertainty by being adaptable. To achieve a resilient supply chain, organisations need to be more agile to sense, predict and respond to disruptions. Embracing advanced digitisation will lead to an increase in overall organisational productivity. Making use of Industry Business Networks (like Catena-X) to enable next-level collaboration with business partners improves the overall efficiency and connectivity between the supply chain members. This will help run more sustainable business practices by being more transparent on emission, circularity, and social responsibility topics.

Companies that have made their supply chain more resilient have also invested in making the supply chain more digitised. SAP solutions support the digital transformation of the supply chain to better source, plan, design, manufacture, deliver, operate, and recycle products. This leads to increased supply chain visibility and better-informed decisions based on data-driven insights. SAP Industry Networks and Digital Twins play a significant role in making supply chains more resilient.

SAP: Sustainable Programming

SAP has had quality measures for performance in place for several decades already. These rules and guidelines ensure good performance and scalability of software components, scenarios, and processes with reasonable and sustainable resource consumption. Through sustainable programming, SAP developers and architects can reduce energy consumption and greenhouse gas emissions, contributing to SAP's commitment to become net-zero by 2030.

Sustainable programming requires finding the right balance between end-to-end response time, throughput and sustainable resource consumption. Via an e-learning offering and comprehensive documentation, SAP developers are trained to optimise their programming. SAP developers also learn about the side-effects and trade-offs related to SAP's optimisation strategy in the context of enterprise software which is the saving of CPU, disk I/O and network I/O by using memory.

SAP also supports the HPI clean-IT Initiative: an open platform for academia, the IT industry, NGOs and policy leaders to exchange ideas on how to reduce energy requirements of digital technologies with guiding principles of algorithmic efficiency and sustainability by design in engineering.

SAP: Cybersecurity

As enterprises move their core processes to the cloud, and increase data sharing across Business Networks, cybersecurity becomes a larger priority for information technology (IT) security professionals and business leaders around the world. Since 2018, SAP employs a Chief Security Officer, reporting directly to the CEO, to lead a

global team whose mission is to create a company-wide 'security culture' to support enterprises in their transformation by helping them to run as sustainable, intelligent enterprises. This shared vision is carried out by executives who must meet cybersecurity goals, leaders who make security a priority and teams who participate in ongoing trainings. By aligning people, processes, and technology to protect data, SAP limits risk and helps to achieve regulatory compliance. SAP follows the NIST (National Institute of Technology in North America) cybersecurity framework, a holistic security strategy based on repeatable processes. SAP is also investing in strategic higher-education partnerships to foster the next generation of cybersecurity professionals.

SAP: Data Centre Sustainability

As more global businesses move to the cloud, data centres play an increasing strategic role for SAP and its customers, and are a primary focus of SAP's carbon reduction efforts. To minimise the negative impact of its internal and external data centres, SAP ensures that all SAP-owned, co-located, and hyperscaler data centres run with 100% renewable electricity. SAP achieves a 'green cloud' by: 1) investing in high-quality, EKO energy-certified Energy Attribute Certificates (EACs) to foster renewable energy generation, and 2) continuously optimising and reducing our electricity consumption. This allows us to reduce and compensate for our data centre electricity consumption emissions (one major step towards achieving carbon neutrality by 2023). More importantly, it enables our customers to significantly reduce their carbon emissions by using our green cloud solutions and services. SAP is also in the process of investigating further renewable electricity concepts such as enhanced investments in its own PV infrastructure and Power Purchasing Agreements.

Siemens: Gathering CO_2 Data Along the Value Chain (SiGREEN)

90% of emissions originate in complex and distributed supply chains. Hence decarbonisation requires communication between multiple partners. To help manufacturers determine their products' carbon footprint (PCF) accurately, Siemens has developed the SiGREEN application. SiGREEN enables companies to efficiently request, aggregate and share PCF data.

The main goal of SiGreen is to move from static database averages (mainly used in PCF reporting) to a dynamic PCF management. By enabling (through effective data sharing) efficient communication between the manufacturers and suppliers, PCFs become dynamic and a management tool that can be used to set targets for efficient reduction measures and to precisely quantify their impact on product carbon footprints.

In cross-company data exchange, data sovereignty must not be sacrificed for transparency. Therefore, SiGREEN leverages Distributed Ledger Technology to verify information exchanged peer-to-peer. There is no central database, nor data monetisation.

Siemens: Digital Twin for Fingrid

The Finish transmission system operator introduced Siemens digital twin to support asset and operation management and infrastructure investment planning. In a context of rising use of decentralised, renewable energy input, balancing the power system requires a lot of data collection and analysis. The use of Siemens' digital solution allows Fingrid to reduce the effort on data collection and focus on the analytical part to organise power distribution and plan the evolution of the grid. Indeed, with the detailed model provided by the digital twin, Fingrid can plan investments up to 25 years in the future based on an accurate single 'source of truth'. To integrate and develop clean power sources in the grid, more than €1 billion are currently being invested, based on projections made by Siemens digital twin. Since the tool is used for operations, asset management, and investment planning, it is tested daily. The testing and the quality of the data analysed not only ensure cost-effectiveness but also allow the Finnish grid to have a reliability of 99.9996%.

Siemens: Energy Consumption for Sello

In 2015, Sello in Espoo, Finland, became the first shopping centre to achieve the LEED EB Platinum certification. With more than 25 years of collaboration with Siemens, the Sello centre has been deeply attached to strengthening energy efficiency and lowering its carbon footprint. The virtual power plant developed and maintained by Siemens optimises energy consumption and reduces the load on the main grid. From 2010 to 2020, Sello's annual energy consumption has dropped from 34 GWh to below 28 GWh. By analysing data from occupancy rates, weather, air quality and HVAC systems, Siemens identified the areas that could be improved to ensure efficiency. Through a cloud-based energy and sustainability platform and an onsite energy management team, Siemens provides services to harmonise processes between the microgrid, the intelligent systems, and the energy requirements. Sello is the example of how the optimisation of air quality, energy savings and customer experience can be achieved by using digital solutions.

Siemens: Aspern Smart City

Aspern Smart City in Vienna is one of Europe's most innovative energy-efficiency projects, investigating how smart energy systems and intelligent buildings operate together in a real urban subcenter. The objective of this city of the future is to create a sustainable and efficient environment while improving the quality of life of the inhabitants. The district is organised around four pillars: first is the Smart User that can access a wide range of settings to ensure energy efficiency (e.g. deactivation of WLAN, isolation of sockets for electric kettles, controlled heating…) through an app. Intelligent systems (like the buildings), a smart grid optimising power supply and smart ICT (Information and Communication Technology) are the three other key components of the city of the future. Siemens Electrical Digital Twin is one of the technologies deployed, leading altogether to 70% reduction in CO_2 emissions of more than 200 apartments with a combination of PV, solar, heat pumps and €10,000/year savings in energy costs for the smart district. Smart ICT coordinates the data flows and processes between the smart grid, the intelligent systems, and the users. By doing so it contributes to designing an urban space that is efficient, sustainable, and worth living in.

Telefónica: Telecommuting

Scope 4 refers to those carbon emissions that have been successfully avoided thanks to digitalisation and technology. One of the cases that better exemplifies this new scope is telecommuting.

The provision of personal and business connections has enabled a shift in the behaviour of companies and employees, enhancing 'working from home' approaches while reducing the need for the employee to commute or travel. This shift has translated into lower carbon emissions.

Telefónica has sought to quantify the total carbon abatement that may be attributed to the connections that they provide, which in the case of telecommuting was around 20% based on fixed line connections and 15.3% for B2B mobile connections. These approximations have been obtained by estimating the number of people telecommuting each workday, the avoided emissions based on the average commute fuel consumption as well as office energy consumption per employee, and the offset by the increase in home energy consumption.

Telefónica: 5G and Optic Fibre Networks Efficiency

While internet traffic has greatly increased, improvements in energy efficiency have avoided a drastic rise in energy consumption, decreasing the energy demand per traffic unit. These efficiencies have been achieved thanks to 5G rollout and fibre networks; 5G networks are up to 90% more efficient than previous technologies. In the coming years, although 5G networks are likely to drive a dramatic increase in mobile traffic, they are also designed to be more energy efficient than their predecessors. This growth comes on top of rising demand for digital services over the past decade: since 2010, the number of internet users worldwide has doubled while global internet traffic has grown 12-fold. However, rapid improvements in energy efficiency have helped to limit energy demand growth from data centres and data transmission networks, which each accounted for around 1% of global electricity use in 2019.

TotalEnergies: Renewable Energy Data Centres

TotalEnergies announced in 2021 a strategic collaboration with two major cloud service providers:

- TotalEnergies will supply renewable electricity and batteries for their data centres;
- Cloud providers will help TotalEnergies accelerate its digital transformation.

These strategic agreements span both the TotalEnergies and cloud providers' businesses:

- Renewable Energy: TotalEnergies and partners have signed power purchase agreements ('PPAs') for a commitment of more than 500 MW of renewable capacity. By supplying renewable energy and potential battery energy solutions, TotalEnergies will contribute to partners' commitment to power operations with 100% renewable energy and reach net-zero carbon emissions.
- Cloud Computing: With both partners as key cloud providers, TotalEnergies will accelerate its move to the cloud, boosting its IT transformation, the digitisation of its operations and its digital innovation. In particular, TotalEnergies' Digital Factory will benefit from the breadth and depth of cloud services including infrastructure, speed, reliability and innovative services. TotalEnergies will also evaluate High Performance Computing technology to accelerate critical workflows

and further speed up innovation across its businesses around the world.

- Explore and co-innovate on areas of collaboration around sustainability, further digital transformation and AI solutions accelerating the transition to a net-zero economy, for example, the deployment of low-carbon and carbon-removal technologies.

Vodafone: Smart Water Meters

The digitalisation group Vodafone and the energy company E.ON launched a cross-industry innovation and technology partnership to detect tap water damage much earlier and thus conserve resources. It is being used immediately in first companies and facilities in the Ruhr region. As part of their partnership, E.ON and Vodafone are planning to use the technology in a similar form for electricity and gas meters in the future. The aim here is also to save resources, detect damage at an early stage and offer new services for consumers.

From now on, Vodafone and E.ON are equipping water meters with intelligent wireless technology. The installed smart meters detect irregularities in water consumption and thus reliably indicate possible line damage at the earliest stage. This enables rapid intervention and avoids expensive renovations at the customer's premises. All data and error messages are transmitted to the users via the mobile network. Almost 200 networked water meters are already in use, with another 1,000 to be installed by the beginning of 2023. The new technology can furthermore be retrofitted to existing water meters with a few simple steps via 'plug and play', so no replacement is required. In the future, the technology will also be used on a large scale in private households. With the "Water Heroes" app, users will then be able to keep track of all their water consumption data on their smartphone and be alerted directly if any damage occurs – or manage consumption habits for a more sustainable lifestyle.

Vodafone: Smart Farming

IoT-based solutions are increasing the amount of information that farmers have available to them, enabling them to optimise their operations and use of resources. This enables a decrease in the use of pesticides and fertiliser. The use of technology could furthermore enable the reduction of emissions, water use and resource consumption, and could contribute to the protection of biodiversity and increasing yields. For instance, Vodafone IoT technology is being used to deliver real time app and SMS-based information to farmers concerning environmental factors such as insect presence, soil temperature, humidity and crop growth and local weather information.

Volvo Group: Digital Electromobility Tools and Services for Route Planning and Charging

Most of the vehicles in the future will be electric and they will become a cornerstone for commercial vehicles, with green energy supplied by batteries or hydrogen fuel cells depending on the application. Volvo Group ambition is that by 2030, electric vehicles will account for at least 35% of the global vehicle sales. EU transport system will need to be even more progressive.

Policy support and funding will be needed to initiate a rapid infrastructure deployment. Connectivity and connected services will be crucial as well as availability of fossil-free energy and storage so that we can secure the capacity need in the right places. This will demand increased collaboration with public and private stakeholders as well as relevant partners.

Vehicle fleet owners will need digital services that guide where charging infrastructure is available and adapted route planning tools that can support logistics planning. There must be booking systems that work for all types of operators and charging infrastructure details described in a similar manner. This will demand harmonised communication between different sub-systems and between the logistics systems and other societal systems. The purpose of the services is to guide the customers in their journey towards electrification.

Volvo Group: Volvo Construction Equipment: Efficient Load-Out

In a mass excavation project, one of the most important parameters to keep CO_2 emissions down is optimising the outbound transportation of mass.

Volvo Construction Equipment has developed "Efficient Load Out"– a cloud-based software solution designed to enhance the accuracy and efficiency of mass excavation projects. In a construction project, every single load is vital to all concerned since even small disruptions may have a large impact over time.

Regardless of the brand of equipment, it connects all parties such as machine operators, truck drivers and site-managers in real-time in the loading process and helps all involved actors in optimising the loaded weight. Optimising the loaded weight for each truck not only maximises the efficiency but also the sustainability since it reduces the number of truck passes, the amount of on-site traffic and CO_2 emissions.

"Efficient Load Out" gives the possibility to digitally label each load with a material code, this is to ensure that the mass gets to the right destination. In a large excavation there could be several types of mass, ranging from hazardous waste to rock and gravel. Each truckload of mass can play a role in achieving a more circular mass management.

In digitalising the load receipts "Efficient Load Out" also supports safety at the site as the interaction between machine operators and truck drivers enables handover of receipts from the safety of the cab.

Volvo Group: Zero Emission Zones to Stimulate Electrification

To enable the development of electrified vehicles and machines, incentives and policies to stimulate customer demands will be crucial. The technology is on its way, but the harmonised implementation of zero emission zones across the Single Market is what would create a solid and significant demand for zero emission vehicles.

There are now also digital means available to control and steer the zones more dynamically. As an example, the deployment of geographical zones opens up for more dynamic steering and efficient use of the infrastructure and the vehicles. Digital solutions could be used to inform vehicles/drivers of various current and future zone requirements ahead, including time-dependent charges and parameters such as speed, weight, length and emission limitations. It could also include possible solutions such as reloading at transport hubs outside the zone for further zero emission transport into the city. Positive effects are an accelerated development towards less noise, less congestion, less greenhouse gases and more efficient and safer transport.

The European Round Table for Industry (ERT) is a forum that brings together around 60 Chief Executives and Chairmen of major multinational companies of European parentage, covering a wide range of industrial and technological sectors. ERT strives for a strong, open and competitive Europe as a driver for inclusive growth and sustainable prosperity. Companies of ERT Members are situated throughout Europe, with combined revenues exceeding €2 trillion, providing around 5 million direct jobs worldwide - of which half are in Europe - and sustaining millions of indirect jobs. They invest more than €60 billion annually in R&D, largely in Europe.

This Expert Paper has been prepared by the Task Force on the Digitally Enabled Green Transition of the European Round Table for Industry.

More info and previous papers on: https://ert.eu/focus-areas/digital-economy/ and https://ert.eu/focus-areas/energy-and-climate-change/

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