DIGITALISATION AS A KEY ENABLER FOR A RESILIENT AND SUSTAINABLE ENERGY ECOSYSTEM

DIGITALEUROPE

TABLE OF CONTENTS

Foreword

The EU should use the current energy crisis as an opportunity to increase collaboration between the digital and energy sectors. Digital technologies can help the EU transition away from a state of energy dependency - preventing Russia, for instance, from continuing its weaponisation of energy resources – and instead allow it to embrace energy sovereignty through accelerating the rollout of renewable energy, improving energy efficiency and saving costs for EU consumers and business.

Digital is also a must-have in the fight to reduce emissions more broadly, and the EU has a collective responsibility to not only firmly acknowledge this fact, but to now actively work with digital to allow it to fulfil its enabling potential.

In this light, DIGITALEUROPE on the 27th October 2022 hosted a high-level roundtable on the digitalisation of the energy ecosystem.

Executive level representatives from both the energy and digital sectors met to define the key accelerators and most important technologies that Europe can quickly adopt and scale up to drive forward the digital transformation of the energy ecosystem.

Of **DIGITALEUROPE's** eight previously identified twin transition accelerators (please find these on page 24), four key accelerators[1] were identified that both the European Commission and Member States need to focus on to ensure that Europe is an environment where: member states can move as one in a harmonised way; data can flow; we have a fast and intelligent energy ecosystem that can actively adapt to demand; and where Europe is an environment which attracts and encourages investment.

Specifically, the four accelerators to achieve the above are:

TWIN TRANSITION ACCELERATORS

1 Data cooperation
(to enhance access to and use of sustainability data)

2 Green Network Infrastructure
(to speed up connectivity)

3 Investment
(to boost R&D and innovation in green tech)

4 Enabling regulation
(to create synergies between digital and green policies)

[1] DIGITALEUROPE, Digital Action = Climate Action: 8 Ideas to Accelerate the Twin Transition, https://digital-europe-website-v1.s3.fr-par.scw.cloud/uploads/2021/10/DIGITALEUROPE_Digital-action-Climate-action.pdf

In addition, we challenged the participants to identify a small set of **winning and fast accelerating digital technologies** where Europe can lead, out of a long list of important ones. These are:

1. Cloud, AI, machine learning
2. IoT and edge control

The energy sector can be considered an early adopter of digital technologies[2] however it must now be enabled to be a continued and efficient adopter. These digital technologies can help a wide array of sectors of the economy, including energy, become significantly greener. By 2030, digital technologies have the potential to help resource-intensive industries in particular reduce their global Co2 emissions by 20%. In other words, these technologies can save 9.7x more emissions than they produce.[3]

Importantly, when combined, the abovementioned digital technologies can be applied to deliver significant results, outlined here below and delved into later in the report:

1. Digital Twins
2. Enhancing flexibility
3. Enabling end-user systems and platforms

We have the ***what*** (a need to digitalise the energy ecosystem), the ***why*** (to foster resilience and achieve our climate goals), and today, this report outlines the ***how*** (investing in and using these accelerators and key winning technologies that will drive the transition forward).

[2] International Energy Agency (2017), Digitalisation & Energy, p.25, https://iea.blob.core.windows.net/assets/b1e6600c-4e40-4d9c-809d-1d1724c763d5/DigitalizationandEnergy3.pdf
[3] GeSI (2015), #SMARTer2030 ICT Solutions for 21st Century Challenges, https://smarter2030.gesi.org/downloads/Full_report.pdf

FOUR KEY ACCELERATORS

Ahead of DIGITALEUROPE's roundtable, we asked our participants to rank eight accelerators by level of importance, impact, and ultimately: to rank highest those that will accelerate the twin transition most effectively and rapidly. These are: data cooperation, green network infrastructure, investment and enabling regulation.

Data cooperation

The enabling potential of digital in the energy ecosystem cannot come to fruition without data. Data is essential for measuring, monitoring, predicting, innovating, and much more. Importantly, we need access to data as one cannot reduce nor improve what one cannot measure. Not only is access to data vital, but this data must be of high-quality and reliable in order to be of value. On top of this, it must also be interoperable to allow for data sharing and collaboration opportunities.

In this light, DIGITALEUROPE welcomes the Digitalisation of Energy Action Plan (DoEAP) published by the European Commission[4], which states its intention to develop a common European energy data sharing framework. In theory, such a space will allow for: innovation to thrive, an ecosystem that is able to collaborate, widespread efficiency to occur, and for the overall adoption of digital to accelerate.

"Data standardisation is critical for interoperability and security. Industry can play an important role in defining these standards, which will ensure an effective and efficient data exchange"

Martine Gouriet
Director of Digital Uses, EDF Group

[4] Digitalising the energy sector – EU action plan, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13141-Digitalising-the-energy-sector-EU-action-plan_en

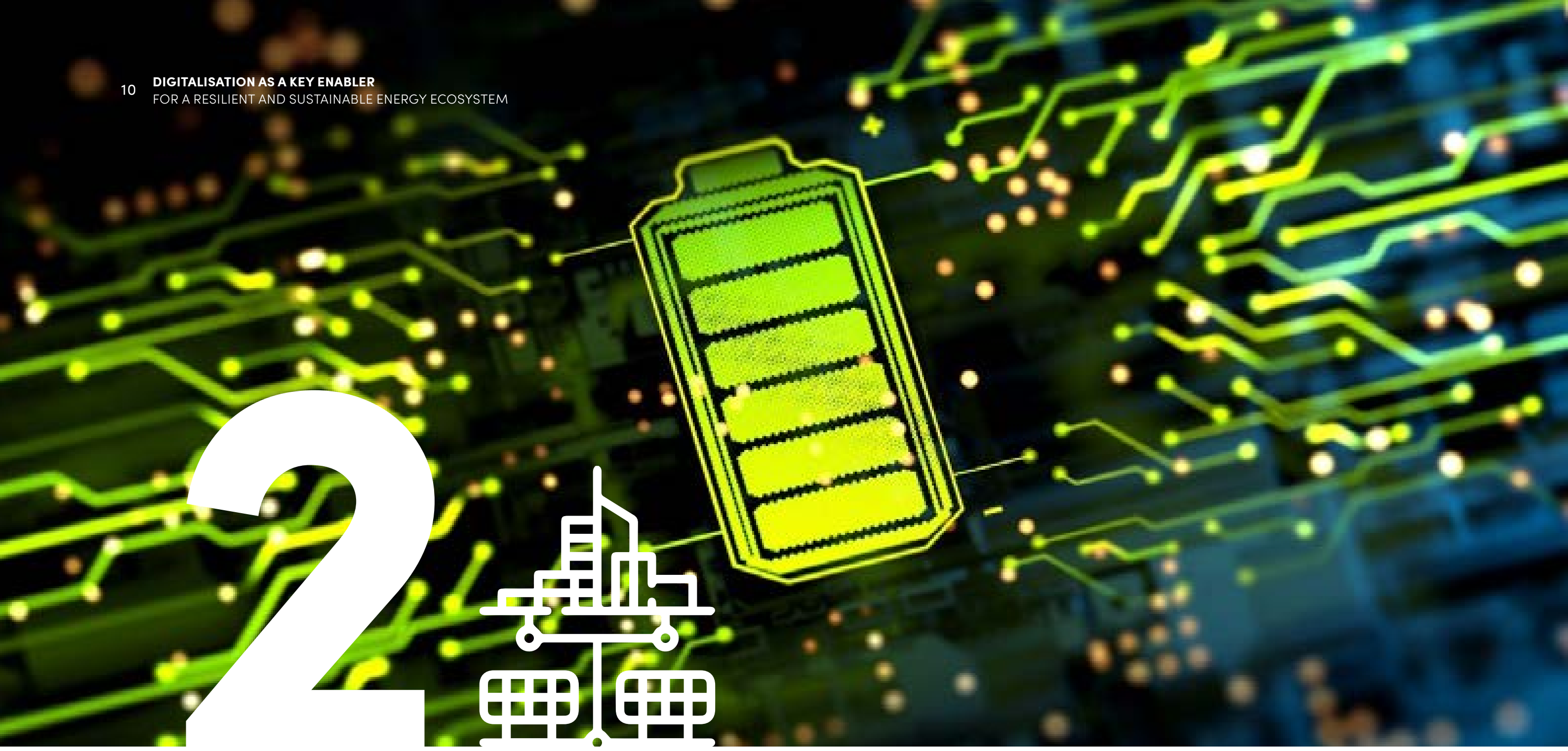
In practice however, a wide range of challenges will emerge. These will include: how to adequately protect intellectual property rights, defining the types of data that need to be shared and how they can be shared, and ensuring specific technical standards are harmonised across the EU.

It is vital that a data sharing framework ensures that the right data goes to the right people, whilst remaining protected, private and secure. To overcome these inevitable obstacles, industry must step up to act as a key stakeholder in the development of such a space. It cannot be developed without valuable and necessary input from business.

Importantly, **an efficient and effective energy data sharing space is paramount to deliver and inform digital technologies that will allow the digitalisation of the energy ecosystem to take place.** Digital twins for instance, cannot be developed without access to high-quality and interoperable data.

> **Whilst the proposed energy data space is welcome and will enhance both trust and collaboration, it is not enough to have businesses working together and sharing data. Public and private collaborations are also key**

Natalie Schnippering
Head of Digital Services, Danfoss



Green network infrastructure

As abovementioned, a resilient and sustainable energy ecosystem will be driven by trusted and effective access to data. However, the benefits that come from having access to troves of valuable data will fall short if it is not able to move quickly, efficiently, or if it is not able to be processed. This is where DIGITALEUROPE's second key accelerator comes in: the importance of connectivity and ICT infrastructure.

High speed Connectivity is a prerequisite for facilitating the twin transition as it is a critical enabler for digital technologies, which cannot be fully deployed nor allowed to fulfil their transformative potential without this connectivity. Telecommunication technologies are proving to be essential in delivering real-time value across the ecosystem, and thus of delivering sustainability gains.

The Internet of Things (IoT) for instance, allows for the collecting, transferring and analysing of a vast amount of data in near real-time. In the construction sector, IoT measuring or sensing devices have been deployed in buildings, allowing for energy optimisation strategies to be put in place, which in turn allow for ultra-efficient and zero-carbon buildings that deliver huge energy efficiency gains when compared to buildings that do not utilise digital technologies.[5]

Similarly, without WIFI, LTE/LTE-Advanced, or 5G on a manufacturing site, data would not be able to be collected or shared in real-time to enable systems and operators to make decisions that save energy and resources. Not only will the expansion of 5G allow for the development of smart energy solutions but in a study carried out by Ericsson and Telefonica in 2021, they showed that 5G technology is additionally up to 90% more efficient than 4G in terms of energy consumption per unit of traffic (W/Mbps).

90%

5G technology is additionally up to 90% more efficient than 4G

[5] Ericsson (2021), Achieving Sustainability with Energy Efficiency in 5G Networks, https://www.ericsson.com/en/blog/3/2021/1/achieving-sustainability-with-energy-efficiency-in-5g-networks

High speed connectivity is now a goal for most nations and the EU should not fall behind in ensuring that data can move quickly between, and to, all regions, businesses and citizens of the EU.

As well as connectivity, another piece of important infrastructure is the much-spoken about data centre. Where telecommunication networks are the rails, data centres are the engine of the digital transformation train and this train cannot run effectively nor efficiently without both. They constitute two pieces of critical infrastructure that are a must-have if the EU is to reach its green goals.

Data centres are the control centres, and telecommunication networks are the backbone and neural system of the digital world and of our modern society, the reason that 'working from home' was possible during the Covid-19 crisis and the reason much of the online world is able to function as it does today.

Crucially, data centres are the engine that allow for big data processing in a safe and secure environment, in the most sustainable way. Additionally, it is important to remember that **the alternative to data centres is hundreds of thousands of inefficient servers spread across the EU, processing information in a much less efficient way.**

"In a number of European countries, there is the realisation that enhanced resilience and security of the utilities telecommunications infrastructure is fundamental to ensuring resiliency of the electricity grid - whilst enabling the digitalisation of the grid to edge"

Chris Jones
Head of Energy Europe, Nokia

Investment

Investment to boost R&D and innovation in the area of green tech is paramount if the EU wants to achieve its goal of driving forward the twin transition, and in this context in particular, of successfully digitalising the energy ecosystem. This is why it is concerning that to date, out of the over €700 billion made available through the Recovery and Resilience Facility (RRF), only €100 billion has been disbursed.[6] The funds are available yet they remain difficult for Member States to access.

Whilst the energy and effort that is going into RRF fund allocation should no doubt be celebrated, if the European Commission would like the RRF to achieve its goal of being Europe's answer to an unprecedented crisis and of providing all-encompassing support to the twin transition[7], it must make it easier for Member States to access these funds more quickly. Additionally, many

"Digitalisation of the energy system is the key enabler for the energy transition and, also, for energy security, but if we want to exploit its full potential, we need a strategic vision and concrete actions, as we have in the form of DIGITALEUROPE's eight twin transition accelerators"

Dario Pagani
Head of Digital & Information Technology, ENI

European governments have separate spending plans for digitalisation and decarbonisation in their national recovery plans. **If we want to drive forward the twin transition, green and digital should not be looked at as two separate investment areas.**[8]

Ultimately, as DIGITALEUROPE highlighted in its previous thought leadership piece on digital action driving climate action, innovative digital products and services for the green transition should be both celebrated and supported through accessible funding.[9] However, this report goes a step further to emphasise that the key now is a combination of making the already-available funds more easily accessible and, of enabling dialogue to happen to assist member states in finding the links between the twin transition and the right enabling solutions. Industry must have the opportunity to talk to Member State authorities about ***why*** and ***where*** to invest these funds.

[6]More information: European Commission (2022), Review Report on the Implementation of the Recovery and Resilience Facility, https://data.consilium.europa.eu/doc/document/ST-11586-2022-INIT/en/pdf
[7]As above
[8]DIGITALEUROPE, Digital Action = Climate Action: 8 Ideas to Accelerate the Twin Transition, p.24, https://digital-europe-website-v1.s3.fr-par.scw.cloud/uploads/2021/10/DIGITALEUROPE_Digital-action-Climate-action.pdf
[9]DIGITALEUROPE, Digital Action = Climate Action: 8 Ideas to Accelerate the Twin Transition, p. 25

"If Europe succeeds at digitalising the energy infrastructure, it will differentiate, become extremely competitive globally and create high value jobs. However, from a market's point of view, it is problematic that in most countries there is still a disconnect between digital and green policies at a governance level and it is particularly important to merge their ambitions when it comes to funding and investment"

Agostino Santoni
VP of Cisco's South Europe Operations

Enabling regulation

The final key accelerator is regulation that enables the digital and energy sectors to work together. **We need a strong regulatory framework that will strengthen the link between digital and green policies, considering them in an integrated way.**

Legislative proposals today simply cannot afford to fail to recognise the horizontal and enabling nature of digital. For instance, a recent example is Europe's ambitious "Fit for 55" package which sets out how the EU aims to reduce its net greenhouse gas emissions by at least 55% by 2030 yet fails to recognise and leverage the enabling potential of digital technologies in this mission. Digital transformation must be embedded into these types of sectorial strategies.

This is particularly relevant in light of the European Commission's Digitalisation of Energy Action Plan (DoEAP). The DoEAP is an ambitious and high-potential initiative and it is crucial that enabling regulation is put in place that will allow for the key actions outlined in the DoEAP to be practically delivered. For instance, the proposals to develop a digital twin of the energy grid and a common EU energy data sharing space can only be achieved with common, harmonised and coherent legislation in place. All ambiguity must be removed so that the innovators of today can push forward in rapidly driving the digitalisation of the energy ecosystem with actions such as digital twins and a data space.

The telecommunication and energy networks regulators (e.g. DG CONNECT and DG ENERGY at EU level) need to be aligned on the common goal to provide secure telecommunication networks and infrastructure in the utility space, as the key enabler for the digitalisation of the energy ecosystem.

Member states must come together during this energy crisis, as they did during the Covid-19 crisis, where they harmonised standards and shared data to tackle the virus.

The potential impact of the energy crisis on citizens and business will be just as potent, and thus Europe's response should be just as urgent.

Energy, like Covid-19, will require steadfast cooperation and Member State leadership to empower a European Commission that can harmonise its approaches.

Member states must come together during this energy crisis, as they did during the Covid-19 crisis, where they harmonised standards and shared data to tackle the virus.

WINNING TECHNOLOGIES AND APPLICATIONS WHERE THE EU CAN LEAD

The adoption of digital technologies to improve energy systems is not new[10], yet as digital technologies become increasingly sophisticated, so too do potential gains for Europe in achieving its green goals. There now exist a range of digital technologies that the energy ecosystem can use to empower businesses and consumers to continue moving the transition forward.

Upon challenging the participants of our roundtable to identify a small set of winning and fastest accelerating digital technologies where Europe can and should lead, we found that cloud, AI, machine learning, IoT and edge control emerged on top.

[10] International Energy Agency (2017), Digitalisation & Energy, https://iea.blob.core.windows.net/assets/b1e6600c-4e40-4d9c-809d-1d1724c763d5/DigitalizationandEnergy3.pdf, p.25

Importantly, when combined, the abovementioned digital technologies can be applied to deliver significant results. Of note:

Digital Twins

By building detailed digital models of energy assets, digital twins will be able to monitor threats and visualise processes which will allow for improvements in the performance of energy ecosystems. It will also act as a tool for various sectors to first design large scale projects virtually, therefore eliminating flaws that could translate to millions in costs and resources.

For example, when applied to buildings, digital twins can be used with Building Information Modelling (BIM) to identify opportunities for energy efficiency improvements, both at the building stage and to subsequently monitor buildings in real-time, allowing engineers to quickly identify problems. **This is important as buildings generate about 40% of the EU's energy consumption and 36% of its greenhouse gas emissions.**[11]

"Digital twin applications are one of the most precious answers to accelerate the efficient and reliable integration of renewable generation and new loads. It's now time to break down silos and speed up their deployment moving from pilots towards their broad use across the EU"

Ben Gemsjaeger
Director of Business Development Europe, Siemens Smart Infrastructure

[11] More information: European Commission, Energy Performance of Buildings Directive. https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en#energy-performance-of-buildings-standards

Enhancing flexibility

Digital technologies can provide flexibility to the electricity grid by allowing for the connection and management of different energy sources, using specific energy sources at the most efficient time, and by preventing energy wastage.

For example, bidirectional charging exemplifies such flexibility. Also known as V2X ('vehicle-to-everything'), bidirectional charging allows electricity to flow between electric vehicle batteries and the grid multiple times and importantly, in both directions – creating an energy exchange.

Enabling end-user systems and platforms

Data-driven digital technologies will continue to create new markets for consumers.

An excellent example of an end-user-technology that currently operates in France is EDF & Me, a free mobile app that enables customers to access and monitor their energy consumption on a daily basis and to receive personalised and easy-to-implement tips on how to reduce it.

It is vital that the European Commission and Member States keep these digital technologies and applications in mind when investing funds into the twin transition and when developing legislation.

"An acceleration of the deployment of digital technologies at the infrastructure level is necessary to drive an effective energy transition. We can transform energy systems only with a digital infrastructure that enables automation and data utilisation"

Francesco Pititto
Global CTO for Energy, Dell Technologies

Use Cases

The enabling potential of the key accelerators and digital technologies are clear, however, what is lacking are use cases demonstrating the real-added value and tangible impact for citizens, business and society as a whole. Additionally, it is important to note that use cases should not be limited to only a few technologies but a broad range, including current digital communication technologies.

Overall, the participants of DIGITALEUROPE's high-level roundtable agreed that there is a need for more concrete use cases. These should focus both on the benefits for the end consumers but also highlight the business case as the EU needs business to innovate and practically develop and implement these use cases.

Additionally, **use cases can inspire Member States by allowing them to understand why they must dedicate funds towards digital technologies and solutions.**

For instance, the EU needs more use cases demonstrating the tangible effect that a digital twin of the energy grid will have not only on the EU's ability to be resilient in the face of the energy crisis, but also demonstrating how it can help the EU reach its green targets. Use cases can illustrate how to integrate digital technologies to allow for maximum impact.

"Identification of use cases is lacking. When working on use cases, it is important that all actors involved know what they are to gain from them"

Andrej Bregar
Deputy CEO, Informatika

"There is a risk that digitalisation of the energy system will not be succesful if there are no specific use cases. We need examples that clearly measure the costs, risks and benefits of digital, and that clearly outline why an accelerator or digital technology is crucial"

Wanda Buk
VP for Regulatory Affairs, PGE

Conclusion

The digitalisation of the energy ecosystem and the twin transition more broadly will shape Europe's ability to be increasingly independent from foreign actors, shift to renewables and to increase its security and cost effectiveness. It will allow the EU to build a resilient energy ecosystem ready for any crisis – current or future. Additionally, **this transition will ensure the EU's position as a frontrunner and first-mover and will allow it not only to stay competitive at an international level, but provide it with the opportunity to become a global energy champion.**

Energy champions on DIGITALEUROPE's Executive Board:

"Digital innovation and software are the 'game changer' to accelerate energy decarbonisation of buildings. However, we are not currently acting at the speed required to meet the challenge. Based on the current renovation rate, we estimate it would take approximately four centuries to renovate the building sector in Europe. On the other hand, by deploying digital technologies, Europe could be on target within one generation!"

Marc Nézet
SVP Energy Management Software Transformation at Schneider Electric

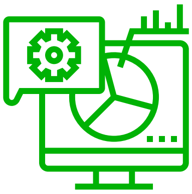
"A greater focus on digital means benefits for the whole construction ecosystem. By transitioning towards digital and new technologies, helping workers develop necessary ICT skills, and by providing them with the necessary tools, the digital Renovation Wave can be a real success. Digitalisation also helps us increase transparency and optimisation by capturing data that can be analysed. Connectivity and digitalisation are not the end per se, but rather the critical tools to achieve building-related improvements, energy savings, and so on"

Junichi Suzuki
CEO Panasonic Europe

"Elaborate energy management systems allow building operators to track and analyse energy consumption, allowing them to identify abnormal performance, and thus sources of waste as well as improving energy efficiency. This is even more important for buildings that have their own power generation and storage units – e.g. a photovoltaic panel, a battery or a heat pump for heating water"

Norbert Lütke-Entrup
Head of Corporate Technology and Innovation Management at Siemens

8 ideas to accelerate the twin transition

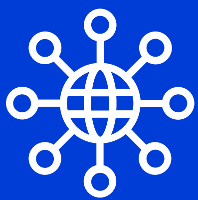


Set ambitious KPIs to measure Europe's success in accelerating the twin transition

The EU should set concrete targets, similar to those in the Digital Decade post-COVID strategy, and measure the uptake of digital technologies to support our climate goals. These should be both horizontal and sector-specific.

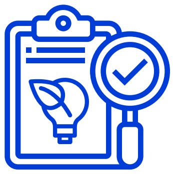
Promote data cooperation to enhance access to and use of sustainability data

In order to make intelligent decisions and cut our energy usage, technologies like AI and the Internet of Things (IoT) rely on access to high-quality and interoperable data. The EU's plan for common European data spaces is a unique opportunity to promote the pooling of sustainability data.



Boost connectivity and infrastructure

Again, strategic digital solutions like AI and IoT rely on high speed and high-quality connectivity. The EU and Member States should increase funding for available and affordable high-quality network infrastructure, such as fibre and 5G, and speed up rollout.



Develop international standards for measuring digital's enablement and carbon footprint

There already exist methodologies and international standards for how to measure the direct environmental footprint of ICT products. However, this is not the case for their enabling effect, that is, the ability for ICT solutions to reduce emissions across other sectors.

The understanding of ICT's impact is therefore limited, and this has an impact on the investments made and ultimately the deployment of solutions. To boost the uptake of digital technologies for the green transition, we need consistent and comparable assessment methods.

Increase access to funding for R&D and innovation spending in green technologies

Europe is lagging behind other major economies in research and innovation spending. Achieving climate neutrality by 2050 means a dramatic scale-up of climate-driven ICT solutions, as well as technological breakthroughs we have not seen yet.

Both EU and national funding programmes should therefore allocate greater resources to help boost clean tech initiatives, notably from start-ups, small and medium-sized enterprises (SMEs), and to create public-private partnerships among industry and academia to fuel technological innovation.

Launch a continent-wide drive for green tech skills

ICT skills such as data literacy, computational thinking, and critical thinking are at the core of Europe's quest to meet its climate neutrality goals. Specific skills are also needed to translate applications of digital solutions to business and industrial uses.

The EU should use its full toolbox of investments and policy to make sure citizens have the skills they need to thrive in a digital and green economy, and that industry has the digital talent it needs to take bold climate action.

Strengthen the link between digital and green policies

Despite the ambitions there are still too many recent examples of legislative proposals that failed to recognise the horizontal and enabling nature of digital. We need to recognise the complementary nature of policy interventions and embed digital transformation into sectoral strategies such as the Renovation Wave, the Common Agricultural Policy, and the "Fit for 55" package, to name just a few.

Create sector-specific action plans to facilitate the uptake of digital technologies across Europe's most energy-intensive sectors

The horizontal actions above should be reinforced by sector-specific action plans at EU and national levels. Each major industry should aim to have a plan in place identifying specific targets for digital uptake; the key technologies they will need to achieve them; what data, research, and skills they need; and an assessment of the regulatory environment and public procurement market.

CASE STUDIES

Using blockchain enabled traceability to digitalise the supply chain and build a circular battery economy

Challenge:

To decarbonise and electrify the energy sector, global lithium-ion battery capacity will rise five-fold by 2030, according to Wood Mackenzie. Making this change means securing exponentially more critical minerals– the building blocks of clean energy – than ever before. It is paramount that these critical minerals are responsibly sourced and sustainably produced, and to prove this, supply chain traceability is key.

This is no easy task given industry is facing unprecedented challenges. The geopolitical landscape and resulting supply chain disruptions highlight how fragile our supply chains are and exposes us to risks we've never seen before. In parallel, increasing consumer awareness, as well as regulatory, and investor pressures to prove products are produced sustainably, is compelling organisations to better track and analyse their supply chains, drive responsible sourcing of critical minerals, and reduce greenhouse gas emissions.

Energy infrastructure, like other industries, faces insecurity caused by material shortages, price inflation, freight disruptions and labour constraints—all of which are exacerbated by the pandemic and Ukrainian crisis. Circulor tracks the supply chains that build up our energy infrastructure giving the visibility needed to de-risk and make them more resilient. To improve circular economies of clean energy technologies, Circulor's supply chain traceability provides the visibility to ensures upmost capacity and efficient pathways into second life and recycling – essential to plug the critical mineral shortfalls expected in Europe.

Solution:

Digital supply chain solutions will enable Polestar to prove its progressive sustainability strategy; to become a climate neutral company by 2040; to halve emissions per sold car by 2030 compared to 2022; and create a climate neutral car by 2030. With greater transparency of their supply chains, **Polestar has been able to reduce emissions used to produce each car by 6%.**

Circulor and Polestar have been working together to trace battery materials and ensure responsible sourcing, which started with Circulor tracking cobalt for the Polestar 2. As the Polestar portfolio has expanded, so has the Circulor partnership, with the company now tracking mica, lithium, and nickel.

Circulor's blockchain traceability platform traces complex industrial supply chains from raw or recycled materials through production to final product. They do this by creating a digital twin of the material itself at the source and then digitally tracking the materials as they flow through the supply chain, connecting all participants together in order to create accountability and build trust.

Circulor's supply chain traceability solution enables companies to continuously collect their GHG emissions data, to set benchmarks and identify CO2 hotspots across the supply chain - with actionable insights that drive informed decision making.

While they have no direct emissions, EVs, solar and wind have significant emissions in through their manufacturing and additional environmental and social impacts. To ensure we are taking advantage of the energy transition, we need digital solutions, like Circulor, that enable the climate-neutral production of these products. We need this this decade, so that production can be scaled up next decade.

Circulor's platform also collects CO2 across Scope 1, 2, and 3, as well as ESG metrics, and attaches this activity from every participant to the product itself. This provides proof to OEMs like Polestar, and their customers, that minerals and materials are responsibly, ethically, and sustainably produced.

Main technologies:

IoT, Cloud Compute, Blockchain, Data analytics

Member:

Circulor (techUK member, in partnership with Polestar)

The role of V2G towards a zero-carbon future

Challenge:

16% of global carbon emissions are produced by transportation. As countries around the world commence their green transition, solutions that enable sustainable transportation will be widely adopted.

If we want to see electric vehicles reach their full potential in the future, we need to change the way we use them now, starting with the energy that powers them.

We investigated how vehicle-to-grid (V2G) technology could reduce the demand that electric vehicles (EVs) put on energy networks, whilst demonstrating the economic benefits of V2G technology for commercial fleet owners.

Solution:

E-Flex is a London-based vehicle-to-grid demonstration project that uses active electric vehicles in real-world fleets to prove the value of V2G technology. E-Flex drove vehicle-to-grid (V2G) technology from theory to commercial reality and demonstrated the role that V2G can play in supporting the transition of energy demands from cities and energy services towards a zero-carbon future.

The consortium, led by Cisco, is comprised of world-leading expertise from across the technology, academic, energy and public sectors. These partners are Cenex, Nuvve, the Greater London Authority, Transport for London and Imperial College London.

V2G technology is connected by Cisco's industrial routers and secured by Cisco Umbrella, with future iterations of the solution planned to incorporate AppD.

The impact is substantial: In the Royal Borough of Greenwich, **1,500 kg of CO2 have been offset thanks to five V2G capable Nissan eNV200 vans.** The vans were charged during off-peak grid times when more renewable energy sources were available, with energy discharged to the grid during peak times to reduce the demand on carbon intensive energy sources.

Main technologies:

Security technology, data collection, data dashboard, connectivity for two-way charging stations, cybersecurity, cloud-based apps, cameras, remote monitoring

Member:

Cisco (in partnership with Cenex, Nuvve, the Greater London Authority, Transport for London and Imperial College London)

Real-time eMobility ecosystem monitoring to help optimise charging and power supply decisions

Challenge:

EY predicts that by 2030, the EV parc will grow to ~65 million vehicles and double to 130 million vehicles by 2035. To cater to 130m vehicles, an equally strong charger base is needed. According to our estimates, ~65m charger units will be required in Europe by 2035.

With millions of charging points coming online, new challenges will emerge. Namely: utilities will have unpredictable and intermittent EV loads on their networks; Charging Point Operators will have multiple chargers and IT systems to manage all with varied integration and management requirements; fleet managers will have to manage several chargers spread across thousands of depots; governments will struggle to keep an account of their ESG targets as the source of energy dispensed at these terminals remains a secret; and with millions of chargers coming online, customer will find it difficult to have visibility of their preferred charging points.

EV ecosystem participants will need new digital solutions to connect, monitor, control, an orchestrate the massive fleet of EV chargers

Solution:

EY EV Operations Centre (EVOC): EY, together with Microsoft, has developed an IoT-enabled cloud-based platform (prototype) for real-time eMobility ecosystem monitoring to help optimise charging and power supply decisions.

Key objectives:

- Enable electricity grid operators to enhance network planning & resilience
- Create a user-centric platform
- Foster a better and optimised charging network
- Incentivise collaboration to facilitate a seamless eMobility experience
- Establish a foundation for innovation and new services

How EVOC works:

1. It combines mock data from over 20 thousand public charging units with relational weather, electricity source and pricing data. It facilitates open and fair access to whole of market data.
2. It integrates data from multiple eMobility ecosystem participants and systems such as DERMS, GIS, commercial systems from retailers and CPOs etc.
3. It provides a single comprehensive view of the eMobility ecosystem; real-time visualizations provide cutting-edge insights into the asset health, utilization, availability, financial performance, etc.

EY has identified ~60 use-cases for EVOC which benefit all key eMobility ecosystem players. This includes utilities, by offering E2E visibility of charging patterns and energy demand patterns, thus helping plan grid upgrades and extensions; government, by helping drive ESG goals by tracking the energy consumption for charging and its source; and customers, by addressing concerns around charger and range anxiety through the provision of real-time visibility and status of charger availability.

Main technologies:

An IoT-enabled cloud-based platform

Member:

EY

AI for data centre cooling and industrial control

Challenge:

Google has taken extraordinary steps to make our data centres some of the most energy efficient in the world, providing 5 times more computing power with the same amount of electrical power than we did 5 years ago. We have achieved this through a relentless quest to eliminate energy waste at every level of our operations.

We have designed highly efficient Tensor Processing Units, outfitted all of our data centres with high-performance servers, deployed smart temperature, lighting, and cooling controls, and even used machine learning to automatically optimize cooling in our data centres.

Machine learning and artificial intelligence hold significant promises for advancing the efficient use of energy across a number of domains. At Google, we have deployed a cloud-based, AI-powered recommendation system to improve the energy efficiency of Google's already highly-optimized data centres. The system is **delivering consistent energy savings of around 30% on average.**

Solution:

Every five minutes, our cloud-based AI pulls a snapshot of the data centre cooling system from thousands of sensors and feeds it into our deep neural networks, which predict how different combinations of potential actions will affect future energy consumption. The AI system then identifies which actions will minimize the energy consumption while satisfying a robust set of safety constraints. Those actions are sent back to the data centre, where the actions are verified by the local control system and then implemented.

We have seen energy savings of 30% on average. If similar tools are deployed across the industry it would lead to even more energy savings.

Main technologies:

AI, Cloud, Machine Learning

Member:

Google

Saving money and energy with Smart Thermostats

Challenge:

Not only are there cost implications that come from turning up the heating, but there are environmental impacts too. The average cost of heating a home in the US is expected to rise more than 17% compared to last year.[12] This places a burden on consumers and on the planet.

Solution:

Smart thermostats, such as Google's Nest Thermostat, can help save both energy and costs through features like temperature scheduling and by helping optimise home electricity usage.

Simple adjustments enabled by **Google's Nest thermostats have saved over 116 billion kilowatt hours (116B KWh) of energy.**

Nest thermostat features like Seasonal Savings and seasonal adjustments make small tweaks to consumers' temperature schedule as the seasons change to help them save energy and lower their bill. These little changes can really add up: Last winter, Google estimates that millions of Nest thermostat users who enrolled in Seasonal Savings collectively saved over $50 million on their energy bills.

Additionally, Google enables Nest thermostat customers to support grid reliability via advanced demand response programs. At times of peak energy demands ("energy rush hours") – which happen when everyone in an area turns their heating on at once – the providing of energy becomes less reliable, more expensive and less environmentally friendly. This is where demand response programs come in: the Nest thermostat will make subtle changes to the temperature in a consumer's home during peak energy usage times, lowering the demand on the power grid whilst keeping consumers comfortable.[13] One is able to change the temperature on their thermostat at any time but the smart thermostats ensure that the default is energy saving.

Main technologies:

Smart thermostats

Member:

Google

[12]Google Nest, Save money and energy this winter with Nest thermostats, https://blog.google/products/google-nest/save-money-and-energy-this-winter-with-nest-thermostats/

[13]Google Nest, Save money and energy this winter with Nest thermostats, https://blog.google/products/google-nest/save-money-and-energy-this-winter-with-nest-thermostats/

Accelerating wind energy development with advanced data management and AI

Challenge:

Google and ENGIE have joined forces to accelerate wind energy development using artificial intelligence (AI) and advanced data management to predict how much wind power should be sold on which power market and at what price.

This is a challenge due to the complexity of the short-term power markets and the unpredictable nature of wind production. In order to tackle this problem, vast amounts of data from various sources needs to be collected, stored and analysed. The AI solution leverages a performant and scalable data system and advanced machine learning algorithms to extract value from the data that supports subsequent decisions.

Solution:

This project will facilitate transactions for wind asset developers and create benefits for wind power producers, accelerating the energy transition.

Once this project is complete, the scale of the impact could be far-reaching: there are hundreds of Gigawatts of wind farms operating around the world, all of which could benefit from improved forecasting using AI.

Main technologies:

AI, Cloud Computing

Member:

Google (in partnership with ENGIE)

AI-based tool reducing energy costs of industrial processes

Challenge:

The energy market is experiencing continuous electricity cost rises and increased variability in prices on the spot market. The difference between the most and least expensive hour of the day has reached upwards of 550€/MWh in 2022. This variability in the markets is mainly due to the increasing share of renewable production and is thus bound to stay in the long term, even if price increases slow down.

Due to these changes, while it was previously only applied to the very largest consumers, we are now seeing smaller industrial entities starting to have energy contracts which are directly correlated to the spot index. It is important for those smaller entities to smartly control their processes by steering their energy demand to when it is the cheapest given their tariffication formulae, for example. Similarly, if those entities have renewable production means, they should try to synchronize their demand and production as much as possible.

One should be able to: predict the market price and its renewable production, predict the constraints on its demand and from these predictions, compute an optimal injection / offtake schedule to minimize energy costs.

Solution:

Optiflex is an AI-based tool reducing energy costs of industrial processes. The tool aims at moving the energy demand of the process to time slots where prices are low and/or local renewable production is high. Not only does synchronising energy demand and local production reduce energy costs, but it also helps the grid by reducing injection (and thus load). This is done by taking into account all constraints of the underlying process, including temperature level for fridges, water volume for reservoirs, minimal state of charge for a battery etc.

To this end, the tool is able to forecast market prices and all variables related to the process' constraints. Using these forecasts, an optimisation process is used to compute the optimal commands schedule for all controllable assets in the process. Finally, it is important to note that both the schedule and forecasts are continuously updated in real-time to always compute control commands in light of all available information.

One of the success stories of Optiflex is the Hydroflex project. Here, the tool enables a hydraulic process in which pumps control the water volume of different reservoirs. By changing the moments at which pumps are activated, the solution was able to steer electricity demand and show a **reduction on the pumping costs of around 10%.** The Hydroflex project is live at the SWDE (Société Wallonne des Eaux), a Belgian water utility.

Main technologies:

AI, Optimisation, the Cloud

Member:

Haulogy (Agoria member)

Achieving surplus energy distribution through a dynamic solar panel model

Challenge:

Distributed energy is one of the key tools to enhance the participation of the consumer in the energy system. It also represents an advantage for the electrical system as a whole as it reduces the energy dissipated through transmission networks. In order to speed up the deployment of distributed energy generation, we must promote the installation of solar panels that cover the whole rooftop, maximizing the use of available surface.

This can be incentivised by allowing customers to generate energy cost savings by sharing the surplus energy from solar panels (energy that they cannot self-consume) with nearby consumers. This is called collective self-consumption. Collective self-consumption transfers benefit multiblock buildings and single-family homes, as well as neighbourhoods of different social strata, thus democratising the access to cheap and clean energy.

Solution:

Rooftop solar generation splitting should be done through dynamic distribution models, allowing for an efficient allocation of the common resource.

We have approached the problem from a mathematical optimisation perspective. Based on a series of restrictions (historical customer consumption, electricity generation forecast, land registry) we seek to maximize an objective function: surplus energy distributed among our customers.

Our dynamic model generates distribution coefficients for every hour of the day by matching the excess production from the self-consumption installations and the consumption of nearby houses. The model has proved to **maximize the self-consumption of solar panels by up to 90%.**

Main technologies:

Big data, Machine learning & Data Science, Cloud Computing, IoT

Member:

Holaluz (Adigital member)

Preventing CO2 emissions with the cloud and data analytics

Challenge:

Coping with ever-increasing data volumes and closely monitoring individual devices in order to improve energy efficiency is a challenge. To continuously improve the energy efficiency of buildings, Techem relies in particular on connectivity and regular data collection.

Having a solid data corpus is necessary to furnish customers with the required level of transparency, awareness of their own consumption, and improving the energy efficiency of their buildings. What was needed was a powerful and, most importantly, scalable solution to work with big data. Only when the right data are available and accessible in real time, can lower energy consumption happen.[14]

Solution:

Using Azure Data Explorer, device monitoring and data analytics are made possible. Techem uses a variety of Microsoft tools – such as the Azure cloud, Azure Data Explorer, and Azure IoT Hub - to evaluate data and so improve energy efficiency.

The data passes through Azure IoT Hub on its way to Azure Data Explorer, where it is made usable. Thanks to advanced analysis, machine learning with Databricks, and visualisation using Power BI, the data now provides valuable insights. For example, a heating system that is not set correctly makes it generate more heat than will be consumed which in turn translates into unnecessary CO2 emissions. This is precisely the kind of anomaly that this data analysis brings to light, allowing the settings to be optimised.

In the Cloud, temperature and meter data are collected every 15 minutes. Any discrepancy compared to reference values immediately triggers an alarm, which users can see in their Power BI dashboard. Digital and intelligent management of heating systems can **cut emissions by up to 15 %** and Techem **customers avoid producing approximately 8.7 million metric tons of CO2 every year** thanks to Techem's devices and services, based on Microsoft IT technology.

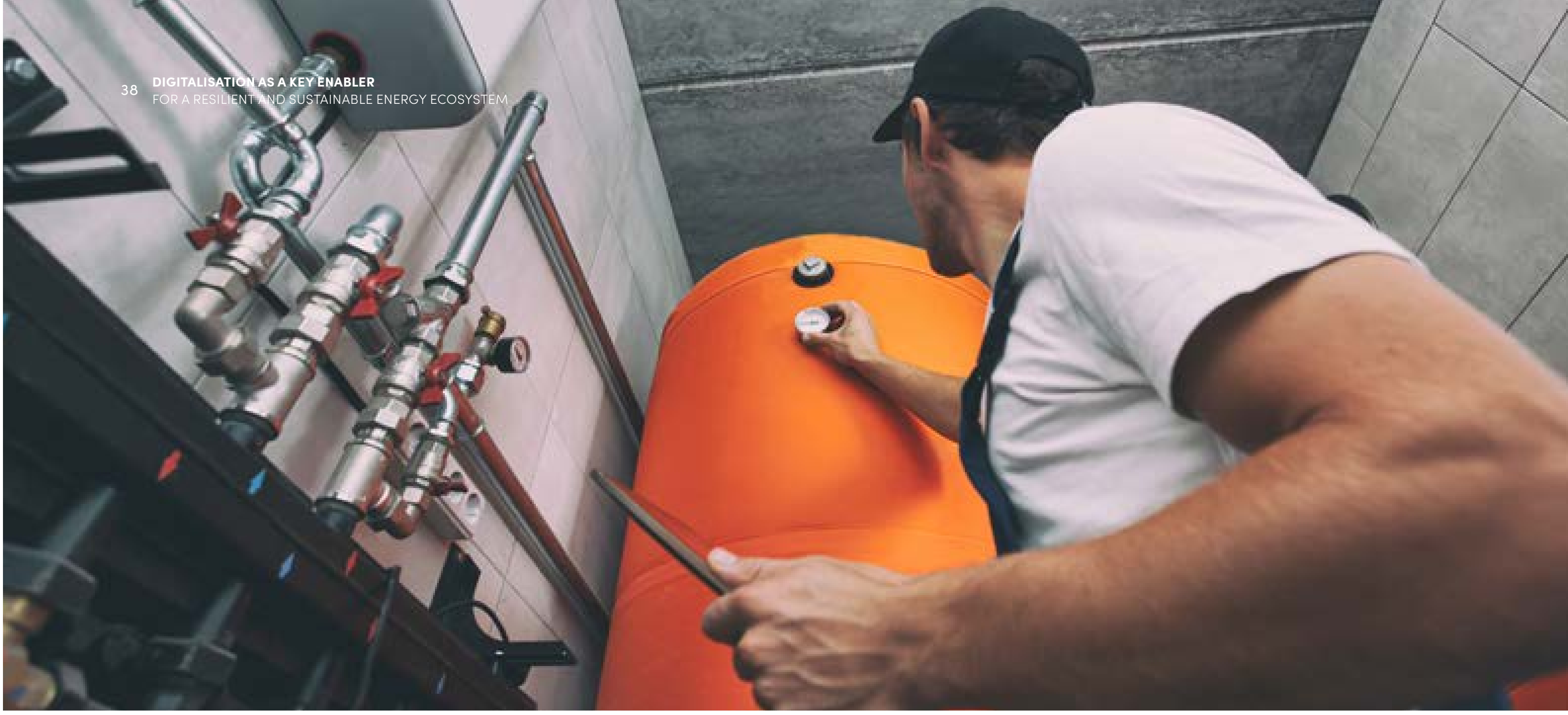
Main technologies:

AI, Cloud computing, IoT

Member:

Microsoft

[14]Microsoft, How the cloud is helping prevent CO2 emissions: Techem relies on Azure IoT for its measuring technology. https://customers.microsoft.com/en-us/story/1472885733931371161-techem-azureiot-en



Accelerating the rollout of sustainable district heating and cooling grids

Challenge:

Control and scale smart grid internationally: In the age of climate change, energy must be used more efficiently, utilities have to invest in advance innovations and waste heat should no longer go unused. That's why E.ON energy supply is moving toward heat pumps and chillers, which can generate heating or cooling for buildings from low temperature excess energy. E.ON's objective is to maximise the reuse of energy within the system and reduce the energy supplied by up to 75%.

Solution:

E.ON relies on Azure Machine Learning, Azure Data Factory, and Azure DevOps for the orchestration to ensure that it can prepare the ML models for international rollout as quickly as possible and develop and refine them at any time as needed. The cloud-native environment offers significant advantages: Azure Machine Learning stack provides a coherent workspace for data scientists or data engineers as well as for the DevOps pipelines. For the ML training, E.ON uses the parallel setup and gets the result immediately with no system administration whatsoever. With Azure ML, the data science team can focus entirely on the business benefits." In 6 months of operating of Azure, E.ON calculated that Azure Data Factory and Azure ML enabled them to **speed up the data feed for more than 400 buildings by about 25%;** now that their calculations can be performed in parallel, they can train models even 50% faster. They are also **25% faster when it comes to assigning building scores,** which allow to reach energy efficiency in more buildings, more areas, faster.

Member:

Microsoft

Optimising wind energy production by reducing the negative impact of turbine wakes

Challenge:

Optimizing wind energy production by reducing the negative impact of turbine wakes. IEEE Spectrum estimates that 10 percent of potential wind power is lost to wake effects—the result of turbulence from one turbine negatively affecting others behind it.
Even a 1% improvement could translate to millions of dollars in revenue and a more sustainable energy future. As a global leader in renewable energy and the largest wind turbine manufacturer in the world, Vestas' continuous challenge is to optimize all aspects of wind power to boost the business case for its customers as well as sustainability.

Solution:

Vestas ran a reinforcement learning engine using machine learning and Microsoft Azure high-performance computing and storage resources. Vestas now has the tools to generate simulations that offer the potential to help wind farms mitigate wake effect, generate more wind energy, and build a sustainable and prosperous energy future. Vestas uses this platform to run complex simulations at scale to rapidly train models (controllers) capable of automatically reacting to wind conditions to minimize power loss from wake-effect turbulence. Vestas uses this method of training controllers to take appropriate actions based on inputs from the wind farm environment, like adjusting turbine yaw in response to wind direction, speed, and wake effect to mitigate wake effect and increase wind farm efficiency and yield. The value delivered by the technologies built on Microsoft Azure HPC unlocks wake mitigation, but also other use cases that make wind power even more competitive. Vestas now aims at optimizing design and profitability of sustainable energy solutions for customers.

Member:

Microsoft

Image by Ed White from Pixabay

AI technologies and accelerated computing infrastructure to predict effects of climate change

Challenge:

The extreme weather events we are experiencing are a consequence of global warming. Greenhouse gas emissions from human activities are responsible for approximately 1.1°C of average warming since the period 1850-1900. What we're experiencing is very different from the global average. Although we will not feel the impact of our efforts for decades, we must confront climate change and act with urgency today.

The answer is simulation. To develop the best strategies for mitigation and adaptation, we need climate models that can predict the climate in different regions of the globe over decades.

Unlike predicting the weather, which primarily models atmospheric physics, climate models are multidecade simulations that model the physics, chemistry and biology of the atmosphere, waters, ice, land and human activities.

Climate simulations are configured today at 10 to 100-kilometer resolutions, take a long time to run, and produce predictions that are difficult for stakeholders such as policymakers to interact with. Greater resolution is needed to model changes in the global water cycle — water movement from the ocean, sea ice, land surface and groundwater through the atmosphere and clouds. Of relevance, changes in this water system can lead to intensifying storms and droughts.

Solution:

Earth-2 (E-2) is an NVIDIA initiative to build AI technologies and associated accelerated computing infrastructure to predict climate change in unprecedented fidelity. E-2 aims to allow researchers and decision-makers to interact with data and rapidly explore what-if scenarios in order to better understand and predict the effects of climate change, as well as accelerate mitigation and adaptation efforts. Earth-2 will be used for local and global climate predictions in four major ways:

- **Modeling:** E-2 will be used to predict extreme weather events such as hurricanes.
- **Mitigation:** E-2 will accelerate the energy transition by improving the use of renewable energy. It will be able to predict how different configurations of a solar farm will perform in the future, allowing for the best configurations to be adopted, in turn ensuring the best results.
- **Monitoring:** E-2 will be used to explore and monitor the state of the world today and tomorrow through the detection and monitoring of deforestation, melting glaciers, coral bleaching, wildfires, and air quality.
- **Adaptation:** E-2 will be used to predict future global climate patterns, and how we can prepare for them. Its ice and sea-level change prediction capabilities will help public authorities adopt relevant adaptation measures.

Main technologies:

AI, high performance computing (HPC), metaverse, accelerated graphics technology

Member:

NVIDIA

Photo by Lucy Meadows

Advanced Building Management System providing carbon savings

Challenge:

Buildings generate about 40% of the EU's energy consumption and 36% of its GHG emissions.

Solution:

An Advanced Building Management System is a BMS with an additional IoT sensing and analytics layer. This technology brings significant carbon savings and can even be carbon positive in a relatively short timeframe (just under one year) for an average European all-electric reversible heat pump equipped building.
The Advanced BMS Solution has sensors that allow it to provide efficient light and HVAC services by detecting when to turn off lights and switch off heating. While a standard BMS, which has controllers and meters with no spatial or time granularity linked to sensors, is already providing savings, the advanced BMS solution provides further benefits by adding the digital layer (HW & local IT infrastructure).

As an example, two all-electric commercial buildings in Grenoble were audited.

Schneider Electric looked at the difference between extra savings from avoided emissions on HVAC and other usages, and extra emissions (embodied and at use) of the added/delta IoT Hardware & IT infrastructure.

A bill of materials (each functional zone is fitted with 2 combined light level/occupancy sensors and 1 temperature, relative Humidity and CO2) was created to assess the embodied emissions of the solution.
Then, operational emissions were assessed based on local IT infrastructure and a data retrieving scheme.

Energy savings were retrieved from real data (T11 building) showing savings over several years. A detailed analysis per usage was done on energy consumption (which can be split out by function: heating, cooling, non-weather dependent load and weather normalized), and energy (electricity) savings brought by the solution. **The deployed solution allowed for a 15% increase in energy savings (55MWh) over the 2019-2021 period,** which corresponds to the EU target for energy consumption reduction.

Schneider Electric has demonstrated that an Adv. BMS solution can reach a carbon "break-even point" in less than one year for an EU all-electric office building.

Main technologies:

Advanced BMS, data collection, sensors, IoT hardware & IT infrastructure

Member:

Schneider Electric

Photo by Sabian Mahmud

Siemens' digital twin of the electrical grid to develop clean power sources

Challenge:

The Finnish transmission system operator Fingrid introduced Siemens' digital twin to support asset and operation management, as well as infrastructure investment planning. Its aim is to address challenges such as the rise of decentralized, renewable energy input that makes it harder to balance the power system hour by hour.

It was also noted that the existing customer-built network model management had reached its limit and there is a need to increase data accuracy and consistency across their entire IT landscape.

Solution:

The use of Siemens[15] digital solution allows Fingrid to reduce the effort on data collection and focus on organising power distribution and planning the evolution of the grid. 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 euros are currently being invested, based on projections made by the Siemens digital twin. Since the tool is used for operations, asset management, and investment planning, it is tested on a daily basis. The testing and the quality of the data analysed not only ensure cost-effectiveness, but also **allows the Finnish grid to have a reliability of 99.9996%.**

Siemens Electrical Digital Twin solution provides a common database model that contains power system data across multiple enterprise systems; enables systematic and consistent exchange of data across various utility domains and extended API integration facilitates automated calculations and processing.

Main technologies:

Digital twin of the electrical grid, advanced grid software solutions

Member:

Siemens
(in partnership with Fingrid)

Cloud computing solution transforming energy grids to deliver environmentally clean power

Challenge:

Globally, power service providers are looking for ways to reach their sustainability goals without reducing the resiliency of the grid. However, many of the renewable energy solutions that are being commissioned to displace existing fossil fuel solutions are changing the operating characteristics within their service territories. Centralised management systems have begun to deliver significantly advanced capabilities in improving outage response times, business continuity, and overall power quality. However, data quantity and quality are the key factors to their performance, with a heavy reliance on high-speed, high-bandwidth connectivity and growing requirements for compute.

Solution:

The innovation project[16] with UK Power Networks will transform their grid into an intelligent, environmentally clean power system, offering their participants and customers real savings while facilitating massive amounts of data. Software-defined systems hosted on VMware, known as Virtualized Protection, Automation, and Control (vPAC) will be used at each power system station, delivering protection, custom controls, and automation of high voltage equipment, previously performed by a large grouping of traditional microprocessor devices, onto a small set of computing hardware. High speed and consistent performance remain available, even after consolidation. UK Power Networks expects to enable and increase the available capacity of renewables, **offsetting a projected 1.9 million tons of CO2 and to save their customers well over £100 million by 2030.** The portability and scalability of the software-defined system offers significant advantages in terms of standardisation of deployment and flexibility in operation.

Main technologies:

Edge cloud computing

Member:

VMware

[16]https://innovation.ukpowernetworks.co.uk/projects/constellation/

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