GREEN DIGITAL DIPLOMACY

Time for the EU to lead

by

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INTRODUCTION

In the second that just elapsed, over 116 terabytes of data were exchanged throughout the internet [1], an amount comparable to ten times that produced by the Hubble Space Telescope in one year [2]. Data has become an essential resource for economic growth, job creation and societal progress. It will 'reshape the way we produce, consume and live' [3].

However, our increasingly digital way of life comes at a cost for the environment. The 2020 speech 'The state of the planet' by UN Secretary-General António Guterres made it clear: the world economy needs to transform to embrace a sustainable economic model with cleaner infrastructure, including digital and internet infrastructure [4]. It is a global problem that requires a concerted international effort. And yet the environmental impact of new technologies is hardly addressed as a foreign policy issue. The EU–Japan Green Alliance signed in May 2021, despite being relatively comprehensive, does not make any reference to the environmental challenges of digital transition [5]. The partnership between the European Commission and Breakthrough Energy Catalyst [6] to boost investments in critical climate technologies focuses on green hydrogen, direct air capture, long-duration

Summary

> To be responsible digital players, states need to address the environmental cost of using digital services that rely on large volumes of data and to promote green solutions as part of their international digital engagement strategies.

> For the EU's foreign policy, this means embracing 'green digital diplomacy' as one of the priorities and a chance to exercise normative leadership.

> Green digitalisation represents a strategic opportunity for the EU's foreign and security policy to exercise influence in times of geopolitical competition and trade tensions.

> It is also a means to strengthen the resilience and reduce the vulnerability of partner countries while at the same time contributing to the EU's own security in the long term.

> Concrete objectives for the EU's green digital diplomacy should include promoting globally sustainable data practices, strengthening the focus on sustainability as a shared responsibility, and fostering good practices in 'green by design' approaches to digital transition.

energy storage and sustainable aviation fuels, but not on the information technology sector.

This is puzzling given that data centres that power the Information and Communications Technology (ICT) sector generate up to 2 % of global carbon emissions, a number comparable to the aviation sector [7]. The ICT sector accounts for around 7 % of global electricity use, but according to certain predictions, it could be using one fifth of all the world's electricity by 2025 [8]. By the same year, the ICT sector may be responsible for 5.5 % of the world's greenhouse gas (GHG) emissions. If the ICT sector were a country, this would make it the fifth largest polluter in the world, after China, the United States, India and Russia [9].

Consequently, any international actor aspiring to global leadership on climate change needs to look beyond the energy consumption, GHG emissions and natural resources related to design, production and end-of-life of the digital sector. To be responsible digital players, states need to address the environmental cost of using digital services that rely on large volumes of data and to promote green solutions as part of their international digital engagement strategies. For the EU's foreign policy, this means embracing 'green digital diplomacy' as one of the priorities. Such an approach would bring digital and climate – two of the EU's key policy priorities – under the same roof and contribute to promoting a 'European way, balancing the flow and wide use of data, while preserving high privacy, security, safety and ethical standards' [10]. It also offers a new opening for the EU's commitment to strengthening multilateralism and a rules-based international order, including through setting norms and principles for the world's digital transition, and the EU's capacity-building and development cooperation.

This Brief starts by providing an overview of the impact that the increasing use of data has on the environment to debunk the myth of its intangibility. It then proceeds with a discussion of what green digital diplomacy could look like for the EU, focusing on three specific areas: green data coalitions, shared responsibility and green 'digital by design'. It concludes with observations on how to conduct green digital diplomacy in order to maximise its impact.

> **T**o be responsible digital players, states need to address the environmental cost of using digital services.

THE MYTH OF DATA INTANGIBILITY

Attracting political attention to this challenge might be difficult without better awareness and understanding of the challenge that green digital diplomacy aims to address. The way data is collected, accessed, used, stored, transferred and disposed of has an environmental impact in terms of electricity consumption and carbon outputs. Nowadays, more than 5 billion users are connected worldwide. In the past 21 years, the number of users has grown by 1 300 % [11]. To put the numbers in perspective, only yesterday a city the size of Frankfurt went online, and tomorrow another one will be connected to the internet, generating new quantities of data.

However, contrary to common belief, cyberspace is not just an intangible flow of codes and data. It relies on a very tangible backbone that requires energy to operate. Data is produced (or collected), accessed, used, stored, transferred and in the end deleted. All these steps require energy. If the environmental footprint of the digital sector is comparatively small on the individual scale, the aggregate figures become more relevant as more users join the internet and new connected technologies reach global markets. When it comes to the data economy specifically, in 2018, data centres worldwide consumed around 200 TWh or about 1 % of global electricity use (roughly the current energy consumption of Belgium and the Netherlands together). With 45 % of the population in Asia and 57 % on the African continent still to come online [12], the EU's objective of closing the digital divide needs to take into account the potential environmental impact of these policies.

There is also a positive development, which proves that the growth of the data economy does not necessarily lead to significant increases in energy consumption. Despite the 419 % increase in internet traffic between 2015 and 2021, the energy demand of data centres has remained constant at around 200 TWh during the past 6 years. Such an achievement was possible thanks to rapid improvements in the efficiency of servers, storage devices and data centre infrastructure. In particular, energy efficiency has been doubling every couple of years, mainly owing to aggressive improvements to circuit design, component integration, software optimisation and power management schemes [13]. As a result, it was possible to keep up with the ubiquitous use of connected devices with relatively little concern about how the use of these technologies could affect the environment.

However, as the Covid-19 pandemic led to a data traffic increase of 50 % in some markets, it is uncertain if this trend will be sustainable, as a number of collaborative platforms have been struggling to keep up with the upsurge in demand [14]. Emerging technologies such as machine learning, distributed ledger, edge computing and virtual reality will make the ever-increasing availability of large pools of data a necessity. It is estimated that the total internet traffic of data centres will increase by another 693 % by 2030 [15]. For instance, data-demanding technologies such as blockchain – open and decentralised lists of records that guarantee the integrity of data without the intervention of any trusted third party – are likely to be increasingly employed in smart contracts, secure certificates, personal health records, e-government, cryptocurrencies, contact-tracing applications, etc.

Developments in how data is processed and stored will have crucial energy consequences as well. As a matter of fact, hyperscale data centres consume proportionally much less energy than smaller data centres. At present, 80 % of the current processing and analysis of data takes place in data centres and centralised computing facilities. Yet by 2025 these proportions are likely to be inverted because of smart connected objects such as cars, home appliances and manufacturing robots [16]. It is increasingly likely that future efficiency gains – the main factor responsible for the current flat curve in data centres' energy consumption – may be unable to keep pace with the growing data demand and the changes in the use of data brought about by disruptive technologies [17].

PROJECTING 'GREEN DIGITAL EUROPE'

The European Green Deal committed the EU to sustainability by providing a roadmap to a climate-neutral EU by 2050. However, mentioning the 'twin challenge' of the green and digital transformations, the Commission also recognises that 'Europe needs a digital sector that puts sustainability at its heart' and says that it 'will also consider measures to improve the energy efficiency and circular economy performance of the sector itself, from broadband networks to data centres and ICT devices' [18]. In other words, 'the ICT sector also needs to undergo its own green transformation' [19].

This commitment needs to go beyond the EU's borders and translate into the EU's engagement with other regions. As the communication on multilateralism argues, 'increasing the EU's capacity to be a global actor also means ensuring consistency between the EU's external actions and its internal policies' [20].

It means that the EU's international engagement on digital issues should simultaneously address the potential environmental impacts, in particular in terms of energy consumption, of the planned initiatives in partner countries. For instance, the EU has set digitalisation as one of its priorities for engagement with Africa and other regions. At the same time, succeeding at home will put the EU in pole position to provide thought leadership on green digital transition globally, especially in its bilateral relations and multilateral forums.

Digitalisation also acts as 'an accelerator and enabler of many, perhaps all of the Sustainable Development Goals [SDGs]' [21]. In this perspective, a sustainable digital economy serves several priorities, including building resilient infrastructure, promoting inclusive and sustainable industrialisation and fostering innovation (SDG 9), ensuring sustainable consumption and production patterns (SDG 12) and taking urgent action to combat climate change and its impacts (SDG 13). In other words, green digital diplomacy focused on promoting sustainable digital economy and growth has the potential to become a flagship European project. At the conceptual level, green digital diplomacy is the EU's chance to exercise normative leadership. At the institutional level, it encourages increased coherence of external policies and tools combining foreign policy, climate, digital, trade and development policies.

WHAT IS DIGITAL GREEN DIPLOMACY ABOUT?

Green digitalisation not only serves environment-friendly transition, but also represents a strategic opportunity for the EU's foreign and security policy to exercise influence in times of geopolitical competition and trade tensions. Like 'ecological diplomacy' [22], sustainable green digital transition is a means to strengthen the resilience and reduce the vulnerability of partner countries and regions while at the same time contributing to the EU's own security in the long term. This approach is a direct translation of the Council conclusions on climate diplomacy [23] in which Member States pledged to 'help raise global ambition' to tackle the climate challenge and reiterated the need to urgently scale up these efforts beyond the EU.

Certain elements of what could be considered green digital diplomacy are already mainstreamed into the EU's trade and digital policies. As part of the European Green Deal, the European Commission proposed to raise the 2030 GHG emissions reduction target to at least 55 % compared with 1990, including emissions
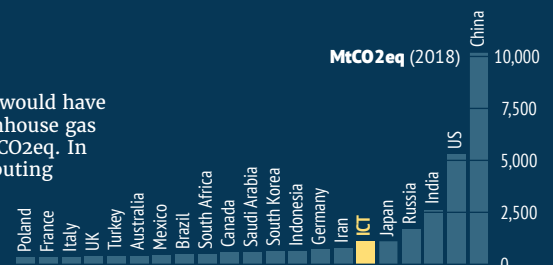
Digital polluters

As interconnected technologies become ubiquitous, sustainable digital solutions are indispensable to fight climate change.

Digital transition – with data at its core – is transforming virtually every area of life. But information and communication technologies (ICTs) also have energy and emission bills that rival those of entire countries. Population growth, an uptick in connectivity in developing countries, and our increasing reliance on connected technologies due to the COVID–19 pandemic, make sustainable ICTs a necessity.

IF ICT WERE A COUNTRY

If the ICT sector were a state, it would have ranked 6th in the world in greenhouse gas emissions in 2019 with 1 100 MtCO2eq. In this measure, ICT includes computing devices, data centres and communication networks.

MtCO2eq (2018)

Poland, France, Italy, UK, Turkey, Australia, Mexico, Brazil, South Africa, Canada, Saudi Arabia, South Korea, Indonesia, Germany, Iran, ICT, Japan, Russia, India, US, China
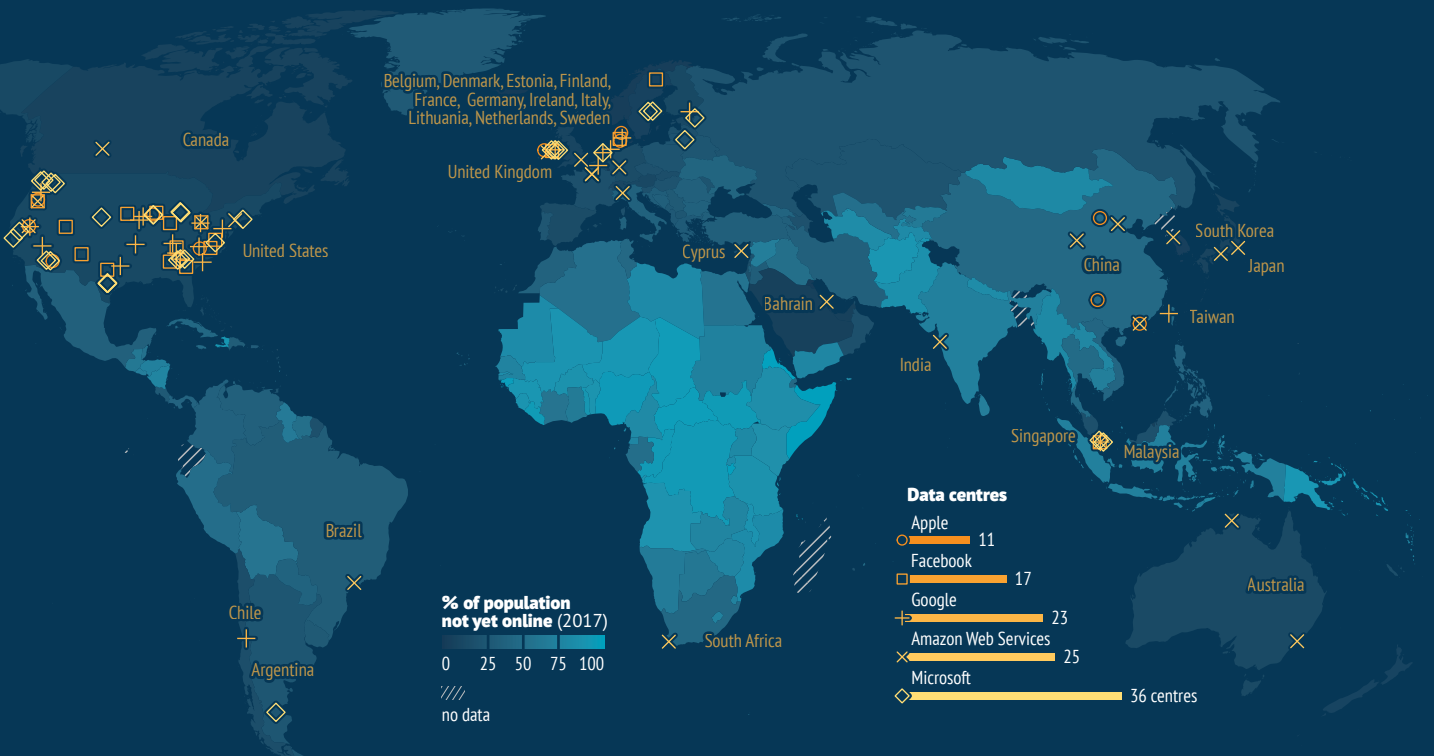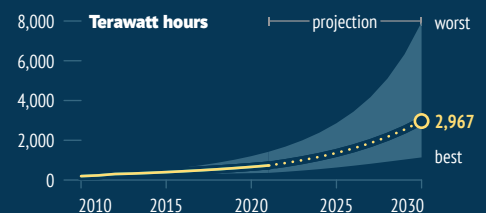
10,000 / 7,500 / 5,000 / 2,500 / 0

DATA CENTRES AND INTERNET PENETRATION AROUND THE WORLD

Big tech's data centres are mostly located in the Global North, where technological advancements and climate conditions make them among the most energy efficient. In the future, increasing internet users and demands for sovereignty over data can expand new data centres worldwide. To keep emissions low, it will be key that all data centres are climate–neutral.
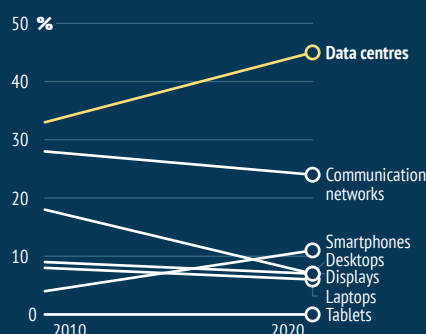
ENERGY DEMAND

While internet traffic has grown by 419 %, the energy demand of data centres has remained constant in the past six years. However, the Internet of Things, edge computing, and data localisation rules may change this picture.
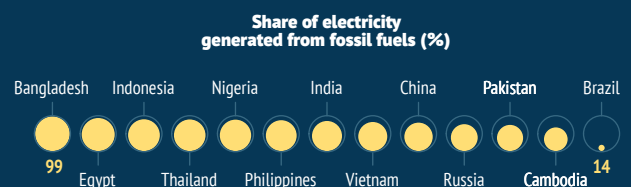
8,000 / 6,000 / 4,000 / 2,000 / 0
Terawatt hours — projection — worst

2010 2015 2020 2025 2030
○ 2,967
best

Canada

Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Lithuania, Netherlands, Sweden

United Kingdom

United States

Cyprus

Bahrain

India

China

South Korea

Japan

Taiwan

Singapore

Malaysia

Brazil

Chile

Argentina

South Africa

Australia

% of population not yet online (2017)

0 25 50 75 100

//// no data

Data centres

Apple — 11
Facebook — 17
Google — 23
Amazon Web Services — 25
Microsoft — 36 centres

DATA CENTRES OUTGROW THEM ALL

Relative contributions to ICT's carbon footprint show that end–user devices took less of a share in 2020 (31 %) than they did in 2010 (39 %). At the same time, data centres grew by 12 percentage points, to account for nearly half of the emissions (45 %).

50 **%**
40
30
20
10
0

2010 2020

○ Data centres
○ Communication networks
○ Smartphones
○ Desktops
○ Displays
○ Laptops
○ Tablets

PRIMED FOR GROWTH

Many countries with high GDP growths and a significant proportion of the population not yet connected to the internet use mostly fossil fuels for electricity production.

Share of electricity generated from fossil fuels (%)

Bangladesh Indonesia Nigeria India China Pakistan Brazil
99
Egypt Thailand Philippines Vietnam Russia Cambodia
14

and removals. Further elements of this policy were set in the provisional deal on the European Climate Law agreed in April 2021. In trade policy, on the other hand, the EU urges states to also align their trade promotion, finance, aid and foreign investment strategies with their domestic climate pledges and Paris Agreement commitments, and to institute sustainable and climate-sensitive policies for economic recovery from the Covid-19 crisis as an important element of a sustainable growth strategy and an immediate investment in a climate-resilient, inclusive and just transition.

A similar level of ambition is needed to strengthen the sustainability of the data ecosystem. The steps that may help in achieving this objective vary from regulatory solutions to technical innovation, awareness raising and adaptations in consumer behaviour. Consequently, concrete objectives for the EU's green digital diplomacy should include the following.

1. **Promoting globally sustainable data practices**, alongside the energy efficiency of physical devices. This encompasses bringing data sustainability into climate and digital diplomacy, in particular as one of the priorities for engagement with developing countries. Given the transborder nature of data production and data flows, partnerships will be crucial in this endeavour;

2. **Strengthening the focus on sustainability as a shared responsibility** among governments, citizens and consumers, including through 'green by design' digital solutions and more sober lifestyles (e.g. digital literacy programmes could include sustainability as an element);

3. **Fostering good practices in green by design approaches to digital transition**, in particular through research on the relationship between sustainability and digital transition in order to have more up-to-date data, pushing for a more comprehensive life-cycle assessment of the footprint of the data economy, and conducting assessments of the EU policies on data governance through the lens of environmental sustainability.

BUILDING A GREEN DATA COALITION

The EU has made an ambitious commitment to become the first climate-neutral continent and climate-resilient society by 2050. Other countries,

The EU is uniquely placed to forge a global green data coalition.

such as China, Japan, the Republic of Korea, the United Kingdom, the United States and more than 110 others, have committed to carbon neutrality by 2060 or sooner. The blueprints for international cooperation towards achieving these goals already exist: the 2030 Agenda, the SDGs and the Paris Agreement on climate change. But, as the experience of the past years has shown, translating these goals into concrete achievements will be more difficult. While remaining committed to supporting the UN objective of building a truly global coalition for carbon neutrality, the EU should champion the green data cause in its multilateral and bilateral engagements.

In that respect, the EU's credibility as a committed multilateralist [24] may be a particularly powerful tool in promoting this agenda. The EU is uniquely placed to forge a global green data coalition, building on the ongoing government- and industry-led initiatives in this domain undertaken at the UN and its specialised agencies, the World Trade Organization (WTO), Organisation for Economic Co-operation and Development (OECD) and G7/G20. Such a coalition should also include development and financial institutions whose lending policies may be a powerful tool in promoting the green digital transition and data economy. For instance, digital infrastructure roll-out programmes need to assess the sustainability and environmental impact of the whole data ecosystem – in other words promote sustainable policies from cable to cloud. Similarly, capacity-building programmes in the digital domain should include green data – or more broadly green digital – elements that would strengthen the recipients' capacities to develop and implement adequate regulatory frameworks and policies, build up their skills and strengthen the institutions. This element is of particular importance given that most of the online population in the coming years will come from the Global South, where several digital transformation programmes have been announced. Paradoxically, these are also the regions that are experiencing the most severe consequences of climate change. Consequently, a green digital transition needs to go hand in hand with strengthening their overall societal resilience. Adapting global trade rules in the WTO to the new context will play an important role in promoting multilateral trade rules that support the global transition towards a climate-neutral and resilient society.

To reaffirm its role as a leader on digital and climate policies, the EU should convene an international multistakeholder conference on green digital transition bringing together key players and organisations, such as Mission Innovation and the Clean Energy Ministerial. Supporting these goals will also require close cooperation with other partner countries and key players, in particular China and the United States. Promoting green digital transition globally will also

require strengthening the EU's own capacities in its representations across the world, as well as embassies and trade offices of Member States. For instance, digital and trade attachés in the EU delegations should receive additional training when it comes to delivering a green digital transition.

PROMOTING GREEN DIGITAL DIPLOMACY AS A SHARED RESPONSIBILITY

In pursuing its green data diplomacy goals, the EU needs to embrace cooperation with the private sector and civil society organisations that are at the centre of technological change, and to provide legitimacy. Voluntary norms and solutions adopted by the leading companies have proliferated. Their focus is on generating large energy savings and carbon emissions reductions, driven by their commitment to more sustainable business models, attention to savings or availability of resources. This is particularly important in the case of big tech companies, which already benefit from the exponential growth in data creation and consumption the most. Since 2017, Google has matched 100 % of its electricity consumption with purchases of renewable energy, making the company the world's largest corporate buyer of renewable power (2.6 GW of wind and solar energy). In 2019, Amazon pledged to reach net zero carbon by 2040, including emissions from Amazon-operated and third-party freight, electricity use, branded products, capital goods, business travel, packaging, and other purchased goods and services. Microsoft pushed the envelope even further by committing to becoming carbon negative by 2030 – that is, removing more carbon from the atmosphere than the company emits – and to removing by 2050 all the CO_2 that it has emitted since it was founded in 1975. These objectives will be achieved through a series of carbon capture and storage technologies, research and self-levied taxes on carbon emissions, combined with a commitment to add new renewable energy to the grid whenever new projects require it.

Partnerships with these and other large tech companies might be particularly valuable, given that they operate globally and, through their policies and products, can promote specific policies and consumer behaviour. The Global Tech Panel – an informal body of leaders from the worlds of technology, civil society and diplomacy under the auspices of the EU's High Representative – could be leveraged as a platform for such a conversation. A declaration adopted in March 2021 by the members of the European Green Digital Coalition provides a great opening, with the signatories committing to, among other actions, promoting

cross-sectoral dialogue and contributing to the development of guidelines and recommendations for the deployment of green digital solutions in different sectors.

ADOPTING A 'GREEN DIGITAL BY DESIGN' MINDSET

The EU has announced that digital transition will become one of the cornerstones of its Covid-19 recovery plans, including through developing technologies and solutions relying on big data. Consequently, the final element of the EU's green data diplomacy lies in developing and fostering good practices that are green by design. The European Commission has recognised that 'data centres and telecommunications will need to become more energy efficient, reuse waste energy, and use more renewable energy sources [and that they] can and should become climate neutral by 2030' [25]. So far, the EU Data Centre Code of Conduct – a voluntary initiative managed by the European Commission's Joint Research Centre since 2008 – served to improve understanding of energy demands within data centres, to raise awareness and recommend energy efficient best practices and targets [26]. Around 20 % of European data centres are currently using the Code, accounting for around 9 % of the electricity demand of data centres in the EU. As a consequence, since 2010 efficiency has increased by 80 %, especially in large-scale data centres. However, it is crucial that not only big but also smaller data centres become energy efficient and carbon neutral, especially in the light of the likely move to edge computing.

The extent to which the new initiatives reliant on big data will consider the sustainability of data is yet to be seen. It will become clearer as new initiatives progress, including the amendment to the renewable energy and energy efficiency directives, the data act and the review of the database directive, the artificial intelligence packages, or the digital tax. As a matter of fact, if climate neutrality of data centres and telecommunications is to be achieved by 2030 [27], it is important that environmental sustainability appears as a guiding principle in a range of fields. In this respect, sustainability should be more than mere energy efficiency gains or a competitive advantage for virtuous companies. The first signs of such an approach are already there. In its Council conclusions on digitalisation for the benefit of the environment, the Council called on the European Commission to propose regulatory or non-regulatory measures to reduce the environmental footprint of data centres and communication networks, as well as to present an action plan by the end of 2021 on how to reduce the amount of ICT products disposed of by 2025 [28]. In

March, 24 EU Member States, together with Iceland and Norway, signed a declaration to accelerate the use of green digital technologies for the benefit of the environment, committing to using the Recovery and Resilience Facility and the earmarking of expenditure on reforms and investments to support the mutually reinforcing green and digital transitions [29].

An honest approach to data sustainability should also consider digital inequalities manifesting themselves in the form of digital overconsumption typical of higher-income countries. According to the Carbon Literacy Project, the footprint due to the emails received by an average office worker is around 0.6 tonnes of CO_2 equivalent every year [30]. While the average American consumes up to 140 GB of data every month and owns 10 digitally connected devices, the average Indian consumes 2 GB of data every month, typically on one device only [31]. Taking as a reference the email footprint above, this amounts to saying that it just takes the emails received by three average office workers during one year to surpass the total GHG emissions produced by all of an Indian citizen's activities in one year [32]. In that vein, the EU may want to consider proposing a soft law mechanism – for instance a 'data emissions' trading scheme or a similar digital emissions monitoring tool – as a way to raise awareness of data overconsumption and to promote behavioural change. Most users still have very limited understanding of how their digital lifestyles impact the environment. Apart from the energy efficiency of various digital devices (certified by, for example, the EU Energy Star programme or EU Ecolabel), it is quite hard for a European citizen to assess their digital footprint. That makes it even harder to adopt more sober consumption habits.

CONCLUSIONS AND RECOMMENDATIONS

This Brief has argued that green digital diplomacy is the EU's chance to exercise normative leadership globally. Including sustainability as a principle that informs the EU's external relations may have negative impacts on the flow and availability of data (e.g. if sustainability is intended as a condition), on the trade of tech products and on the availability and price of devices for European consumers. However, the experience of the EU's general data protection regulation (GDPR) shows that the EU can act boldly when core values are at stake and act as a norm entrepreneur internationally. To achieve this goal, the Brief proposes a set of four main recommendations for the EU.

1. To convene an international multistakeholder conference on green digital transition, bringing together key players and organisations, including Mission Innovation and the Clean Energy Ministerial;

2. To embrace closer cooperation with the private sector and civil society organisations that are at the centre of technological change. The Global Tech Panel could be leveraged as a platform for such a conversation;

3. To establish a green data coalition that will build on the ongoing government- and industry-led initiatives in this domain, including the work undertaken at the UN, WTO, OECD and G7/G20;

4. To propose a soft law approach or another voluntary mechanism – for instance a data emissions trading scheme or a similar digital emissions monitoring tool – as a way to raise awareness of data overconsumption and promote behavioural change.

But the recommendation to take up this agenda comes with a few words of caution. First, it is no mystery that countries in the Global South should be the primary recipients of the EU's attention. The exponential growth in the online population in those countries in the coming decades will result in a significant increase in the amount of data being produced, consequently leading to the need for more and bigger data centres consuming large amounts of energy. The growing interest in digital sovereignty – including over data – around the world may imply that new data centres will have to be built there rather than in the Global North, as is the current practice. While it is true that significant progress in technology has made data centres more energy efficient and environmentally friendly, energy production patterns show that developing countries – but not only they – still rely significantly on fossil fuels or are expanding their consumption of energy produced from fossil fuels. While China, Europe, India, Russia and the United States appear among the top consumers, in the past 20 years countries such as Bangladesh, Oman, Qatar, Turkmenistan and Vietnam– to mention just a few – have registered increases in the use of energy from fossil fuel, ranging from + 473 % to + 236 % [33]. There is therefore a clear need for a transfer of good practices, know-how and technologies as part of the EU's diplomatic actions and international partnerships with those countries.

Second, with data becoming one of the main trading 'goods', there is also a need for discussion about a more equal distribution of responsibility for digital pollution and the rules governing the use of this new resource. In that respect, the EU is well positioned to foster closer international cooperation in this domain and to take up the role of a leader when it comes to global data governance. This is particularly relevant in the context of the calls for digital or technological

sovereignty in Europe, which are already emulated in other parts of the world, most notably in China and India. The issue of data governance has already started polarising the international community. At the closing of the G20 summit in Japan in 2019, a number of developing countries, led by India, Indonesia and South Africa, refused to sign a declaration on data flows – the so-called Osaka Track – arguing that they had no opportunity to ensure that their own interests in data were reflected in the document. This episode should be a warning for the EU should it decide to assume such a leadership role in global (green) data governance, in order to avoid being accused of 'digital colonialism' [34] or 'tech colonialism' [35]. In that regard, the EU's narrative of human-centric digital solutions – targeting primarily domestic audiences – needs to be more nuanced in order to attract others. To do so, the EU needs to adjust the technology diffusion argument to achieve a more focused approach that recognises the importance of 'indigenous' technologies and promotes more culturally sensitive discussion about how technology functions within specific regional contexts [36].

References

[1] Internet Live Stats (https://www.internetlivestats.com/one-second/).

[2] NASA, 'About the Hubble Space Telescope' (https://www.nasa.gov/mission_pages/hubble/story/index.html).

[3] Commission communication – A European strategy for data, COM(2020) 66 final, 19 February 2020 (https://ec.europa.eu/info/sites/default/files/communication-european-strategy-data-19feb2020_en.pdf).

[4] Guterres, A., 'Secretary-General's address at Columbia University: "The state of the planet"', 2020 (https://www.un.org/sg/en/content/sg/speeches/2020-12-02/address-columbia-university-the-state-of-the-planet).

[5] EU–Japan Summit, 'Towards a Green Alliance to protect our environment, stop climate change and achieve green growth', 27 May 2021 (https://www.consilium.europa.eu//media/49932/eu-japan-green-alliance-may-2021.pdf?utm_source=dsms-auto&utm_medium=email&utm_campaign=EU-Japan+Green+Alliance).

[6] European Commission, 'Commission and Breakthrough Energy Catalyst announce new partnership to support investments in clean technologies for low-carbon industries', Press release, Brussels, 2 June 2021 (https://ec.europa.eu/commission/presscorner/detail/en/IP_21_2746).

[7] UNFCCC, 'ICT helping tackle climate change could help cut global emissions 20 % by 2030' (https://unfccc.int/news/ict-sector-helping-to-tackle-climate-change); Whitehead, B., Andrews, D., Shah, A. and Maidment, G., 'Assessing the environmental impact of data centres part 1: Background, energy use and metrics', *Building and Environment*, Vol. 82, 2014, pp. 151–159.

[8] Vidal, J., '"Tsunami of data" could consume one fifth of global electricity by 2025', *Climate Home News*, 11 December 2017 (https://www.climatechangenews.com/2017/12/11/tsunami-data-consume-one-fifth-global-electricity-2025/); Andrae, A. S. G. and Edler, T., 'On global electricity usage of communication technology: trends to 2030', *Challenges*, Vol. 6, 2015, pp. 117–157 (www.mdpi.com%2F2078-1547%2F6%2F1%2F117%2Fpdf&usg=AOvVaw365eFAr18nrXBOI-w4YSb9).

[9] Belkhir, L. and Elmeligi, A., 'Assessing ICT global emissions footprint: Trends to 2040 & recommendations', *Journal of Cleaner Production,* Vol. 177, March 2018, pp. 448–463.

[10] Communication – A European strategy for data, op.cit.

[11] Internet World Stats, 'Internet users distribution in the world –2021' (https://www.internetworldstats.com/stats.htm).

[12] Ibid.

[13] Koomey, J. and Naffziger, S., 'Moore's Law might be slowing down, but not energy efficiency', IEEE Spectrum, 2015 (https://spectrum.ieee.org/computing/hardware/moores-law-might-be-slowing-down-but-not-energy-efficiency).

[14] Hartmans, A., 'Netflix is reducing its streaming quality in Europe to avoid straining the internet during COVID-19', World Economic Forum, 20 March 2020 (https://www.weforum.org/agenda/2020/03/netflix-is-reducing-the-quality-of-its-streams-in-europe-to-avoid-straining-the-internet-during-the-coronavirus-outbreak/); Fleming, S., 'Will the coronavirus break the internet?', World Economic Forum, 23 March 2020 (https://www.weforum.org/agenda/2020/03/will-coronavirus-break-the-internet/).

[15] Andrae, A. S. G. , 'Total consumer power forecast', paper presented at the Nordic Digital Business Summit, Helsinki, 5 October 2017.

[16] Communication – A European strategy for data, op.cit.

[17] Kamiya, G., 'The carbon footprint of streaming video: fact-checking the headlines', IEA, 2000 (https://www.iea.org/commentaries/the-carbon-footprint-of-streaming-video-fact-checking-the-headlines); Lawrence, A., 'Is PUE actually going UP?', Uptime Institute, 2019 (https://journal.uptimeinstitute.com/is-pue-actually-going-up/).

[18] Commission communication – The European Green Deal, COM(2019) 640 final, 11 December 2019 (https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf).

[19] Commission communication – Shaping Europe's digital future, COM(2020) 67 final, 19 February 2020 (https://ec.europa.eu/info/sites/default/files/communication-shaping-europes-digital-future-feb2020_en_3.pdf), p. 12.

[20] Joint communication – Strengthening the EU's contribution to rules-based multilateralism, JOIN(2021) 3 final, 17 February 2021 (https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021JC0003&rid=2).

[21] European Commission, European Fund for Sustainable Development (EFSD) Guarantee (https://ec.europa.eu/eu-external-investment-plan/sites/default/files/efsd-guarantee-windows-digital-for-development.pdf).

[22] Lazard, O. and Youngs, R. (eds.), *The EU and climate security: toward ecological diplomacy*, Carnegie Europe, 12 July 2021 (https://carnegieeurope.eu/2021/07/12/eu-and-climate-security-toward-ecological-diplomacy-pub-84873).

[23] Council of the European Union, Council conclusions on climate diplomacy, 5033/20, 20 January 2020 (https://data.consilium.europa.eu/doc/document/ST-5033-2020-INIT/en/pdf).

[24] Council of the European Union, Council conclusions on digital diplomacy, 12804/20, 17 November 2020 (https://data.consilium.europa.eu/doc/document/ST-12804-2020-INIT/en/pdf).

[25] Commission communication – Shaping Europe's digital future, op.cit.

[26] The EU has taken measures to improve the environmental performance of its products by setting a framework for manufacturers of energy-related products (through Directive 2009/125/EC, the ecodesign framework directive) and to enable end consumers to identify the better-performing energy-related products (through Regulation (EU) 2017/1369, the energy labelling framework regulation).

[27] Commission communication – Shaping Europe's digital future, op.cit.

[28] Council of the European Union, Draft Council conclusions on digitalisation for the benefit of the environment, 11 December 2020 (https://data.consilium.europa.eu/doc/document/ST-13957-2020-INIT/en/pdf).

[29] European Commission, 'EU countries commit to leading the green digital transformation', 2021 (https://digital-strategy.ec.europa.eu/en/news/eu-countries-commit-leading-green-digital-transformation).

[30] Richards, E. C., 'The carbon cost of an email', Carbon Literacy Project, February 2018 (https://carbonliteracy.com/the-carbon-cost-of-an-email/).

[31] The Shift Project, *Lean ICT – Towards digital sobriety*, March 2019, p. 61 (https://theshiftproject.org/wp-content/uploads/2019/03/Lean-ICT-Report_The-Shift-Project_2019.pdf).

[32] 'The carbon cost of an email', op.cit.

[33] Ritchie, H. and Roser, M., 'Fossil fuels', Our World in Data, 2017 (https://ourworldindata.org/fossil-fuels).

[34] Hicks, J., '"Digital colonialism": why some countries want to take control of their people's data from Big Tech', The Conversation, 26 September 2019 (https://theconversation.com/digital-colonialism-why-some-countries-want-to-take-control-of-their-peoples-data-from-big-tech-123048).

[35] Amrute, S., 'Tech colonialism today', Points, Data & Society, 2020 (https://points.datasociety.net/tech-colonialism-today-9633a9cb00ad).

[36] Arnold, D., 'Europe, technology, and colonialism in the 20th century', *History and Technology*, Vol. 21, No 1, 2005, pp. 85–106 (https://www.tandfonline.com/doi/full/10.1080/07341510500037537).