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Razumkov centre

RMsMANAGER

Sustainability and digitalization: challenges and opportunities

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Sustainable development and digitalization

***Eco-innovations can*:**

- reduce the number of materials to provide a particular service (weight loss);
- extend of product life (durability);
- reduce of energy consumption (efficiency).

The advantage of eco-innovations – is a combination of tools of innovation and environmental policy, which accelerates the emergence of non-standard solutions and provides a closer interaction between the economy and the environment.

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Can the digital revolution be environmentally sustainable?

- ***First***: common situation in climate change
- **Second**: the advantages of digital technologies in different sectors
- ***Third***: digital technologies disadvantages for climate change
- ***Fourth***: recommendations regarding enhancing advantages and reducing disadvantages of digital technologies

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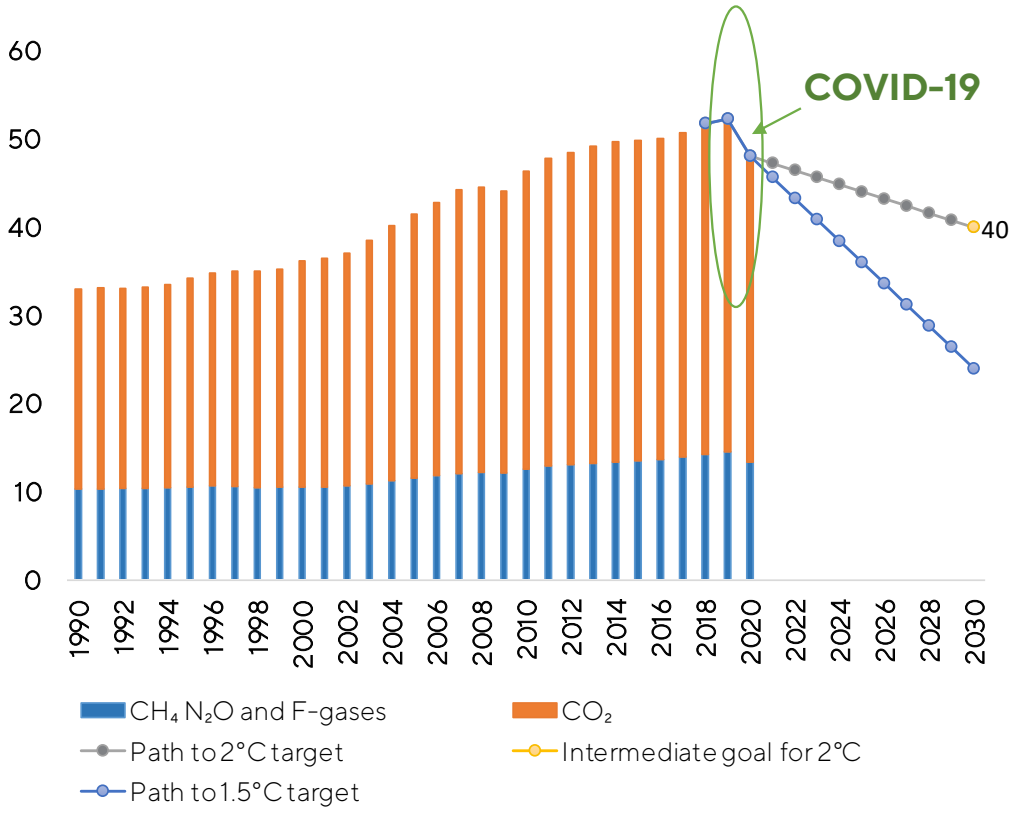
GHG emissions



In 2018 GHG emissions reached a record level of 51.8 Gt. Together with emissions generated by changes in land use the total emissions amounted more than 55 Gt. This level is approximately 55% higher than in 1990 and 40% – the level of 2000.

According to preliminary estimates, in 2020 global CO_2 emissions were reduced by 8%. However, this phenomenon is temporary.

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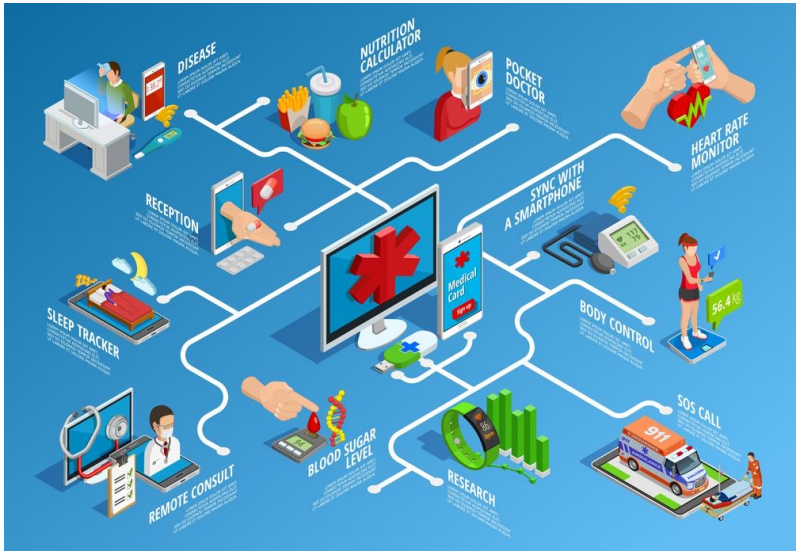
Digital technologies contribute to:

- ✓increasing the level of innovation of the economy, based on knowledge, skills, investment and creativity, with an emphasis on high-tech production, education, health care and "green" tourism;
- ✓export opportunities, capital and services growth;
- ✓gradual reduction of economy carbon intensity;
- ✓expanding opportunities to increase jobs and improve the training system;
- ✓increasing trust in basic public services and improving relations between citizens and authorities.



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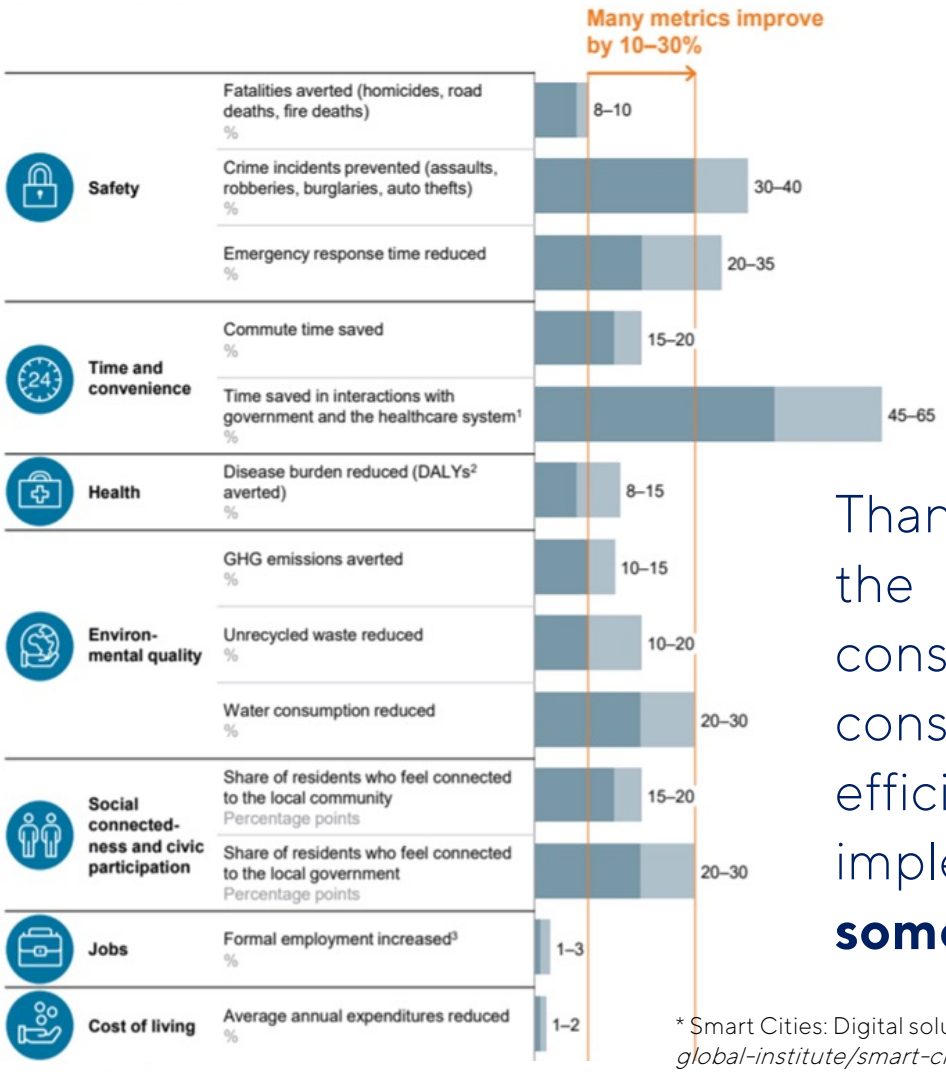

Thanks to the implemented digital technologies in the physical infrastructure we can achieve considerable success: reduce energy consumption, reduce water leakage and more efficiently dispose of waste. It is pretty clear that implementing **digital solutions can improve some key quality of life indicators by 10-30%.**

* Smart Cities: Digital solutions for a more livable future. – McKinsey Global Institute, 21 May 2018, *https://medium.com/mckinsey-global-institute/smart-cities-c0d557ff42c1#:~:text=A%20new%20report%20from%20the,indicators%20by%2010-30%20percent.*

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The simplest examples

The saving of paper, which requires maintenance and processing costs. Digitization of documents has advantages in terms of cost savings, ease of use and sharing in real time, as well as security.

It will take more resources to build a new computer than it does to install new RAM (random-access memory) on existing computer. Computer recycling results the spread of harmful materials such as lead and mercury. Digital technologies make up for this shortcoming.

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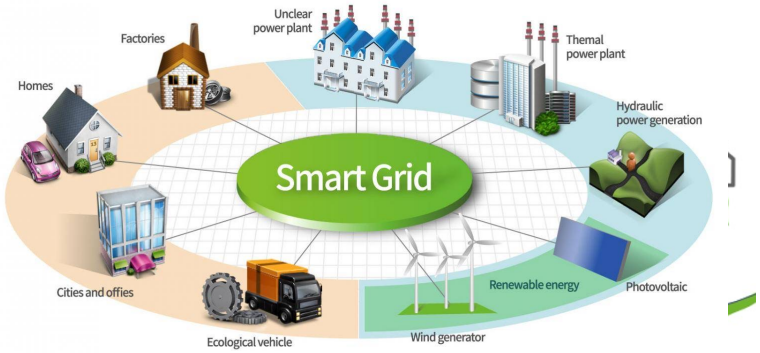
Impact on energy sector



- ✓ ***Smart grids*** can simultaneously generate and consume electricity. Allow not only transport energy, but also generate and direct data to end users.
- ✓ ***Micro networks*** help to reduce energy losses during transmission and distribution.
- ✓ ***Smart metering***: "smart" meter records electricity consumption and sends received data to the utility company. Thanks to such meters, consumers are involved in energy saving measures, especially when demand is at its peak.
- ✓ ***High-speed devices*** reduce energy demand during peak hours. For instance, household appliances such as washing machines and dryers may temporarily.

The biggest savings – from 15% to 50% (depending on the technology) – in heating, cooling and lighting. According to IEA the digitalization can reduce overall energy consumption in residential and commercial buildings by around 10% by 2040.

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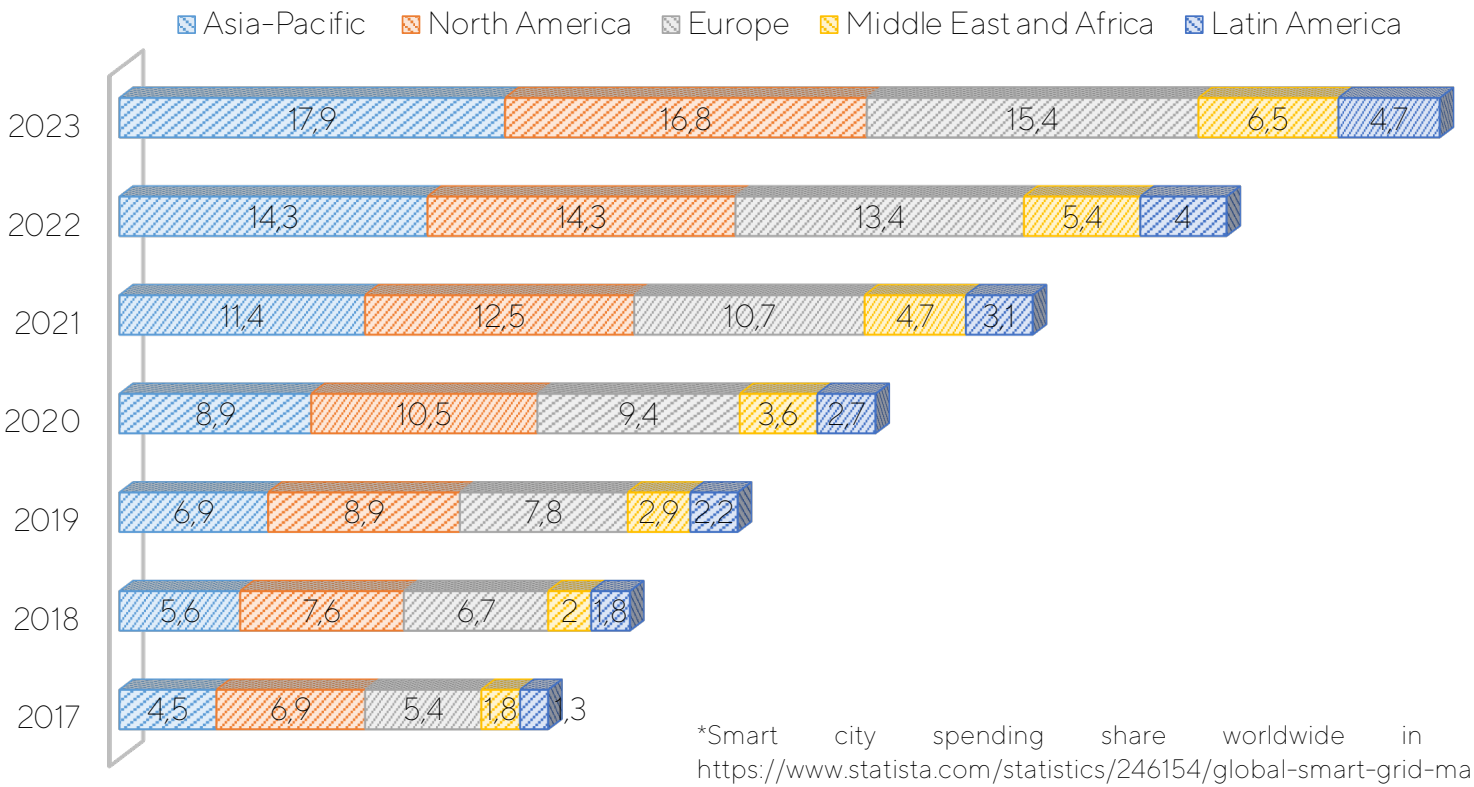
The size of the global smart grids market by region of the world, $ bn*



*Smart city spending share worldwide in 2019, by use case. – Statista, https://www.statista.com/statistics/246154/global-smart-grid-market-size-by-region/.

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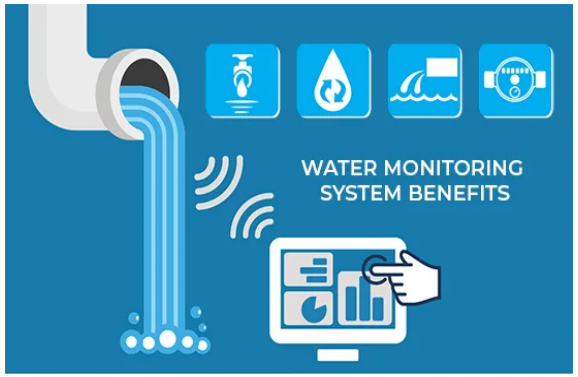
Impact on transport sector

Digitalization affects the transport sector (through automation and shared transport), which accounts for 28% of global energy consumption and 23% of global CO_2 emissions. Thanks to "***intelligent" transport*** systems, the level of safety increases, the level of energy consumption and CO_2 emissions decrease.

Impact on water resources



Leak detection: equipping the distribution network with sensors to provide real-time information on pressure, flows/leaks and water quality.

Pollution detection: using sensors to measure surface water quality in real time, which contributes to the sustainable development of urban resources.

Water infrastructure maintenance planning: different data sources are combined (for example, sensors in pipes measure flow and pressure).

It is projected that by 2024, 45% of cities and communities in the world will use the IoT water management system to monitor water use, quality and leakage.

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Impact on waste management

System of rational waste management allows to reduce waste volumes and provide sorting waste by types, source formation and also develop methods of its proper processing.

Smart solution is to equip garbage containers with sensors that detect the amount of waste. The obtained data allow to optimize the number of garbage trucks and their routes.

Smart garbage collection station is being introduced in the buildings, where residents dispose of garbage bags (divided into organic and inorganic). Sensor-equipped garbage collection station determines when it becomes full.

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Impact on health care

- ✓***Measurement of indicators***. Sensory technologies built into human things and mobile devices, and provide self-examination.
- ✓***Empowering patients***. Online access to personal electronic medical records kept by health care professionals.
- ✓***Physician support through AI***. AI technology and cognitive computing help physicians interpret medical data to make the correct diagnosis and determine the most effective treatment.
- ✓***Robotics in treatment and care***. Used for the implementation of highly specialized medical tasks.

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Impact on education

- ✓ ***Digitization of education*** involves changing the way of learning. The number of mass open online courses conducted by world universities.
- ✓ ***Adaptive training and counseling*** creates valuable data that form an idea of the student's profile. This allows to combine education and counseling.
- ✓ ***Personalization of education.*** It is possible to combine educational services from different education providers. Offer to shape the learning path based on personal preferences, interests and talents.
- ✓ ***Continuing education***. Online education promotes lifelong learning.

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Will digitalization help humanity move closer to sustainable development or will growing dependence on digital technology eventually accelerate negative climate change?

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The Shift Project estimates that the energy intensity of the digital industry is growing by 4% annually, and the share of digital technologies in global CO_2 emissions has increased from 2.5% to 3.7% between 2013 and 2018.

The Öko-Institut founds that each search query generates about 1.45 grams CO_2. If we use a search engine to generate about 50 search queries a day, it generates 26 kg of CO_2/year. For example, Google in its 2017 Environmental Report identified its carbon footprint for 2016 at the level of 2.9 mln tonnes of CO_2, and electricity consumption – 6.2 TWh.

The average annual generation of CO_2 by streaming online video is over 300 mln tonnes/year (in 2018). Music streaming via Spotify or Apple Music, according to the **Universities of Glasgow and Oslo** research, generated between 200 and 350 mln kg of GHG in 2015 and 2016 accordingly.

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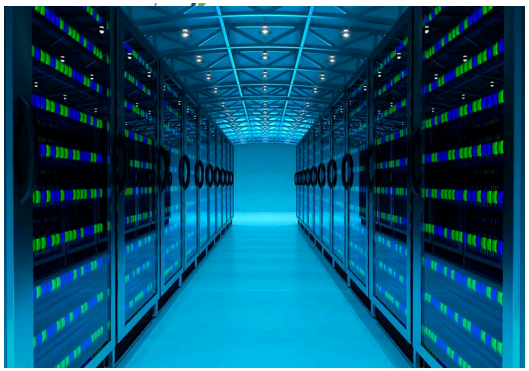
Data processing centers (use phase) and **data transmission networks** (transmission phase) have the greatest influence on CO_2 generation in the digital technology sector.



In 2019 data centers consumed about 200 TWh, which is about 0.8% of world electricity consumption. According to the IEA study for 2017 data transmission network in 2015 consumed about 185 TWh. Forecasts of further consumption differ significantly – for 2030 it is expected to reach 200-3,000 TWh/year.

A number of studies report an annual increase in the volume of IP traffic of the global data center by 25%, which will lead to the growth of world energy consumption to 13% in 2030 . **The worst-case scenario is that the IT sector may consume up to 51% of the world's electricity in 2030 and generate up to 23% of global CO_2 emissions**.

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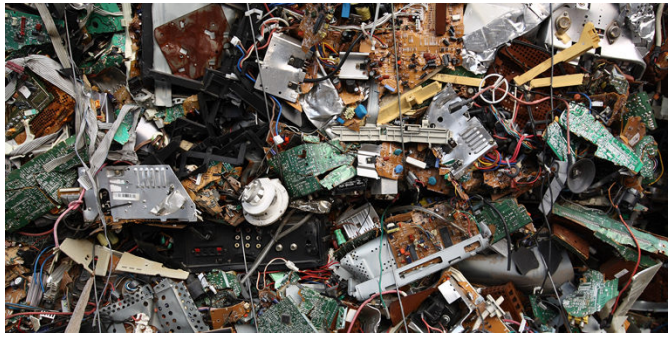
According to the **Bitcoin Energy Consumption Index** (2018), bitcoin uses about 40-80 TWh/year. This is approximately 0.2-0.3% of electricity consumption. Technical University of Munich in 2018 estimated that the entire bitcoin system produces about 22 Mt CO_2/year and could lead to global warming above 2°C.

According to the UN, 50 million tons of **electronic waste** is generated annually in the world in 2021 projected growth to 52 mln tonnes. Despite the fact that 95% of computer devices can potentially be recycled, in 2016 80% (35.8 mln tonnes) of the world's electronic waste has not been recycled. The greenhouse gas emissions from the production, operation and disposal of digital devices and infrastructure are between 1.8% and 3.2% global emissions (as of 2020).



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Enhancing advantages and reducing disadvantages

- ✓Decisive political action
- ✓Understanding of digital technologies real impact on the environment
- ✓Raising awareness of the digital environment
- ✓Promoting best eco-design practices for software, data and equipment
- ✓Methods of carbon incorporation into digital decision-making
- ✓Optimizing equipment standards and reusing or recycling equipment
- ✓Eco-procurement
- ✓Energy efficiency in processing centers data (possibility of using heat in district/local heating networks)
- ✓Increasing the use of RES and reducing the use of toxic materials.

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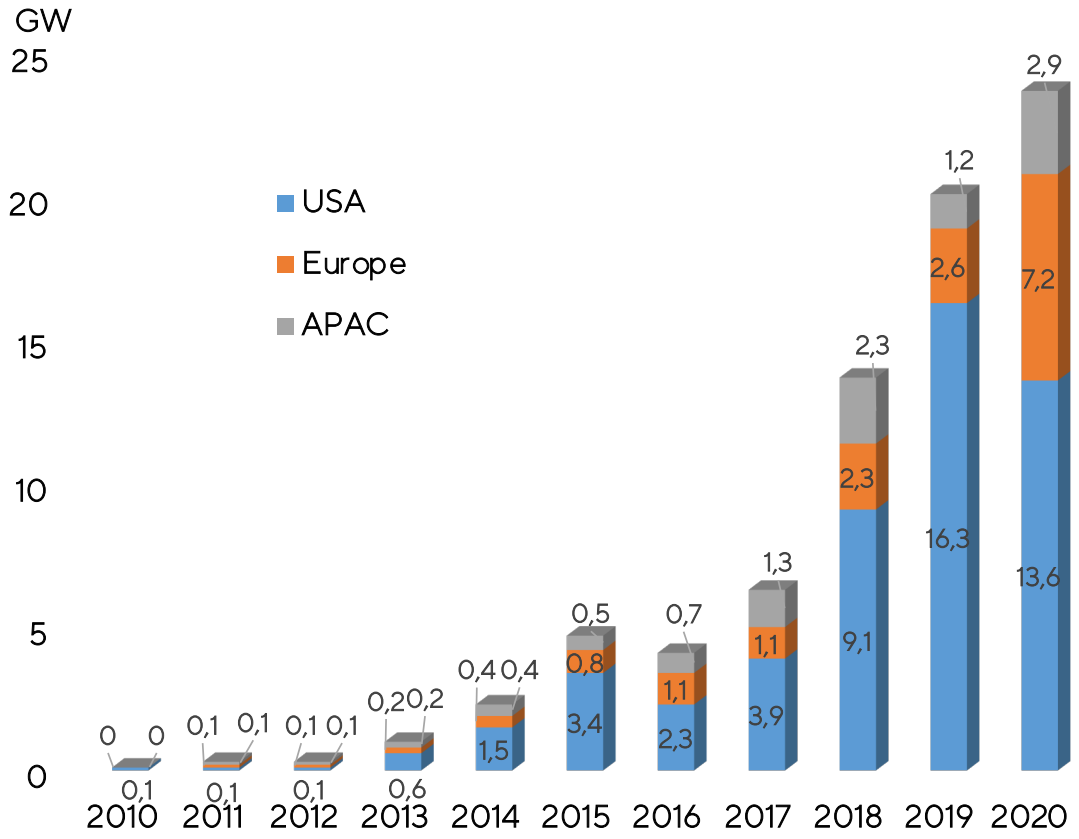
Annual volume of cPPAs build-out*



*Aurora Energy Research, BNF

In recent years, IT companies have accounted for about half of the world's corporate RES procurement. Only Google has signed 2.7 GW **Corporate Power Purchase Agreements (PPAs)**. Global companies are increasingly thinking about reducing emissions: total corporate PPAs world in 2020 reached 23.7 GW. Among other things, large data center operators will try to be based in regions that generate low-carbon electricity.

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Conclusions

Overall CO_2 emissions from DT are growing, and ***methods of carbon incorporation into digital decision-making are needed***.

The growth of ***CO_2 emissions is a stark reminder*** of the challenges faced by governments around the world in reaching their emissions reduction targets.

The advantage of DT in ***minimizing the negative environmental consequences*** of manufacturing, operation and disposal of products. But, increased digital efficiency can lead to ***more energy consumption and generate emissions.***

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Thanks for your attention!

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