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THE INTERNATIONAL ENERGY AGENCY'S REPORT ON "DIGITALIZATION & ENERGY"

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A Summary
EDDIE Consortium

On November 2017, International Energy Agency (IEA) published a Technology Report , which was a comprehensive effort to depict how digitalisation could transform the world's energy systems with expertise from across the agency and the aim to provide an accurate and balanced view of what is happening using analytical tools, to paint a picture of what could happen next.

Digital technologies are set to transform the global energy system in the coming decades, making it more connected, reliable and sustainable. It analyses how digitalization is transforming energy systems. From the rise of connected devices at home, to automated industrial production processes and smart mobility, digital technologies are increasingly changing how, where and when energy is consumed. The electricity sector and smart grids are at the centre of this transformation, but ultimately all sectors across both energy supply and demand, households, transport and industry, will be affected. Digitalisation is already improving the safety, productivity, accessibility and sustainability of energy systems. But digitalisation is also raising new security and privacy risks. It is also changing markets, businesses and employment. New business models are emerging, while some century-old models may be on their way out.

Policy makers, business executives and other stakeholders increasingly face new and complex decisions, often with incomplete or imperfect information. Adding to this challenge is the extremely dynamic nature of energy systems.

Across all transport modes, digital technologies are helping to improve energy efficiency and reduce maintenance costs. In aviation, the latest commercial aircrafts are equipped with thousands of sensors, generating almost a terabyte of data on an average flight. Big data analytics optimise route planning and can help pilots make in-flight decisions and reduce fuel use. Ships are also being equipped with more sensors, helping crew take actions to optimise routes, while advances in satellite communications are enabling greater connectivity. The most revolutionary changes from digitalisation could come in road transport, where ubiquitous connectivity and automation technologies could fundamentally transform how people and goods are moved. Automated driving technologies can improve safety and driving convenience through advanced sensing and automated decision-making capabilities that can assist or replace human control.

Buildings account for nearly one-third of global final energy consumption and 55% of global electricity demand. Electricity use in buildings is set to nearly double from 11 petawatt hours (PWh) in 2014 to around 20 PWh in 2040, requiring large increases in power-generation and network capacity. Digitalisation, including smart thermostats and smart lighting, could cut total energy use in residential and commercial buildings between 2017 and 2040 by as much as 10% compared with the Central Scenario, predict, measure and monitor in real time the energy performance of buildings, allowing consumers, building managers, network operators and other stakeholders to identify where and when maintenance is needed, when investments are not performing as expected and where energy savings can be achieved.

In industry, many companies have a long history of using digital technologies to improve safety and increase production. Further cost-effective energy savings can be achieved through advanced process controls, and by coupling smart sensors and data analytics to predict equipment failure.

Digital technologies have also had an impact on the way products are manufactured. Technologies such as industrial robots and 3D printing are becoming standard practice in certain industrial applications. Digitalisation can improve safety, increase productivity and reduce costs in oil and gas, coal and power. Further digitalisation in the upstream oil and gas industry in the future is likely to initially focus on expanding and refining the range of existing digital applications already in use.

In the long term, one of the most important potential benefits of digitalisation in the power sector is likely to be the possibility of extending the operational lifetime of power plants and network components, through improved maintenance and reduced physical stresses on the equipment. The electricity sector is at the heart of this transformation, where digitalisation is blurring the distinction between generation and consumption, and enabling four inter-related opportunities: 1) smart demand response; 2) the integration of variable renewable energy sources; 3) the implementation of smart charging for EVs; and 4) the emergence of small-scale distributed electricity resources such as household solar PV.

Rolling out smart charging technologies for electric vehicles could help shift charging to periods when electricity demand is low, and supply is abundant. This would provide further flexibility to the grid while saving in avoided investment in new electricity infrastructure between 2016 and 2040.

While digitalisation can bring many positive benefits, it can also make energy systems more vulnerable to cyber-attacks. To date, the disruptions caused to energy systems by reported cyber-attacks have been relatively small. However, cyber-attacks are becoming easier and cheaper to organise, while digitalised equipment and the growth of the Internet of Things (IoT) are increasing the potential “cyber-attack surface” in energy systems.

A review of key energy sectors demonstrates the many, and varied, ways in which digital technologies can affect jobs and skills in the energy sector. Overall, digitalisation is likely to lead to further efficiencies along the supply chain but is less likely to replace still-sizeable labour needs for major engineering and construction activity related to physical infrastructure. Jobs composed of a high share of automatable tasks – such as those involving predictable, routine and repetitive physical activities, and the collection and processing of data – may be at higher risk of automation than those with less routine activities. The pace and extent of digitalisation and its impacts on jobs in the energy system remain highly uncertain and will depend on a number of factors that will vary across regional and sectoral contexts. Policy makers in the energy field should participate in broader government-wide deliberations about these effects and how to respond to them.

Workers supporting digital infrastructure will need specialised ICT skills, such as coding and cybersecurity, while across the energy sector, all workers will need generic ICT skills to operate digital technologies. Complementary “soft” skills such as leadership, communication and teamwork skills will become increasingly important for the growing number of opportunities for ICT-enabled collaborative work. Policy and market design are vital to steering digitally enhanced energy systems onto an efficient, secure, accessible and sustainable path.

Digitalisation could also benefit specific clean energy technologies like carbon capture and storage. Digital technology applications for CO2 capture are similar in nature and benefit to digitalisation in industry and power generation.

Policy-making processes can also benefit from more timely and sophisticated collection and publication of energy data that greater access to digital data could facilitate. Digitalisation can facilitate positive change, but only if policy makers undertake efforts to understand, channel and harness digitalisation’s impacts and to minimise its risks.

IEA recommends ten no-regrets policy actions that governments can take to prepare. This list is not intended to be exhaustive or definitive and recognises that national circumstances and contexts vary between countries. It was prepared to foster further discussion among governments, companies and other stakeholders.

- Build digital expertise within their staff
- Ensure appropriate access to timely, robust, and verifiable data
- Build flexibility into policies to accommodate new technologies and developments
- Experiment, including through "learning by doing" pilot projects
- Participate in broader inter-agency discussions on digitalisation
- Focus on the broader, overall system benefits
- Monitor the energy impacts of digitalisation on overall energy demand
- Incorporate digital resilience by design into research, development and product manufacturing.
- Provide a level playing field to allow a variety of companies to compete and serve consumers better
- Learn from others, including both positive case studies as well as more cautionary tales.