International Energy Agency

Digital transformation of energy systems: global trends

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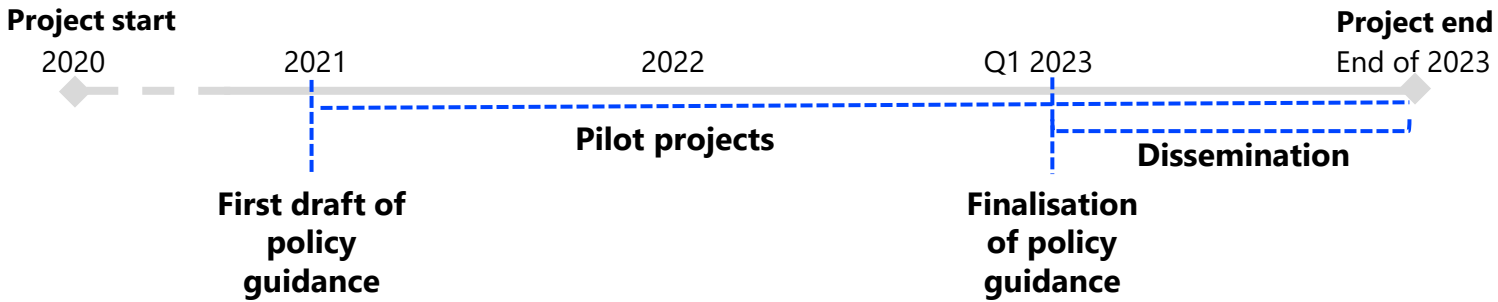
Paris, 22 June 2022

Overview of Digital Demand-Driven Electricity Networks Initiative (3DEN)

- **Aim of the Project** - providing actionable guidance to policy makers on the policy, regulatory, technology and investment context needed to accelerate progress on power system modernisation and effective utilisation of demand side resources
- **Outputs**
  - Tools and policy guidance documents
  - Pilot projects assessment guide including methodology and indicators
  - Interim outputs: webinars, roundtables, events, articles, chapters in publications and commentaries
- **Geographic focus, including but not limited to**
  - Key Countries – Brazil, Colombia, India, Indonesia, Morocco, South Africa, Tunisia
  - Key Regions – Latin America, Africa, South East Asia
- **Tentative Project timeline**



ISGAN INTERNATIONAL SMART GRID ACTION NETWORK

AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

MISSION

Accelerate the development and deployment of smarter electricity grids worldwide, enabling increased demand response and energy efficiency. It focuses on five principal areas: policy standards and regulation, finance and business models, technology system development, workforce skills and knowledge, user and consumer engagement.

GOALS

ISGAN is an international platform for the development and exchange of knowledge and expertise on smarter, cleaner, and more flexible and resilient electricity grids ("Smart Grids"). ISGAN provides an important channel for the communication of experience, trends, lessons learned, and visions in support of global, national and regional clean energy objectives as well as new flexible and resilient solutions for Smart Grids.

LEAD GOVERNMENTS

COORDINATOR

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

KSGI Korea Smart Grid Institute

PARTICIPANTS

Australia, Brazil, Canada, China, Denmark, European Commission, Finland, France, Germany, Israel, Japan, Netherlands, Norway, Russia, South Africa, South Korea, Spain, Sweden, United Kingdom

PARTNERS

European Technology and Innovation Platform Smart Networks for Energy Transition (ETIP SNET), Global Smart Energy Federation (GSEF), International Energy Agency (IEA), India Smart Grid Forum (ISGF), Mission Innovation (MI)

ISGAN IEA Website / ISGAN CEM Website/ Youtube channel / Linkedin / ISGAN Awards of Excellence promotional video

Contact: Secretariat@CEMSecretariat.org

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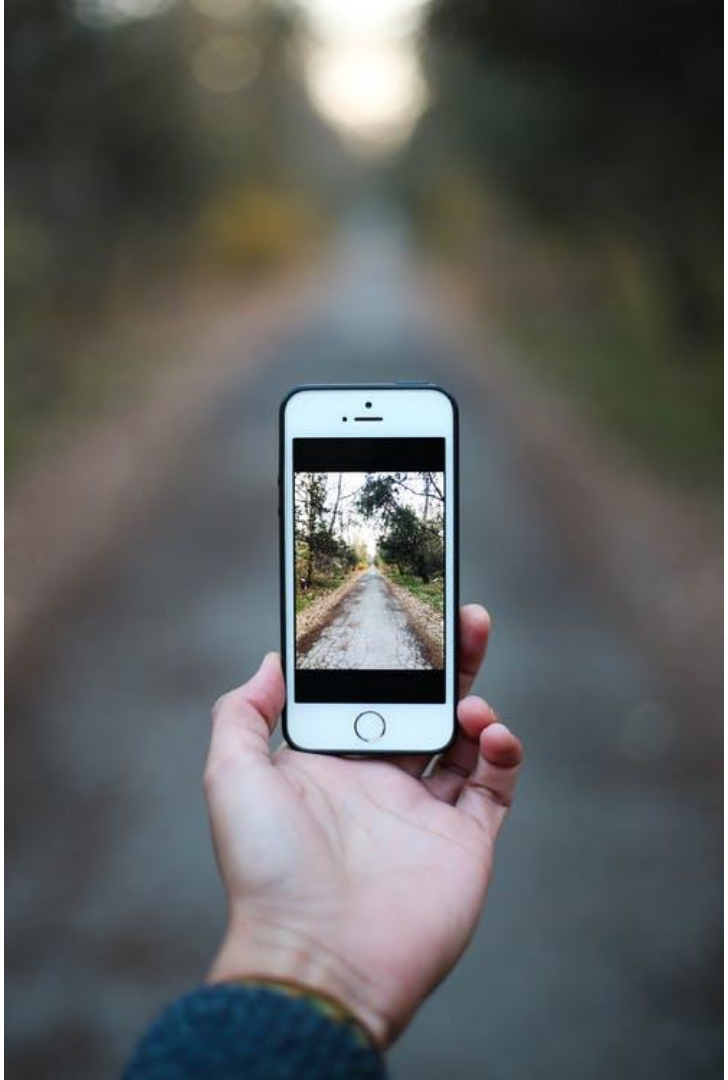
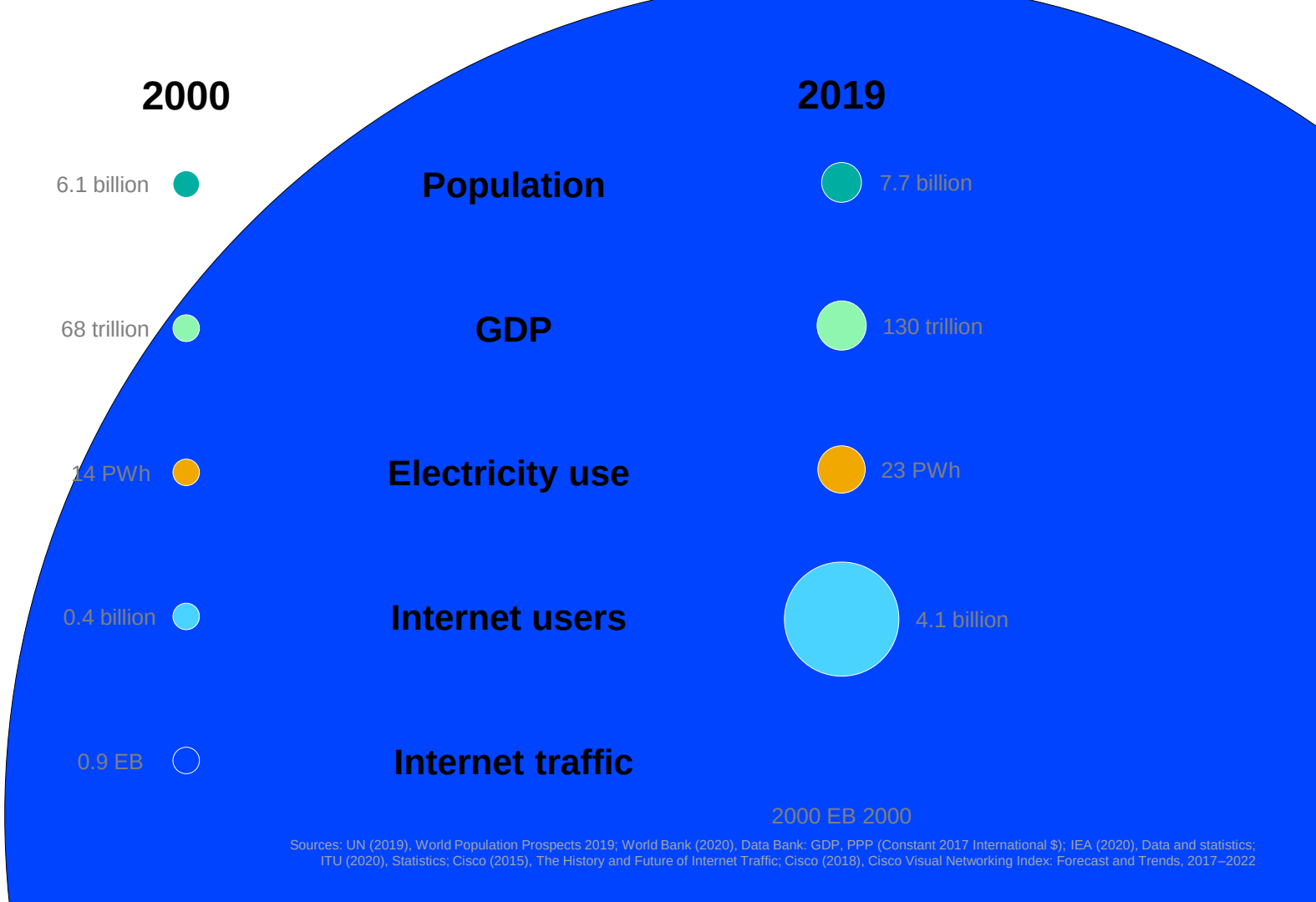
A global transformation





Sources: UN (2019), World Population Prospects 2019; World Bank (2020), Data Bank: GDP, PPP (Constant 2017 International $); IEA (2020), Data and statistics; ITU (2020), Statistics; Cisco (2015), The History and Future of Internet Traffic; Cisco (2018), Cisco Visual Networking Index: Forecast and Trends, 2017–2022

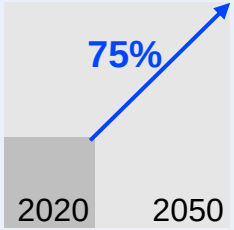
Buildings are driving energy demand growth

Energy- and emissions-intensive technology…

28% of energy-related emissions
(without construction-related emissions)

…with rising demand…

Buildings floor area



80% of the increase is in **emerging economies.**

...but potential savings exist.

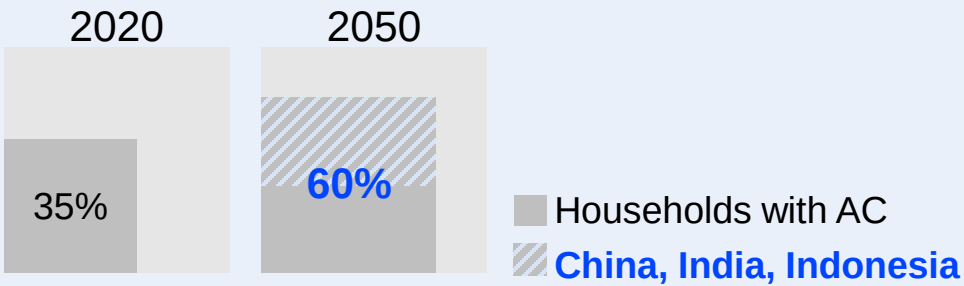
Smart Controls enable efficiency gains reducing **350 $MtCO_2$** by 2050.

Cooling is a major driver of demand

Energy- and emissions-intensive technology…

8.5% of electricity consumption & **1 $GtCO_2$** in 2019

…with rising demand…



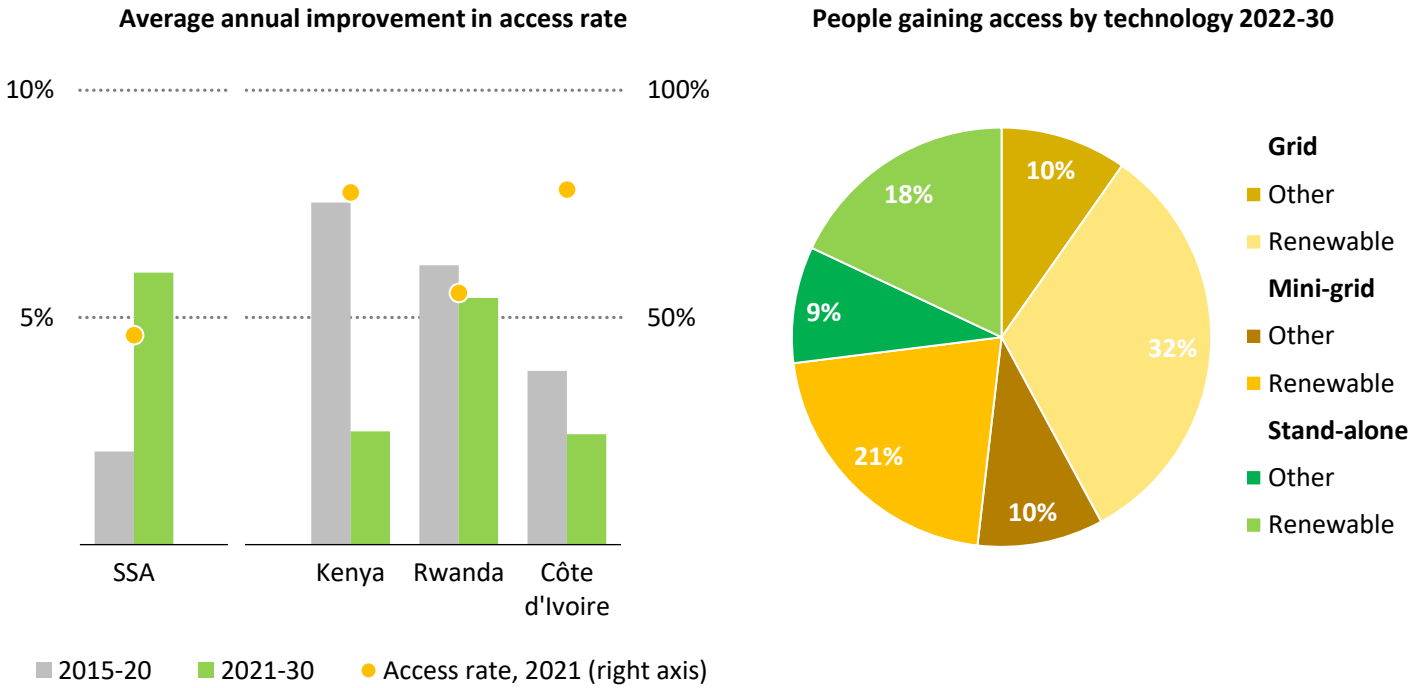
...but potential savings exist.

Residential building improvement and higher efficiency equipment

2000 TWh
Of savings globally in 2050

Decentralised solutions key to achieving universal access by 2030

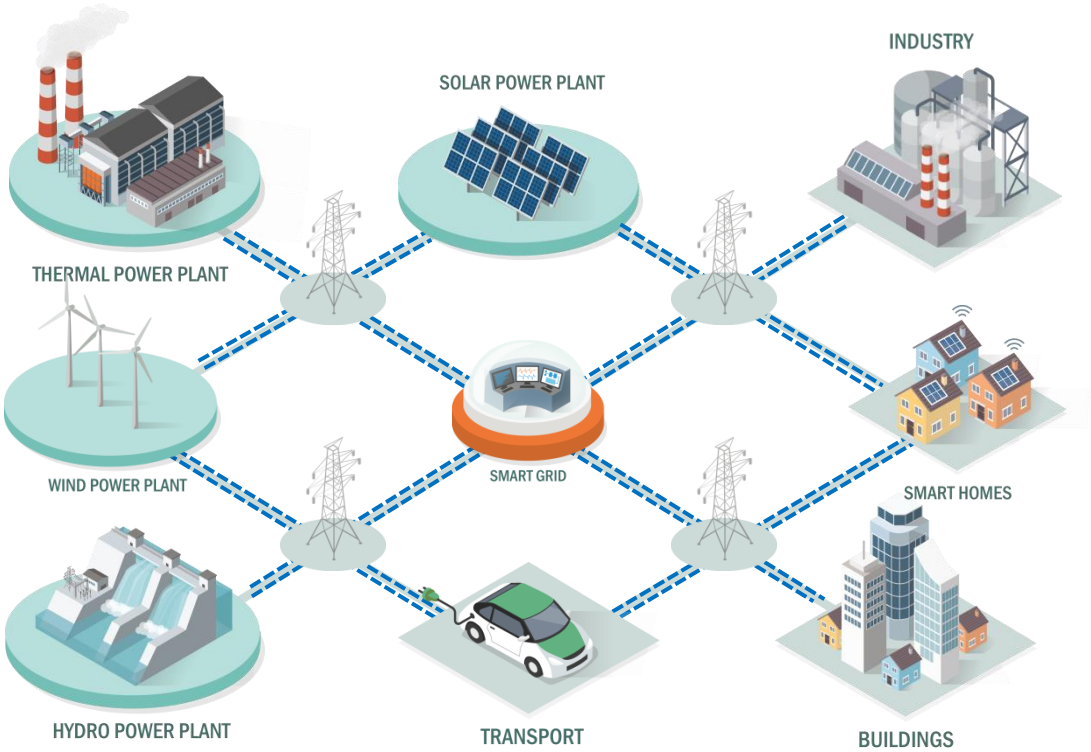
Improvement in access to electricity and number of people gaining access by technology in sub-Saharan Africa in the SAS



Rates of new access to electricity in sub-Saharan Africa need to improve threefold to 2030, emulating those achieved in some countries prior to the Covid-19 pandemic.

The digital axis to energy transitions

The power sector landscape is changing dramatically



Traditional system

Centralised / dispatchable

High inertia and stability

Central planning

One way flows of energy and communication

Closed networks, few devices

New system

Decentralised / variable generation

Low system inertia from rotating machines

Multiple actors / competitive markets

Two way flows of energy and communication

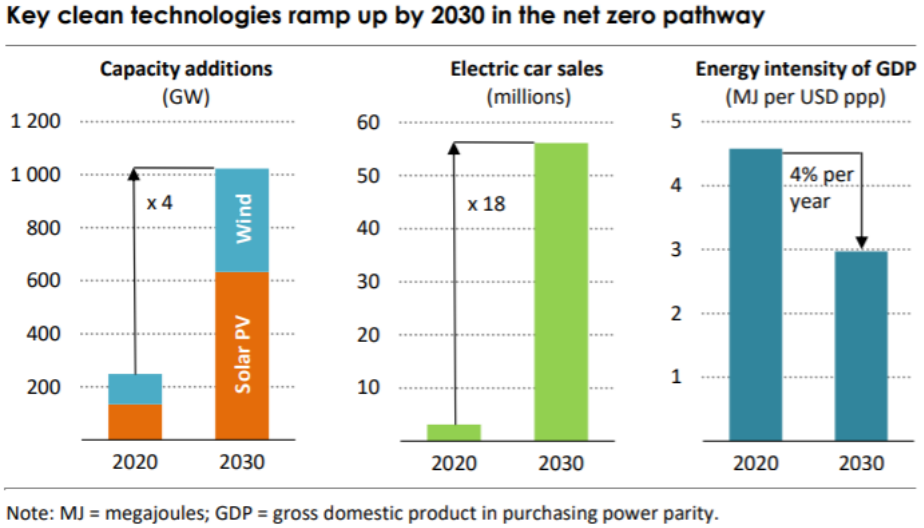
Open networks and many devices

Changing climate patterns

Digital is key for net zero pathways

Net Zero Emissions by 2050 Scenario (NZE) milestones:

- Yearly **wind and solar PV capacity** additions **>1 000 GW** by 2030;
- **5 million heat pumps** installations/month in NZE by 2030;
- **100 million buildings** with residential PV by 2030;
- **All new** buildings **zero-carbon-ready** by 2030;
- **150 Mt low-carbon hydrogen** by 2030, 850 GW electrolysers.



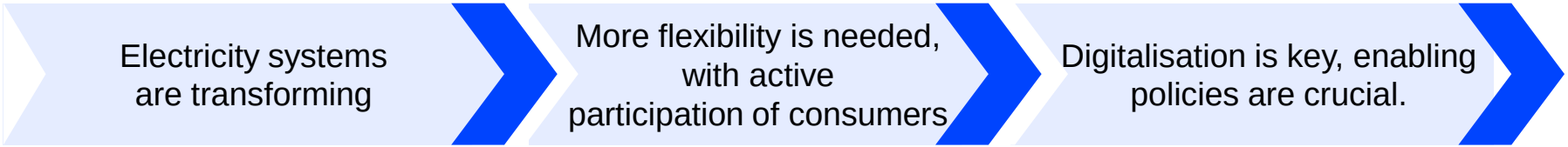
Note: MJ = megajoules; GDP = gross domestic product in purchasing power parity.

These massive changes will require more flexibility. In the NZE:

- **>500 GW** of demand response brought to market by 2030;
- **Tenfold increase** in global inventory of **flexible assets** by 2030, including grid-connected electrolytic hydrogen production;

https://www.iea.org/reports/demand-response
https://www.iea.org/reports/world-energy-outlook-2021
https://www.iea.org/reports/net-zero-by-2050

A deep transformation of energy systems, with electricity at the centre

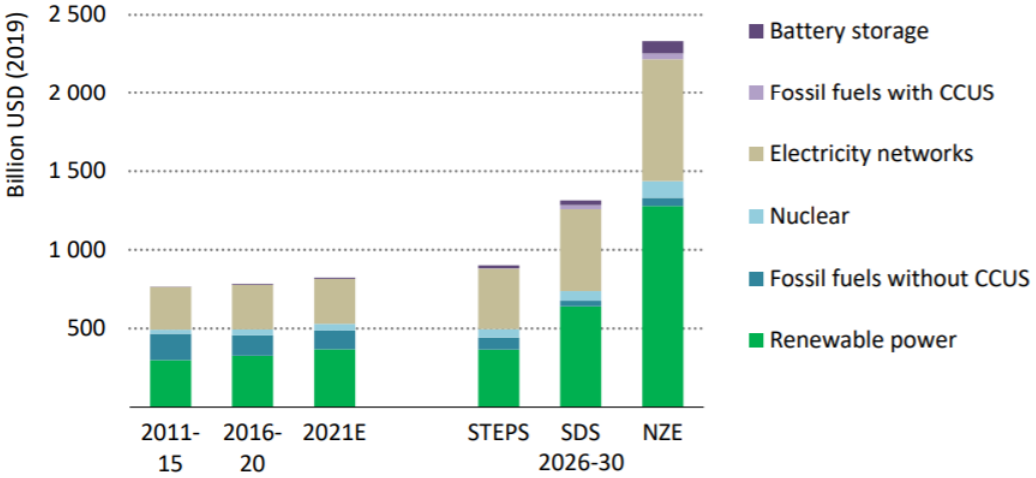


- **Digitalisation** can help leverage opportunities:
  - Create a more interconnected and responsive electricity system
  - Support carbon emissions reduction
  - Help to minimise system cost and need for new investment
  - Improve stability, resilience and security
  - Enhance quality of power supply

Implementing right policies, digital technologies and new business models is key to enable transformation

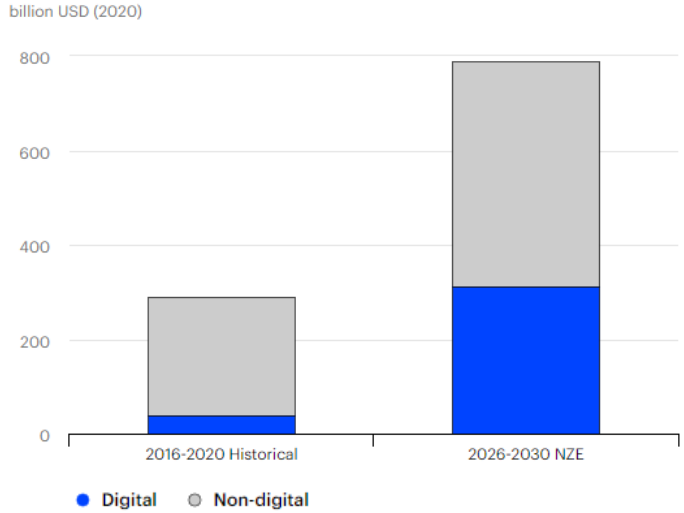
Significant increase in investments needed

Global investment in the electricity sector compared with annual average investment needs, 2025-2030, by scenario



Note: STEPS = Stated Policies Scenario, SDS = Sustainable Development Scenario, NZE = Net Zero Emissions by 2050.

Investment spending in electricity networks, 2016-2020 and 2026-2030 in the Net Zero Scenario

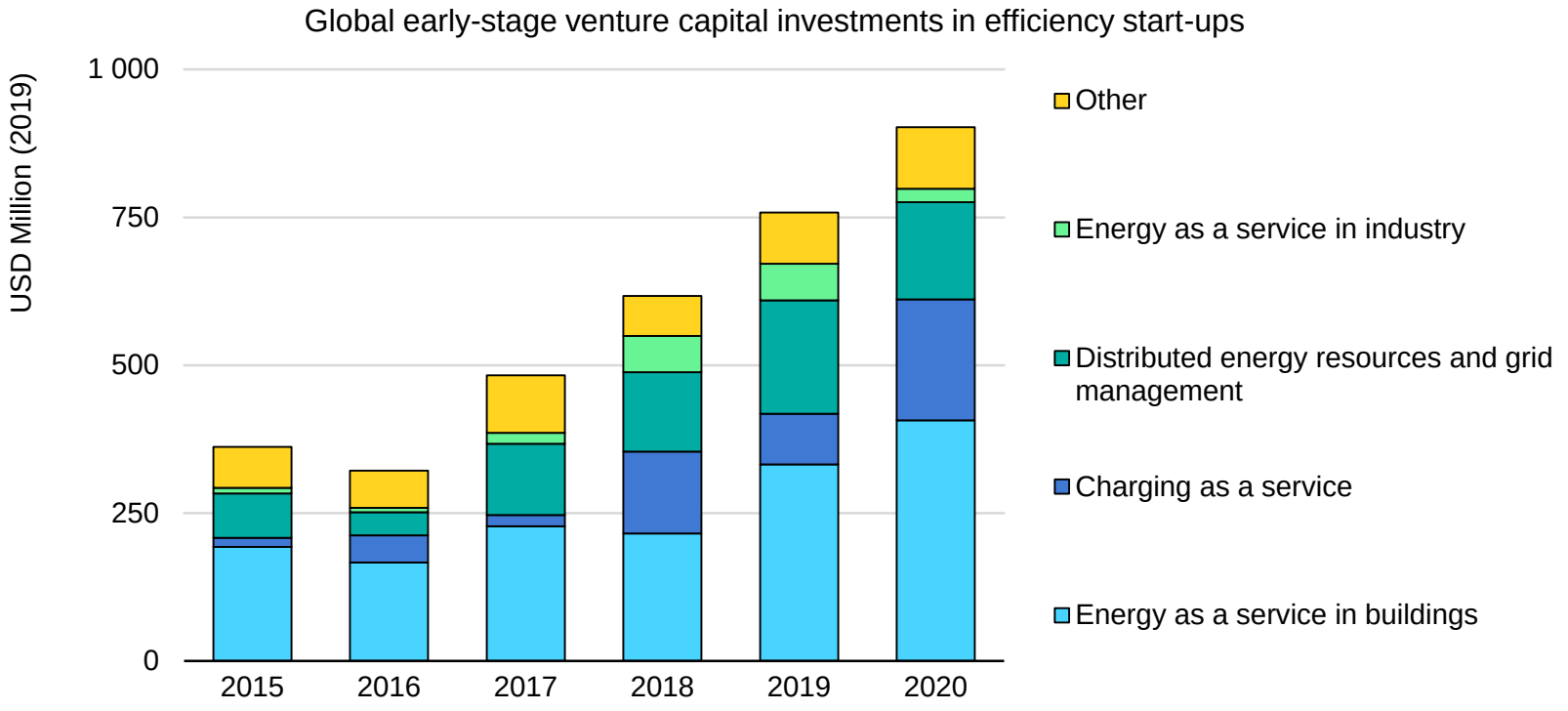


Annual electricity network investments need to nearly triple to an average of almost USD 800 billion by the late 2020s, and investments in digital assets must increase eightfold, at more than twice the speed of total investments in transmission and distribution.

www.iea.org/reports/smart-grids
www.iea.org/reports/world-energy-investment-2021

Harnessing the opportunity

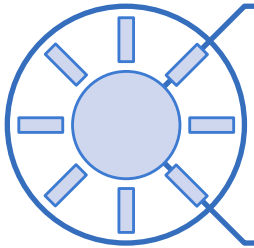
Investments in digital efficiency are on an upwards trajectory



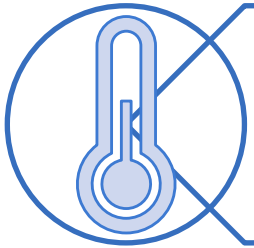
The number of digital energy start-ups reached 64% of total global energy start-ups in 2020

Examples - energy as a service

ENGIE in Latin America offers a smart charging plan to enterprise clients, which it says can reduce their infrastructure and energy costs by around 40%. EaaS models rely on internet-connected smart phones and display devices as platforms where customers can actively track their energy performance and financial status.



Uganda-based Fenix, provides solar systems to households, farmers and small businesses. Its platform enables access to ultra efficient technologies such as LED lights, TVs and other appliances, coupled with off-grid solar and storage. Alternative payment options exist to accommodate customers without access to traditional banking services, while instalment schedules can be adjusted for those whose incomes are seasonal or irregular.



In India, CoolCrop, supported by the Basel Agency for Sustainable Energy, provides off-grid solar powered refrigeration with digital controls to farmers lacking cold storage resources. Up to 20% energy savings thanks to a remotely accessible control module that optimises energy use. Lower energy bills can increase farmers' incomes by 50% or more and can reduce post-harvest spoilage by more than 20%.

Nigeria, ColdHubs provides a plug-and-play, modular, efficient, solar-powered walk-in cold room. The company says its solution reduces post-harvest losses by 80% and increases farmers' annual income by 25%.

Examples - smart meters

Democratic Republic of Congo DRC is in the process of deploying 1,000,000 digital prepaid meters, which, where installed, are already showing an improvement in reliability for and control by users, while providing faster payments for utilities.

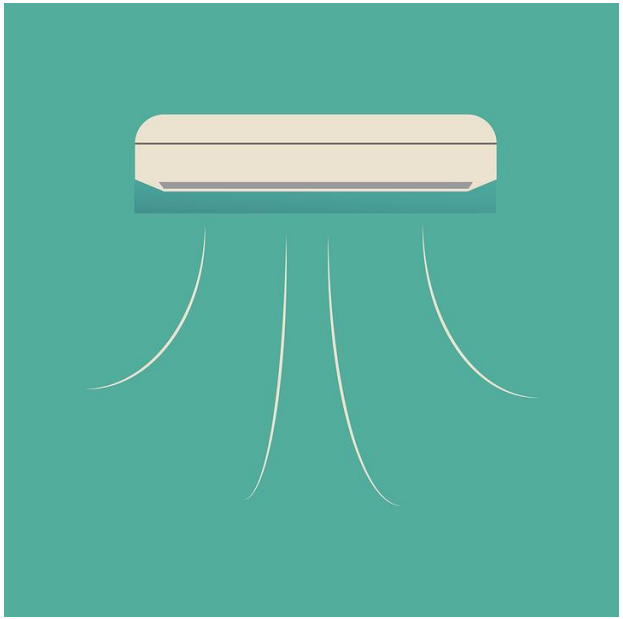
Mali and Burundi are installing smart meters with the aim to reduce energy losses by 20% and 22% respectively.

Bénin has initiated a smart metering roll out with 40,000 smart meters and an energy prepayment management platform for customers in the city of Cotonou to help reduce losses (aiming to reduce losses by 5-10%) and billing errors

Safaricom (telecommunication service provider) is set to install smart meters to 1,292 Kenya Power distribution feeders, 73,000 distribution transformers and 256,000 consumers with a monthly use of over 200 kilowatts. With a second phase of 330,300 meter roll out to large power users. The modernisation is expected to bring in additional revenue to Kenya Power of USD 627 million over 8 years. Safaricom is paying for the modernisation and is receiving a share of the revenue.

Examples - access to cooling and grid management

- Burkina Faso is one of the hottest countries in the world, with air conditioner ownership rising rapidly.
- Load shedding is common, especially during the hottest months. Air conditioning coincides with peaks.
- **Minimum energy performance standards** and **building energy codes** are expected to achieve electricity savings of 20% or more.
- **“10 Actions Canicule” campaign**. Encourages citizens to set air conditioner temperatures to between 24 °C and 28 °C and to turn them off 30 minutes before leaving the room to reduce consumption without compromising comfort. Social and physical media.



Africa Energy Outlook 2022 – Analysis - IEA

Digitalisation calls for a comprehensive approach to policymaking