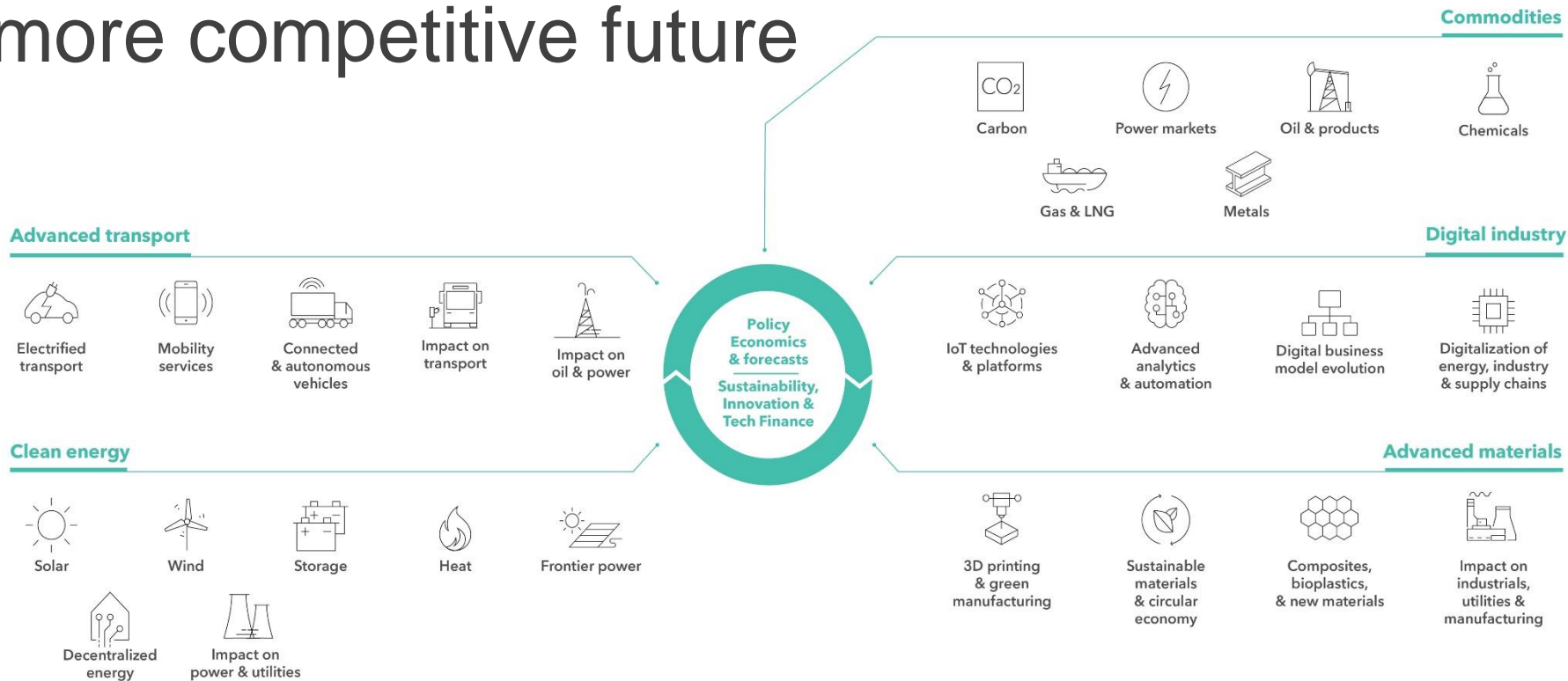# Integrating Data into the Digital Grid
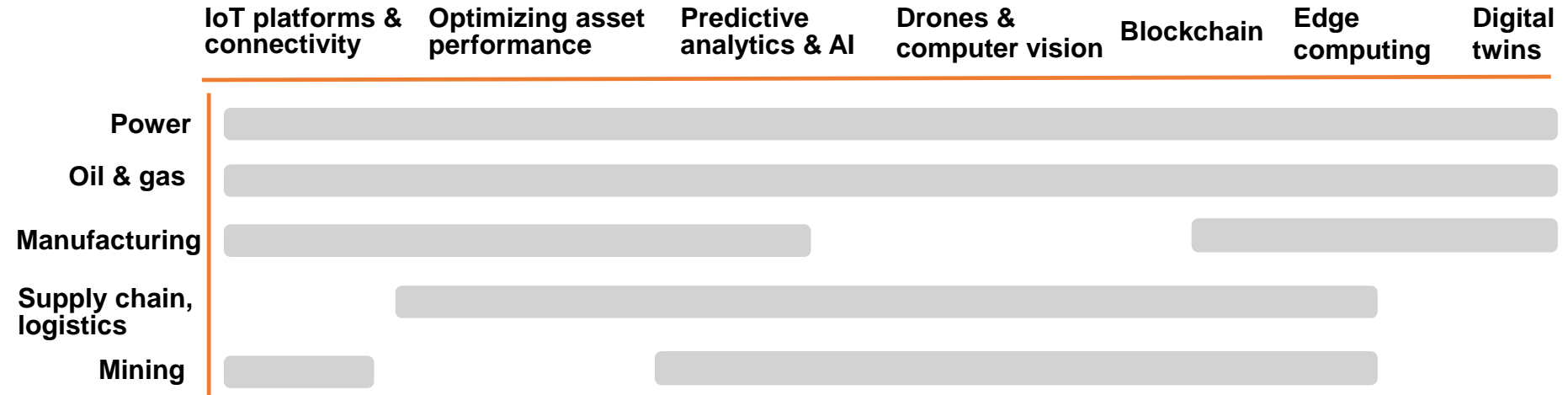
Eleonore Lazat

BloombergNEF

Strategies for a cleaner, more competitive future

Commodities

- Carbon (CO_2)
- Power markets
- Oil & products
- Chemicals
- Gas & LNG
- Metals

Advanced transport

- Electrified transport
- Mobility services
- Connected & autonomous vehicles
- Impact on transport
- Impact on oil & power

Clean energy

- Solar
- Wind
- Storage
- Heat
- Frontier power
- Decentralized energy
- Impact on power & utilities

Policy Economics & forecasts

Sustainability, Innovation & Tech Finance

Digital industry

- IoT technologies & platforms
- Advanced analytics & automation
- Digital business model evolution
- Digitalization of energy, industry & supply chains

Advanced materials

- 3D printing & green manufacturing
- Sustainable materials & circular economy
- Composites, bioplastics, & new materials
- Impact on industrials, utilities & manufacturing

Digital industry coverage

	IoT platforms & connectivity	Optimizing asset performance	Predictive analytics & AI	Drones & computer vision	Blockchain	Edge computing	Digital twins
Power	███
Oil & gas	███
Manufacturing	████████████████████████████				████████████████████
Supply chain, logistics		███
Mining	███████		██████████████████████████████████

Source: BloombergNEF

Contents

Challenges to utilities

Decarbonization & aging assets

Growing renewable generation stresses the grid
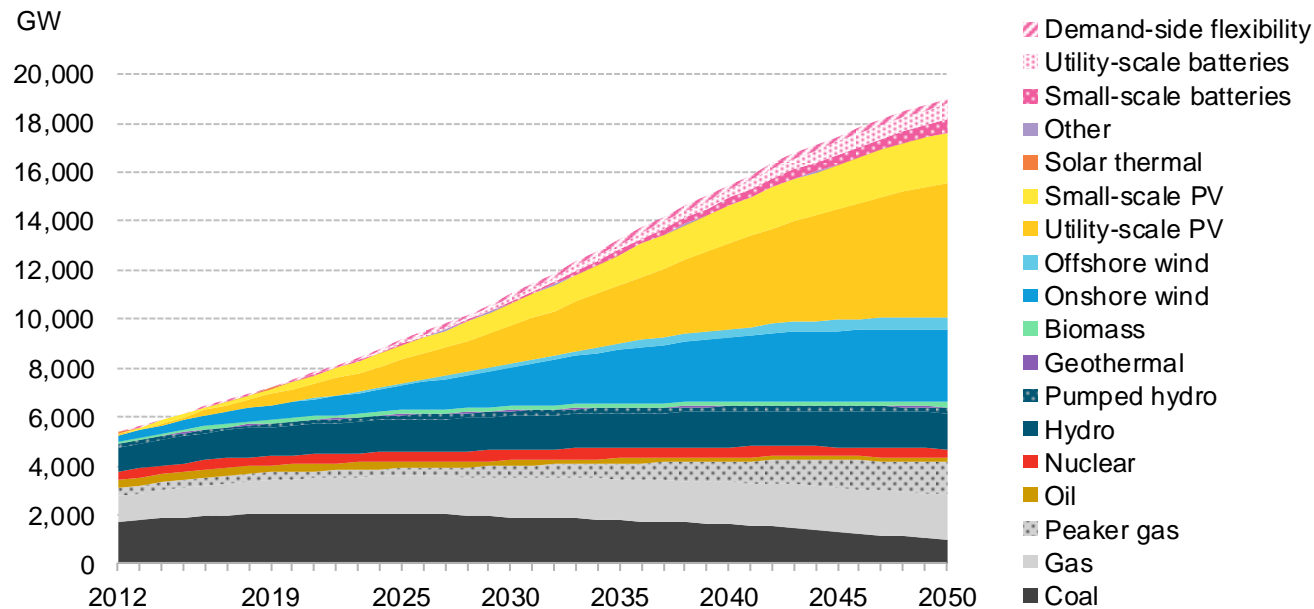
Source: BloombergNEF

# Growing renewable generation stresses the grid

GW

Legend:
- Demand-side flexibility
- Utility-scale batteries
- Small-scale batteries
- Other
- Solar thermal
- Small-scale PV
- Utility-scale PV
- Offshore wind
- Onshore wind
- Biomass
- Geothermal
- Pumped hydro
- Hydro
- Nuclear
- Oil
- Peaker gas
- Gas
- Coal
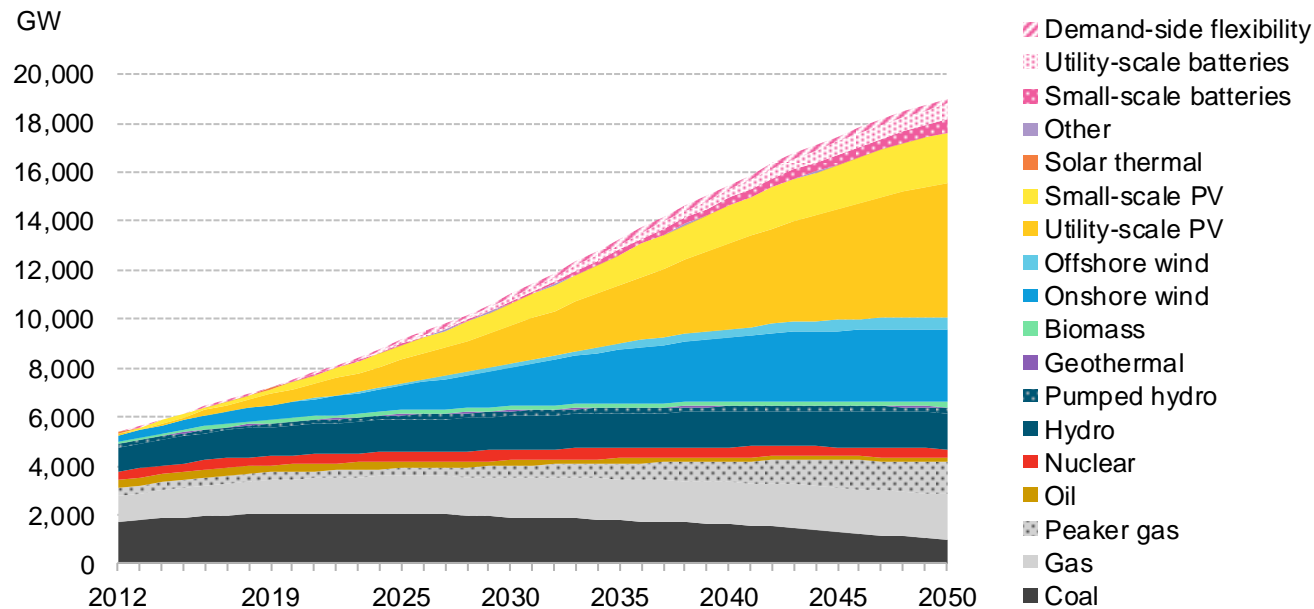
Source: BloombergNEF

BloombergNEF New Energy Outlook

- 62% increase in electricity demand

- Wind and solar make up 50% of world electricity in 2050

- 12TW expansion of generating capacity, $12.3 trillion new investment

Stepping up investment for T&D expansion

Transmission capacity

million km

Distribution capacity
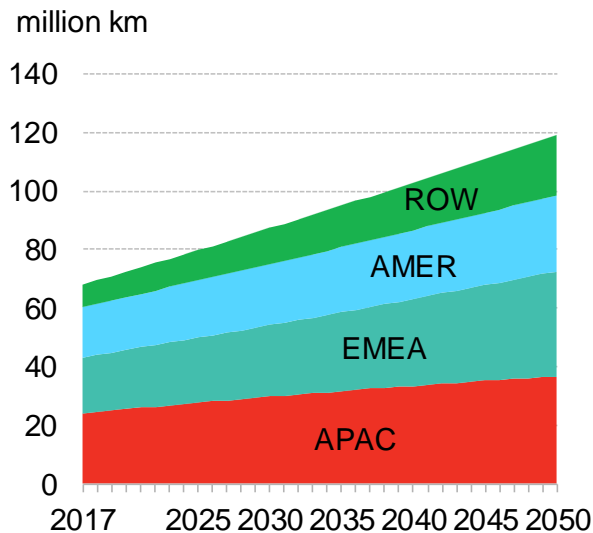
million km
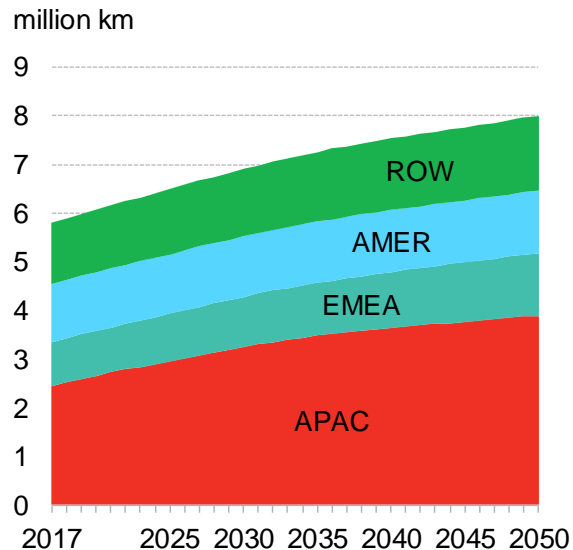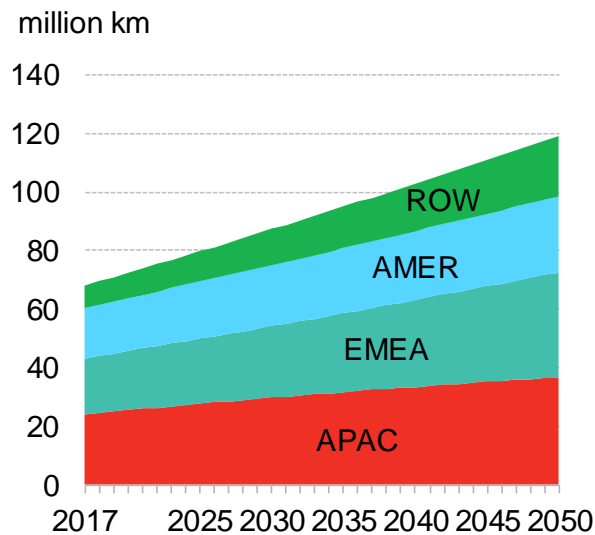
Source: BloombergNEF

Stepping up investment for T&D expansion

Transmission capacity

million km

Distribution capacity

million km
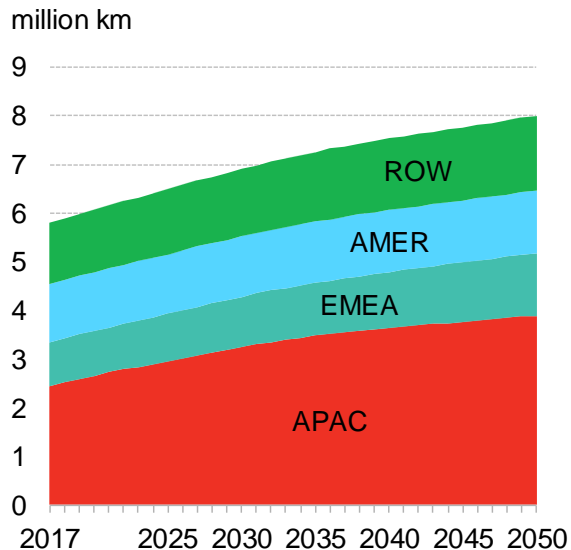
NEO

- Transmission grids will grow 36%, distribution by 71%.

- NEO estimates $11.4 trillion investment needed in T&D.

- The EU has estimated 2.2 billion euros for grid expansion and maintenance

Source: BloombergNEF

Ageing grids tend to fail more

Operating life of infrastructure

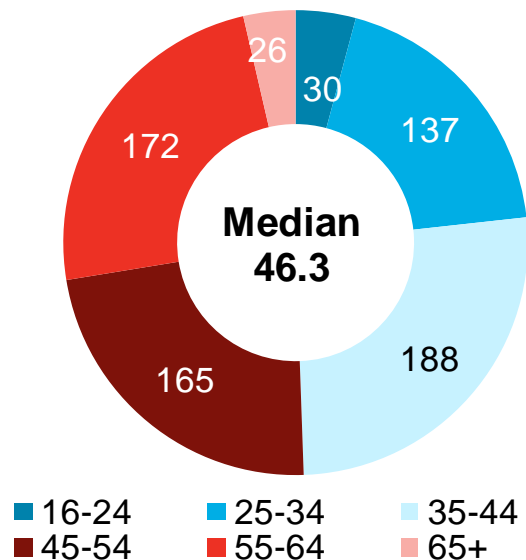| Infrastructure	Life span
Gas transmission grid	80
High voltage transmission network	60-80
Overhead lines	40
HDVC interconnector	40

Source: BloombergNEF, EIRGrid

Scottish Power Energy Network assets over 40 years old
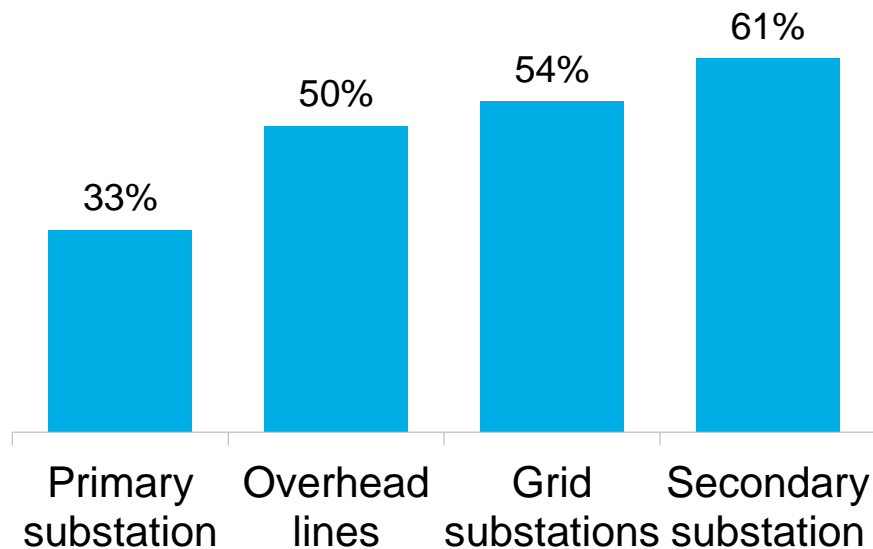
Source: BloombergNEF, Scottish Power Energy Energy

And ageing staff will take away knowledge

U.S. utility employees by age

Pie chart values:
- 30 (16-24)
- 137 (25-34)
- 188 (35-44)
- 165 (45-54)
- 172 (55-64)
- 26 (65+)

Median 46.3

Legend:
- 16-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

Source: BloombergNEF, U.S. Bureau of Labor Statistics

27%
U.S. utility workforce is over 55

20%
National Grid workforce due to retire in five years
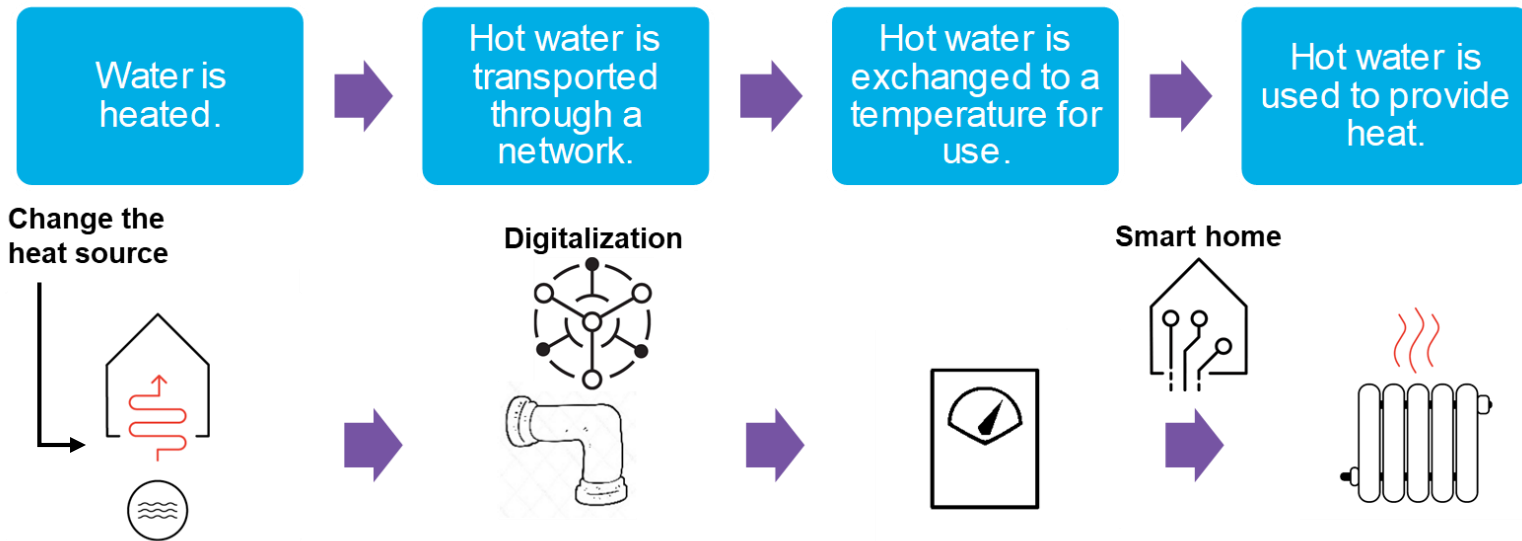
District heating still relies on coal and gas

Heat supply sources for district heating
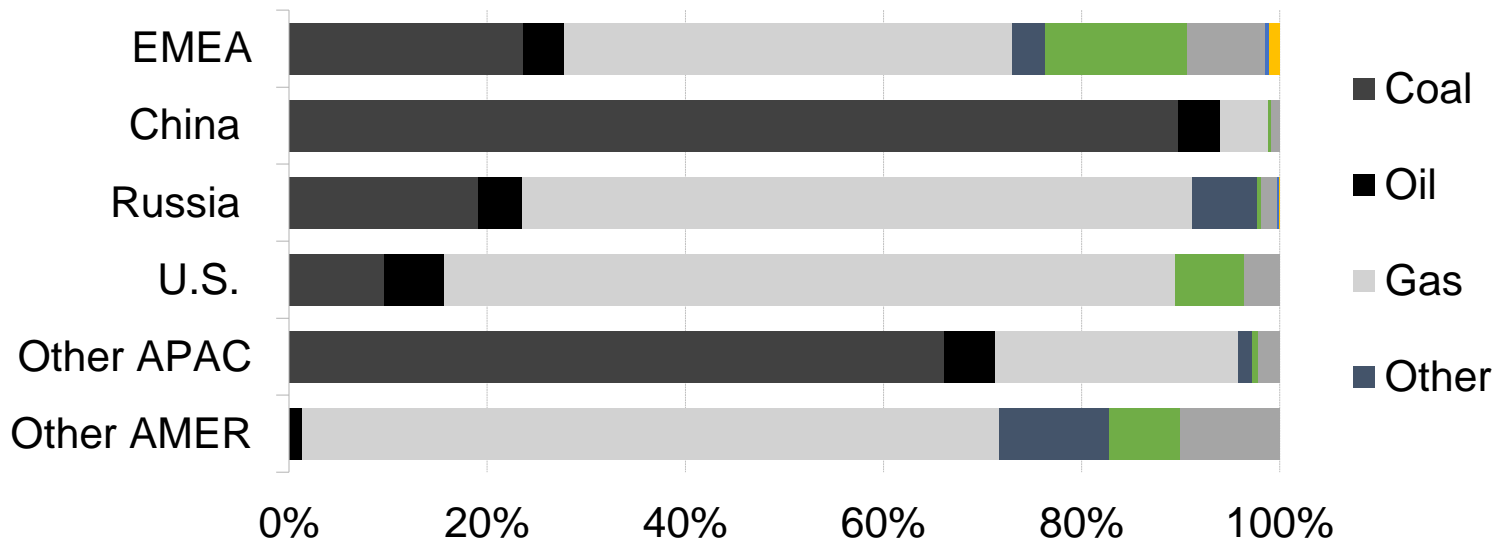
Source: IEA, BloombergNEF Note: IEA district heating includes any heat that is sold to a third-party in the form of steam/hot water. This includes district heating networks and campus heat networks where the supplier and consumer are different entities. It excludes on-site generation owned by a building/campus/industrial site.

Cleaning up the district heating network
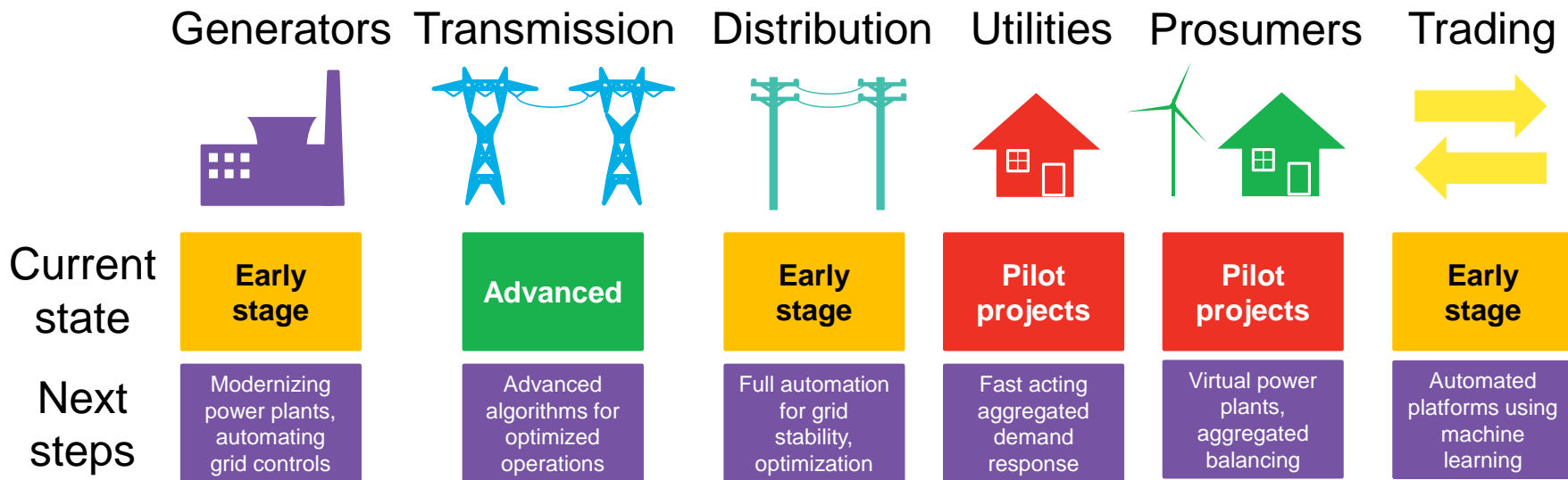
Simplified stages of a district heating network

| Water is heated. | → | Hot water is transported through a network. | → | Hot water is exchanged to a temperature for use. | → | Hot water is used to provide heat. |

Change the heat source

Digitalization

Smart home

Source: BloombergNEF

Digital technologies for grids

Solutions, technologies and status

State of digitalization of the electricity value chain

	Generators	Transmission	Distribution	Utilities	Prosumers	Trading
Current state	**Early stage**	**Advanced**	**Early stage**	**Pilot projects**	**Pilot projects**	**Early stage**
Next steps	Modernizing power plants, automating grid controls	Advanced algorithms for optimized operations	Full automation for grid stability, optimization	Fast acting aggregated demand response	Virtual power plants, aggregated balancing	Automated platforms using machine learning

Source: BloombergNEF

Digital technologies on all grid layers
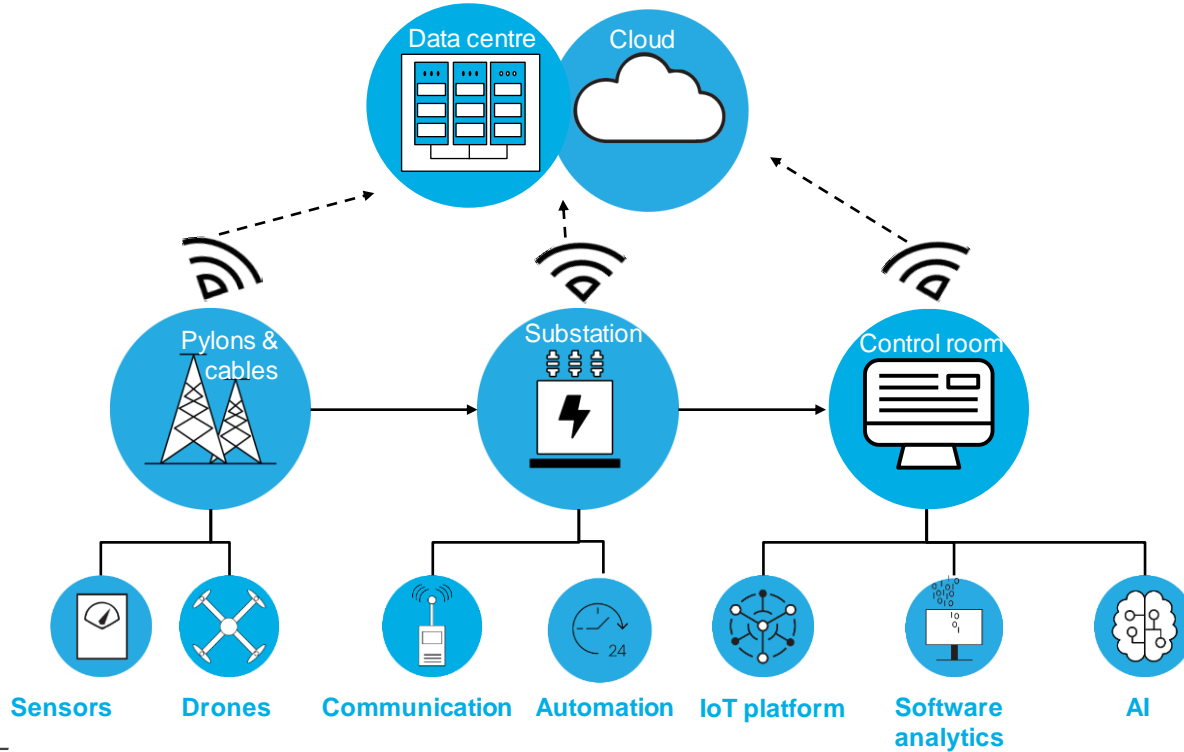
Source: BloombergNEF

# Digital tech for maintenance

Digital tools and adoption status

Industry	Mobile	Wearables	Digital tools	Virtual reality	Computer vision	Augmented reality
	Tech available today				**Further away in the future**	
Utilities adoption	Mobile devices deployed to in-field workers	Health and safety	Digitalized tracking of tasks	Learning platforms	Surveillance and monitoring	AR for supervision and recognition

adopted · deploying · early pilots
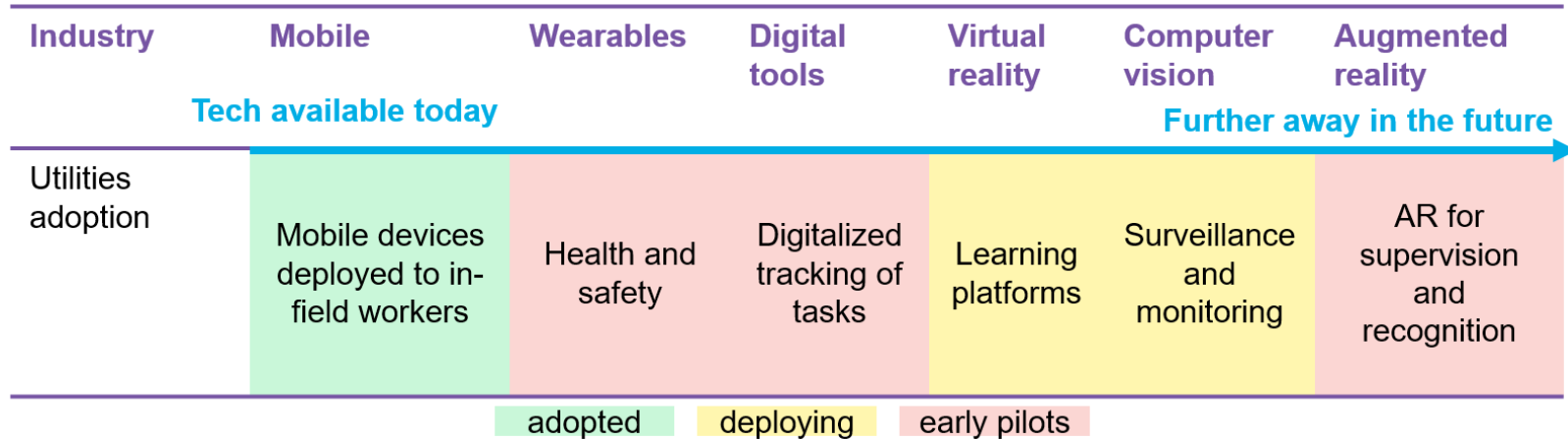
Source: BloombergNEF

Digital tech for balancing

Blockchain based coordination of flexibility

Without blockchain

Aggregator serves as
single point of contact
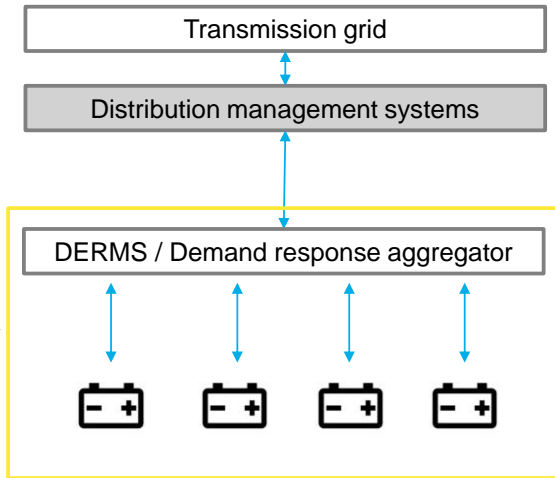
With blockchain

Transmission operator can trust
disaggregated data from each asset
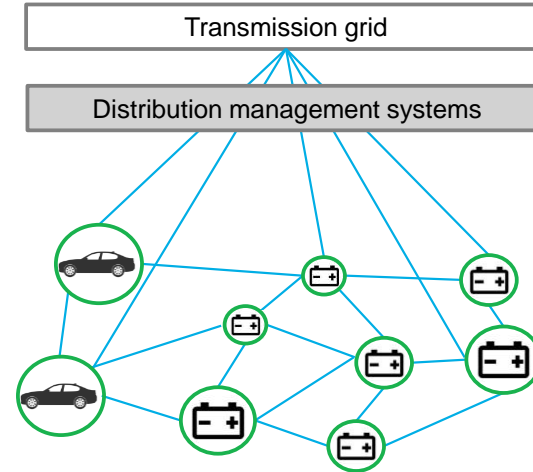
Source: BloombergNEF

Visibility, transparency, open source

Enabling a faster shift

Data sharing efforts: Norway

Elhub contributors

110 electricity suppliers

3,000,000 metering points

190 power supply offers

130 distribution network operators
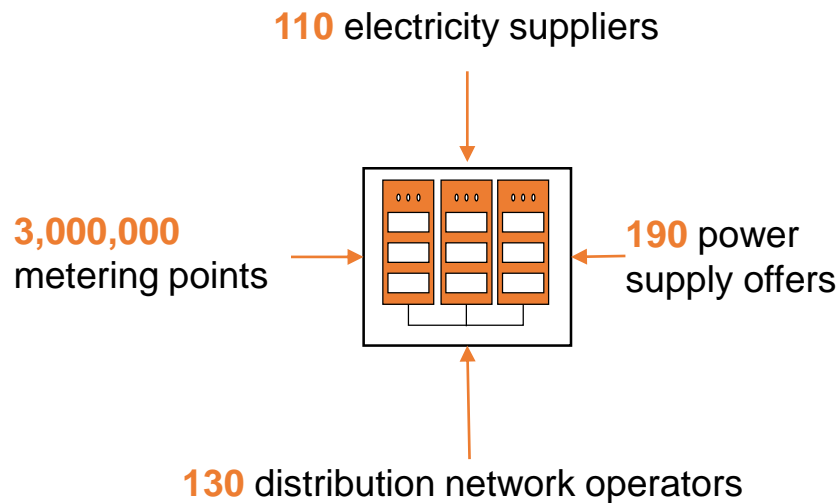
Source: BloombergNEF

- Launched February 2019
- Central IT system or data hub to streamline all Norwegian power data
- Driven by national regulation
- Automatic data processing and sharing
- 70 million values shared daily

Data sharing efforts: U.K.

U.K. energy data taskforce

- U.K. government setting standards for data capture and use in the power system

- Regulation on data sharing. Should be:
  - Open source
  - Visible
  - Common standards

Electron structure

Electron

National Grid

UK Power Networks

SP Energy Networks
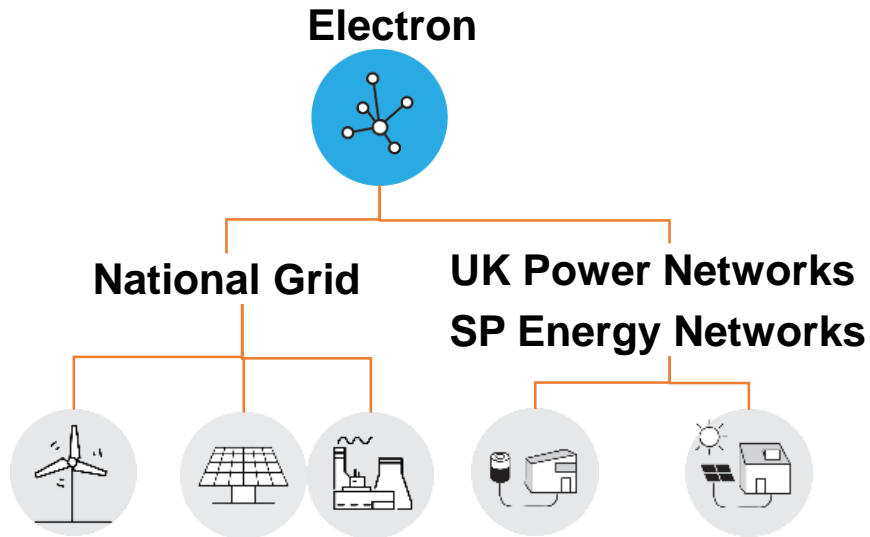
Source: BloombergNEF, Electron

Open source, a big deal for tech companies

Bloomberg

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IBM to Acquire Linux Distributor Red Hat for $33.4 Billion

By Ed Hammond, Kiel Porter, and Alex Barinka

October 28, 2018, 5:54 PM GMT *Updated on October 28, 2018, 8:34 PM GMT*

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Microsoft adds 60,000 patents to the Open Invention Network

TC

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By Dina Bass and Eric Newcomer
June 4, 2018, 2:10 PM GMT+1 Updated on June 4, 2018, 5:51 PM GMT+1

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37 million

Developers on GitHub

100 million

repositories

Open source applied to energy

Publicly available community based technology, which can be inspected, modified, enhanced and shared by all

Advantages		Disadvantages	
Free and fast to pick up existing code		Difficulty to evaluate or compare	
High quality thanks to corrections by the crowd		No tech support	
Flexibility to adapt the code		Cannot check everyone on the platform	

Source: BloombergNEF

Examples and case studies

Linux Foundation Energy

- "10,00 developers to electrify the planet"
- 25 partners
- 6 applications developed

OSeMOSYS

- [OSeMOSYS](#) is an energy systems model generator
- Analytical toolbox on GitHub for energy planners
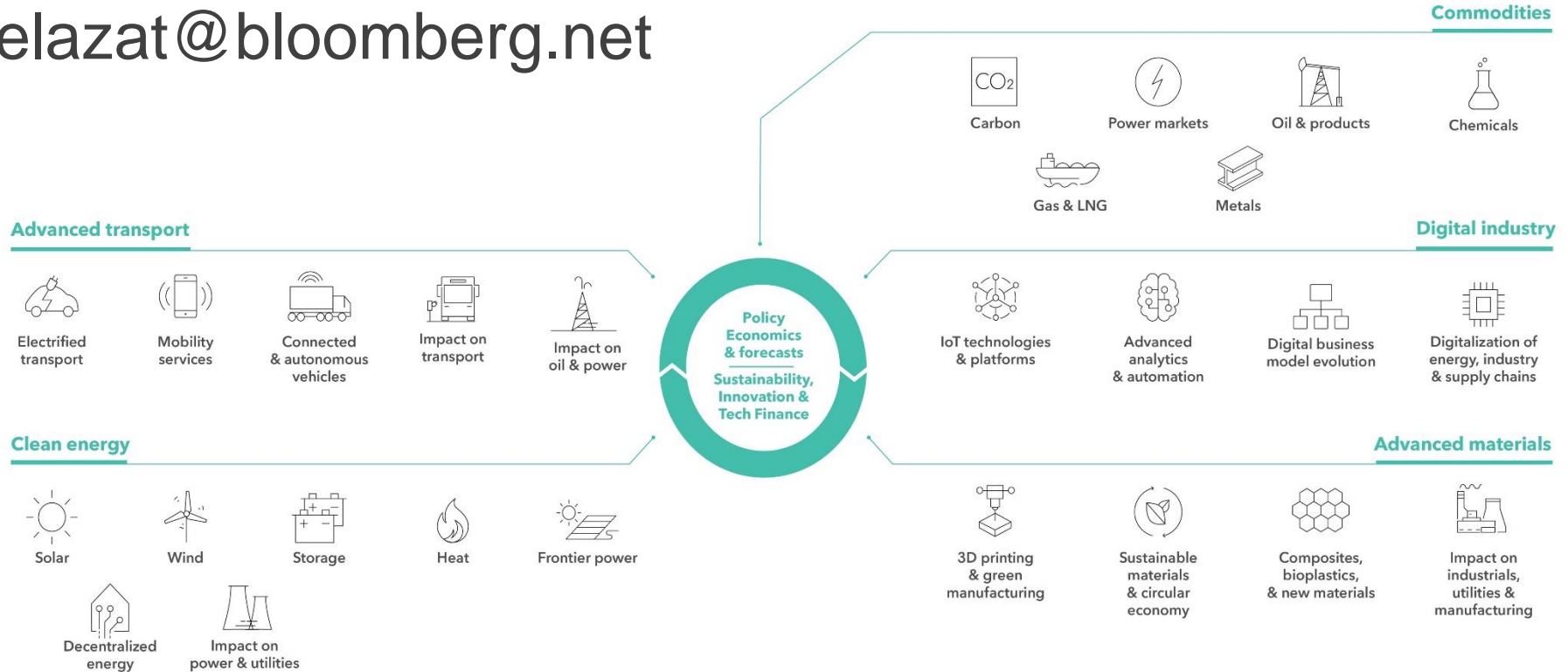- Developed by KTH Royal Institute of Tech with partners the U.N., World Bank, IRENA, WWF

OpenDSP

- Avista Utilities and Duke Energy
- Open source distributed system platform
- Contribution from 40 utilities since launch in January 2019

Visibility, transparency, open source

elazat@bloomberg.net

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Chemicals

Gas & LNG

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Composites, bioplastics, & new materials

Impact on industrials, utilities & manufacturing

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