



**BloombergNEF**

# Digital Energy Summit

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November 20<sup>th</sup> 2018

**Digital: Accelerating the transition to a lower carbon future**



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**BloombergNEF**

# **Speakers & Moderator**



## Speakers & Moderator



**Michael Wilshire**

Head of Strategy, BNEF

Michael leads BNEF's strategic research into the energy sector, with a particular focus on the impact of emerging or disruptive technologies in transforming both energy and transport



**Paul Massara**

CEO: Electron

Paul is CEO of Electron, a UK based blockchain-based, decentralised flexible energy trading platform. Backed by Shell & EDF amongst others. Paul has more than 25 years' experience in the energy sector



**Jacqueline de Rojas CBE**

President: techUK

Jacqueline is President of techUK - which represents the companies and technologies that are defining today, the world that we will live in tomorrow



# Objective of the Digital Energy Summit



## What is digitalization?

Digital technologies have been in use for more than 50 years and have become the dominant form of electronics and communications. Initially the term was used to describe the shift from continuously varying signals to those made up of step changes, of zeroes and ones. However, as rapid data processing and transfer has become more simpler, cheaper and more widespread, the term “digitalization” has taken on a new meaning, representing increasing connectivity and data sharing in industrial, consumer and energy sectors.

### The value chain of digitalization therefore includes:

- Sensors to report data from connected machines
- Communications networks to transmit it
- Software platforms to organise and redirect selected data
- Analytics programs to generate insight and conclusions

### The aim of the Digital Energy Summit:

To hold a lively and challenging open discussion on the topic of digitalisation, and how it will accelerate the transition to a lower carbon future.

### BloombergNEF’s definition is:

“*Digitalization: the process of connecting devices through digital communications, collecting and sharing data, and analysing that data to improve machine or system operations*”



# The role for digital in accelerating the energy transition



## Why does energy need digitalization?

Digital infrastructure has been embraced by the industrial sector as a way to streamline operations, predict and prevent failure, and shorten product design cycles, all while collecting and analysing data. Many of the systems can be replicated within the energy sector.

### **The major current applications include:**

- Reducing operation and maintenance (O&M) costs through predictive maintenance and monitoring
- Increasing uptime or energy production
- Improving product design and reducing time to market by feeding back operational data
- Aggregating and analysing third-party data along with operational data, to improve forecasting (e.g. weather data)
- System optimization (e.g. increasing the effective capacity of grids through better flow control)



# Energy challenges and digital opportunities

## Challenges

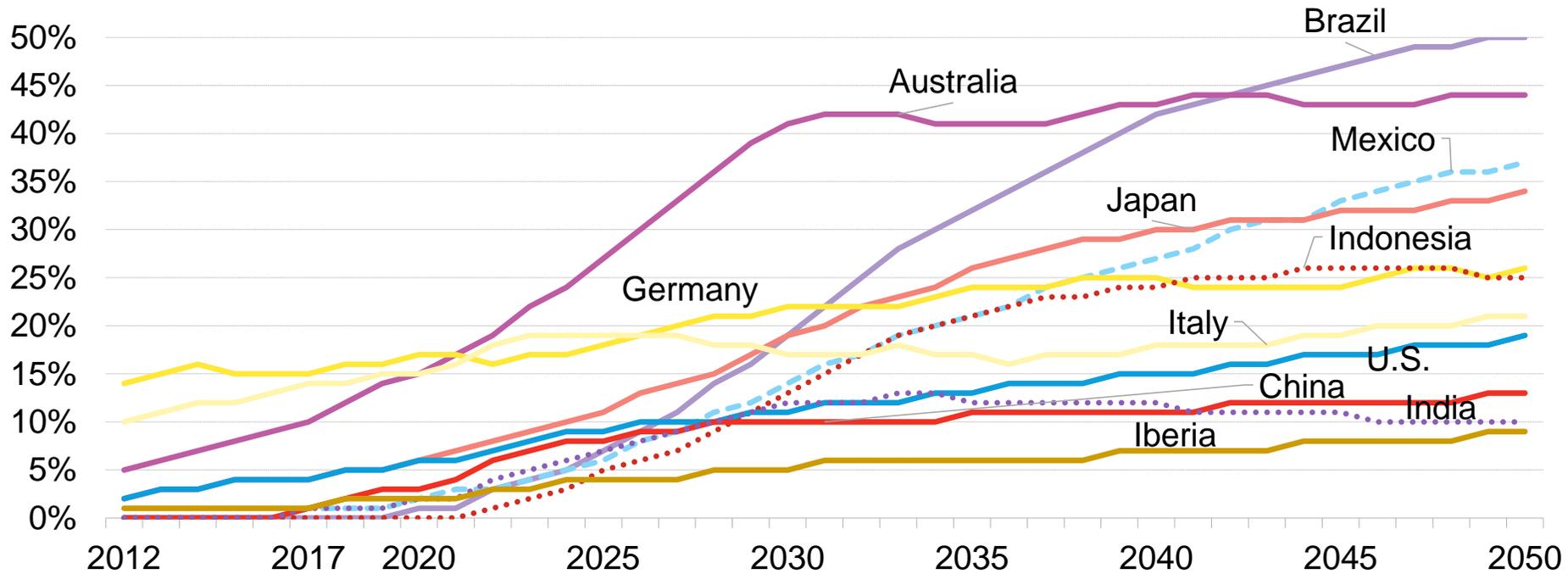
- Reducing the costs of electricity generation and oil & gas industries to sustain margins
- Increasing electricity system flexibility to enable high penetration of renewables
- Managing an increasingly complex system of more distributed assets
- Optimizing asset performance and utilization
- Reducing CO<sub>2</sub>, and other emissions
- Creating new services, changing business models

## Examples of digital opportunities

- 'Internet of Things' – sensors, big data, communications networks, analytic software
- Predictive maintenance
- Machine learning – finding patterns, detecting anomalies, optimizing complex systems
- Asset analytics and performance management
- Drones for inspection, fighting emissions
- Microgrids
- Blockchain for energy trading, distributed asset management
- 3D printing

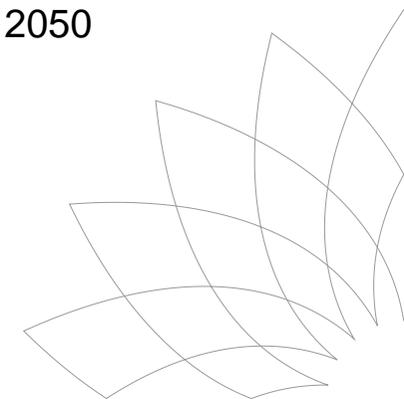


# Electricity generation is increasingly decentralized

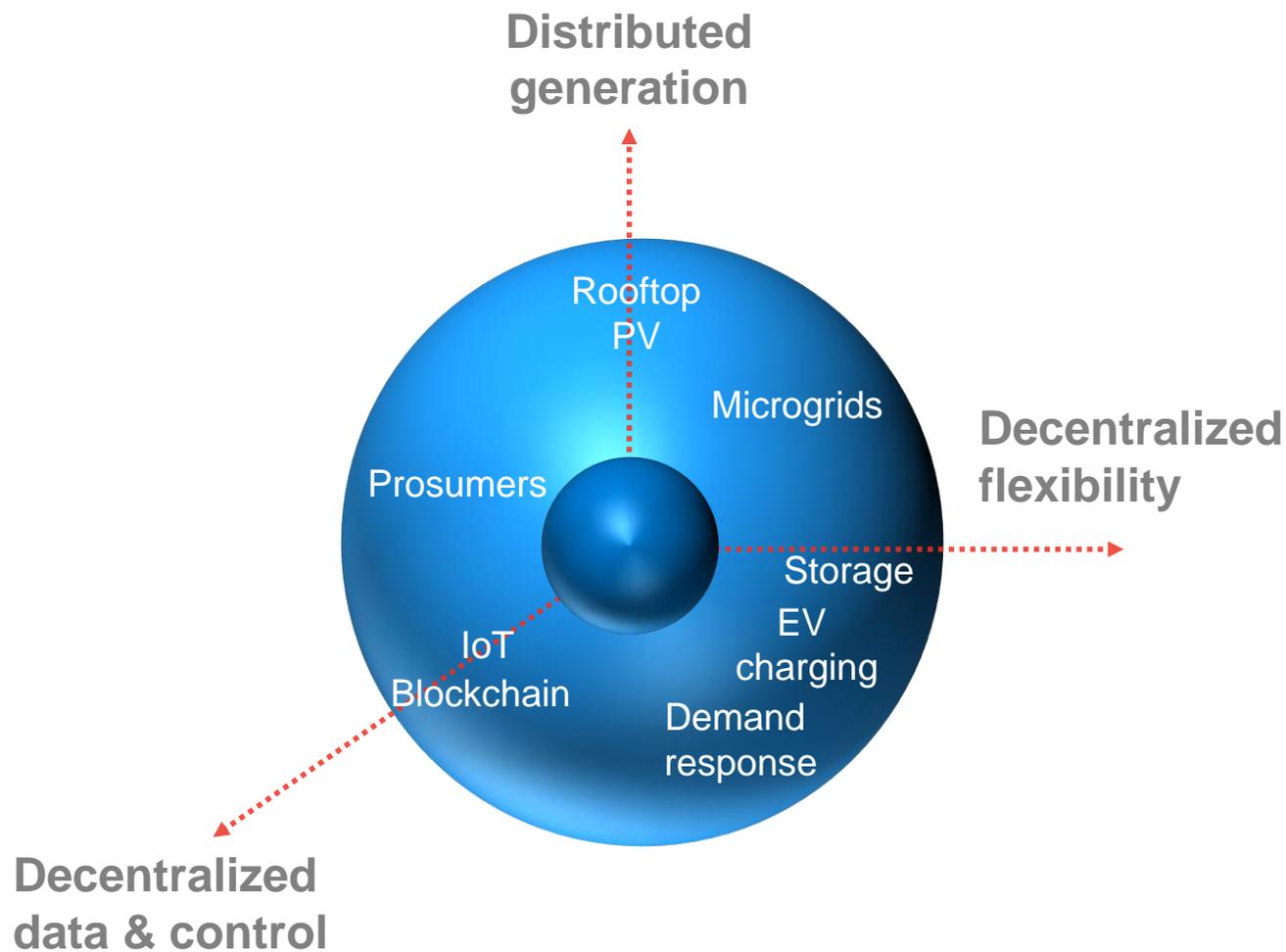


Source: BloombergNEF

Note: decentralization ratio is the ratio of non-grid-scale capacity to total installed capacity



## But decentralization of energy has more dimensions...

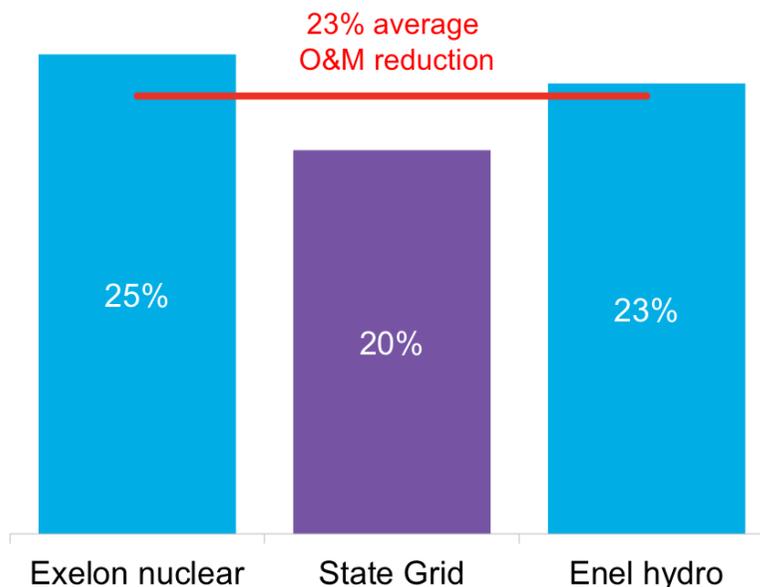


- Decentralization creates opportunities but increases complexity
- Digital technologies needed to organize and optimize these systems



# Digital technologies reduce costs of thermal, hydro and nuclear generation

O&M savings for thermal power plants, % reduction



Predictive maintenance for reducing operating costs and avoiding failures

Optimization of assets to improve performance, efficiency, fuel burn

Weather forecasting to predict renewables output and protect assets

Worker optimization for improved productivity and safety

**\$240m**

Iberdrola expected savings from 2017-22 due to digitalization alone

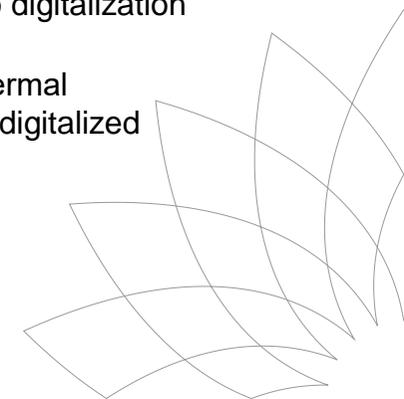
**3.2%**

Average power loss reduction at power plants due to digitalization

**100%**

All of Iberdrola's thermal power plant fleet is digitalized

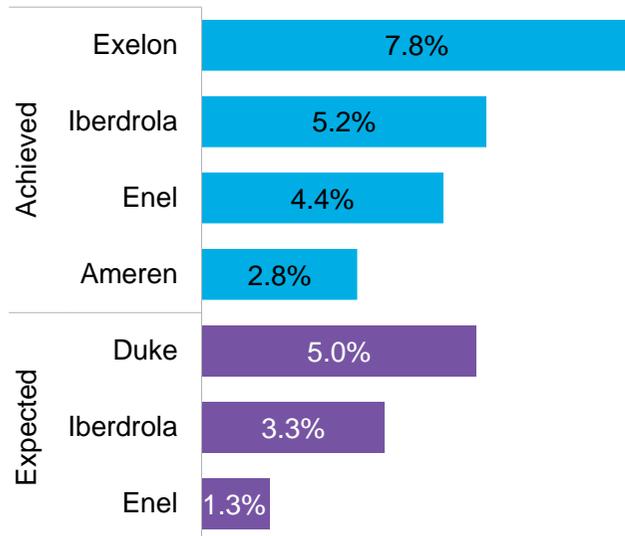
Source: BloombergNEF, company reports and presentations. Note: 'Power losses' and efficiency gains show Shenhua-Guodain's reported gains for 2016-17, 2018 expectations for China State Grid, and 2017-22 targets for Iberdrola. 'O&M reduction' is specified as digitalization-only for Exelon, but unspecified in source for China State Grid and Enel. All three are historic values. In addition to power plant automation/sensors, Enel has a target to reach 60% IoT-enablement, from 6% of capacity today.



# Power grids are becoming more automated, more flexible

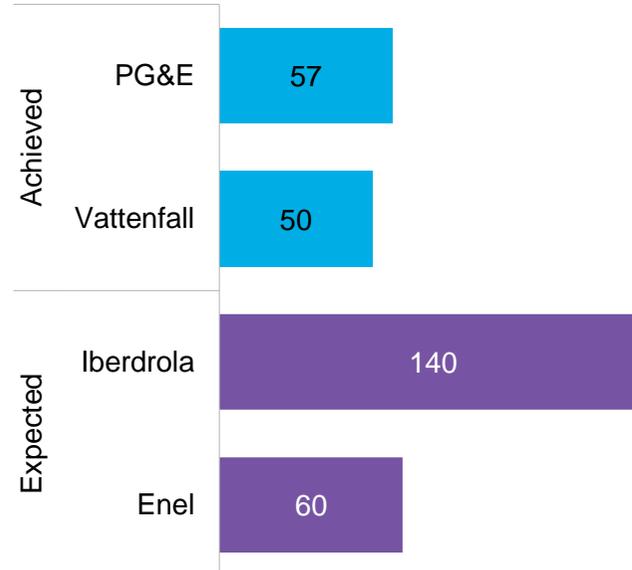
Outage reductions, annualized

Percent outage reduction



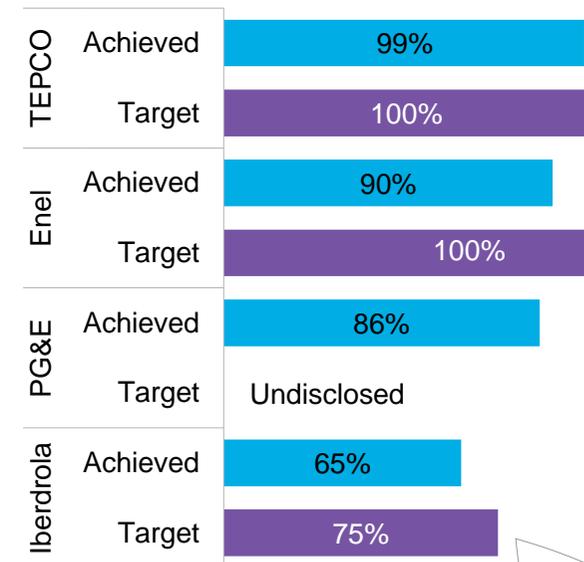
Dollars saved, annualized

Million dollars

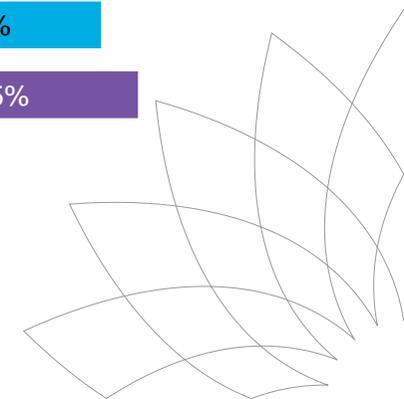


Penetration of automated network operations (e.g. digital control)

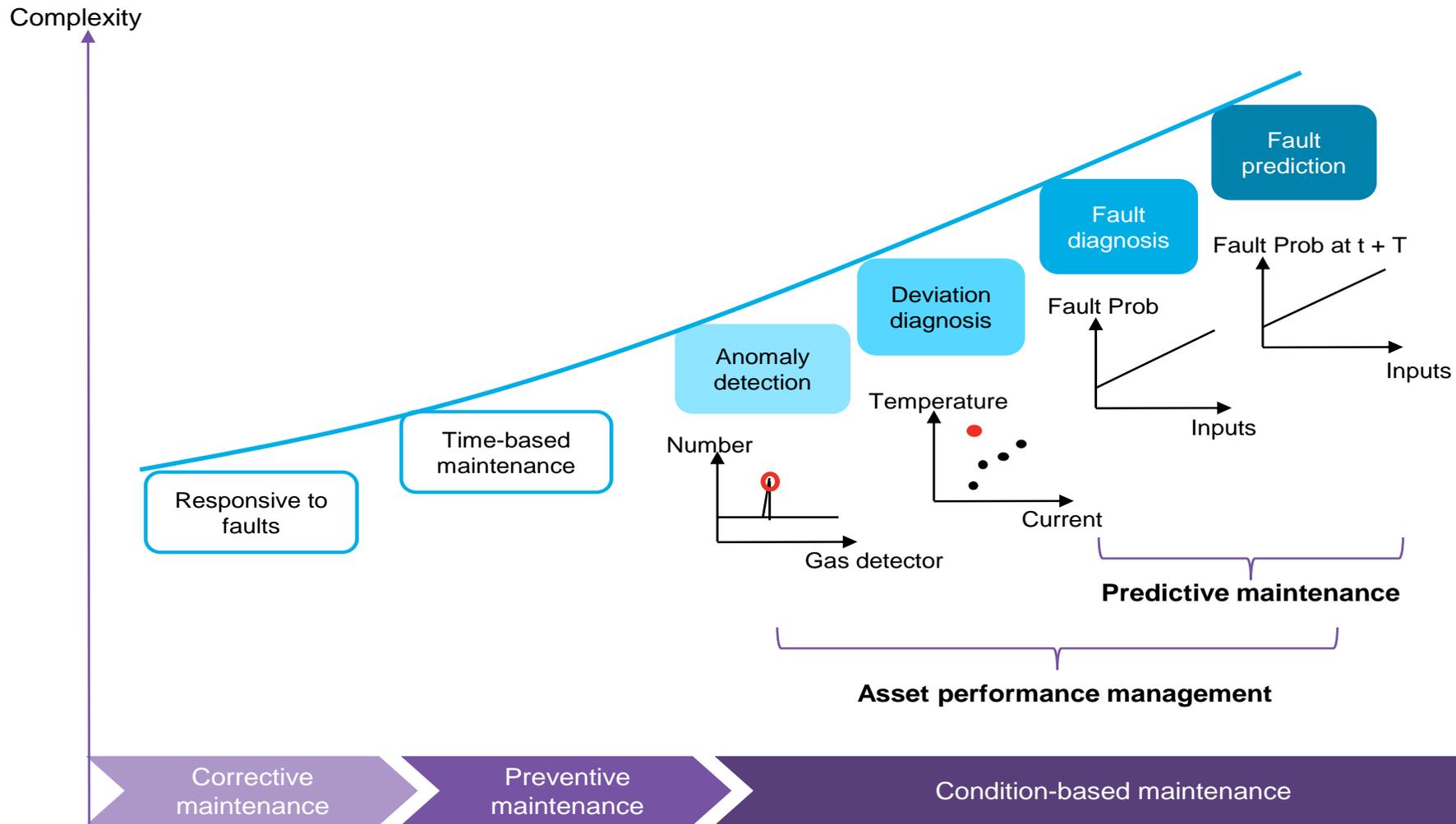
Percent of network automated



Source: BloombergNEF, company reports and presentations. Note: 'Outage reductions' based on minutes interrupted for Iberdrola, Enel's on SAIDI figures, Exelon's outage duration for ComEd, and Ameren's unclarified. 'Dollars saved' represents opex for Iberdrola and Enel, capex for Vattenfall, and both for PG&E. PG&E penetration is based on percentage of circuits automated, while Enel and Iberdrola are based on substations. Enel has 28% of grids with smart tech monitoring, targeting 90% by 2020.

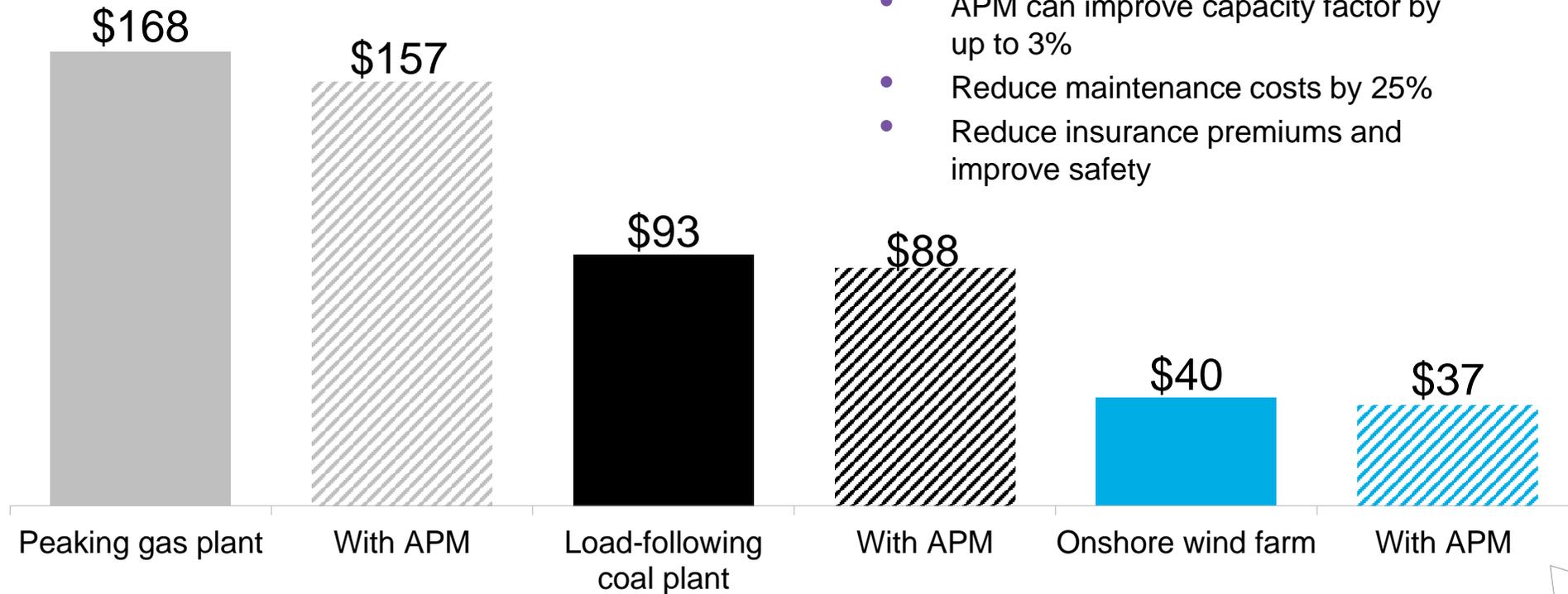


# Increasingly sophisticated asset analytics



# Asset performance management – results

## U.S. levelized cost of electricity (\$/MWh)



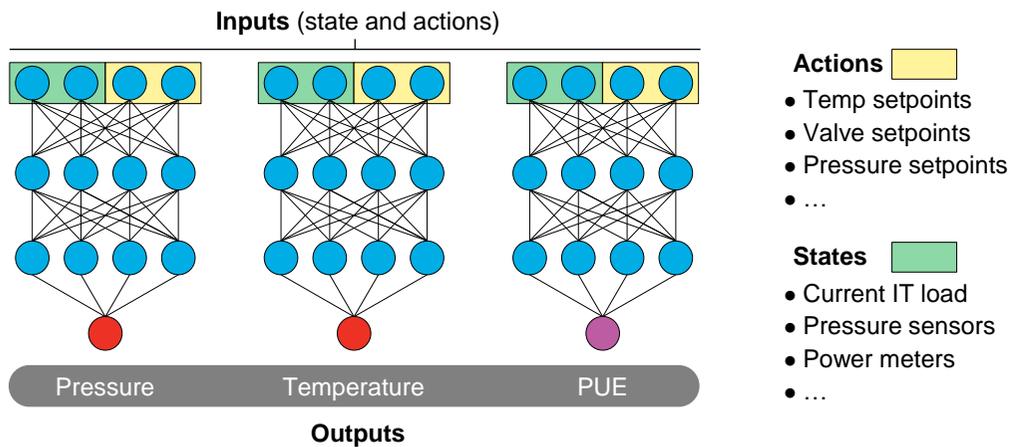
## Benefits

- APM can improve capacity factor by up to 3%
- Reduce maintenance costs by 25%
- Reduce insurance premiums and improve safety

Source: BloombergNEF



# AI helps optimize energy systems and efficiency– Google’s data centre example



Power usage effectiveness (PUE)



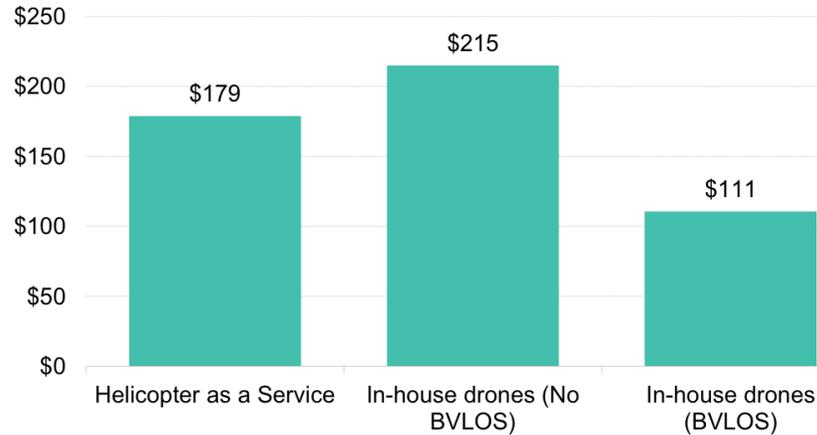
Source: [Google](#), BloombergNEF. Note: PUE near 1.0 means nearly all of the energy is used for computing, as opposed to cooling.



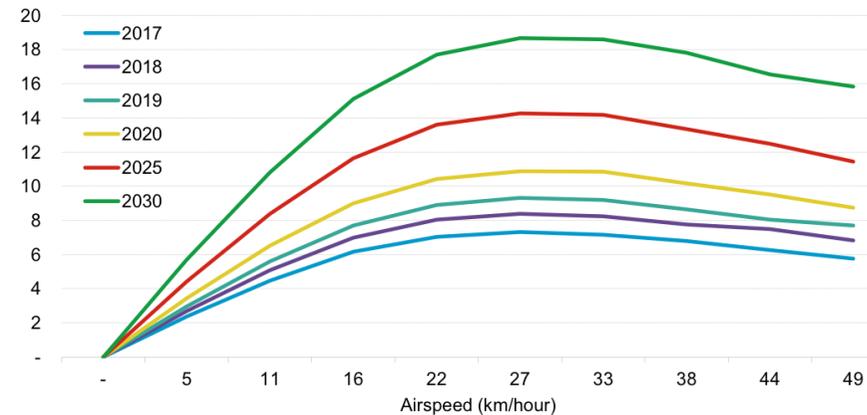
# Drones for pipeline and linear inspection



Cost of pipeline inspections (\$/km)



Improvements in drone range (km)

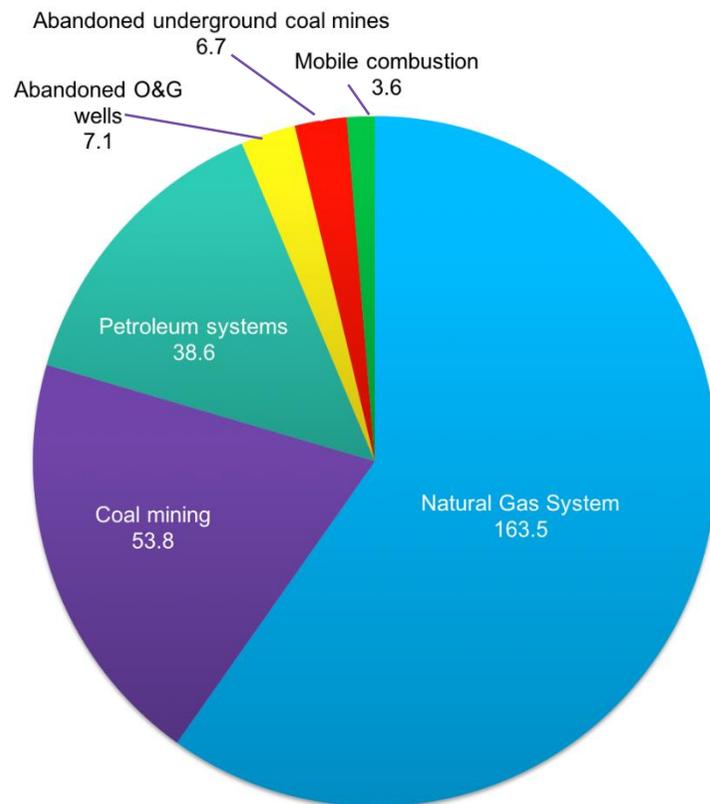


Source: BloombergNEF, Measure, Sterblue, Bershadsky et al, GNC.com



# Drones fighting emissions

## U.S methane emissions, million metric tons CO<sub>2</sub>e, 2016



Source: BloombergNEF, EPA

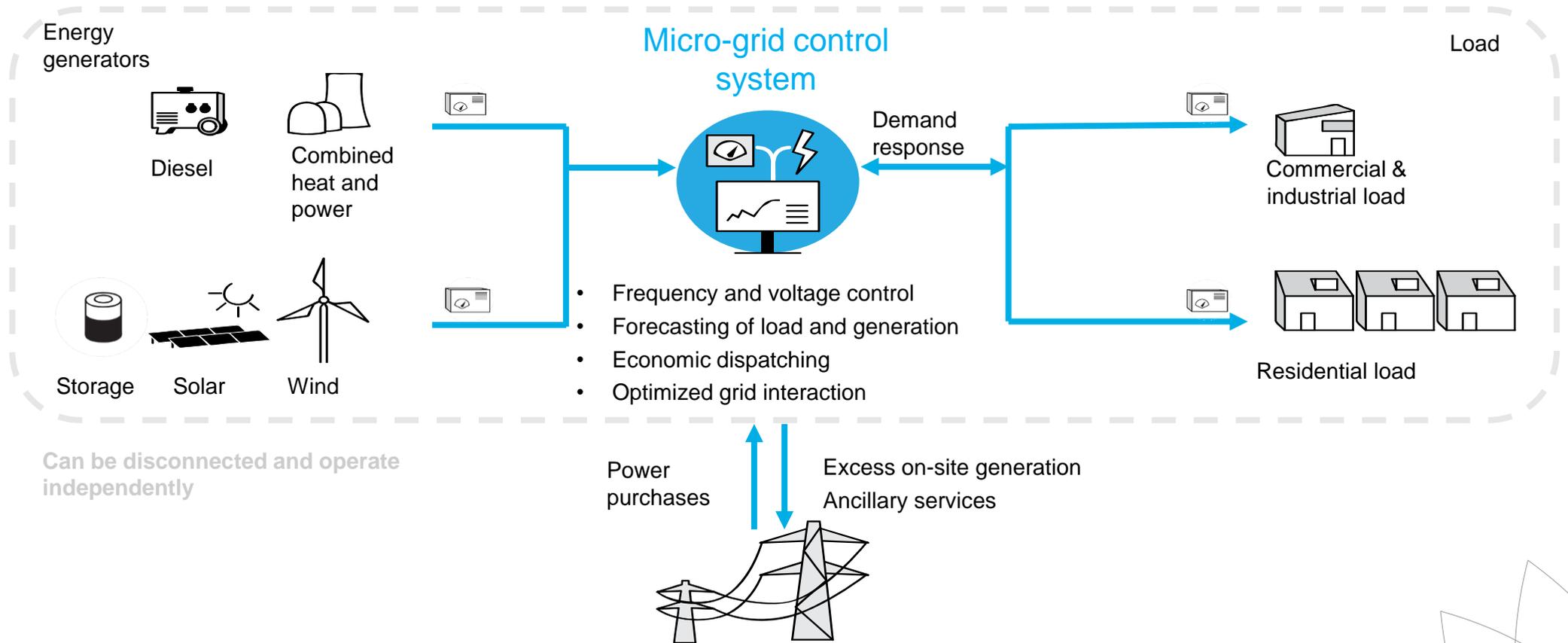
## JPL sniffer drone



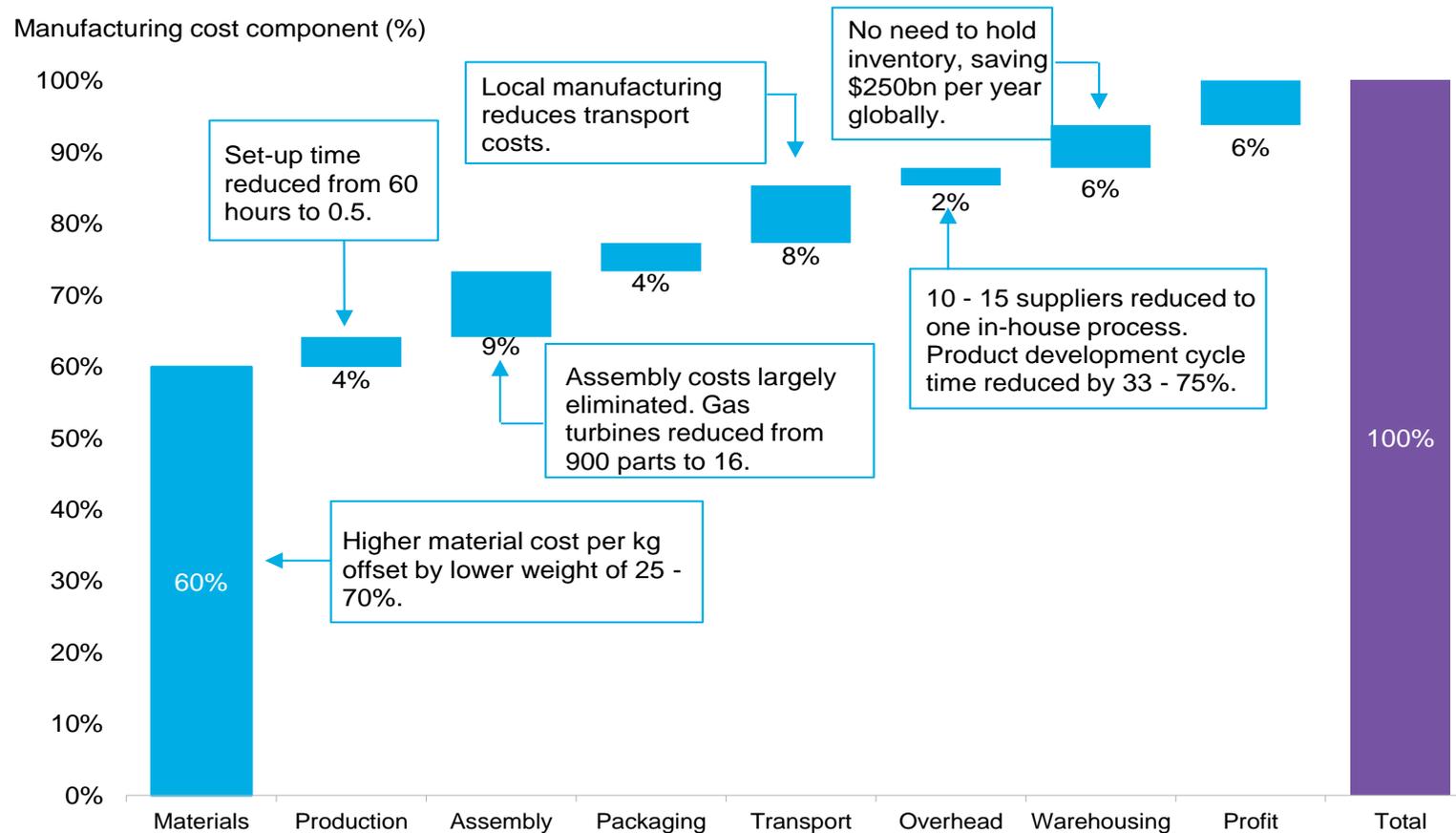
- Drones with probes can smell methane at 1,000 times sensitivity of traditional methods
- Can fly safely and cheaply over remote pipelines and offshore
- In U.S, could reduce methane emissions by 95 million metric tons of CO<sub>2</sub>e



# Microgrids can balance generation and flexibility at the edge of the network ....



# 3D printing – reducing costs, transforming supply chains



Source: BloombergNEF, IKEA, GE, Siemens, NIST



# Reflections & Conclusions



# Digital accelerating the energy transition

- **Cybersecurity continues to be a major priority for corporates globally**

Opportunities within penetration testing, system hardening, protection of industrial control systems and security for connected energy assets are some of the recent areas to be awarded funding.

As corporations evolve, develop and understand the interaction between their integrated assets, the need for more cybersecurity systems will increase.

- **Countries have a bigger impact to play in protecting their citizens' data**

As data becomes more commoditised, the need for more stringent data regulations from governments and business need to be addressed. Protection of individuals' data is paramount. Data alliances between countries are increasing to develop and enhance AI opportunities.

- **Oil companies continue to drill into IoT**

Three of the worlds largest Oil & Gas majors have continued to explore and look at the roll out of IoT applications to support their business. BP Plc implemented the roll out of a data analytics software package to a number of offshore platforms. This software helps with predictive maintenance to streamline resources and save capital. Royal Dutch Shell also started using an AI-enabled data platform, to deploy advanced analytics on its assets worldwide.

- **Companies team up within the digital sphere**

We are seeing an increased collaboration between corporations globally to leverage each others assets and enhance their own capabilities. Recent examples include Doosan Heavy Industries partnering with Dell to integrate their cloud computing and data organisation software.

- **3D Printing**

One of the most exciting innovations impacting the future of the manufacturing value chain is 3D printing. This process is being adopted by companies to reduce overheads and streamline supply chains.



# Digital accelerating the energy transition

- **Hardware is important in the digital future**  
As technologies evolve, the hardware and components being manufactured become more advanced and technical. The advancement of 3D printing, drone technology and robotics is changing how companies purchase, maintain and build elements of their portfolio.
- **Digital O&M can improve LCOE's**  
Digital technologies can significantly reduce the cost of generating electricity from both renewable and fossil fuel-fired plants. Advancements in asset performance management (APM), a key application for many IoT platforms uses sensors and machine data in conjunction with analytical software to optimise asset reliability and reduce operational costs.
- **Drones, the future for O&M?**  
Recent reductions in cost, hardware miniaturization, and automation and analytics improvements continue to open up possibilities for industrial drone applications. Within the Oil & Gas sector, drones are increasingly being used to spot methane emissions and are helping to reduce CO<sub>2</sub> emissions.
- **What is the demand for Bio-plastics?**  
As consumers and governments push for more sustainable products, bio-plastics sense an opportunity. To counter this, oil companies and plastic manufactures alike are diversifying and looking into bio-based polymers.



# **Selected Questions**



## Speaker answers to audience questions

Is the potential from digital limited because of a problem with data?

“

The industry has been full of data for a long time. The issue is that it is often out of date, unstructured and badly coordinated. At the moment it takes you 23 days to switch supplier. On blockchain we enable you to do that in 21 seconds. Think about the user experience consumers are going to have in five years' time. How are you going to manage that change for the consumer and how is the consumer going to manage that? They're already disengaged with the energy supply business. Now they have many more things to manage – the world is far more complex. This is a question of creating a user interface for the future that allows consumers to be engaged and takes complexity away, making it an easy user experience.

”



Why is diversity important in technology?

“

If we are creating more technology than we can regulate, and we are, then we must find a way as an industry to self-regulate diversity in the design process is perhaps the only real way to make sure that everybody has a voice at the table. I might remind you that algorithm already decides whether you are granted a mortgage, whether you get a job interview, whether your kids get a place at university, perhaps even whether you live or die. So, who is designing the algorithm? I hope we start to mandate that we have diversity on every design team where technology and digital is concerned because then we will have a voice at the table for everybody and that will enable us to self-regulate when it comes to digital in our connected future.

”



## Speaker answers to audience questions

### How do we develop new skillsets for digital?

“

I think we have to commit to personal accountability for lifelong learning. We can't wait for our boss or somebody else to say, 'Come and learn this new thing'. The way that we absorb information now is changing... I've got apps which summarise books which I need to read at speed – technology is helping us to get skilled and up to speed with what's happening. We can't learn how we've always learnt, we're going to have to learn faster, pivoting more quickly and more often. But we can't leave anyone behind – inclusion matters. We can't leave people that aren't digitally savvy on the fringes, even though machines can be doing a lot of the work for us.

”



### Have we got a problem in the UK with scaling up?

“

We actually find it's quite a good environment – the UK government have done a great job on the energy side by allowing the Distributed Network Operators... to have innovation funding as part of their grants, as part of their asset base which has allowed capital to flow and to try new things. That, plus the fact that Ofgem has allowed sandboxes to happen, allows a degree of experimental and change. The issue is that if you go to a venture capital guy in the States, they're much more willing to say, 'This is amazing, here's 50 million'. In the UK they are likely to say, 'Here's 3-4 million. Come back in a year's time and prove yourself. Then here's another 6-7 million'.

”



## Speaker answers to audience questions

**What could the UK Government be doing to help drive digital take up?**

“

66% of all jobs in this country come from small businesses and I would love to see one switch in the government's policy relating to tax. At the moment there are tax breaks on CapEx but not on OpEx and if we gave tax breaks on OpEx, small businesses would have access to cloud technology which would get them digitised faster. I think they would adopt technology much more quickly. The countries that adopt technology fastest will win in the innovation stakes, no question, so I am poking our government in the eye every day on this front.

”



**What could the UK Government be doing to help drive digital take up?**

“

On the energy side... if you want to decarbonise... the government are going to have to intervene to get the changes it wants. I think what's super important is that the government creates clarity of direction, clear goals and clear principles. We need a consistent picture so that people can make bets.

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