



DIGITALIZATION AND THE FUTURE OF ENERGY

Beyond the hype – how to create value by combining digital technology, people and business strategy

ABOUT THE RESEARCH

'*Digitalization and the future of energy*' is an industry report which reveals the current attitudes to, and challenges and opportunities for digitalization in the energy industry.

This report is based on a global survey¹ of 1,919 energy industry professionals, alongside in-depth interviews with market leaders and insight from business experts.

The respondents were taken from across the energy value chain, including organizations operating in a variety of energy industry sectors including renewables generation (solar PV, onshore and offshore wind), energy storage, transmission and distribution, energy efficiency/energy management and finance. The respondents represent a range of business sizes from start-ups to large corporates and a range of functions within the industry, from board-level executives to senior engineers, developers and financiers.

Acknowledgements

We would like to extend our thanks to all participants, and to the following interviewees for sharing their time and insights with us:

Joseph Santamaria
SVP, Chief Information and Digital Officer, PSEG

Belinda Kinkead
Director, LO3 Energy

Weiping Pan
Deputy General Manager, Goldwind

Peter Stuart
Group Technical Director, RES

Adam Nancarrow
Managing Director, Macquarie Group

¹ Conducted by Foresight Factory in December 2018 and January 2019



INTRODUCTION

The energy industry is changing rapidly. As we strive to reduce carbon emissions and safeguard the planet for future generations, the way we produce and consume electricity is shifting. In this move away from fossil fuels, renewable energy sources, such as wind and solar, are growing exponentially and are set to account for nearly 70% of global electricity production in 2050². Transport is being electrified, with 50% of all new cars sold globally expected to be electric by 2033. Electricity consumers are now also becoming electricity producers, with the ability to generate your own power using technology such as solar panels now more cost effective than ever before.

Advances in digital technology are enabling these dramatic changes to our energy system. Digitalization is an important instrument for the energy transition and an enabler of two key industry trends: decarbonization and decentralization, both critical to enabling the energy transition humanity needs so desperately to deliver.

As the 4th Industrial Revolution blurs the lines between the physical and digital world, it is driving a fundamental shift in the energy industry and disrupting traditional market players. We've seen other industries fall at the mercy of technological and digital innovation and we've seen new players emerge from these ashes. While the energy industry cannot allow itself to become the next Blockbusters or Kodak, there are already victims of the rapid changes being experienced in the sector. Moreover, power system assets are critical infrastructure and operators need to act based on facts – there's no room for being misled by hype when the reliability of our energy infrastructure has major consequences and can mean the difference between life and death.

Despite its importance for the future of the energy industry, digitalization has become a 'trend'; a buzzword we see cluttering up the business pages of newspapers and overused in PowerPoint presentations. When a topic isn't fully understood, it can be easy to dismiss it, which is why it's time to go beyond the hype and start treating digital transformation like any other vital business process, with defined goals and strategies that create long-term value and the opportunity for organizations to not only succeed, but to take the lead in a rapidly changing energy landscape.

This report explores the views and digital maturity of organizations across the energy value chain. It reveals which digital technologies organizations are investing in now and which they've earmarked for future investment; the goals and benefits being realized and how internal barriers are creating roadblocks to digitalization, which could see some organizations get left behind.

Our findings outline the interplay between the critical elements that organizations need to have in place for digitalization to be a success. Read on to find out which technologies are adding value today, why you need to ensure your employees have the right mindset to enable digitalization, and how you can build a business strategy that goes beyond the hype and positions your organization at the forefront of digital transformation in the energy industry.

² dnvgl.com/eto



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At DNV GL, we see both digital technology and digitalization as key enablers of the transition to a low carbon energy system. The transformative effects of digital technology are clear, however there can be a lot of hype around digitalization so we asked our customers from across the power and renewables industry what their priorities are. We looked at which technologies are making the biggest impact across a range of segments and what the investment strategies are. However, as our study reveals, the digital transformation of the energy industry is not just about technology and big data. Often the biggest challenge is changing culture and changing people - and that means all of us.

”



Lucy Craig
Vice President Technology & Innovation, DNV GL - Energy

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TECHNOLOGY AND DATA

'Digitalization' can be a poorly-defined term. At DNV GL, we use the following definitions.

DIGITIZATION → Making things digital

The process of changing from analogue to digital form, also known as digital enablement. Said another way, digitization takes an analogue process and changes it to a digital form without any different-in-kind changes to the process itself.

DIGITALIZATION → Business opportunities created by digitization

The use of digital technologies to change a business process and enhance efficiency and revenue; it is the process of moving to a digital business.

DIGITAL TRANSFORMATION → Changing business models with digitalization

The use of digital technologies to change a business model and provide new revenue and value-producing opportunities.

COMPUTERS



Large and small
Distributed cloud
Edge

CONNECTIVITY



Internet
Mobile
5G

SENSORS & DATA



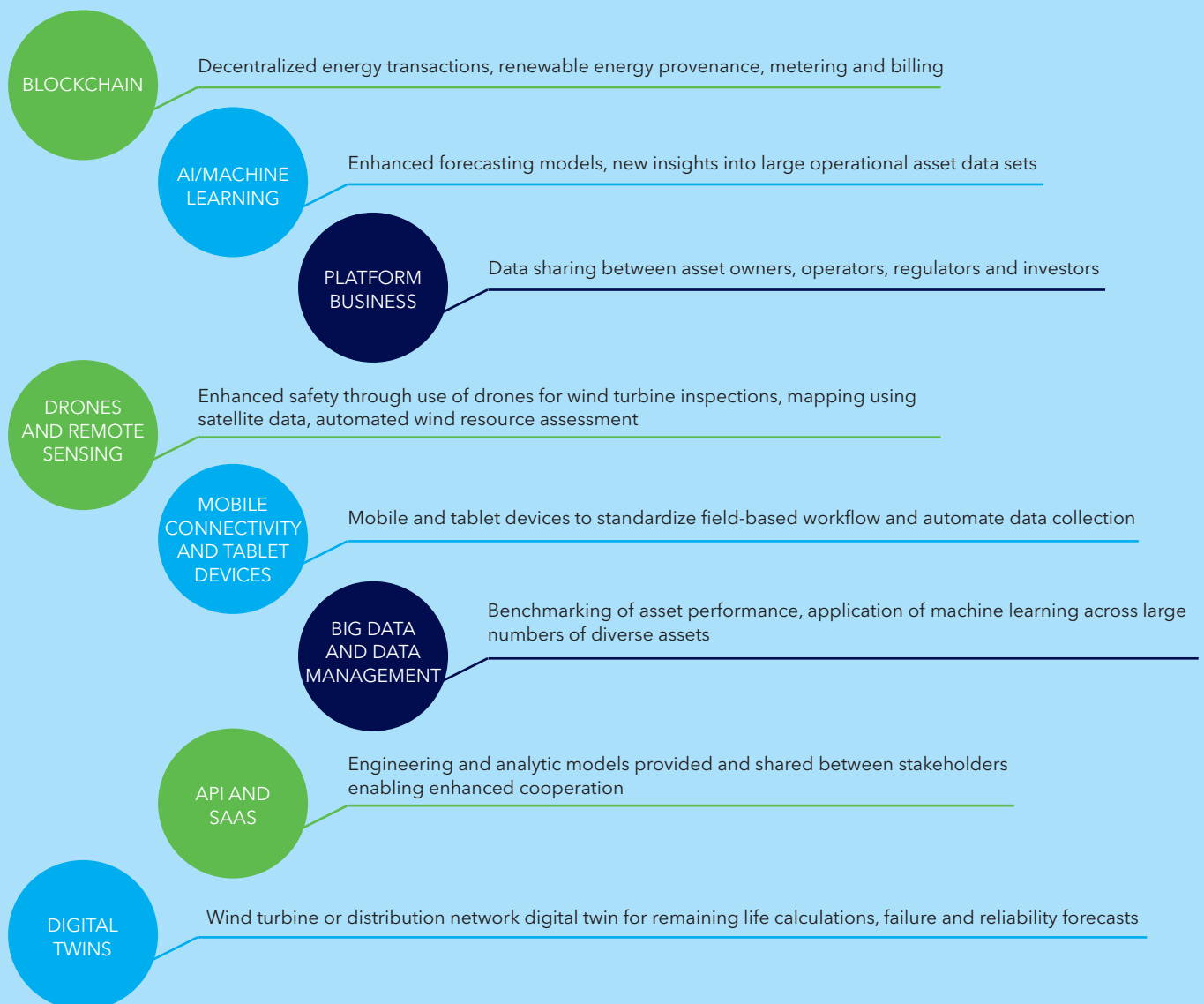
Proliferation of data
Decreasing cost
of sensors
IoT

SOFTWARE



Machine learning
Blockchain
Big data
AI

Example applications of digital technology in the energy industry



However you define it, digitalization is having a profound impact on the energy landscape.

Our research reveals that two fifths of the respondents we surveyed have digitalization as a core part of their publicly stated strategy. Interestingly, the likelihood of digitalization being a core part of an organization's public strategy grew relative to the size of the company, with small companies the least likely to have digitalization as a core part of public strategy and large companies the most likely to.

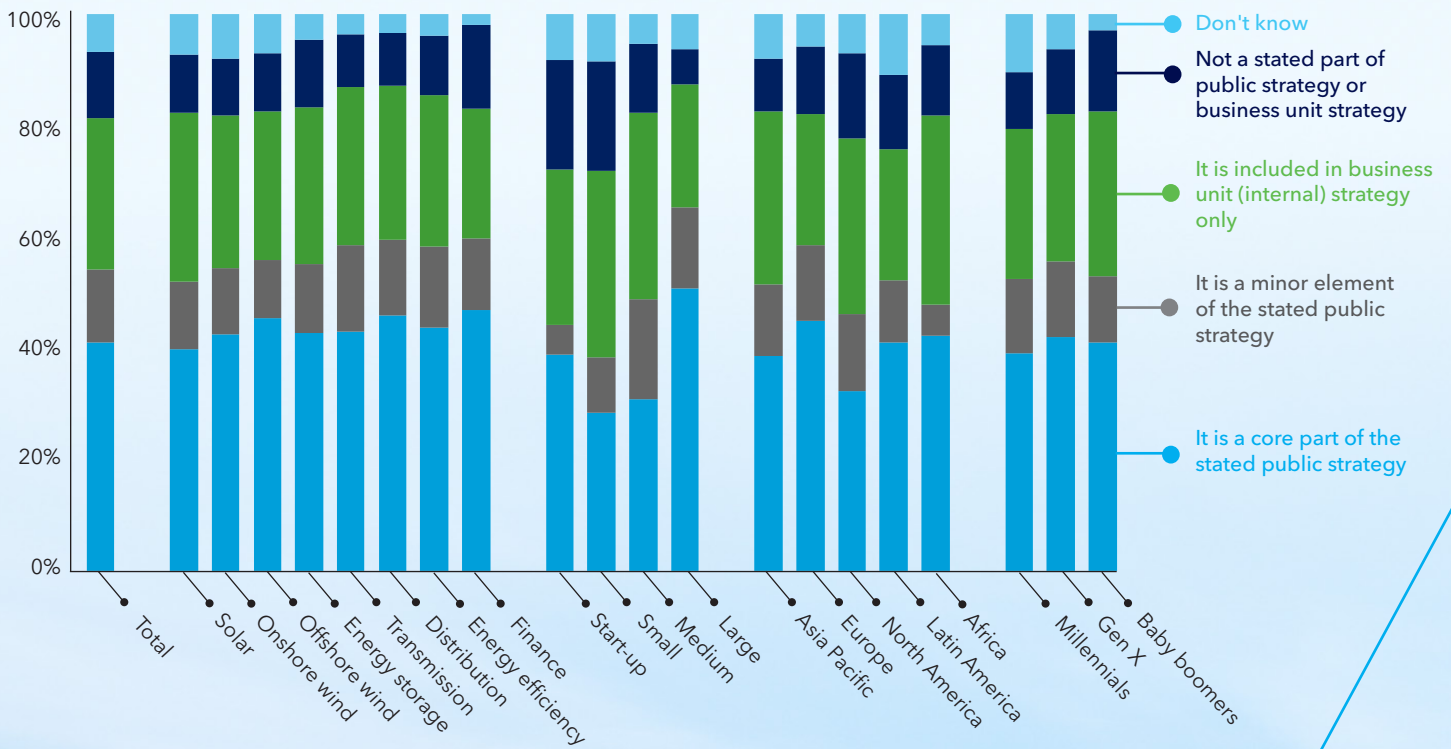
This could indicate that large organizations are leading the way in digital maturity, however, when we asked the respondents whether digitalization was included in their internal strategy, the findings were reversed with smaller

companies more likely than large organizations to say it was. This paints a different picture and could suggest that larger companies are more concerned with creating a public digitalization strategy than building digitalization into their core business processes.

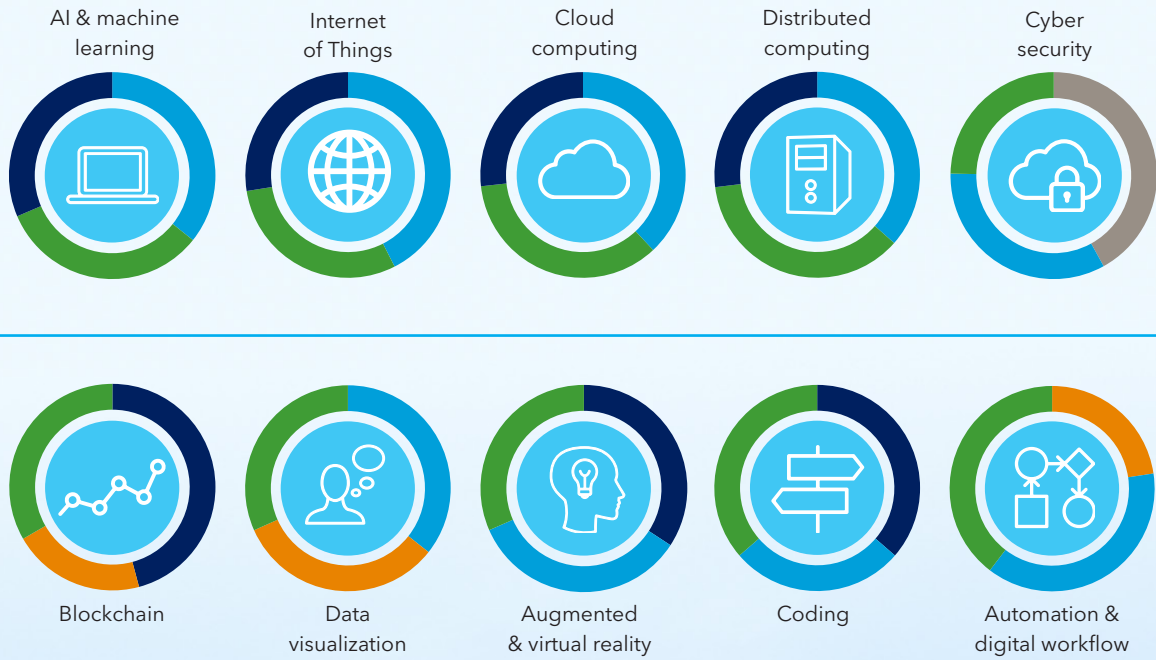
However, despite the focus on digitalization as a core strategy, just 20% of organizations feel more advanced than the industry in their application of digitalization with 42% saying their organization is on a par with industry. This is particularly revealing when it comes to understanding and applying emerging technologies like blockchain and augmented reality, evident by the lack of short-term investment in these technologies – with only 20% of organizations thinking investment in blockchain is an important consideration for the next three years.

Two fifths place digitalization as a core public strategy

Which best describes the way your organization approaches digitalization in your corporate strategy?



Use of technologies



- Developing new services
- Asset optimization
- Product/process improvements
- Planning & strategy
- Regulatory compliance





SPOTLIGHT INTERVIEW



NAME: Joseph Santamaria

ORGANIZATION: PSEG (Public Service Enterprise Group)

POSITION: SVP, Chief Information and Digital Officer

ABOUT THE COMPANY

Public Service Enterprise Group (PSEG) is a North American utility that helps to make New Jersey and New York better places to live and work by providing safe, reliable, economic and greener energy that powers the lives of millions every day.

The dynamics within the energy industry are shifting. The penetration of renewables and the growth of electric vehicles will start to have a big impact on power generation, consumption and the electricity grid. A big change will be dealing specifically with the move from today's predictable generation models to a more variable grid. We're already seeing this shift in the marketplace. However, traditionally our industry hasn't faced many changes of this magnitude, but change is coming nevertheless and we need to be ready to use the change to create a more customer centric, sustainable, and effective operating model.

One of the implications of this change is that we will need to run the grid in a more responsive fashion; more responsive to customers, to the environment, and to the grid of the future. We've defined this into three dimensions; smart energy, smart operations and smart customers. The common variable across all these dimensions is the need for data to understand how the grid is performing at any given time so that as parameters change, variables can be managed, and to understand our customer needs and interactions with our services. To collect this data, we need to deploy sensors, this could be a smart meter, an electric vehicle charger or a smart battery. Once this data has been collected it needs to travel through the network and back to a processing centre so that it can be interpreted and a response can be triggered. Maybe some of the operational needs require decisions to be made at say, substations, and the data needs to be processed what is called at the edge as there is no time to send it back and forth to a processing centre. This entire process of preparing the grid to be more responsive to variable sources of demand and load will depend fundamentally on digitalization.

The second challenge utilities are facing is that customers' expectations have changed, driven by the consumer models like Amazon's or Uber's. We don't get what good service expectation is anymore, we respond to it.

Tomorrow's customers will expect that we will know them better than we know them today. Today, utilities know relatively little about their customers. Most of what we know is around consumption and billing, but in the future, we'll need to know preferences, how best to engage with them and anticipate how we can help them in a proactive way, by offering tailored interactions and services and optimizing these to fit around a customer, while also protecting their privacy and ensuring that they have control of their data.

In addition, there's also an increasing expectation that power supply is continuous and restored very quickly if it does go down, even after a major storm. And finally, we need to continue to offer energy that is affordable for everyone. If you keep in mind that power loads are relatively flat or decreasing, while expectations for sustainability, customer service, and reliability are going up, it means we need to become smarter and more efficient from an operational perspective, using advanced intelligence on assets and predictive maintenance as well as taking advantage of machine learning and technologies that go beyond what we use today.

When it comes to smart energy, the cleanest megawatt is the one you don't use and you don't have to produce. This is about education and working with customers and regulators on energy efficiency and conservation programmes. These don't necessarily need to be connected to the grid, it could be as simple as fixing draughty windows and working out what drives energy loss. This also requires additional data to understand what type of customers are more prone to take advantage of those programmes and which customers need those programmes the most.

To truly take advantage of digitalization the utility industry needs to change its culture. We take a lot of pride in our reliability and history and so we should. Nevertheless, when it comes to digital innovation you need to fail fast and scale fast, learn the lessons and move on. We also need to be more bullish when it comes to attracting and recruiting the right talent and making sure we're attractive in such a fiercely competitive market. Our mission and purpose to better the life of millions should help us with that. As purpose-fit companies go, energy companies are at the top. And lastly, we need funding and this comes from being able to explain to stakeholders and regulators how digital innovation and projects benefit society.

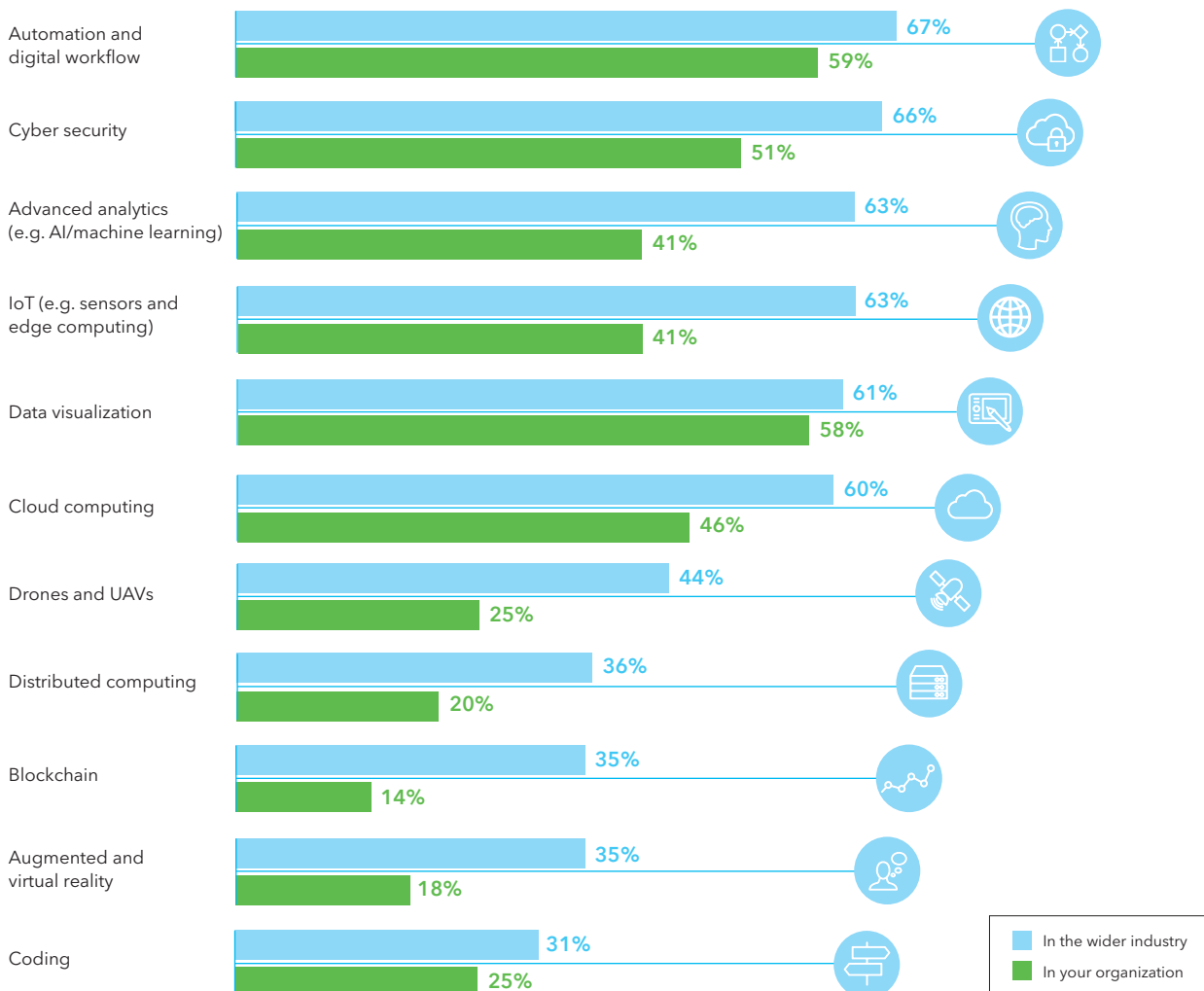
With energy assets defined as critical infrastructure, it's not surprising that in today's security conscious world, our research found that cyber security is the most established focus of digitalization with 40% of respondents considering their organization advanced in this area. Automation follows closely behind and is also widely implemented, with just 10% of respondents not taking advantage of its capabilities at all. Our survey reveals that the most common applications of

digital workflow and automation are asset optimization, product and process improvement, planning and strategy.

Implementation is only one part of the picture, the real value in any technology deployment is being able to prove the impact it has on an organization. Positively, 67% of respondents say automation and digital workflow is already having a significant impact on the energy industry, this figure rises to 93% for large organizations.

Automation is having the biggest impact on industry

Which of the following digital technologies are having a significant impact in your organization/wider industry?



A key challenge with digital transformation is keeping pace with technological change and user adoption rates. Our research indicates that certain technologies, which for many years were considered emerging, are now seen as mainstream, for example cloud computing.

Newer technologies such as blockchain, augmented reality and virtual reality are still in their infancy and are not currently having a significant impact within the organizations of our respondents.

This aligns with Gartner's Hype Cycle for new technologies, which provides a representation of the maturity and adoption of technologies and applications, and how these technologies are relevant to solving real business problems and exploiting new opportunities. The Hype Cycle drills down into the five key phases of a technology's life cycle including Innovation Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment and Plateau of Productivity.

In 2018, Gartner placed blockchain and augmented reality in the trough of disillusionment, which suggests that interests are waning as experiments and implementations fail to deliver. It predicts that producers of the technology will fail and investments will only continue if the surviving providers improve their products to the satisfaction of early adopters. Gartner estimates that the plateau of productivity, where mainstream adoption starts to take off, is not likely to be reached for five to ten years.

Interestingly, although only a small minority (14%) believe that blockchain is having an impact on their organization, 35% of respondents think blockchain is having a significant impact in the wider energy industry.

Despite its perceived popularity, investment in blockchain remains low which suggests a gap between the capability of the technology and its usability. It also highlights that the technology's significance in the energy industry is still difficult to quantify and turn into tangible business value. Could blockchain be the victim of an 'emperor's new clothes' phenomena... the popular kid in the digital technology playground?

However, when questioned about future investment there was a distinct increase in the percentage of respondents (40%) who believe that investment in blockchain will be important in the next 3+ years to achieve successful digitalization.

These statistics point to a current gap in the perceived value versus the deployment of blockchain, and could provide interesting business opportunities for energy companies who can bridge this divide and lead the industry in proving the business case for this technology.



LO3 ENERGY

SPOTLIGHT INTERVIEW



NAME: Belinda Kinkead
ORGANIZATION: LO3 Energy
POSITION: Director

ABOUT THE COMPANY

LO3 Energy is developing blockchain based innovations to revolutionize how energy can be generated, stored, bought, sold and used, all at the local level. LO3 doesn't define itself as a blockchain company, but as an energy company which has chosen to use blockchain because it's currently the most efficient communication protocol.

Is blockchain having an impact on the energy industry?

Blockchain has the potential to make a huge difference to the energy industry. When it comes to managing large volumes of data, it's a natural fit, offering transparency, security and permissioning, allowing multiple people to access the same data in a secure, partitioned way.

The security of blockchain is one of its biggest advantages especially as the energy industry transitions to digital technologies. We've all seen the damage that large-scale cyber-attacks can have and there's increasingly a need for technology solutions that help mitigate the likelihood or severity of an attack and blockchain meets this need. Unlike traditional IT networks a blockchain hacker would need to have control of more than 50% of the connections within a network to have a malign impact.

This inherent transparency and security should make blockchain a very attractive proposition for managing energy use, but to achieve mass-adoption we need proven examples based on real experiences. These are difficult to generate because in a conservative energy industry no one wants to be the first to put their head above the parapet. There are multiple pilot projects in development in the industry, but it's only once these projects yield results and demonstrate that they're able to scale, that blockchain adoption will increase.

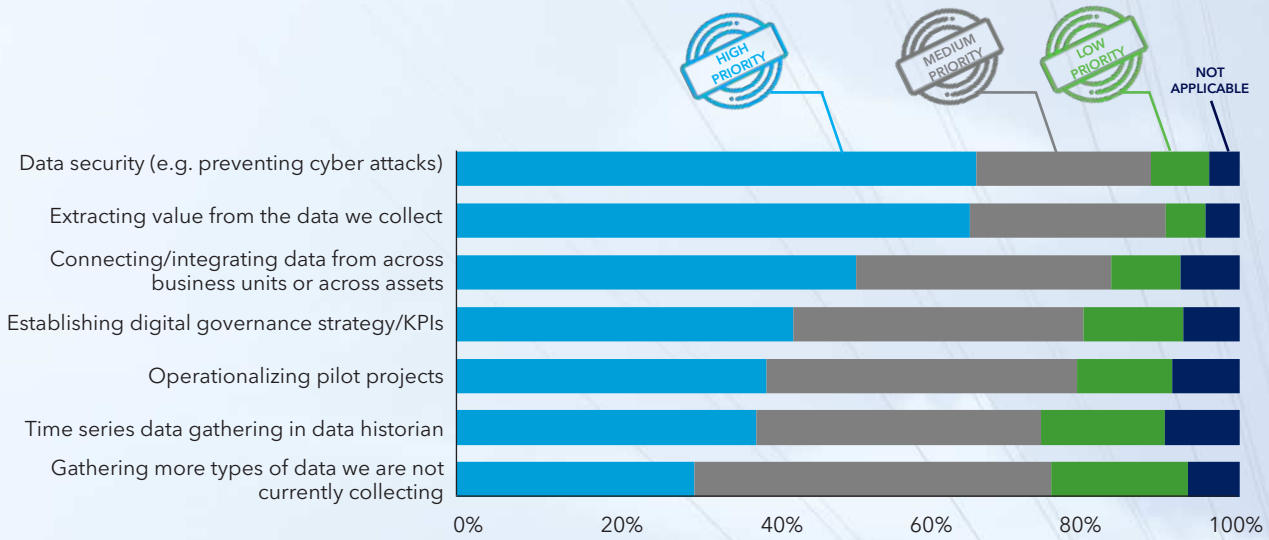
At LO3, we're currently working on a feasibility study using blockchain for the Australian Renewable Energy Agency. The project is based in the Latrobe Valley in Victoria, an area which has traditionally relied on coal-fired power generation. As Australia shifts to green energy the government needs to find innovative ways to meet its citizens' power demand. We've been working with local consumers, utilizing smart meters and blockchain to create a local energy marketplace based on peer-to-peer energy trading in the community and then looking at layering on additional benefits, such as being able to offer demand response, with some very promising results.

The long-term value of a project such as this will be offering the additional benefits on top of the peer-to-peer trading. Although some of these value streams are still being established and require regulatory changes, the initial economic modelling we've done at Latrobe shows that prosumers and consumers in the local energy marketplace could be saving between 6% and 12% on their bills. Additionally, if you're selling electricity into the local marketplace you could be making between 15 and 25% more than the feed-in tariff.

Using blockchain to enable this means as a consumer you have control over your data and you can permission it to certain entities, such as entrepreneurs or start-ups or other service providers. Existing utilities are not necessarily set up to be able to provide those value-add services but once the data is available innovation will come.

Security and extracting value from data are top data management priorities

Thinking about the data management needs of your organization, how important are the following areas?



Security and data sharing

Digital transformation relies on the availability of data. In 2015, there were about 15.4 billion connected devices. According to analysts IHS, this figure will grow to 30.7 billion in 2020, and 75.4 billion by 2025. Intel's projection is even bigger. The company forecasts 200 billion connected devices by 2020. However, much of the data generated by these connections is today untapped.

With vast amounts of data now widely available, new investment efforts to gather this data are no longer a priority. Our research indicates that the energy industry believes it has the necessary data to enable digitalization, with only 3 in 10 respondents considering data gathering as a higher priority.

On the flipside, two thirds of the respondents cite extracting value from the data they hold as a high priority. It's not hard to see why, with Forbes reporting that just a 10% increase in data accessibility could unlock \$65 million for the average Fortune 100 company.

While respondents are seeing the importance of extracting value from data, operationalizing pilot projects is still low on the priority list and could result in missed opportunities for opening new revenue streams by transforming traditional processes.

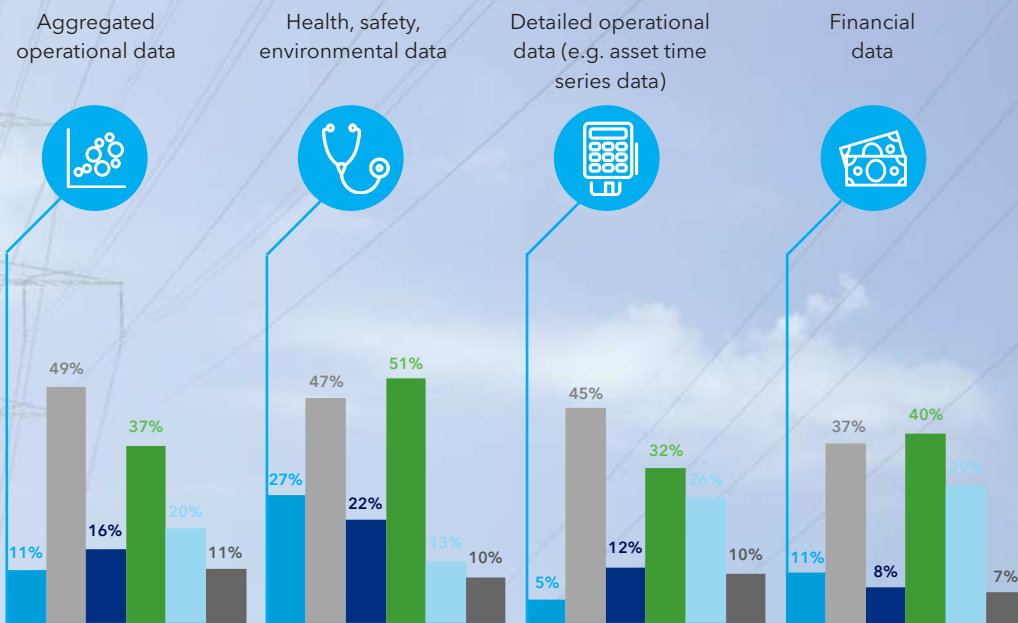
Collaboration is a key success factor for digital transformation, but our research suggests the energy industry is currently being held back by data security concerns with data sharing considered as unappealing for most respondents and just 1 in 10 saying they would be willing to share their organization’s data in the public domain. The exception to this is health/safety/environmental data.

By preventing data-sharing the energy industry restricts access to new market entrants who may bring transformative solutions to add value to the existing data.

The barriers decrease when it comes to sharing data with approved third parties and regulators with around half of participants saying that they would be willing to share aggregated operational data with third parties, and 37% with regulators.

Sharing with third parties and regulators most appealing

In order to carry out data analytics, whom would you be willing to share your organization’s data with?



- The public
- Approved third parties
- Other companies in your sector
- Regulators
- None of these
- Not applicable - my organization does not have this data

SPOTLIGHT INTERVIEW



NAME: Weiping Pan

ORGANIZATION: Goldwind

POSITION: Deputy General Manager, Group R&D Center & Goldwind International Business Unit, Wind Energy Business Group

ABOUT THE COMPANY

Goldwind is a world leading wind turbine technology and energy solutions provider. Through the implementation and investment in industry-leading turbine technology, water treatment solutions and other green energy technology ventures, Goldwind has been hailed as one of China's most innovative companies.

How do you feel that digitalization is changing the industry today and what do you think some of the biggest changes will be in future?

Digitalization is a key trend in our industry, not only for us internally at Goldwind but also for our customers, both the utility scale customers and private wind farm developers.

Driven by a need for efficiency, both from an operational standpoint but also a decision-making one, our customers have an increased need for analysis of the data generated from wind farms. Although there's a common consensus regarding the importance of digitalization, there are several levels of maturity in the industry.

Some stakeholders are very advanced when it comes to using and interpreting data and know how to capitalize on this, while others are just starting out on the journey.

Beyond data, digitalization has enabled virtual technology which means we can reduce cost and maximize resources using digital models that mimic the operation of a real wind farm. This means we can validate our products in terms of the performance and technical specifications. In the past, before we could rely on the simulation of our digital models, we had to rely on field testing of our equipment which was time consuming and expensive.

Mindset can also be a big challenge. At Goldwind there is a common understanding and awareness of digitalization, which feeds into recruitment. To enable digitalization the industry needs employees with advanced skills for data crunching, who understand the requirements both for hardware and software to run the data analysis and then to have also an understanding of the process and have the capability of data interpretation.

For the energy industry, digitalization is a new area and while some organizations already have the awareness of potential benefits, others need to do more to remain competitive. However, without success stories and use cases there remains a level of uncertainty and risk.

The best way to overcome this is as a collective industry rather than as individual companies. If we could capitalize on the strengths of industry and form a consortium to work on the common problems with an open mind, we could all enjoy the benefits sooner.

There is no denying that digitalization is having a profound and disruptive impact on the energy industry but there is currently a disconnect between the technology and the organizations that implement it. While certain technologies are now considered mainstream, such as cloud computing, the potential of newer technology, like blockchain remains largely untapped. There is also a disconnect between the perceived impact these technologies are having on the energy industry and the reality.

If we want to enhance the speed of digitalization and encourage adoption of new technologies, we need to encourage honest conversation in the industry. As an industry, we need to be open to sharing, not only our data but also our experiences, our successes and our challenges for the common benefits of the energy industry and the public which relies on our services.

02

PEOPLE AND DIGITAL SKILLS ARCH

Enabling successful digital transformation goes beyond technology. For an organization to truly benefit from any new approach, every layer of the organization needs to be involved and every employee needs to be on board.

Organizations can invest millions into new systems, processes and technologies but all this investment will be worthless if the company structure and culture prevents the new digital transformation strategy from becoming established.

A recent survey conducted by North Carolina State University's Enterprise Risk Management Initiative and management consulting firm, Protiviti Inc, of directors, CEOs, and senior executives found that digital transformation risk is their number one concern in 2019. Yet 70% of all digital transformation initiatives do not reach their goals. Of the \$1.3 trillion that was spent on digital transformation last year, it was estimated that \$900 billion went to waste.³

According to the Harvard Business Review⁴ the reason why some digital transformation initiatives fail is that although most digital transformation initiatives enable efficiency gains and customer intimacy, if people lack the right mindset to change and the current organizational practices are flawed, digital transformation will simply magnify those flaws.

Our research confirms this statement and reveals that when it comes to challenges preventing successful digital transformation, internal barriers related to company culture and employees are much more common than external barriers such as regulation or industry standards. In fact, for an industry as highly regulated as energy, regulation was only cited as a top barrier by 15% of participants. If you're still blaming your digital transformation challenges on regulation, maybe it's time to stop and work out what's really holding you back.



“ It doesn't surprise me that lack of digital mindset is a barrier for digitalization. There can be a lot of inertia within traditional electricity suppliers. The innovation team may be very keen but other pockets in the organization are not as convinced on digitalization. This phenomenon is more common in large companies, particularly the bigger incumbent utilities. At smaller companies, it's easier to win hearts and minds and for digitalization messages to spread throughout the organization. ”

Belinda Kinkead, LO3 Energy

³ <https://www.protiviti.com/US-en/insights/protiviti-top-risks-survey>

⁴ <https://hbr.org/2019/03/digital-transformation-is-not-about-technology>

Our findings show that in fact a lack of digital skills and lack of digital mindset are the main barriers to digitalization, including for transmission system operators who cite mindset as the biggest challenge. Our research also reveals unanimous recognition that digital skills training is needed, with 91% of participants regarding it fundamental for their organization to invest in digital skills training, with 71% considering this important for immediate investment.

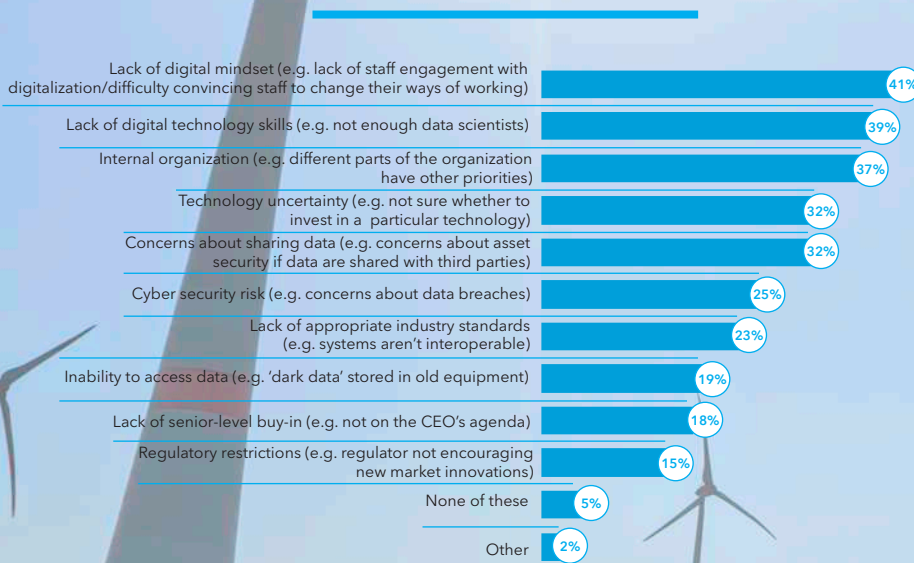
When questioned about the skill sets that were required or lacking within their organizations, 71% of respondents said that they need more employees with combined domain and digital expertise, with 18% claiming to not have any employees with this combined skillset currently.

Creativity was also ranked highly, with 65% of respondents saying that they need employees with creative problem-solving skills among their workforce.

We also explored the digital skillsets considered most important for the energy industry to have among its workforce. Data science came out on top, followed by big data analytics at 41% and 35% respectively. Even though data science was cited as the most sought-after skill, currently only 23% of respondents stated that the role of data scientist exists within their organization.

Lack of digital mindset and skills main barriers

Which of the following do you consider to be the main barriers of digitalization for your organization? % choosing any in their top 3

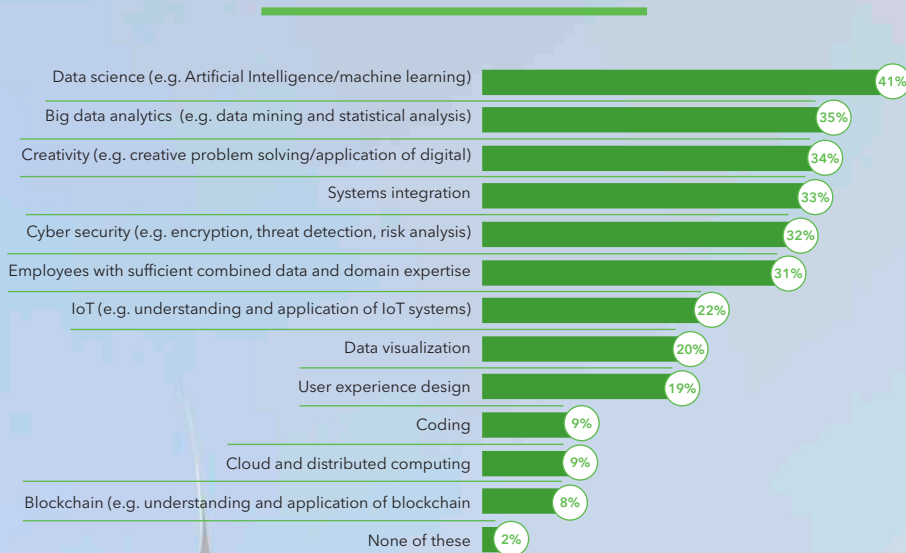


“Creativity is certainly a trait of our business and a key skill for individuals who work here. We're an investment bank which means we're always on the lookout for an opportunity, if you're doing what everyone else is doing then you're not going to be profitable.”

Adam Nancarrow, Macquarie Group

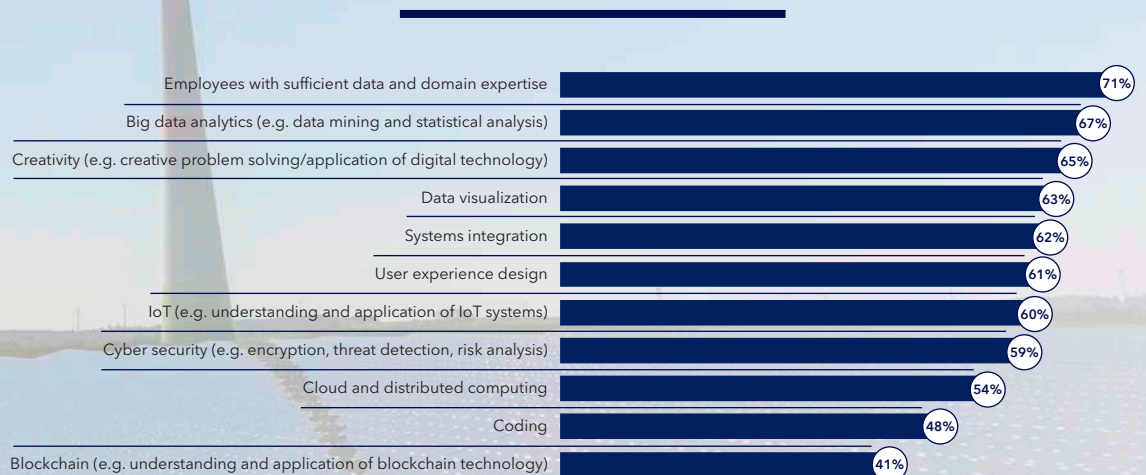
Data skills most important for future energy workforce, creativity also ranks highly

Which of the following digital skillsets will be most important for the energy industry to have among its workforce?
% choosing any in their top 3



Combined skillsets are most in demand

Which of the following digital skillsets does your organization have among its workforce and which does it need? % who need the following skills



The technology to enable digital transformation is available and skills training can be implemented, but there's a critical element missing that needs to be in place for digitalization to be successful. Just as we need to foster an individual mindset geared towards digitalization, we also need to foster a collective one, one which goes to the core company culture and challenges our strategic and operational ways of working.

For traditional energy companies this shift is often centred around collaboration, innovation, networking and breaking down departmental silos. Building a new company culture with digital at its core involves every employee buying into the organization's digital goals and vision.

We asked respondents whether they were actively involved in shaping the digital transformation strategy within their organization. Our findings revealed a disparity between start-ups and large organizations, with half of respondents at start-ups saying they were actively involved in shaping their organization's digital transformation strategy.

This may not be too surprising, after all a start-up's smaller size often makes it easier for them to democratize strategy and roadmaps. In today's world, many start-ups are also digitally native, founded on digital thinking, making it easier to share a common goal, which can be tricky in larger organizations that are adapting conventional and established processes.

However, a more worrying finding was that in larger organizations employees were less likely to be actively involved in their organization's digital transformation strategy. They view digitalization as something that happens to them or happens elsewhere, rather than something that they are shaping and actively participating in.

Even though large organizations are more likely to have a public facing strategy, it seems they're not willing to involve their employees in shaping this, which could spell disaster for motivating and retaining staff, as well as attracting new talent to the organization.

This could be especially detrimental when it comes to attracting younger employees with sought-after digital mindsets and the skills needed to shape the future direction of the company. These digital natives are the ones most overlooked when it comes to shaping an organization's digital strategy, with half of the millennials we surveyed saying that they're not actively involved in their organization's digital transformation strategy, despite saying that it impacts their job.

To ensure that digital transformation is successful, organizations need to ensure they're involving employees, encouraging collaboration, and replacing hierarchy with cross-functional teams. For large organizations, this is especially important to prevent younger employees from jumping ship to join start-ups where they'll be given more involvement in decisions that impact their careers.

“ The industry needs to realize that we are in competition for talent with other industries when it comes to digitalization. There are numerous technology businesses competing for talented staff. There's a very strong employment market for talented individuals, in both financial technology and other types of technology, at big players, such as Facebook, Google, Amazon or at the start-ups. As an industry, we need to position ourselves to attract the best talent and not take for granted the fact that there aren't other industries out there that people are excited about.

The most talented people that tick all the boxes are always going to be in high demand. These are people with digital, data science and problem-solving skills but also good communicators and collaborators. Those are the skills of 2019, that every company is trying to recruit. ”

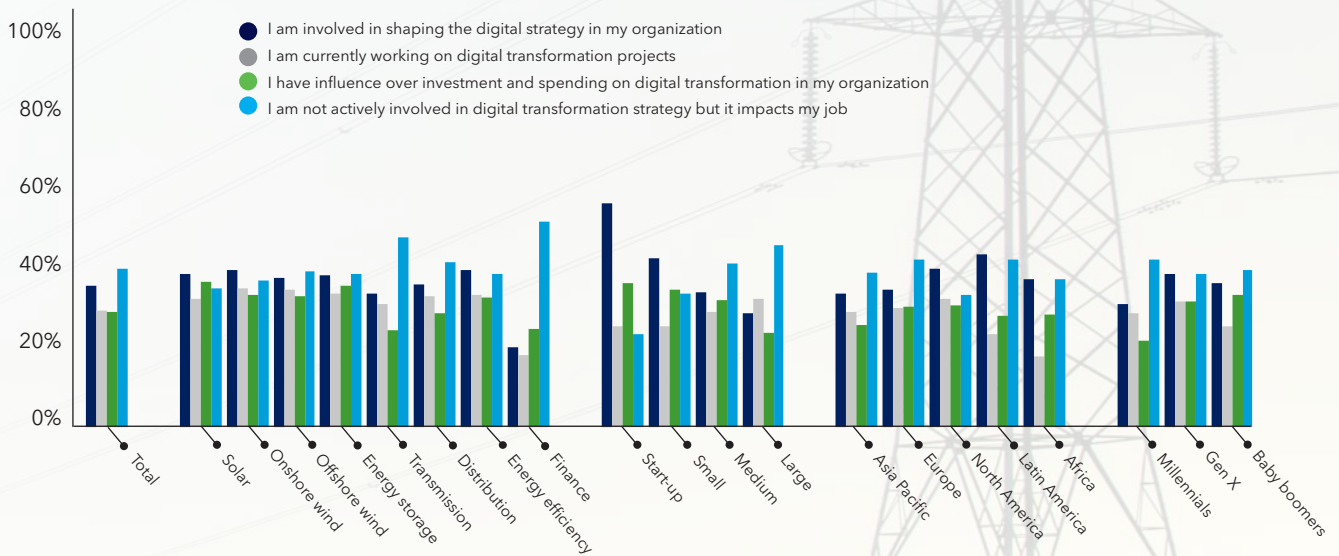
Peter Stuart, RES

“ When it comes to attracting new talent the energy industry needs to get better at selling itself. Employees, especially millennials, want a career that allows them to make a positive impact. When younger employees think of disruptive companies and technologies, energy doesn't really come in to it. It just isn't considered as exciting as the global tech giants, like Google, Facebook or Airbnb. The energy industry needs to communicate the life changing innovations that it is pioneering and demonstrate the huge impact energy developments have on people's lives. ”

Belinda Kinhead, LO3 Energy

Influence of digitalization

Which of the following statements apply to you?



03

THE STRATEGY AND BUSINESS CASE

The technology is in place to enable digital transformation, the data exists and we have the tools we need to extract value from this data. Our research has also explored the barriers to digital transformation and the skills gap that currently obstructs our path. While this is a great starting point, what's often missing is the vital next step in this conversation, the *So what?*

Often it seems our energy is focused on enabling digital transformation without fully appreciating why we should digitalize. Digitalization may be a major strategic goal for two fifths of participants. But, rather than seeing innovation and digitalization as goals and an end, digitalization should simply be the means to an end. On a journey where meeting our long-term business goals is our destination, digitalization is simply one of the modes of transport we use to get there.

Using the insight we have about the technology and business culture we now need to focus on using digitalization to build a strategy focused on making the power systems around the world more:



SPOTLIGHT INTERVIEW



NAME: Peter Stuart

ORGANIZATION: RES (Renewable Energy Systems Ltd)

POSITION: Group Technology Director

ABOUT THE COMPANY

RES is the world's largest independent renewable energy company active in onshore and offshore wind, solar, energy storage and transmission and distribution. At the forefront of the industry for over 35 years, RES has delivered more than 16 GW of renewable energy projects across the globe and supports an operational asset portfolio of 5 GW worldwide for a large client base.

At RES, our vision is a future where everyone has access to zero carbon energy, supplied by renewables. Our view is that this needs to happen quickly. By 2050 the energy supply of the world needs to be provided on a zero-carbon basis. Digitalization can help us achieve this by creating opportunities that drive efficiencies and reduce the cost of energy to the end consumer and by facilitating the integration of renewables into the grid.

If the industry can work hard to adopt digitalization now, at this key moment of transition between subsidized renewables to non-subsidized renewables and use digital in the next phase of growth, it will put renewables a long way ahead of the other energy sources.

Through the adoption of digital technology there's an opportunity to make sure that new power generation plants are designed for renewables from the offset, rather than retrofitting existing plants, which will help put the industry on a good footing to achieve our ambitious growth targets. It's important not to overlook the benefits that digitization could bring to safety too. For example, certain digitization activities may result in the substitution of hazardous operations for safer operations, such as using a drone for tasks that might have previously involved an engineer working at height. This is not only safer, it's usually also cheaper and faster too.

However, there's always some inertia around the status quo. I've never come up against regulatory barriers, but rather the challenge is people getting comfortable with doing things differently and more flexibly.

Making people comfortable will come from proving the value of digitalization by ensuring that any innovations are perceived as beneficial by all the stakeholders in the energy value-chain, especially by investors, who ultimately own and invest in renewable energy assets. Any digital progress needs to de-risk projects rather than being viewed as something new and therefore inherently riskier. The industry also needs to identify pathways for progressive developers, constructors, and operators to adopt digital initiatives without having to prove viability for ten years before digital solutions are considered as bankable relative to established technologies, which are not necessarily any better simply because they've been around longer.

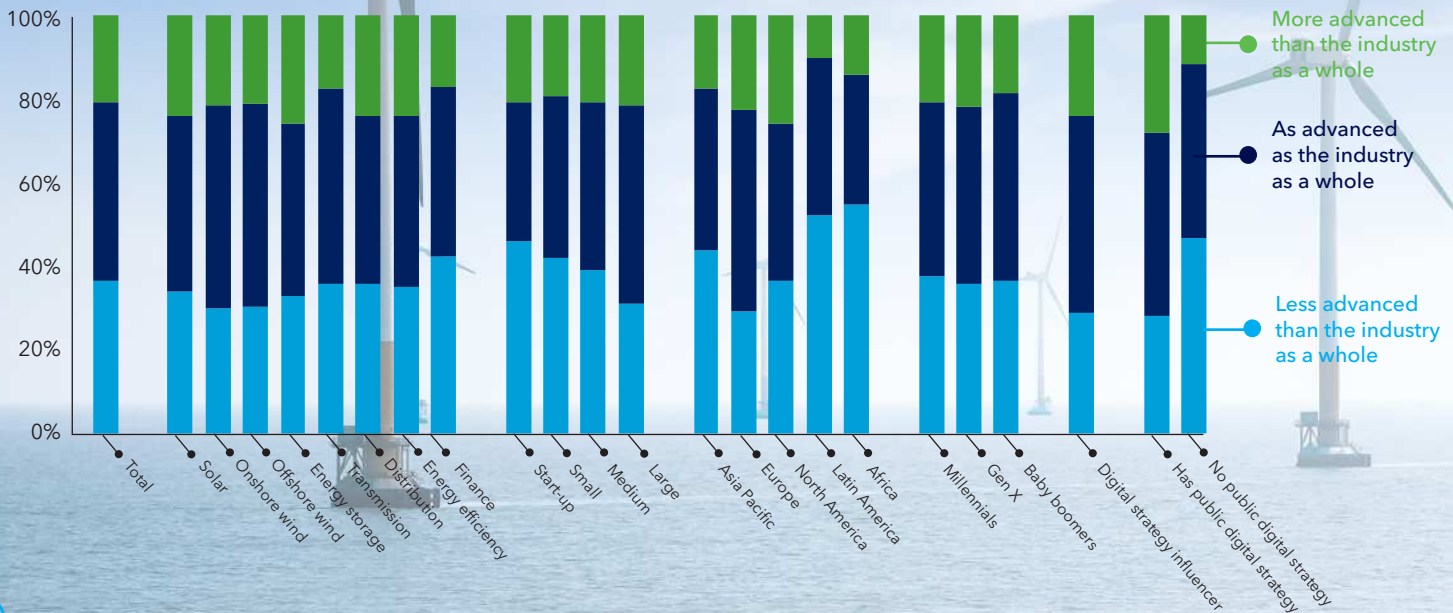
When we talk about technology transformation the most important thing to remember is the human factor. If there's a digital solution to something the industry needs to be aligned that it's the right thing to adopt and work together to change the status quo. This is about being customer focussed, not pushing a product on to a problem but examining the problem and coming forward with a tailored solution.

Our findings show that larger companies are more likely to have a core digitalization strategy. Most respondents with a strategy view their organization as proactive in this digital strategy, with just a fifth of participants seeing their organization as reactive and only responding to immediate needs.

When it comes to reasons for implementing a digital transformation strategy, the organizations with clearly defined goals are already seeing evidence that these goals are being mirrored by the benefits:

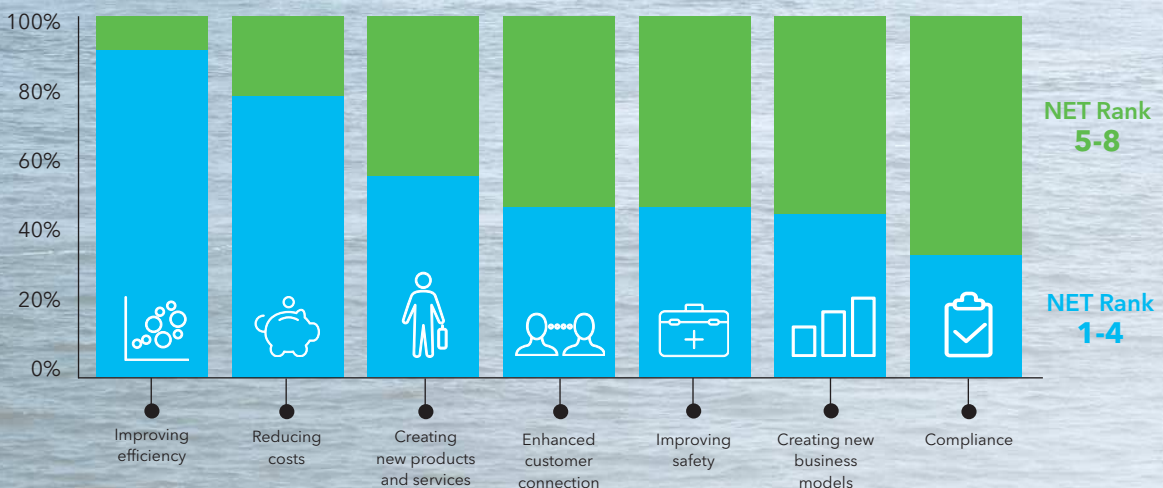
- Improving efficiency is a unanimous goal of digitalization. 88% of participants rank this in the top half of their goals (out of seven), with 49% ranking this as their number one goal. Efficiency was also the most commonly identifiable benefit seen by 55% of participants as a main benefit of digitalization
- Reducing costs is the next most important goal, being identified by 75% of participants, higher than creating new products or services or enhance customer connection.

Compared to your industry as a whole, how advanced do you consider your organization in its current application of digitalization?



Efficiency and cost are main goals of digitalization

What are your organization's main goals regarding their digitalization strategy? Ranked in order of priority



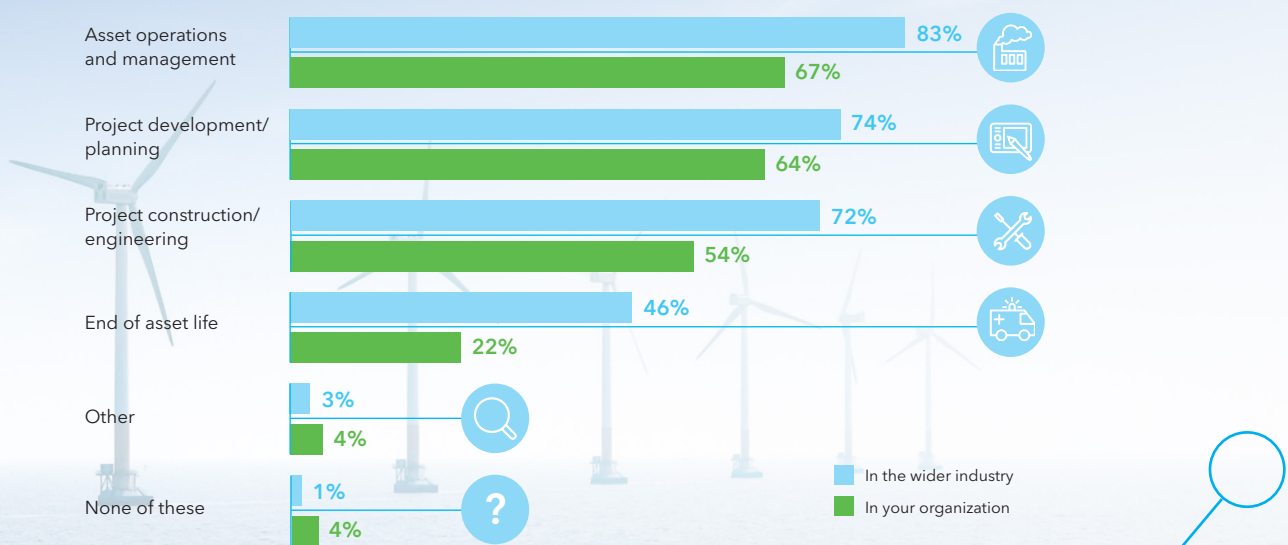
Despite the emphasis on efficiency and cost reduction, several other perceived benefits rank highly for the energy industry, including creating new products, enhancing customer connections and improving safety.

Our research shows that today, digitalization is having the biggest effect on asset operations and management, with larger companies currently seeing a more significant impact.

For many organizations, proving the value of digital transformation will come from real-life use cases that demonstrate digitalization's role as the enabler of decarbonization.

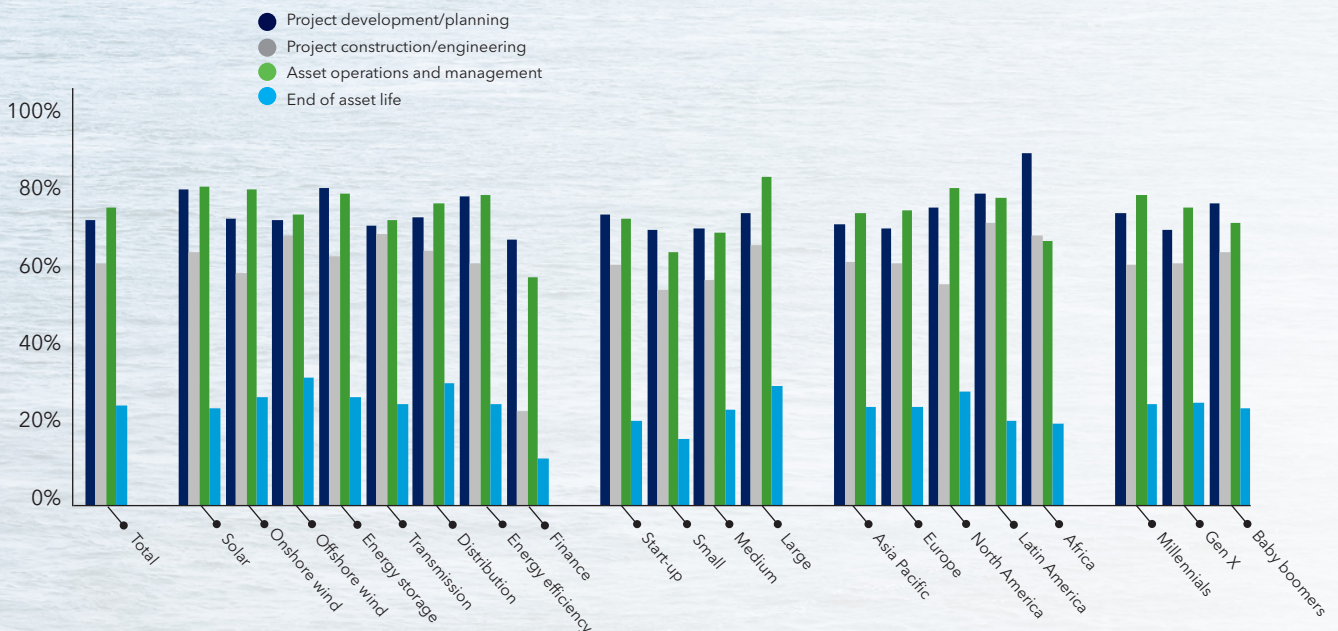
Digitalization has most impact on asset management

In which areas do you see digitalization having a significant impact?



Large companies see more of an impact

In which areas do you see digitalization having a significant impact in your organization?



SPOTLIGHT INTERVIEW



NAME: Adam Nancarrow
ORGANIZATION: Macquarie Group
POSITION: Managing Director

ABOUT THE COMPANY

Macquarie is a diversified financial group providing clients with asset management, banking, advisory and risk and capital solutions across debt, equity and commodities. Macquarie's culture promotes innovation, balanced with robust risk management, to realize opportunity for their clients, community and shareholders.

How is digitalization impacting the opportunities for investing in energy?

It's really surprising that digitalization hasn't yet penetrated centralized infrastructure. While it has been applied broadly to decentralized functions such as hailing a taxi, paying a bill or navigating around a city, it's currently not being used to its full potential in centralized infrastructure. Of course, there are companies within the energy industry that are using digitalization to optimize their assets but there hasn't been a very deep level of penetration yet.

One example is power grids and how digitalization can support energy grid security and the assets that rely on it. This all comes down to data and being able to model how grids can be improved and how projects can be operated. The number of renewable projects is increasing, to a point where the grid will not be able to keep up properly, so the grid needs to be optimized by companies who understand this challenge.

As a business, there's a difference between having digital processes and fundamentally embracing digitalization. Many businesses, especially large ones, may feel advanced when it comes to digitalization but I'm not sure that's necessarily true and some of this is down to regulation.

The financial sector in particular is highly regulated, we need to monitor everything we do on a daily basis. Businesses might record a lot of data about their operations and make changes, but this is company management digitalization, not asset or investment digitalization. For example, a utility might know how much power they're producing and understand the safety statistics but for me that's old-world digitalization, not new-world.

It's understandable that there are barriers standing in the way of adopting 'new-world digitalization'. Before technology is proven, people fear picking winners. Take a non-digital technology, for example solar panels, or floating foundations for offshore wind. At the moment, there are approximately 15 parties around the world that are trying to create foundations for offshore floating wind. People won't invest in that because ultimately there'll be one or two winners. When you translate this to digital technology, there aren't 15 players, there are tens of thousands and picking a winner is extremely challenging and not realistic.

In this instance, you don't need to pick the winner, you just need to find good companies that are doing sensible things in a market that's heading in the right direction. For example, we don't need to pick the new Google of the cyber-security space, we just need to pick someone that is going to have a sustainable business in the future.

In the finance world, of course it all comes down to investments that will give us a return on our capital, it's as simple as that. Although, when it comes to digitalization and new business models the return on economic capital needs to be higher, as opposed to an onshore windfarm, for example, where we just want a relatively small return on economic capital because the risk is lower.

“ Digitalization needs to come from the top down. The CEO and the senior leadership team need to believe in it. They need to accelerate technology-driven innovation and measure success based on this. But most importantly they need to reward the behaviours and mindset that enable digital transformation, making it easy for people that have a desire to leverage technology to rise up through an organization and be promoted based on their track record of improving the business through technology and digital innovation. ”

Joseph Santamaria, PSEG

WHERE DO WE GO FROM HERE?

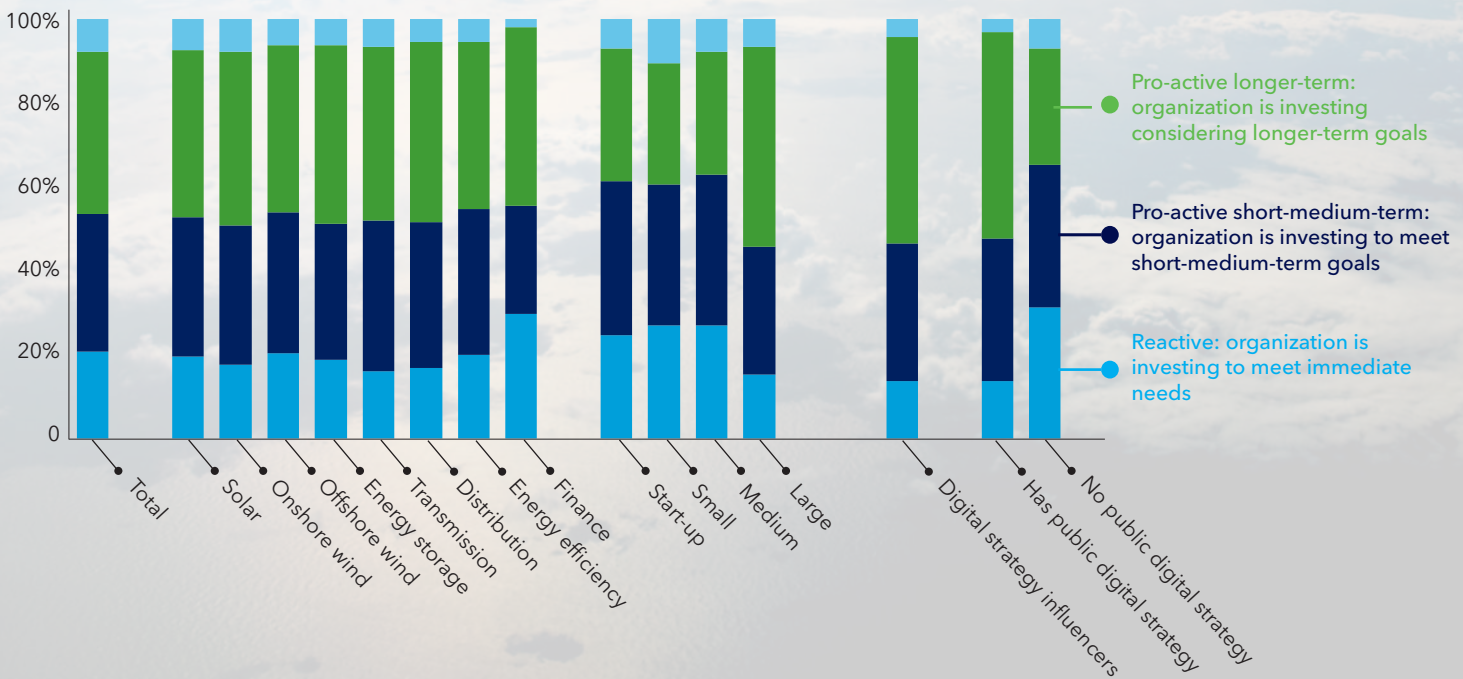
Digitalization is moving beyond the hype, technology is maturing, and the energy industry is getting better at building business cases that drive fundamental change and shake-up traditional ways of working. According to the International Energy Agency, the pace of digitalization in energy is increasing. Investment in digital technologies by energy companies has risen sharply over the last few years, with global investment in digital electricity infrastructure and software growing by 20% annually since 2014. However, the industry is facing internal organizational hurdles that threaten its ability to keep up with the pace of progress. To overcome these challenges and realize the true value of digital transformation, we need employees with the right attitude, skills and mindset.

Having a defined digital transformation strategy, aligned with long-term business goals is vital if we as the energy industry are to succeed with digital transformation. Our research shows that not only are companies with a defined strategy more likely to be proactive in meeting their digitalization goals, but that their own employees will see them as more advanced and in turn be more engaged in the company-wide strategy.

One thing which stands out above all else is that success in the new energy era, won't be about who implements which technology first. Unlike previous revolutions it's not a race determined by size, speed or power. Instead it will be defined by a robust and dynamic strategy and mindset change ready to create value using new and emerging digital systems and processes.

Two fifths of organizations are thinking longer term

How does your organization approach investment in digitalization?





DNV GL - Energy

Utrechtseweg 310-B50
6812 AR Arnhem
The Netherlands
Tel: +31 26 356 9111
Email: contact.energy@dnvgl.com
www.dnvgl.com

DNV GL

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In the power and renewables industry

DNV GL delivers world-renowned testing and advisory services to the energy value chain including renewables and energy efficiency. Our expertise spans onshore and offshore wind power, solar, conventional generation, transmission and distribution, smart grids, and sustainable energy use, as well as energy markets and regulations. Our experts support customers around the globe in delivering a safe, reliable, efficient, and sustainable energy supply.

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