Intelligent Automation in Energy and Utilities

The next digital wave

***Global Automation Research Series:** Energy and Utilities*

Capgemini
RESEARCH INSTITUTE

Introduction

The global energy and utilities sector is undergoing unprecedented change:

- The three "Ds" of decarbonization, deregulation and decentralization are having a significant impact. Currently only 10% of UK's electricity comes from coal-fired generators, and in 2019 the National Grid has logged more than 1,000 hours of coal-free electricity.[1]
- The sector is moving from its conservative, regulated past to a new future where innovation is key. Its consumer base, which used to be largely passive, has now moved to a world of 'prosumers' who expect a sophisticated, service-based industry.
- Digitalization will be critical to capitalizing on these shifts. Technologies, such as automation and artificial intelligence (AI), are playing a pivotal role in managing the balance between demand and supply, boosting efficiencies in all the entirety of the value chain, innovating the customer experience and transforming business models.

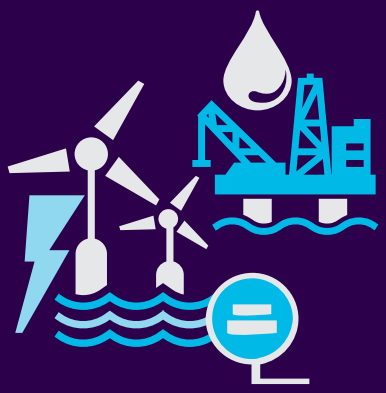
Our October 2018 multi-sector, global research study, *Reshaping the future: Unlocking automation's untapped value*, explored the intelligent automation landscape (by 'intelligent automation', we mean a combination of rule-based technologies such as RPA and added intelligence through advanced analytics and artificial intelligence). Examining specific use cases and the benefits they can deliver, it drew on the views of more than 700 executives involved in implementing intelligent automation solutions. Building on what we learned from that cross-sector program, this latest 2019 research takes a specific look at energy and utilities (oil and gas, electricity utilities, water utilities, energy services and electricity and gas utilities). We surveyed close to 530 business leaders in sector organizations who are experimenting with or implementing intelligent automation solutions. We also analyzed more than 80 use cases, assessing their maturity, complexity, and the benefits on offer.

Our research finds that the sector has underestimated intelligent automation's true potential. Though there has been progress in AI-driven transformation in core technical operations since 2017, many organizations have yet to scale-up their initiatives. We did, however, find an elite group of companies that are making significant progress in driving use cases at scale. The characteristics and approaches of this high-performing group offer an insight into best practices for scaling-up intelligent automation.

This report focuses on four key areas:

- We begin by probing what value intelligent automation offers the industry, including whether organizations have under-estimated the value on offer and where the upside is
- We assess the progress organizations have made and the challenges that are preventing many from reaching scale
- We profile the use cases that offer the maximum potential, and which should provide the focus for investments
- Finally, drawing on the best practices of a high-performing, elite leader group, we outline key recommendations for driving intelligent automation at scale.

Only 15% of energy and utilities organizations have been able to deploy multiple use cases at scale.



Executive summary – key takeaways

The sector has under-estimated intelligent automation's true potential

- Nearly half of the respondents have under-estimated the benefits they derived from their intelligent automation initiatives.
- We estimate that the sector can save between $237 billion to $813 billion from intelligent automation at scale.

Scaling-up initiatives is still a critical issue, though significant progress has been made in the AI solutions

- Like their peers from other sectors, the energy and utilities industry is facing considerable headwinds when trying to scale their automation initiatives. Currently only 15% have been able to deploy multiple use cases at scale.
- The sector has made considerable headway in adopting AI solutions. In 2017, only 28% had a few or multiple AI use cases, but today this number stands at 52%. These use cases are primarily aimed at the core competencies.

Organizations are missing out on critical use cases that can deliver outsized benefits

- In core functions, only 18% of organizations are deploying quick-win use cases (by which we mean they are low on delivery complexity but high in terms of benefits achieved). Use cases such as forecasting, energy trading, yield optimization, grid behavior interfaces and complaints management fall under quick wins.
- Support functions tend to utilize more robotic process automation (RPA) use cases, with quick wins emerging in order management, contract management, employee data management, and defect detection etc. Only 11% of the organizations are focusing on the quick wins in support functions.

The road to scaling intelligent automation

Learning from the best practices followed by high-performing 'Automation Frontrunners', we have developed five recommendations for scaling intelligent automation:

- **Take a pragmatic approach when evaluating and choosing use cases:** Finding and developing viable intelligent automation use cases gives energy and utilities leadership a clear understanding of how they fit in with business strategy, competencies and capabilities.
- **Optimize the right processes before trying for scale:** It is essential that organizations have a strong grasp of the process re-engineering and workforce impact before proceeding to try and scale. Force-fitting solutions to existing structures will lead to undesirable consequences and/or suboptimal gains.
- **Put emphasis on breakthrough technology and ensure sufficient resources in place:** By focusing on technologies such as advanced analytics and deep learning in core functions, you can deliver outsized benefits.
- **Centralize execution, governance and leadership:** Using a dedicated team, along with staff rotated from application areas, can allow you to create and sustain *"lighthouse projects"*.
- **Upskill the existing workforce ensuring change management:** A comprehensive upskilling program will not only give you the viable talent pool you need for execution, it will also help with one of the most challenging areas for any digital transformation – culture. The change management practices will help individuals, teams and overall organizations to scale up and benefit from the intelligent automation.

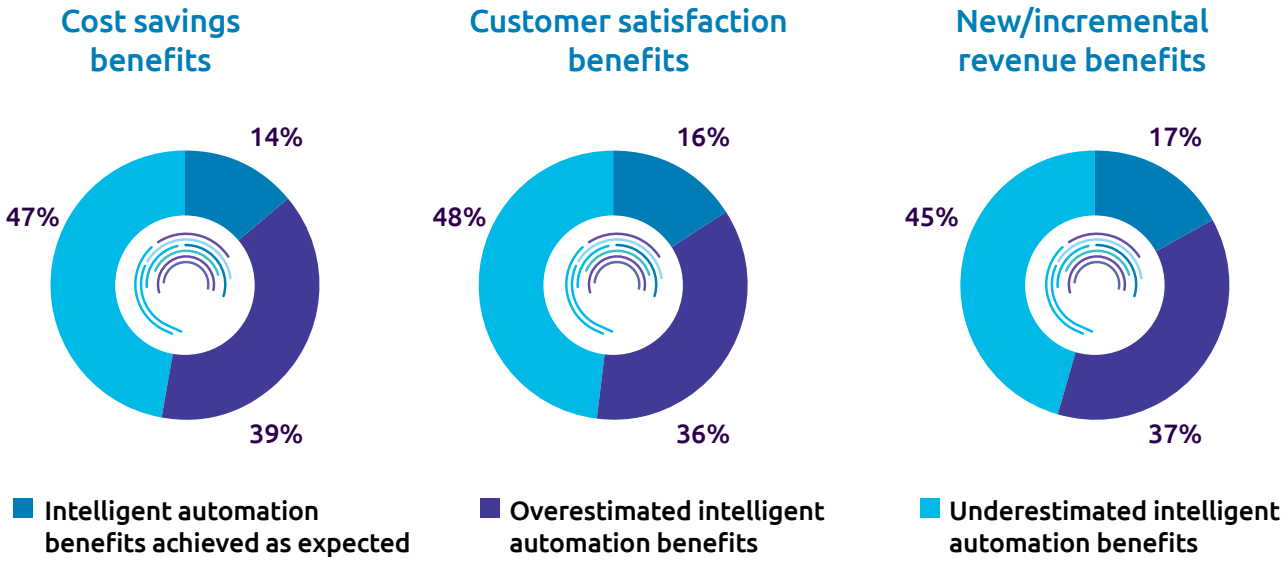
Intelligent automation offers significant value to the sector, and its worth has actually been under-estimated by executives

As a number of organizations are demonstrating, intelligent automation offers significant potential:

- US-based electric and gas utility, Xcel Energy, uses data from sensors on wind turbines to develop high-resolution wind forecasts through predictive analytics and artificial intelligence. As a result, the company has been able to reduce costs to end customers by $60 million by increasing efficiency of generation.[2]
- Gazprom, the Russian gas giant, used robotic process automation (RPA) to automate verification of meter readings. In the first two weeks after the automation went live, an employee was able to validate about 130 invalid meter reads, saving 10 hours of work per employee.[3]
- United Utilities, the UK's largest listed water utility, recently tested an AI platform to analyze large data sets on factors such as weather, demand for water, pump performance and electricity prices. The information is used to make decisions on the most cost-effective and efficient way to run pumps, detect burst pipes and minimize the risk of discolored water. During the trial, the utility saw energy savings of 22%.[4]
- Offset Solar, a US-based solar company, generated $1.2 million revenue within six months using a simple homepage messenger chatbot.[5]

In fact, when companies implement these technologies, they often find they deliver greater benefits than were expected. This confirms a tendency highlighted by Roy Amara, co-founder of Palo Alto's Institute for the Future, who says, "We tend to overestimate the effect of a technology in the short run and under-estimate the effect in the long run."[6] Nearly half of our respondents say that they have under-estimated the true potential of intelligent automation. As Figure 1 shows, 47% say that the cost savings were under-estimated, and many said the same of customer satisfaction (48%) and revenue gains (45%).

Figure 1: **Intelligent automation benefits – expected against actual achieved**

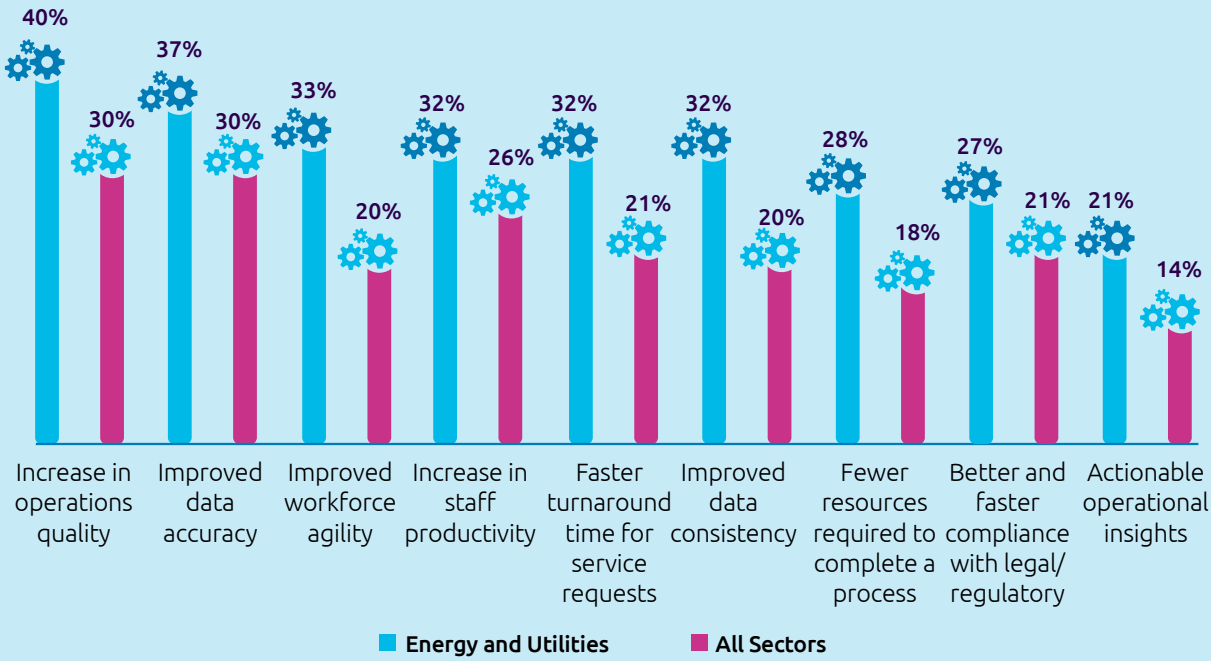


Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.

The sector is driving significant value from intelligent automation compared to other industries

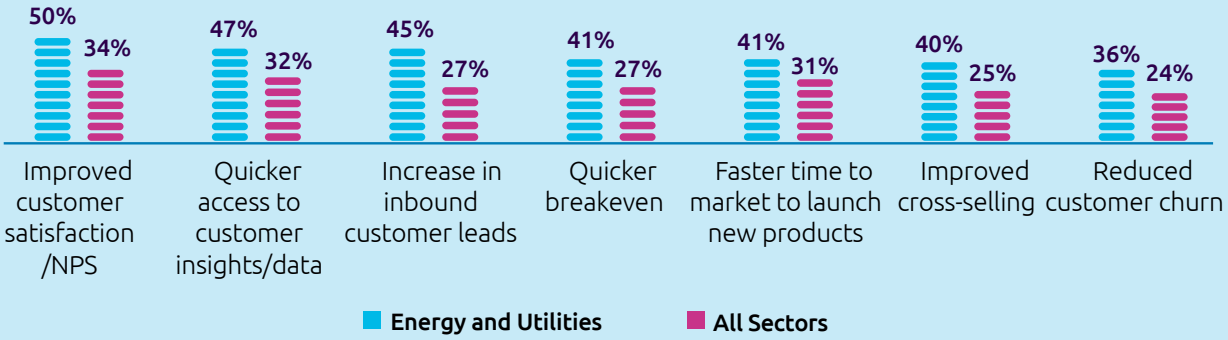
Boosting operations

Figure 2: Percentage of executives saying that they achieved operational benefits from their intelligent automation initiatives (top three benefits ranked)



Topline growth

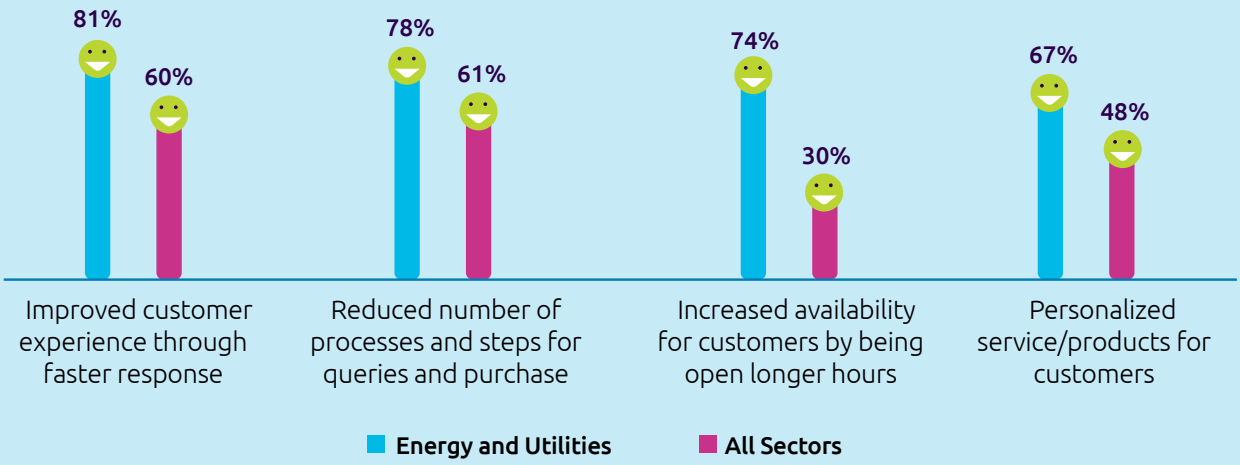
Figure 3: Percentage of executives saying that they achieved revenue growth benefits from their intelligent automation initiatives (top three benefits ranked)



47% executives say that the cost savings of intelligent automation were under-estimated.

Engaging customers

Figure 4: Percentage of executives saying that they achieved customer satisfaction benefits from their intelligent automation initiatives (top three benefits ranked)



Source: Capgemini Research Institute Intelligent Automation Use Case Survey, July 2018, N=705 executives from global organizations that are experimenting with or implementing intelligent automation initiatives; Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.

Intelligent automation can drive significant cost savings across the energy and utilities sector

The energy and utilities sector could realize cost savings from $237 billion to $813 billion if it were to implement intelligent automation in its target processes at scale. To demonstrate the cost efficiencies that intelligent automation can deliver in the sector, we built a model using industry benchmarks and our survey data. (see Figure 5).

Figure 5: Cost savings that could be realized across energy and utilities by implementing intelligent automation

	A. Projected market size (in $ billion)*	B. Operating expenses as a % of revenue** (in %)	C. Projected operating expenses for the sector (in $ billion) (A*B)
Oil and gas	11,564.2	54%	6,243.5
Electricity utilities	2,840.4	53%	1,493.9
Water networks	181.9	60%	108.6
Electricity and gas utilities	1,471.1	55%	815.5
Energy services	705.2	54%	379.5

Conservative benefits estimate			
	D1. Target processes to be automated (in %)***	E1. Average cost savings from intelligent automation (in %)***	F1. Potential cost savings from intelligent automation (in $ billion) (C*D1*E1)
Oil and gas	16%	15%	149.8
Electricity utilities	14%	20%	41.8
Water networks	15%	20%	3.3
Electricity and gas utilities	14%	30%	34.3
Energy services	14%	15%	8.0
G1. Total projected cost savings from intelligent automation (in $ billion)			237.2

Optimistic benefits estimate			
	D2. Target processes to be automated (in %)***	B. Operating expenses as a % of revenue** (in %)	E2. Average cost savings from intelligent automation (in %)***
Oil and gas	22%	42%	576.9
Electricity utilities	20%	43%	128.5
Water networks	21%	48%	10.9
Electricity and gas utilities	19%	44%	68.2
Energy services	20%	38%	28.8
G2. Total projected cost savings from intelligent automation (in $ billion)			813.3

Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives; Capgemini Research Institute analysis; Bloomberg; MarketLine.

*Source: Bloomberg and MarketLine analysis.

** Source: Bloomberg analysis. Note: Operating expenses exclude the cost of goods sold; we have assumed a negative correlation between operating expenses and target processes to be automated.

***Source: Survey data.

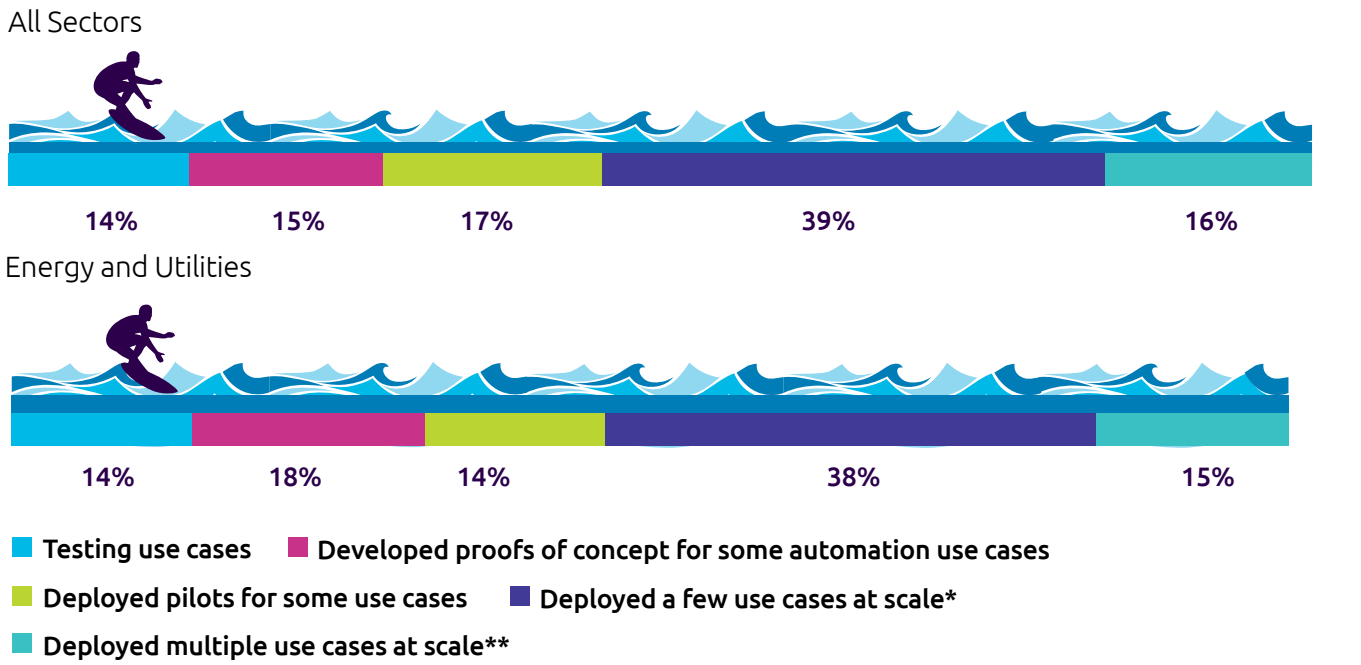
The energy and utilities sector could realize cost savings from $237 billion to $813 billion if it were to implement intelligent automation in its target processes at scale

Artificial intelligence is on the rise, though critical challenges remain in achieving scale

Only a minority are able to scale up their intelligent automation initiatives

We define "scaled adoption" as deployments that go beyond pilot and test projects and are adopted to a significant degree across business units, functions, or geographies. However, scaled adoption in the sector is rare. As Figure 6 shows, this is true at both a global cross-sector level (where in 2018 we found that 16% have reached scale) as well as for energy and utilities specifically (15%).

Figure 6: Current level of intelligent automation deployment among organizations experimenting with or implementing intelligent automation, 2019



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*A few use cases at scale are defined as intelligent automation initiatives deployed at a single/a few geographies or selected business processes.
**Multiple use cases at scale are defined as intelligent automation initiatives deployed across multiple processes and across the breadth of the countries the company operates in.

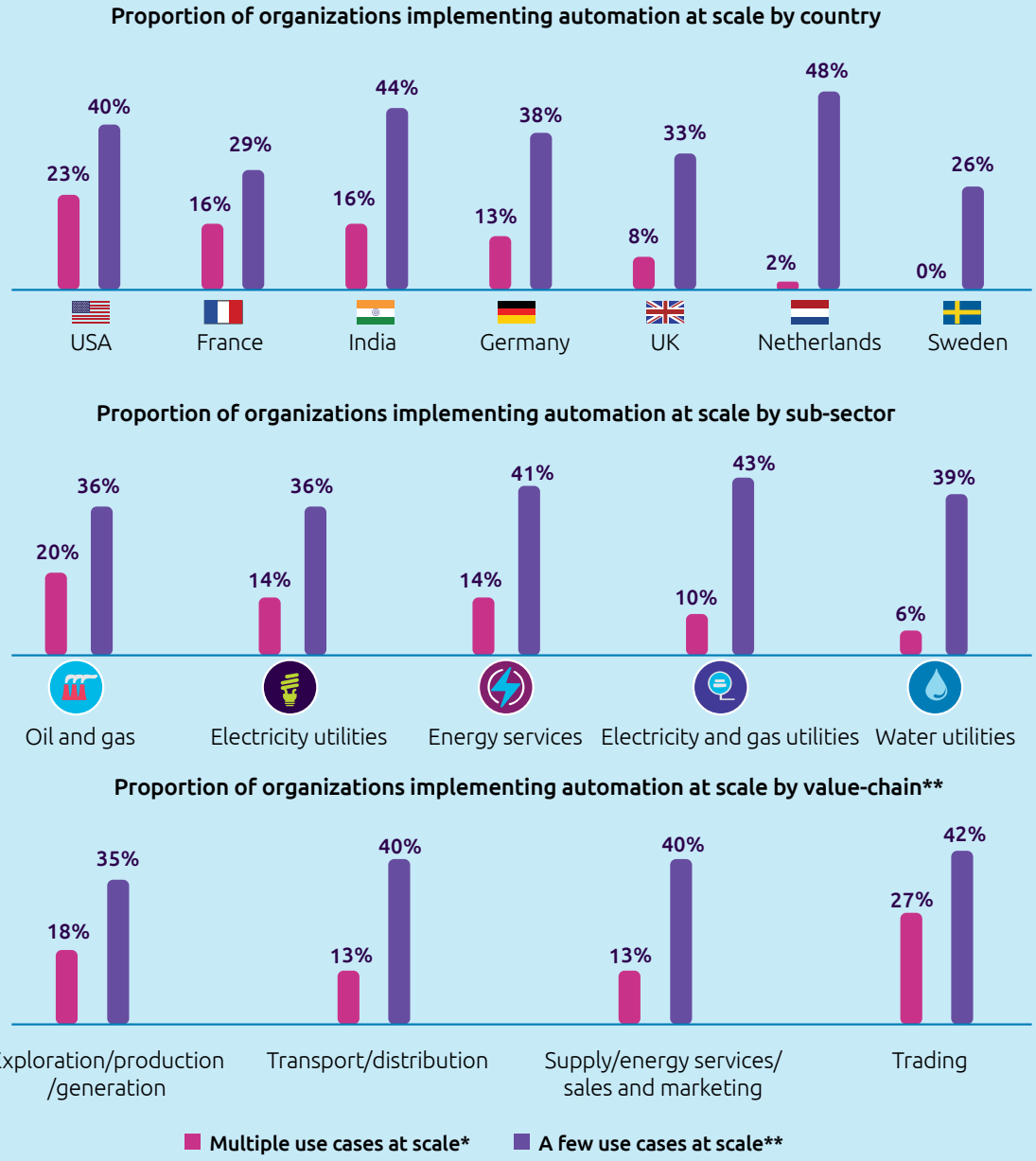
Nikolai Lyngo, senior vice president corporate strategy and innovation at Equinor, believes that moving to greater scaled adoption will require a mindset change. "I think one of the challenges that we have as an industry is our ability to reach full-scale implementation," he says. "I think it is partly because this is something new and requires a different kind of thinking as well as execution. We need to have the basics right – the data. I think sometimes we are trying to do too many things at the same time and that is a problem."

Reaching enterprise-wide adoption after a pilot requires foresight, strong governance, long-term strategic planning and a determination to keep the change management angle front and center. While most organizations understand the importance of automation and AI, they are not always clear on the exact role of these technologies and how they fit into the overall organization strategy. Abhijeet Bhandare, chief automation officer, GE Power says, "The first thing is finding the purpose – why automation? People end up doing automation just because it is cool. We need to realize that these are business dollars that are being put at stake."

Intelligent automation maturity in energy and utilities – a national, sub-sector and value-chain perspective

As Figure 7 shows, the oil and gas segment leads in the deployment of scaled intelligent automation initiatives. The sector has faced significant challenges: the need to cut costs to maintain margins, ensuring safety and reliability in its processes, fluctuating commodity prices, changing regulatory policies and changing demand. These factors have been a catalyst for deploying automation and enhancing efficiency across supply chain processes. Water utilities, on the other hand, lag behind in scaled adoption. However, within that segment, processes such as water purification have considerable automation deployments.

Figure 7: Energy and utilities organizations implementing intelligent automation at scale (as a percentage of organizations experimenting with or implementing intelligent automation)



Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.
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**A few use cases at scale are defined as intelligent automation initiatives deployed at a single/a few geographies or selected business processes.
***Primary revenue value-chain function considered for this analysis; N=361 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.

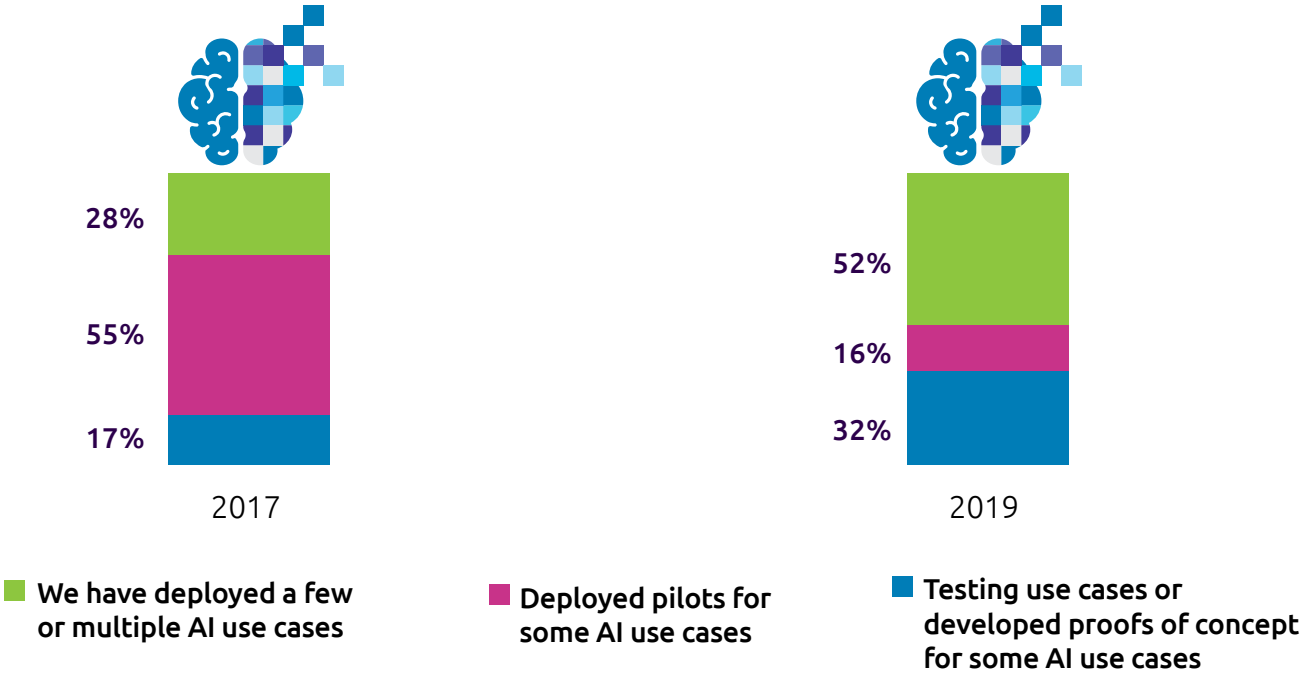
AI has matured since 2017, with use cases emerging in core functions

Energy transition trends – such as generation decentralization, auto consumption, local load-demand balance with energy management systems, and smart devices creating significant volumes of structured and unstructured data – support a variety of transformative AI use cases. AI is helping the sector in a variety of ways, from boosting efficiencies to contributing to the fight against climate change. The rise of renewable power mix is also enabling AI-based use cases, such as forecasting, demand and supply management and energy trading.

In 2017, we surveyed more than 120 senior executives from energy and utilities organizations that are already implementing AI. Today, we have made a like-to-like comparison with our current research, involving the 373 executives that are experimenting with or implementing AI. As Figure 8 shows, we found significant progress:

- Two years ago, the majority – 55% – were just deploying pilots
- Today, the majority – 52% – have actually deployed a number of use cases.

Figure 8: Maturity of artificial intelligence among energy and utilities organizations experimenting with or implementing artificial intelligence, 2017 vs. 2019

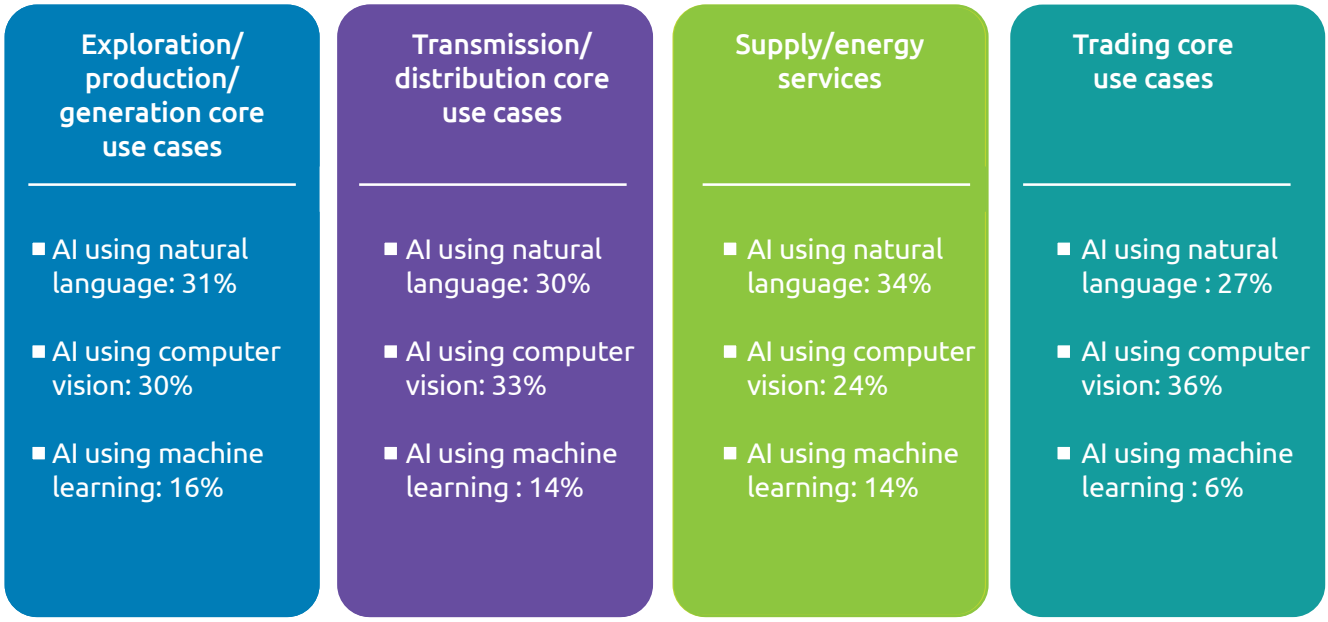


Source: Capgemini Research Institute State of AI survey, June 2017, N=121 executives from energy and utilities companies that are implementing AI; Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=373 executives from energy and utilities organizations that are experimenting with or implementing AI initiatives.

In 2019, 52% of energy and utilities organizations have deployed a few or multiple AI use cases

The sector has made significant strides in deploying AI technologies in core technical operations across the value chain, from generation to trading. We analyzed more than 20 use cases in the core value-chain functions and found that AI technologies dominate (see Figure 9).

Figure 9: Artificial intelligence technology in core functions technical use-cases



Source: Capgemini Research Institute Intelligent Automatio in Energy and Utilities Survey, February 2019, N=361 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.

Exploration/production/generation:

- NextEra Energy, a US-based Fortune 200 energy company, is applying machine learning to optimize operating parameters for its wind turbine fleet. The aim is to maximize output and perform predictive maintenance. "We operate at $3 to $4 [per MWh] better, including availability and operating costs, on the wind side than anyone else in the country," says Jim Robo, CEO, NextEra Energy.[7]
- French Oil and gas major, Total, has signed an agreement with Google Cloud to jointly develop AI solutions that will be applied to subsurface data analysis for oil and gas exploration and production.[8]

Transmission/distribution:

- US-based startup AppOrchid is deploying deep learning and natural language processing to understand grid behavior under variable wind conditions.[9]
- Canadian multi-utility provider, Utilities Kingston, is piloting AI and geospatial analytics to optimize its leak detection activities. The solution is expected to reduce the time and cost of detecting leaks by more than 60%.[10]
- Pacific Gas & Electric has employed machine learning to increase the accuracy of load reduction forecasts for demand response.[11]

Supply/energy services/retail:

- The UK's EDF Energy, serving approximately five million business and residential consumers with electricity or gas, uses Amazon's Alexa as a service channel, helping consumers in areas such as account balance inquiries, learning next payment dates and submitting meter readings.[12]
- Aidan O'Sullivan, head of University College London's energy and AI research says, "The proliferation of virtual assistants in homes, combined with data, could fundamentally disrupt the way we buy and use electricity. The integration of energy data with products like Alexa and Google Home may lead to AI home energy management systems where, for example, rather than turn on your washing machine yourself, you schedule it to run when the electricity price is going to be lower."[13] The use of AI and predictive machine-learning algorithms is enabling the consumer to have foresight over their energy profile.

Trading:

- UK-based start-up, Open Utility, has spearheaded peer-to-peer activity using its algorithm-based platform, Piclo Flex. This is the UK's first online marketplace for renewables. Working in partnership with licensed suppliers, Open Utility provides commercial energy users and generators with a simple, intuitive, and transparent way to buy and sell power.[14]

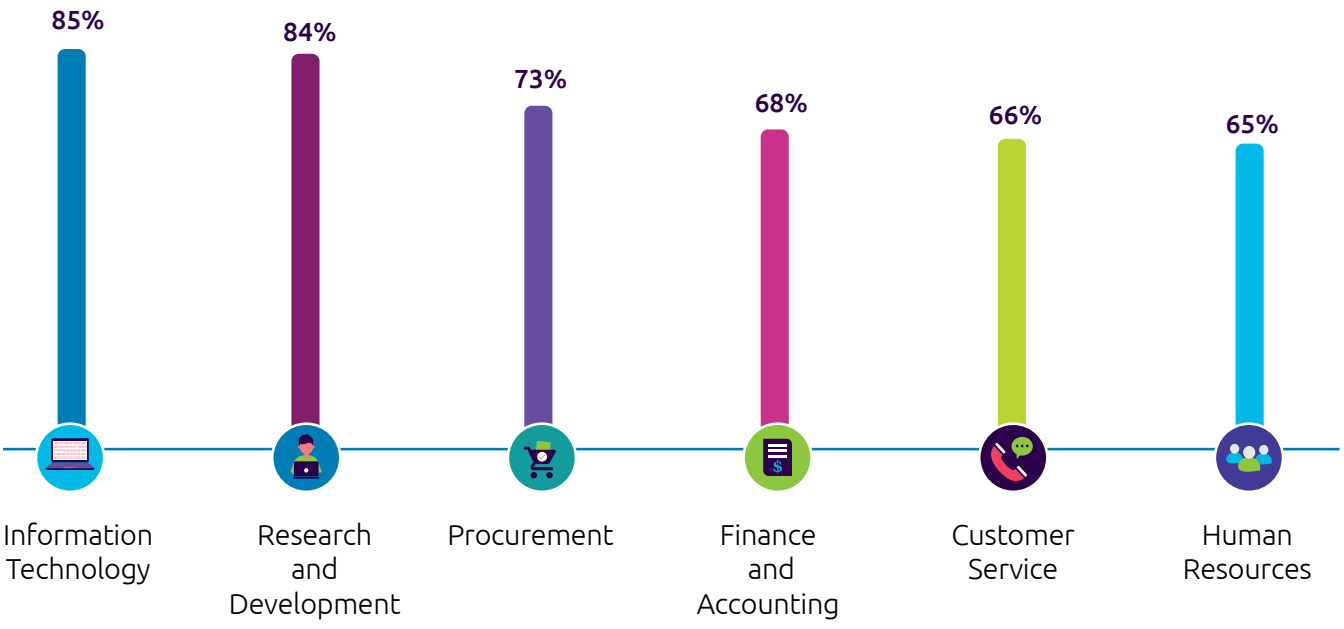
Rule-based technologies dominate in support functions

In line with global averages, rule-based technologies – IT process automation and robotic process automation (ITPA/RPA) – are also prominent in the energy and utilities sector. Three out of every four organizations are adopting ITPA/RPA technologies, with most implementations in support functions rather than core technical operations (see Figure 10).

UK-based United Utilities has been a pioneer in using RPA in its back-office processes. Since 2017, the utility has automated more than 20 processes, with another 12 in development. "The benefits are not just time savings, but making the process robust," says Genevieve Wallace Dean, the company's head of robots about the importance of RPA. "We know the robots aren't going to go on holiday or be off sick."[15]

Even though rule-based automation is most prominent, scaled adoption is still rare. Of those organizations that have deployed rule-based technologies (397 organizations of the 529 we surveyed), only 17% have deployed them at scale. Organizations should ensure that they stabilize and optimize their processes prior to applying automation.

Figure 10: Rule-based (RPA/ITPA) technologies deployed in support functions*

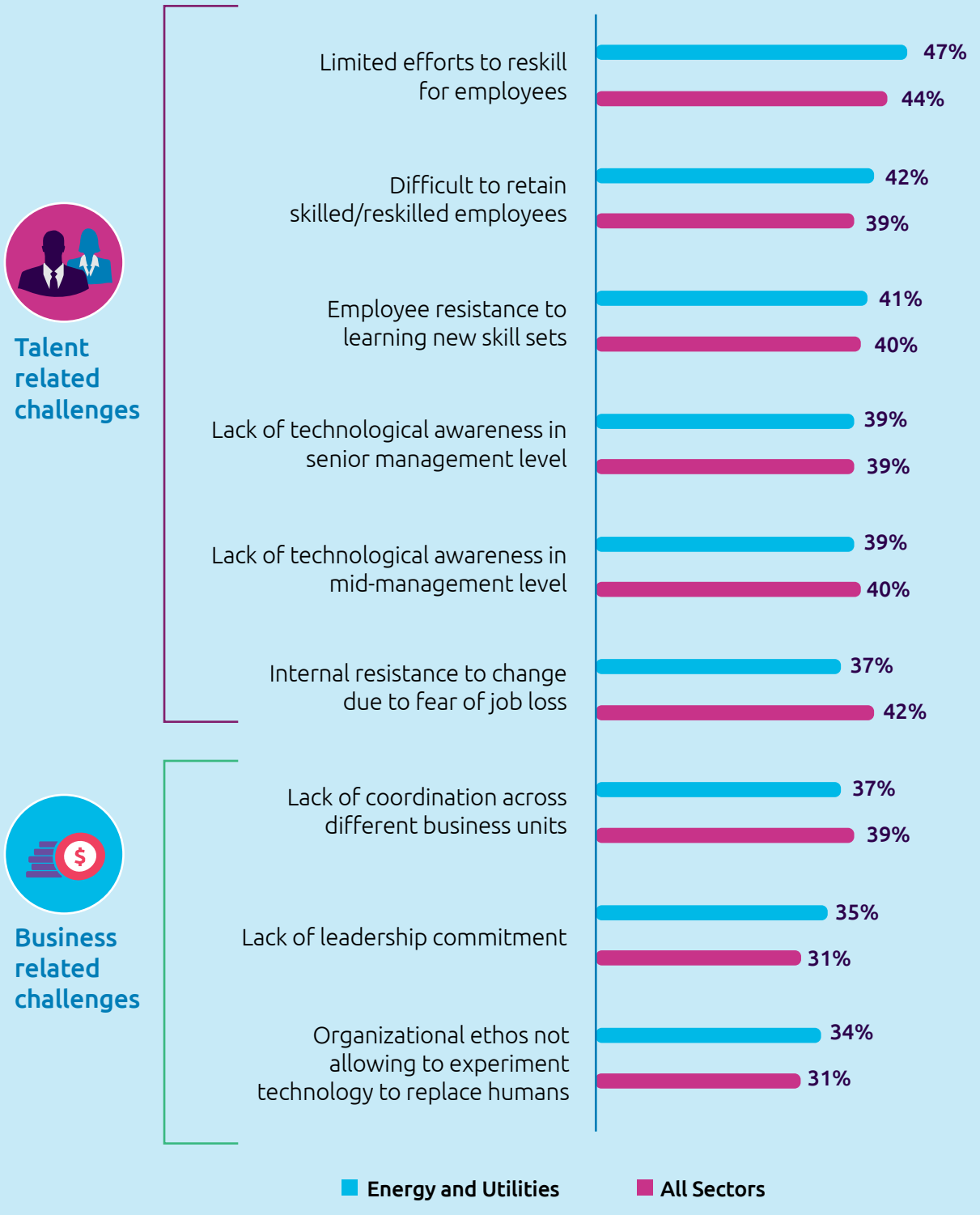


Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives
*As a % of organizations experimenting with or implementing intelligent automation in the respective functions

Of those organizations that have deployed rule-based technologies, only 17% have deployed them at scale.

Critical challenges remain

Figure 11: **Key challenges in implementing intelligent automation among organizations experimenting with or implementing intelligent automation (top three challenges ranked)**



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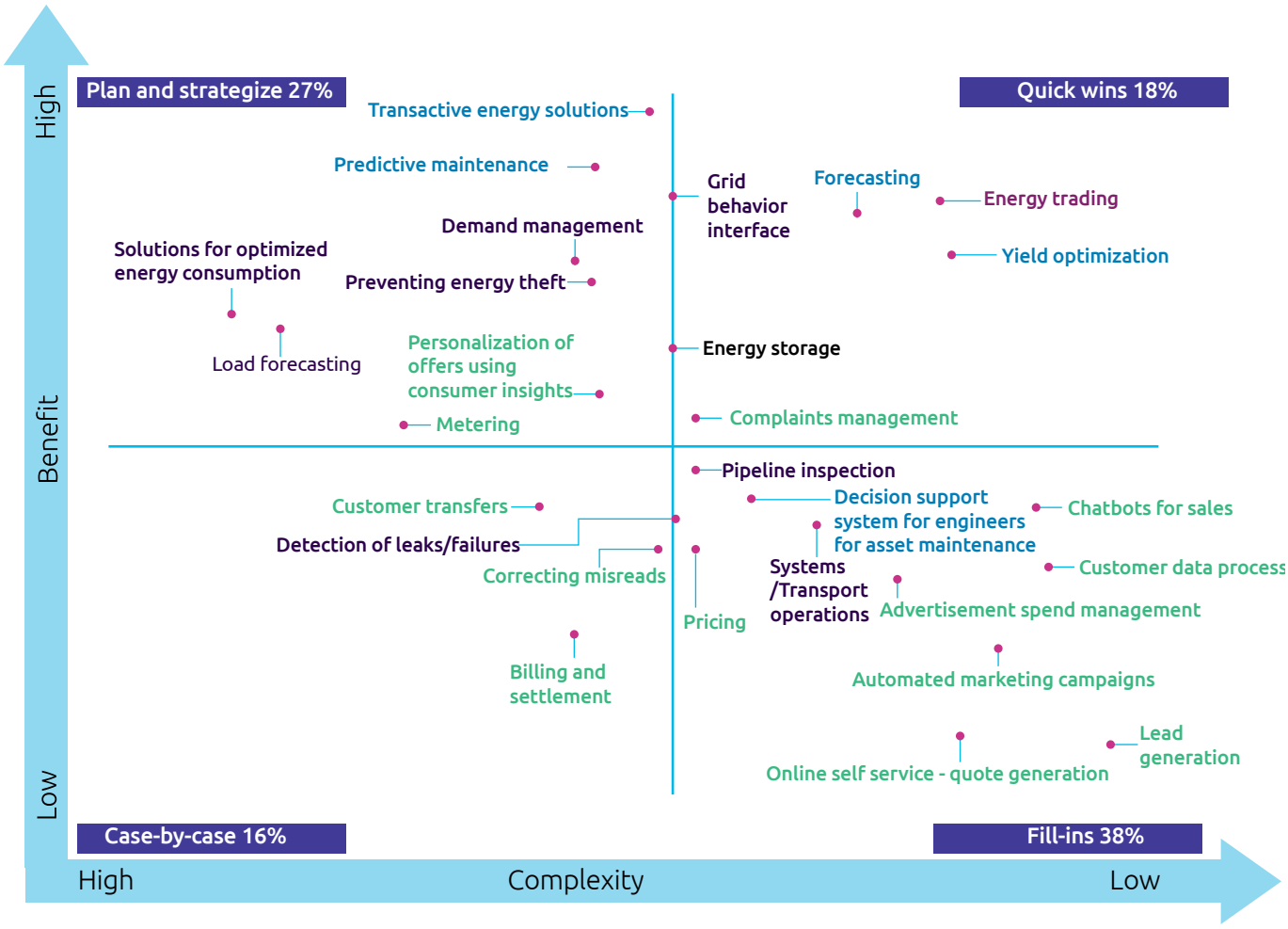
Organizations are missing a big opportunity by ignoring high-impact use cases

Our analysis of more than 80 use cases shows that only a minority are focusing on use cases that are not only easy to implement but have a high-benefit upside (which we call the "quick wins"). Neglecting these automation and AI quick wins – which span core and support functions – is a missed opportunity.

Within core functions, organizations are focusing on low-complexity and low-benefit use cases

Our research shows that over a third of the energy and utilities organizations (38%) are focusing a lot of effort on use cases that are easy to implement but which have a low-benefit upside (see Figure 12). On the contrary, fewer than one in five (18%) are focusing on the quick wins.

Figure 12: Distribution of core-function technical use cases by complexity of implementation and benefit realized (from survey data)



Percentage indicates implementation of use cases by energy and utilities organizations in each quadrant.

Trading **Supply/energy services/sales and marketing**

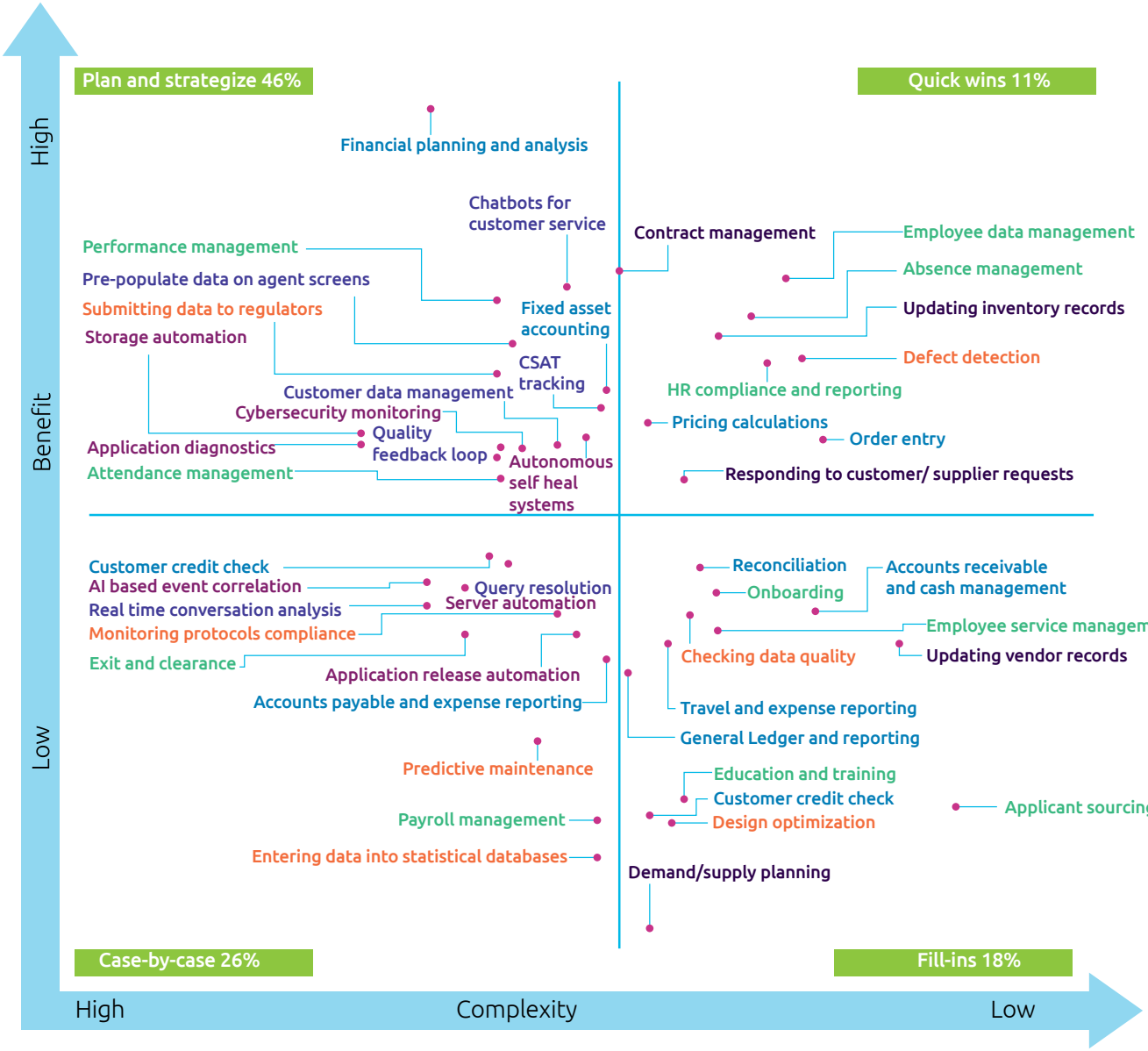
Transmission/distribution **Exploration/production/generation**

Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=361 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.

Organizations are tackling the most complex support function use cases

In support functions as well, only 11% of the organizations are focusing on the quick wins and just over one in four (26%) are focusing on use cases that are not only complex to deliver, but also have a less-compelling upside. Forty-six percent are focusing on high-complexity and high-benefit use cases (see Figure 13).

Figure 13: Distribution of support function use cases by complexity of implementation and benefit realized (from survey data)



Percentage indicates implementation of use cases by energy and utilities organizations in each quadrant.

Human resources | Finance and accounting | Procurement | Information technology | Research and development | Customer service

Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.

Quick wins in core functions

Figure 14: Low-complexity and high-benefit use cases in core functions

Forecasting 	US-based Vermont Electric Power Company (VELCO) uses advanced data science and machine learning techniques to develop a hyperlocal weather forecasting system. Applying the weather model to all the solar and wind farms in Vermont has reduced average energy forecasting errors by 6% for solar and 9% for wind. Kerrick Johnson, VP of strategy and communications at VELCO says, "For every 1% load reduction we can shave off the peak by better orchestrating resources, we save $1m in ratepayer dollars. We know also there are operational gains for us as a transmission utility, for example, in the short-term load forecast."[16]
Yield optimization 	GE Renewable Energy is using machine learning to build virtual windfarms in a cloud-based platform that mimic a real world, physical design. This model runs real wind pattern and calculates electrical output to optimize production on an individual turbine level. It expects to generate 20% boost in energy production resulting in $100 million in savings over the lifetime of a 100MW farm.[17]
Grid behaviour interface 	Alpiq, a leading Swiss energy company, has implemented "Gridsense Technology", which uses algorithms to measure parameters such as grid load, electricity consumption and generation, weather forecasts, and electricity prices. This allows it to better understand consumer behavior. Using this information, GridSense optimizes the utilization of power for consumers and generators and reduces peak loads in the power grid, balances the loads and stabilizes the distribution grid.[18]
Energy storage 	Greensmith Energy, a global energy storage company, uses machine learning to manage energy storage systems and broader energy ecosystems. For example, it provides its software to the Spanish island, Graciosa. The new "Graciosa Hybrid Renewable Power Plant," with its integrated 6 MW/3.2 MWh energy storage management system, can supply 1 MW of solar and 4.5 MW of wind power to the local electricity grid, reducing the island's reliance on imported fossil fuels and significantly cutting down on greenhouse gas emissions.[19]
Energy trading 	British Petroleum is using automation in its trading function. Ayman Assaf, CIO for compliance, regulatory, risk and finance at BP Supply & Trading says, "Automation is allowing us to consolidate data on the trading floor, using robotic process automation to mimic repeated processes. This shifts the role of our analysts, increasingly freeing up their time to focus on higher value tasks. So rather than collecting data sets, they can spend time interpreting and interrogating the meaning of that data."[20]
Complaints management 	US-based electricity and gas utility, Exelon developed a channel-agnostic, AI-powered chatbot to resolve customer complaints on issues such as outages and bills. Exelon was able to reduce customer churn and developed deeper insights into their consumer needs.[21]

Exploration/production / generation

Supply/energy services/sales and marketing

Transmission/distribution

Trading services

Quick wins in support functions

Figure 15: Low-complexity and high-benefit use cases by support function

Finance and accounting	Pricing calculations	**Order entry** EDF Energy, the UK-based utility, is using RPA to automate manual journal entries that previously took 70 man-hours a month to complete. Automating eight processes delivered six times return on investment.[22]
	Order entry	
Procurement	Updating inventory records	**Contract management** Exxon Mobil uses a contract planning bot that provides regular notifications about contracts due for renewal. This means procurement teams have plenty of time to look for alternative suppliers, or to renegotiate existing contracts. It also means that contracts cannot expire without anyone noticing.[23]
	Responding to customer/ supplier requests	
	Contract management	
Human resources	Employee data management	**HR shared services** Synergy, Western Australia's leading energy generator and retailer, has recently expanded its RPA capabilities to HR shared services.[24]
	Absence management	
	HR compliance and reporting	
Research and development	Defect detection	**Defect detection** UK-based water company, Severn Trent, created an advanced detection model that uses data from its network to help identify, locate and manage leaks. The time it takes to find leaks has been reduced by over half and it has reduced leaks by over 16% in areas where it has been piloted.[25]

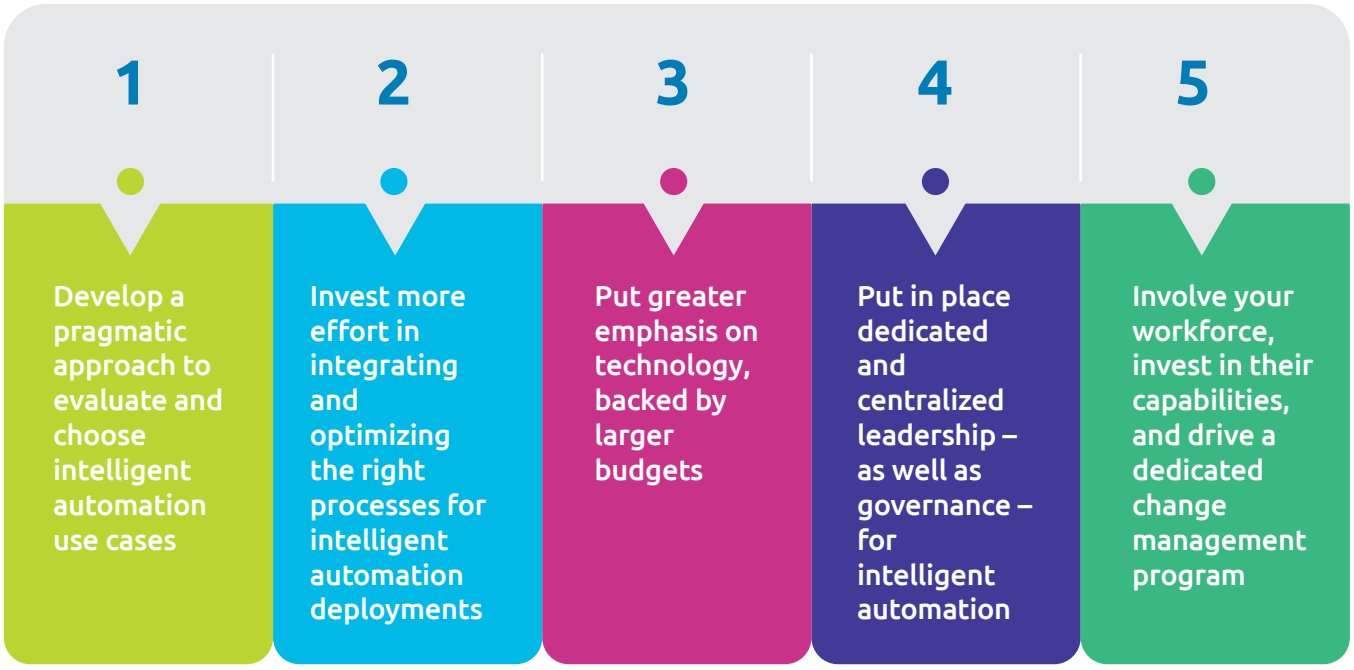
In core functions, fewer than one in five (18%) are focusing on the quick wins.

The road to intelligent automation at scale

The traditional utilities business model is under pressure worldwide, as technology changes and increased competition make their presence felt. However, despite the monumental changes happening, the sector has only just started to advance beyond its existing conservative mindset.

We see this tendency in driving intelligent automation at scale. Our research shows that only a few organizations have been able to break the conservative stranglehold and create truly breakthrough initiatives. We call this group the "Automation Frontrunners" (see Appendix for definition). By studying what these *automation frontrunners* do differently, we have developed five recommendations for companies looking to join their ranks.

Figure 16: Five recommendations to scale intelligent automation initiatives



Source: Capgemini Research Institute analysis.

1-Develop a pragmatic approach to evaluate and choose intelligent automation use cases

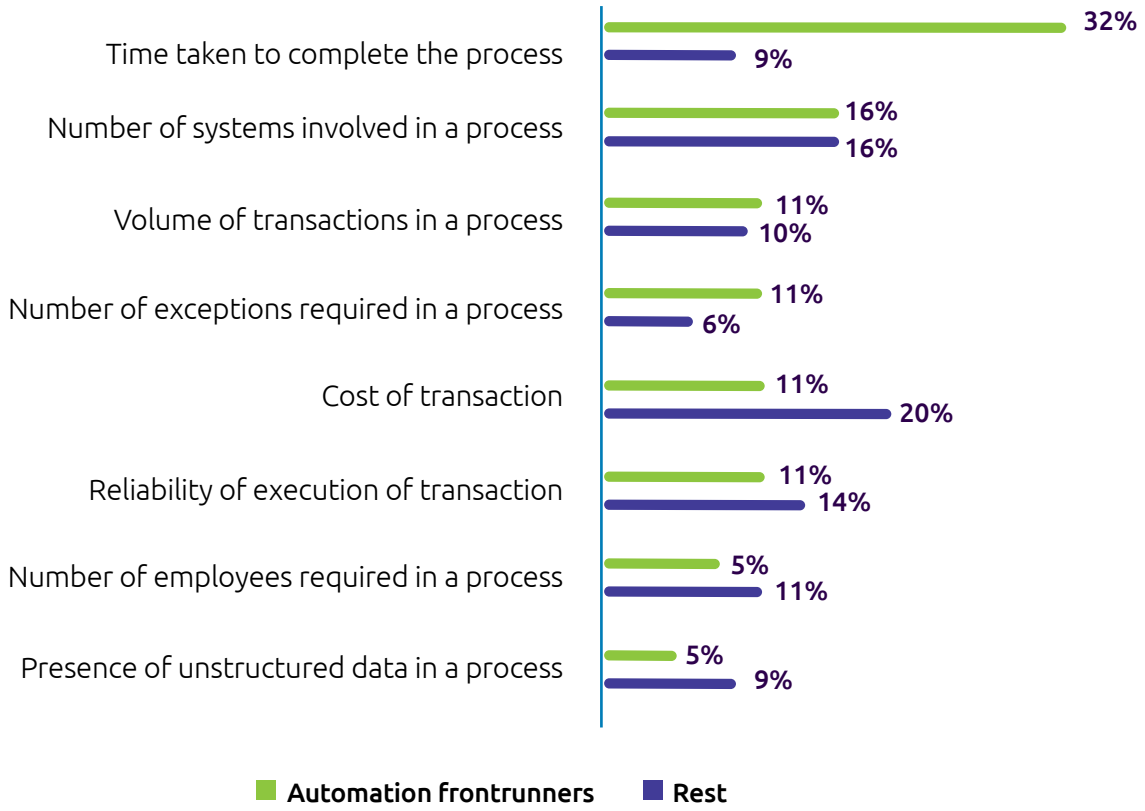
Utilities tend to have a 'conservative' approach in evaluating benefits from automation and AI. As we saw at the beginning of this report, around half of the respondents to our survey said that they undervalued the impact of implementing these technologies, despite the fact that the sector has driven significant benefits compared to other industries. This could reflect the fact that the sector lacks the internal expertise to select appropriate use cases and measure benefits.

Use cases are the foundation of intelligent automation strategy. Finding and developing viable automation and AI use cases gives leaders a clear understanding of how these technologies fit with the organization's business strategy, competencies and current and future technology capabilities.[26] When utilities kick off automation and AI initiatives, they need to consider the following areas:

1. Ensure they have the basic minimum technical talent in place to collaborate with functional teams. Without this expertise, use-case selection and implementation effort will suffer.
2. Cover the underlying fundamentals before proceeding, such as data accessibility, legal and ethical implications, risk assessment, and success criteria/KPIs.
3. The potential scope of impact should also be a key criterion while choosing, initiating, and scaling up use cases.
4. The time and resources invested in AI initiatives require a delicate balancing act. AI applications require time for gestation and optimization. For example, an application may not be fully optimized until it has enough data. Therefore, you need to strike a balance between ensuring AI initiatives have enough incubation time while also ensuring that they do not take up too much of your talent and resources, which will often be thin on the ground.

Abhijeet Bhandare, chief automation officer at GE Power, highlights the importance of developing a strong approach towards use case selection. "We have a very clear filtering criteria defined for automation use cases," he explains. "We have close to 200 automation ideas in pipeline, and on an average about 50% to 60% of them will be rejected. It is important to focus your attention on the remaining 50%, as they will give you the most value. And you must have the right criteria – whether it is value, efficiencies, cost savings or the opportunity cost. Organizations should focus on quality over quantity of use cases."

Figure 17: Top criteria considered while selecting a process for automation – frontrunners vs. all other organizations*



Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives, N=51 executives from energy and utilities automation frontrunners organizations that are experimenting with or implementing intelligent automation initiatives, N=478 executives from the rest energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.
*Top one preference ranked.

32% of automation frontrunners consider time taken to complete the process as the top criteria while selecting a process for automation.

We have a very clear filtering criteria defined for automation use cases. We have close to 200 automation ideas in pipeline, and on an average about 50% to 60% of them will be rejected. It is important to focus your attention on the remaining 50%, as they will give you the most value. And you must have the right criteria – whether it is value, efficiencies, cost savings or the opportunity cost."

says Abhijeet Bhandare, chief automation officer at GE Power.

While automation and AI is a valuable way to transform an existing approach, maximum potential often occurs in new applications. Take, for example, renewable power microgrids. With the advent of battery storage, coupled with predictive analytics, it is possible to build virtual micro grids that can run totally on distributed renewable energy. A high-potential use case like this would not be unearthed and considered if organization only focus on reformulating existing functionalities and processes. "Digital is fundamental to being able to produce the energy, because you want the energy to be increasingly clean and renewable," says BP's chief digital innovation officer Morag Watson. "Digital is fundamental to renewable. You cannot do renewable energy without digital. You can't do it. It's fundamental to solar. It's fundamental to wind. It's fundamental to distributed energy."[27] Using the complexity vs. benefit assessment can help to organize and prioritize intelligent automation use cases to ensure they are aligned with the organization's digital goals.

2-Invest more effort in integrating and optimizing the right processes for intelligent automation deployments

Intelligent automation can remove considerable overhead in both support and core business functions. However, they require considerable integration and re-engineering of process flows. Force-fitting these solutions to existing structures carries risks: financial, safety, or reputational. In our experience, organizations usually over-emphasize the difficulty of technology execution and underestimate the importance of process re-engineering and workforce impact.

Our survey also shows that considerations around security and legacy system integration are still stumbling blocks for the utilities sector. Critical challenges highlighted by our research include:

- Complex IT security requirements
- The significant investment required
- Integrating automation technology with existing systems and tools.

Automation frontrunners are aware of these challenges. We found that over half of them (51%) are planning to set up dedicated teams over the next two to three years to investigate the impact and adoption of automation, compared to just 11% of their peers.

3-Put greater emphasis on technology, backed by larger budgets

Automation frontrunners make greater budget commitments than their peers - they spend 19% of their current IT budget on intelligent automation, compared to 13% in other organizations. Moreover, they intend to increase this by 31% over the next two to three years and aim to automate around 17% of their current business processes. In both these areas, they exceed their peers (see Figure 18).

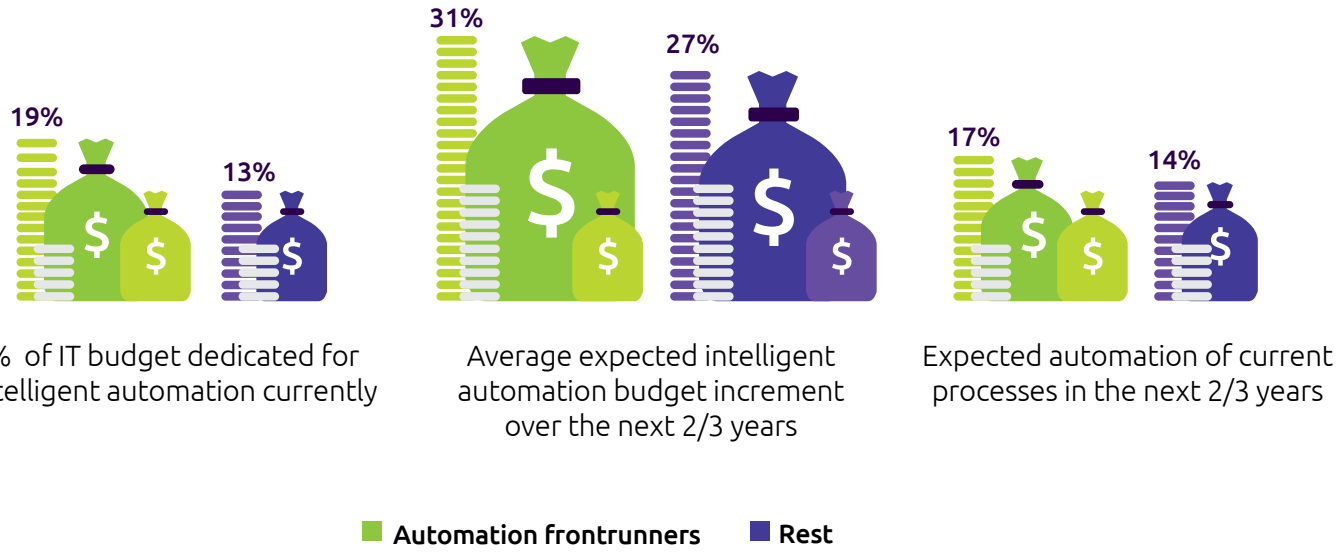
Automation frontrunners are clearly more focused on unlocking untapped potential rather than replacing existing business processes. "I often talk about artificial intelligence as augmented intelligence as opposed to artificial intelligence," adds Morag Watson, chief digital innovation officer in BP. "It really is about bringing something else to the table, such that our experts and people can focus even more on the stuff they were trained to do and on the higher order stuff. Everybody seems to think there's a limited amount of high order stuff to be done, but I don't think we know. I think that there could be a whole new class of jobs, and a whole new range of things to be done in the future, that we didn't know existed."[28]

The increased budget commitment of automation frontrunners reflects their determination to tackle more complex technologies such as machine and deep learning (see Figure 19).

While these technologies are high-cost in terms of talent and resources – and can have a higher risk profile – they tend to deliver greater rewards compared to rules-based automation. As we saw earlier, we also found that most, if not all, high-benefit use cases for core functions are based on AI applications.

The International Energy Agency (IEA) predicts fossil fuel share in global supply will fall to 40% by 2030, with renewables contributing 65% by 2040[29]. On the one hand, this means that utilities will need to adopt highly volatile energy sources such as solar and wind to achieve better economics. At the same time, they need to supply the growing number of high-power applications such as electric vehicles and electric home heating. This could lead to highly volatile demand and supply, potentially overloading or oversupplying a local grid. In this environment, capabilities such as local grid management, weather forecasting, data-driven demand-response strategies, efficient energy storage utilization and dynamic pricing will

Figure 18: Automation frontrunners have placed aggressive goals back by large budget for the initiatives



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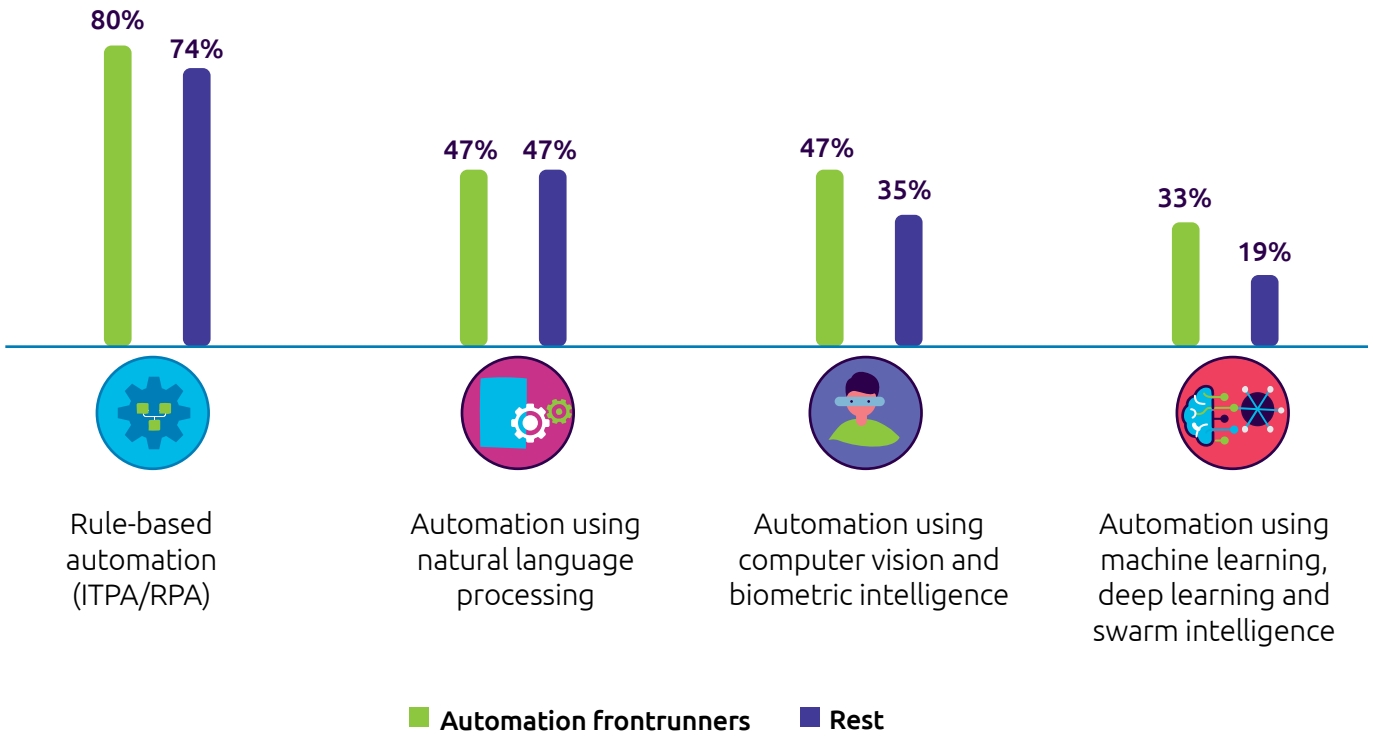
be essential to ensure a reliable operation while ensuring competitiveness. Climate change regulation is also a growing issue. For example, San Diego Gas and Electric prevents wild fires by utilizing sensor data – along with satellite weather monitoring – to ensure distribution assets are maintained.[30] These sorts of sensors and analytics will also play a critical role in ensure the organization can meet California's goal of generating 100% of its electric power by 2045 through clean energy.[31]

Figure 19: Automation frontrunners have aggressive technology adoption



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Automation frontrunners spend 19% of their current IT budget on intelligent automation, compared to 13% in other organizations. Moreover, they intend to increase this by 31% over the next two to three years.

4-Put in place dedicated and centralized leadership – as well as governance – for intelligent automation

With many organizations struggling to find critical digital skills, a centralized and dedicated taskforce can be critical to achieving automation goals. Over time, this centralized approach will also ensure the organization builds the experience and expertise it needs.

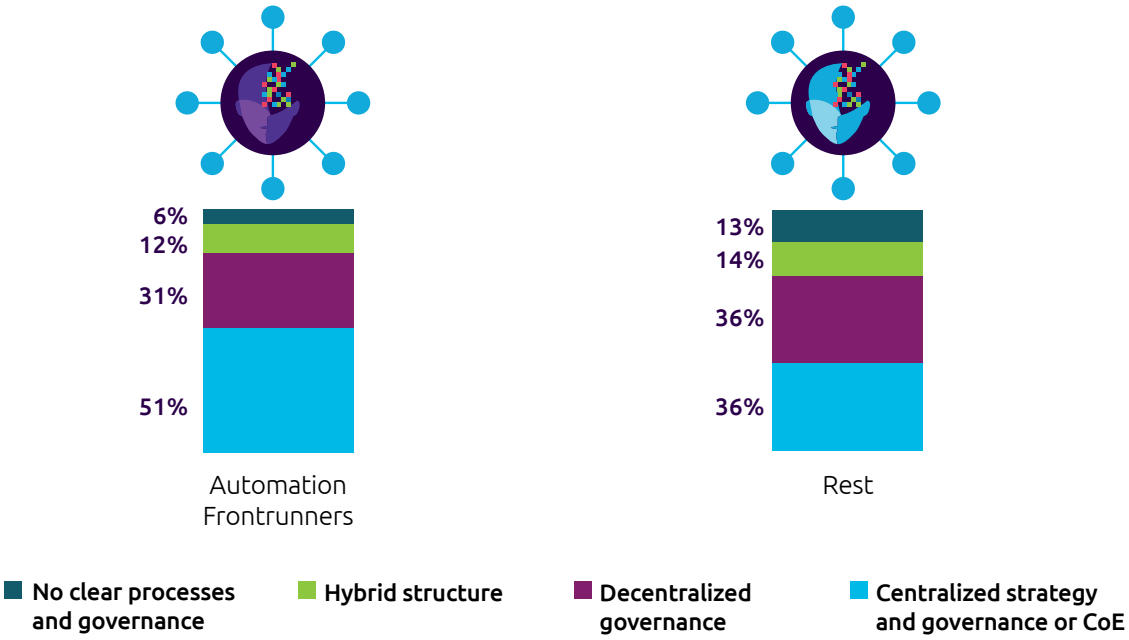
As Figure 20 shows, front-runners are more likely to have a centralized approach than decentralized governance or a hybrid approach – 51% take a centralized approach, but this drops to 36% for the rest of the sample.

In addition:

- Thirty-nine percent have a dedicated leader for automation
- Fifty-five percent have their management board or CEO sponsoring all initiatives.

This top-down approach provides focus and has helped frontrunners deliver multiple projects, at scale, while achieving significant upside.

Figure 20: Automation frontrunners have a more centralized governance



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However, while a centralized approach is key, scaled adoption is not helped by a siloed mentality. It is essential that dedicated automation teams work closely with team-members from the relevant business function, and rotate employees from those functions into the centralized team.

These *'automation ambassadors'* will not only deliver technical insights that the implementation team will need, but also help them address cultural issues and adoption concerns, greatly increasing the likelihood of achieving scale successfully.

5-Involve your workforce, invest in their capabilities, and drive a dedicated change management program

Resistance can be a significant barrier to automation initiatives, but 80% of frontrunners have employees who are open to it. In addition:

- Seventy-eight percent say automation has raised employee satisfaction levels, compared to 65% of the rest of the sample.
- Seventy-six percent say it has created new job profiles, counteracting the fact that 71% also say that it has led to workforce reductions.

The sector's organizations need to design and implement a comprehensive upskilling strategy to realize their goals. It will be critical to achieving scale, encouraging employee adoption, and bridging the talent gap. Hugh Mitchell, chief HR and corporate officer at Royal Dutch Shell, says, "Once we've recruited good people, we ensure they get the training and experience they need to do their challenging jobs effectively and deliver on strategic priorities. We do a careful segmentation of our work force, looking at which types of jobs and skills are likely to give us a competitive edge. That requires an in-depth look at the needs and priorities of the people in these skill pools."[32]

Recent research we conducted on workforce upskilling[33] shows that organizations that are in the midpoint of their upskilling program have:

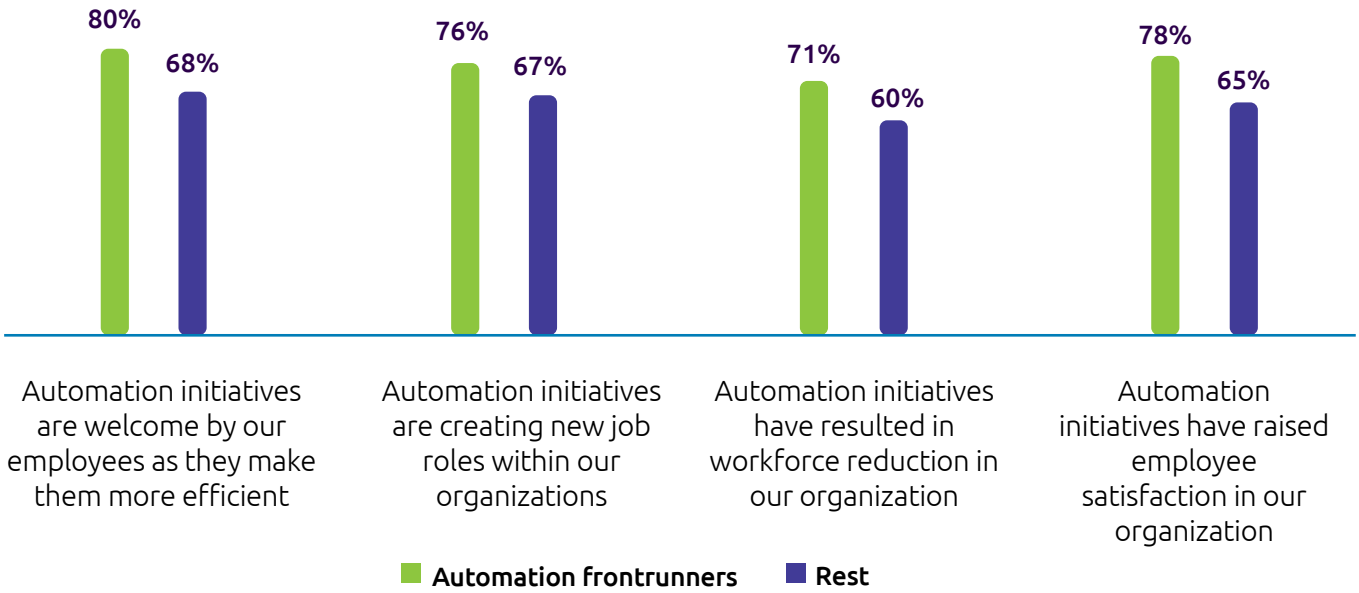
- More successful intelligent automation initiatives
- Higher employee morale
- Support of a significant majority of employees (90%) for automation and AI initiatives.

For energy and utilities, upskilling is a significant issue. As we saw earlier, for example, "lack of talent skilled in automation technologies" was a challenge for 57% of organizations.

To design and implement a successful upskilling program, six factors are critical:

1. Assess your tech investments and to what extent they will impact on the workforce
2. Define the skills you need and when you need them
3. Make the upskilling program a win-win for your people and organization by making them relevant to the needs of the company
4. Align learning with organizational strategy
5. Equip leaders to communicate effectively
6. Ensure you have a change management strategy in place.

Figure 21: Automation frontrunners have on-boarded their employees in their initiatives



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Beyond process automation: How Blockchain can turbo-charge operational transformation and deliver trust and transparency in energy and utilities

Blockchain-based distributed ledgers offer a significant opportunity to re-engineer processes and digitize operations. Supporting capabilities such as smart contracts, distributed ledger technologies (DLT) can facilitate processes involving multiple parties while meeting specific rules and regulatory guidelines. When integrated with existing workflows and back-office operations, DLT provide better visibility into transactions between multiple participants, particularly for inter-organizational processes.

As well as transforming how transactions are managed, Blockchain will play a significant role as the energy and utilities sector makes the shift to decentralized generation, a growing focus on sustainability, the emergence of P2P trading, and flexible load demands. Several examples are emerging of how these technologies can solve broader business challenges:

Electric Vehicles charging: Innogy – a spin-off of German utility RWE – launched a pilot program to develop a distributed, P2P charging marketplace based on Ethereum[34]. Forecasting and time series analysis, using the transparency of blockchain, can dramatically increase the economic viability of power storage and electric vehicles (EV) charging stations, while ensuring reliable demand matching.

Grid optimization: European transmission operator, TenneT, has partnered with battery aggregator Sonnen. Their aim is to use blockchain technology to enable energy storage systems within the network, absorbing transmission grid oversupply from wind generators. Before getting to blockchain though, advanced analytics were essential to forecast when TenneT needed to call on these resources for dispatch.[35]

Transactive energy: On the supply side, renewable energy integration is still a major concern for the industry, with ensuring a reliable and efficient supply a major constraint. Smart contracts, along with AI-based forecasting, offer a viable solution. Trading via micro-transactions provides a transparent way to develop price discovery and authentication among residents locally, while ensuring a decentralized and cost-effective way for authentication and power delivery. Blockchain use cases in this area have been piloted in New York City[36] and Singapore[37].

Intelligent automation plays a key role in driving operational efficiency. However, combining it with distributed ledger technologies and AI can deliver the trust and transparency that is critical to democratizing the energy and utilities sector.

Conclusion

> **"I often talk about artificial intelligence as augmented intelligence. It really is about bringing something else to the table, such that our experts and people can focus even more on the stuff they were trained to do and on the higher order stuff. I think that there could be a whole new class of jobs, and a whole new range of things to be done in the future, that we didn't know existed."**
>
> says Morag Watson, chief digital innovation officer in BP.

The global energy industry is undergoing monumental change. The traditional, centralized provision of power from sources such as coal, gas and nuclear is facing an economic, political and social backlash – a result of climate change, health and safety, and security concerns. At the same time, growing demand from developing countries, as well as new usages like electric vehicles, need to be satisfied. All of these trends mean that distributed and weather-dependent renewable energy is an increasingly critical and growing part of the energy portfolio.

Embracing RPA, advanced analytics and artificial intelligence is absolutely instrumental in meeting climate change goals and the growing demand for clean, cheap, reliable energy. Driving scaled adoption in support and technical functions will play a key role in driving greater efficiency and customer satisfaction while also helping rethink operating and business models. However, our research shows that many organizations struggle to make a success of intelligent automation, failing to achieve scale and drive value. Organizations are also missing out on critical use cases in core and support functions that can deliver outsized benefits. The benefits of intelligent automation are consistently undervalued and misjudged, which reveals a significant gap in capabilities, talent and ambitions.

To address this gap, there are a number of priorities. First, organizations are capturing most automation value from the most mature and accessible use-cases in the downstream business, such as chatbots. But, as our survey shows, more value resides in the upstream business (generation, trading) and midstream activities (networks). Organizations therefore need to focus efforts towards this domain, as well as new businesses, such as renewables and beyond the meter. It is easier to grow the value from a digital enabler in these new deep techs than refurbishing an existing asset (coal or gas plant for example). Second, organizations need to take a pragmatic approach to choosing which automation and AI use cases to focus on, while also making sure they maximize ROI by re-engineering processes prior to implementation. Finally, they must drive change management to create and instill a culture and mindset that welcomes intelligent automation as a necessary component to complement the human workforce, creating the smart, augmented utility of the future.

The traditional business models of stable long-term agreements backed by large tickets capex projects is slowly being replaced with small players and smaller projects – shale oil, rooftop solar panels, micro-grids are a few examples of this trend. If the energy and utilities sector is to grow alongside this era's challenges, it requires an ambitious adoption of automation and AI. We believe organizations who develop such capabilities and culture will be able to innovate more aggressively through new business models and grow vibrantly at the expense of the organizations who fail to change.

Appendix

How do we define intelligent automation in our research?

In this study, we define intelligent automation as a way of process automation leveraged by rule-based and artificial intelligence technologies. Rule-based technologies automate high-volume, repeatable tasks and mimic human actions and include both IT process automation (ITPA) and robotic process automation (RPA). Artificial intelligence (AI) encompasses a range of technologies that learn from data to provide capabilities and behavior that we perceive as intelligent. The AI technologies we include in our report are: speech recognition, natural language generation, context-aware computing, biometrics, image and video analysis, machine and deep learning, swarm intelligence, and chatbots or voice bots.

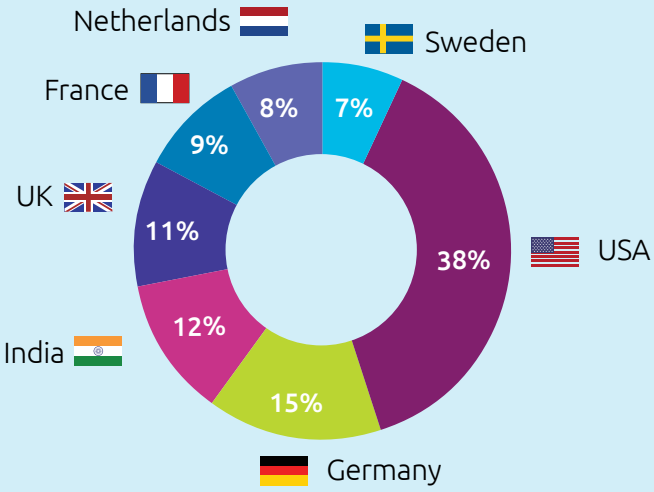
Intelligent automation technologies included in our research

Source: Capgemini Research Institute.

Research methodology

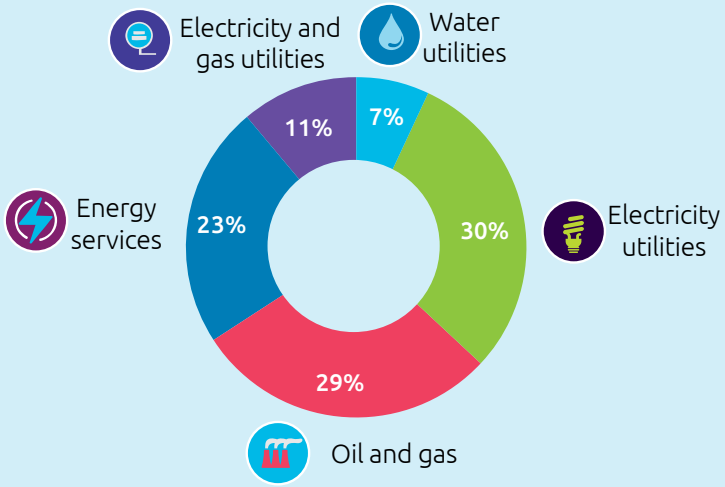
In July 2018, we surveyed 705 business leaders from organizations (experimenting with or implementing intelligent automation) across a range of sectors and countries, with revenue greater than $500 million in FY 2017. In February 2019, we surveyed 529 business leaders at the manager level or above in energy and utilities organizations experimenting with or implementing intelligent automation. Seventy-one percent of the organizations reported revenue of more than $1 billion in FY 2017.

Executives by country



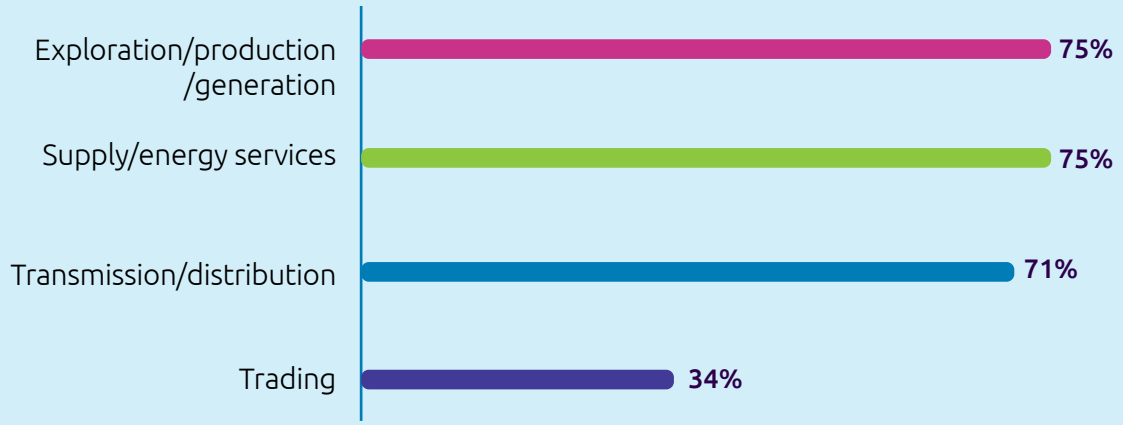
Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.

Executives by sub-sector



Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, N=51 executives from energy and utilities automation frontrunners organizations that are experimenting with or implementing intelligent automation initiatives.

Executives by value-chain



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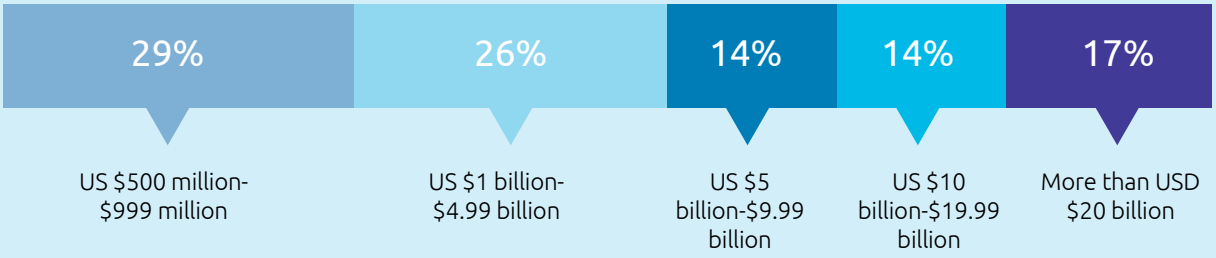
Executives by organizational revenue



Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.

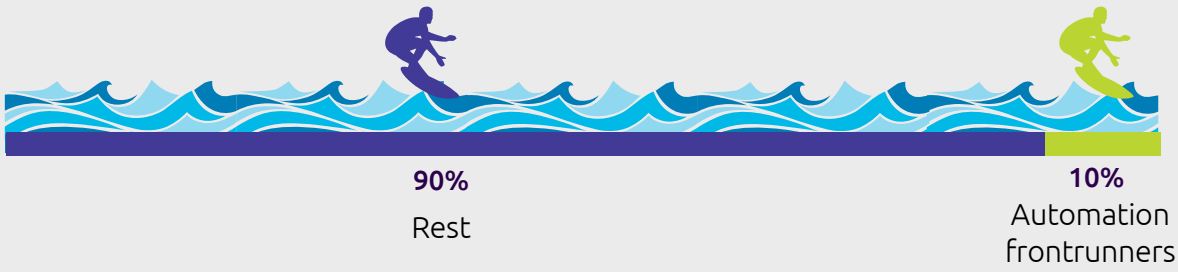
Executives by designation

Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, February 2019, N=529 executives from energy and utilities organizations that are experimenting with or implementing intelligent automation initiatives.

Who are the automation frontrunners?

We define automation frontrunners as executives from the organizations that have deployed multiple intelligent automation initiatives at scale and have also delivered greater cost, revenue and customer satisfaction benefits than the average. This group of 51 executives comprises of 10% of our sample.

Percentage distribution of automation frontrunners and the rest



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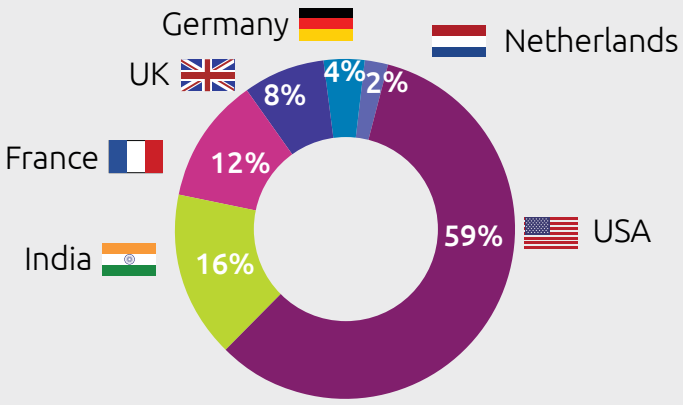
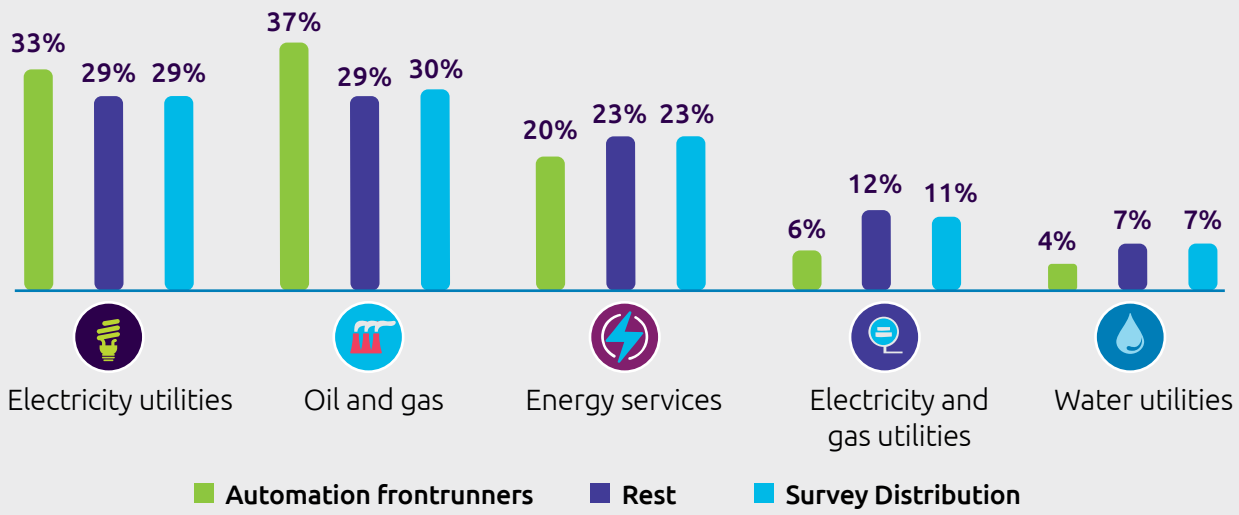
Among the countries, the United States, India, and France have contributed more automation frontrunners compared to their peers. In our sample, the Unites States contributes 59% of automation frontrunners despite representing only 38% of our survey population. Similarly, in terms of sub-sector, electricity along with oil and gas have made more progress in creating automation front-runners when compared to other industries.

Automation frontrunners distribution by geography



Source: Capgemini Research Institute Intelligent Automation in Energy and Utilities Survey, N=51 executives from energy and utilities automation frontrunners organizations that are experimenting with or implementing intelligent automation initiatives.

Automation frontrunners grouped by primary sector



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“We tend to overestimate the effect of a technology in the short run and under-estimate the effect in the long run.”

says, Roy Amara, co-founder of Palo Alto’s Institute for the Future.

Inject peak performance into your enterprise with Capgemini as your partner

We believe that intelligent automation is not only about new intelligent technologies, for Capgemini and our clients, it's much more. We are working with market-leading brands in the Utilities and Energy industry, helping them to orchestrate new ways of working, and injecting powerful intelligent automation solutions into their operations – to unlock the full advantage of the benefits of intelligent automation.

Automation Drive:

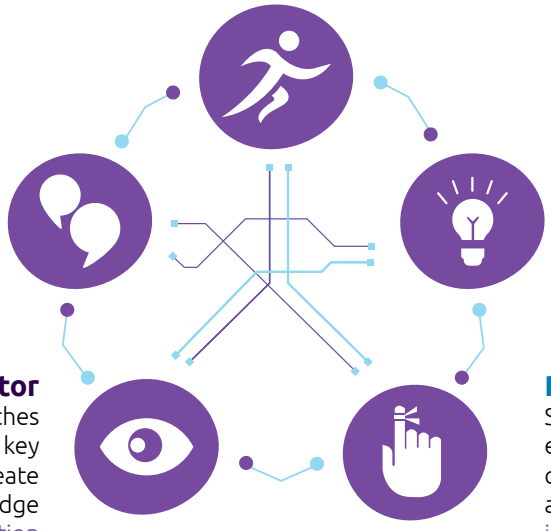
With Automation Drive, Capgemini brings a unified suite of intelligent automation tools, expertise and services, backed by Capgemini Intelligent Automation Platform, a Plug-and-play, cloud based Intelligent Automation platform – that shifts the needle from isolated, limited value initiatives to a holistic, enterprise-wide, automation-first approach with an AI edge.

Automation Drive is supported by the collective skills of over 30,000 automation experts, a library of thousands of re-usable, off-the-shelf assets, and a wide portfolio of end-to-end services. All guided by Capgemini's unique Five Senses of Intelligent Automation methodology.

The Five Senses of Intelligent Automation | Our unique humanlike approach for translating Intelligent Automation into tangible business value

ACT: Service
Using technology to take action or complete process with robots moving from the assembly line into the office.
i.e. IT process automation, RPA, NLP, NLG

LISTEN&TALK: Interact
Listening, reading, talk, writing and responding to IA solution users for an intuitive customer interaction.
i.e. Chatbots, Virtual Agents



THINK: Analyze
Detect patterns and recognize trends – applying algorithms to knowledge to determine appropriate action/predict future consequences.
i.e. Machine learning, Neural networks

WATCH: Monitor
Technology that watches and records key business data to create knowledge
i.e. Anomaly Detection and Self Remediation

REMEMBER: Know
Storing and finding info effectively using tools and components like databases and search engines.
i.e. AI and Knowledge Extraction algorithms

Digital Utilities Transformation Framework

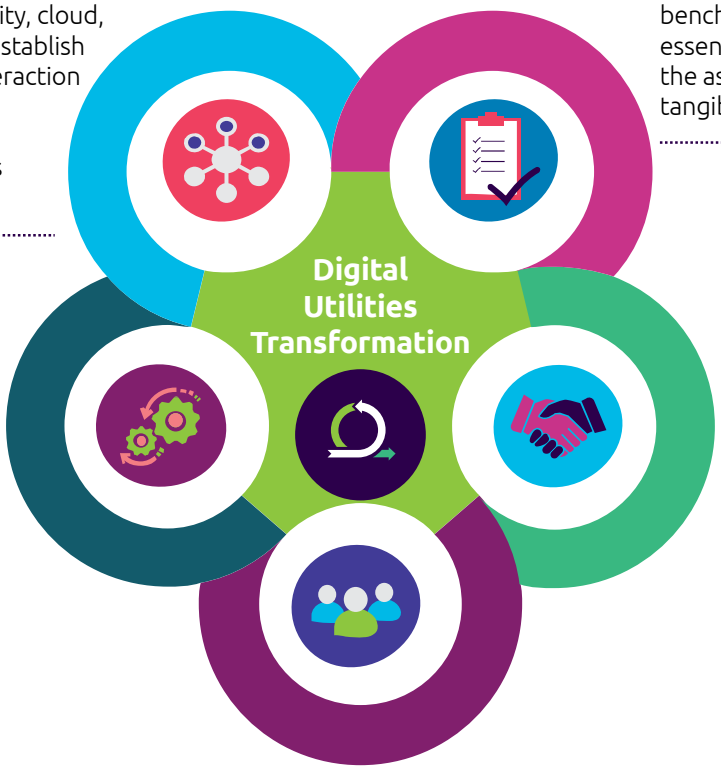
To help clients through their digital transformation, we've created a Digital Utilities Framework that is made up of the following services:

Digital Utilities Enterprise Architecture

We provide services around the design of enterprise architectures starting with discovery of the digital business requirements and consequently incorporating digital technologies like mobility, cloud, big data and BPMS to establish an agile, intelligent interaction layer, while preserving your IT foundation for transactional processes and IT investments.

Digital Utilities Maturity Assessment

The starting point of the digital transformation journey is an assessment of the current maturity of the company's digital agenda. We embed benchmarking on several essential business processes in the assessment to quantify tangible performance results.



Digital Asset Management

Through Digital Asset Management it is possible to capture and analyze all data that is necessary to plan, build and operate assets on a near real time basis. This will deeply change the economics around the asset life cycle and provide optimization of economic return on assets.

Digital Transformation Roadmap

This phase allows Utilities to analyze their current business and operational model, design how digital technologies deliver their digital vision and plan the Digital Transformation roadmap based on business benefits.

Customer & Communities Experience Transformation

We help Utilities to rethink their marketing, sales and service processes to be lean and error-free, leveraged through Business Process Management. We use data and customer analytics to provide the right insight to fine tune cost to acquire, churn management and cost to serve.

Why us?

We bring together key strengths in consulting and technology powered by our global partner ecosystem to deliver end-to-end intelligent automation solutions for our clients.

Our global expertise in large scale transformation projects, combined with our long tradition of technology innovation with clients and partners can help you gain sustainable competitive advantage, taking the brakes off change throughout your intelligent automation journey.

Learn more here:

www.capgemini.com/service/automation-drive
www.capgemini.com/service/digital-utilities-transformation/

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The authors would like to especially thank Subrahmanyam KVJ for his contribution to the report.

The authors would also like to thank Torben Schuster, David Asfaha, Raj Malayathil, Sean Quigley, Ahmed Hamada, Vivek Jain, Dawn Domaschk, Markus Pütz, Gaurav K Gupta, Randall Cozzens, Michael Gardner, Prasad Ramanathan, Mike Wilks, Abdelmajid Boutayeb, Sindhu Bhaskaran, Saugata Ghosh, Zois Tzikas, Johanna Sundh and Bridget Pietsch for their contribution to the report.

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The Capgemini Research Institute is Capgemini's in-house think tank on all things digital. The Institute publishes research on the impact of digital technologies on large traditional businesses. The team draws on the worldwide network of Capgemini specialists and works closely with academic and technology partners. The Institute has dedicated research centers in India, the United Kingdom, and the United States. It was recently ranked number one in the world for the quality of its research by independent analysts.
Visit us at www.capgemini.com/researchinstitute/

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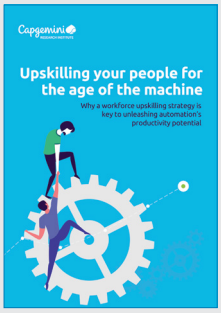

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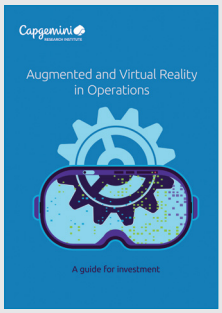

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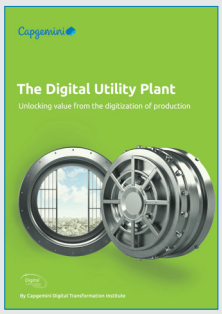

The Digital Utility Plant: Unlocking value from the digitization of production

Digital Transformation Review 11 – Artificial Intelligence Decoded

The Digital Culture Challenge: Closing the Employee-Leadership Gap

About Capgemini

A global leader in consulting, technology services and digital transformation, Capgemini is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital and platforms. Building on its strong 50-year heritage and deep industry-specific expertise, Capgemini enables organizations to realize their business ambitions through an array of services from strategy to operations. Capgemini is driven by the conviction that the business value of technology comes from and through people. It is a multicultural company of over 200,000 team members in more than 40 countries. The Group reported 2018 global revenues of EUR 13.2 billion.

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