
Capgemini
How energy and utilities leaders are navigating the new AI-driven infrastructure supercycle
Energy and Utilities Engineering Pulse 2026

Executive summary

The energy and utilities sector is entering one of the largest infrastructure expansion cycles in its history. Rising demand from AI and data centers, electrification, and energy security is driving unprecedented investment across generation, transmission, and distribution. Duke Energy's recently announced $103 billion five-year capital program[1] is just one indication of the scale of the opportunity ahead.

Yet capital alone will not deliver this infrastructure. The emerging constraint is the industry's ability to execute.

Utilities must build more infrastructure, faster, while maintaining the safety, reliability, and affordability on which the sector depends. At the same time, engineering talent is scarce, supply chains remain constrained, and increasingly complex projects are putting pressure on traditional delivery models.

The operating models that served the industry well in an era of more stable demand were simply not designed for the speed and scale now required. The good news is that this infrastructure supercycle coincides with a technology cycle that can fundamentally change the economics of execution.

AI, combined with digital engineering and new global capability models, offers utilities the opportunity to dramatically increase engineering productivity and capital efficiency. Applied across the capital project lifecycle – from planning and design through engineering, procurement, construction, and commissioning – these technologies can augment scarce expertise, automate engineering workflows, improve decision-making, and help compress project timelines.

The opportunity goes beyond deploying new technology. Capturing its full value will require utilities to rethink how engineering work gets done: redesigning workflows, strengthening data foundations, building new operating models, and scaling innovation within robust governance frameworks.

The question for energy leaders is therefore no longer simply how much capital they can deploy, but how much infrastructure they can deliver for every dollar invested – and how quickly they can turn that investment into productive assets. AI has the potential to fundamentally change that equation.

The new infrastructure imperative

- Infrastructure demand is growing faster than traditional delivery models can support.
- The industry's biggest constraint is shifting from capital to execution capacity.
- AI can act as a force multiplier across engineering, asset management, and operations.
- Global engineering networks can help address critical talent shortages and accelerate delivery.
- Organizations that combine innovation with operational discipline will be best positioned to meet future demand.

What energy leaders should do now

Energy and utilities leaders should focus on scaling AI beyond pilots, modernizing data foundations, and redesigning engineering and operational workflows around human-AI collaboration. At the same time, they must expand access to global engineering talent and adopt new delivery models that can help overcome growing workforce and supply chain constraints. However, technology and talent alone will not be enough.

Success will depend on creating the organizational confidence, governance frameworks, and culture needed to scale innovation safely and reliably. The organizations that act now will be best positioned to deliver the infrastructure required to power both the energy transition and the AI economy.

But what does this look like in practice?

Across the industry, leading organizations are increasing execution capacity and accelerating infrastructure delivery while maintaining safety, reliability, and compliance. The following section explores three critical levers behind this shift: AI and digital engineering, global capability models, and the organizational changes needed to unlock their full value.


Industry response

1 AI and digital: Accelerating the engineering lifecycle

For energy and utilities, AI is an increasingly practical tool for delivering more infrastructure and maintaining more assets with limited engineering capacity.

AI to compress engineering and delivery timelines for energy assets

As energy companies expand infrastructure deployment, AI offers the opportunity to compress delivery timelines, enabling projects to be completed faster and at lower cost.

By applying AI to program and historical delivery data, companies can make more informed investment decisions and optimize asset development programs for new infrastructure and upgrades. AI can also help accelerate permitting processes, by rapidly gathering relevant information and responding to stakeholder and regulatory questions.

As projects get underway, AI can help to manage dependencies across multiple teams and identify emerging risks as they arise, helping teams intervene before delays cascade. Capital projects often involve multiple vendors working across different systems and ways of working. Recent advances in AI allow it to analyze these complex interdependencies and guide managers in coordinating activities towards a shared delivery goal.

What energy and utilities leaders think of AI *

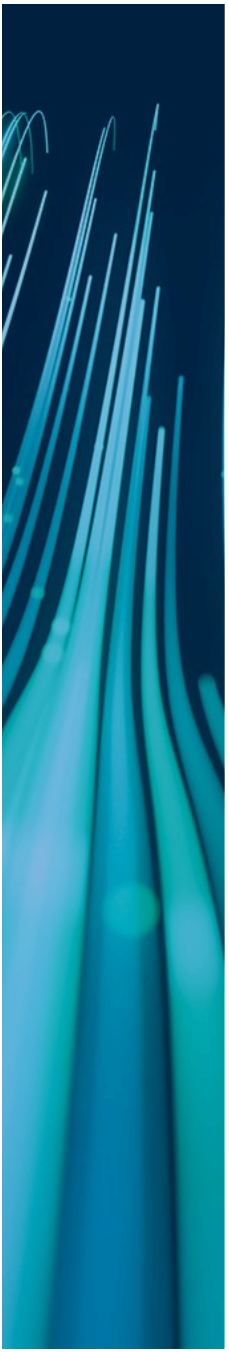
75% expect AI to transform maintenance and support, e.g. through predictive maintenance and decision support

69% expect it to transform documentation and compliance

50% say it will transform manufacturing and operations, e.g. through AI scheduling and supply chain management

Only **24%** of energy and utilities leaders are currently using AI for engineering and R&D

*Data from Capgemini Engineering and R&D Pulse 2026[2] survey of 200 energy and utilities leaders



Whilst not the most glamorous application of AI, it has already shown promise for significantly reducing documentation and compliance workloads[3]. In fact, in Capgemini's survey of 200 energy and utilities leaders – part of our cross-sector Engineering and R&D Pulse 2026[4] report – we found **69% of energy leaders expect AI to transform this area**, with potential to substantially shorten delivery times for major infrastructure programs.

For the engineers doing the work, AI assistants can automate document reviews, check compliance with standards, route approvals, and surface relevant information and contextual guidance. This can remove bottlenecks and enable quicker responses to changing project conditions. With limited pools of engineering talent, this reduces time spent on administration and troubleshooting, allowing engineers to focus on the areas where their expertise is most valuable.

Beyond accelerating capital delivery, AI is also set to become central to operating increasingly complex electricity systems. As renewable generation, batteries, EV charging, flexible industrial demand, and distributed energy resources proliferate, utilities will need to adapt. For example, integrating AI to optimize network flows, balance supply and demand in real time, and maximizing the use of both existing and new capacity.

AI for smarter asset management

Even as utilities build new infrastructure, they must also operate vast portfolios of both new and aging assets with limited engineering resources.

The combination of AI, digital twins, sensors, drones, and computer vision enables a shift from periodic, reactive maintenance to continuous, predictive asset management. These technologies can identify deteriorating asset conditions earlier, predict failures before they occur, and schedule maintenance, based on operational risk.

This is where energy leaders expect AI to have its greatest impact. Our research found that **75% believe maintenance and support will be transformed by AI over the next two to three years**.

A real example of this potential comes from Capgemini's work with EDP Redes España[5]. By applying AI and computer vision to electricity network inspections, we reduced inspection times from a year to a month, while improving defect detection. The result was not only a dramatic acceleration in the inspection process, but also a significant increase in the organization's ability to monitor and maintain its asset base.

AI moves from the digital to the physical world

Perhaps most intriguingly, AI is moving beyond the digital realm to perform physical tasks in both asset delivery and maintenance. The convergence of AI and industrial robotics is creating machines that can perceive their environment, make decisions in unfamiliar or changing conditions, and undertake increasingly complex activities.

For energy companies, this opens new possibilities. For example, inspecting difficult-to-access assets, collecting operational data, and carrying out maintenance activities – particularly in hazardous environments where sending people can be dangerous, costly, and complex.

Consider the example of a nuclear facility. Accessing certain areas may require specialist personnel, detailed work planning, radiological risk assessments, air-fed personal protective equipment, contamination monitoring, and extensive decontamination procedures – before and after the task.

In a world of scarce specialist talent, deploying robots for some of these activities can free experts to oversee a much larger portfolio of work, while reducing operational risk. Capgemini has been testing industrial humanoid AI robots with nuclear fuel manufacturer Orano[6], exploring how these technologies can support the next generation of asset operations and maintenance.

Although still at an early stage, physical AI and robotics have the potential to be transformative for asset deployment and management.

2 Engineering at scale: Accessing the talent needed to build faster

The biggest barrier to faster infrastructure delivery is engineering capacity. Across the energy sector, organizations are being asked to design, build, and maintain more infrastructure than ever before. However, the supply of experienced engineers is struggling to keep pace. In many markets, these skills simply do not exist in sufficient numbers.

Leading organizations are therefore rethinking where engineering work is carried out. Rather than concentrating capability around individual assets, they are building global engineering networks that allow specialist expertise to be accessed wherever it is available.

Whilst an established way of working in industries such as automotive, global delivery has long seemed incompatible with large-scale critical infrastructure. Yet many engineering activities do not need to be undertaken next to the asset itself.

Engineering design, CAD, simulation, documentation, data management, digital twins, software and AI model development, and engineering analytics can all be delivered remotely. This allows local teams to focus on site-based activities, like stakeholder engagement, construction, commissioning, and regulatory approvals.

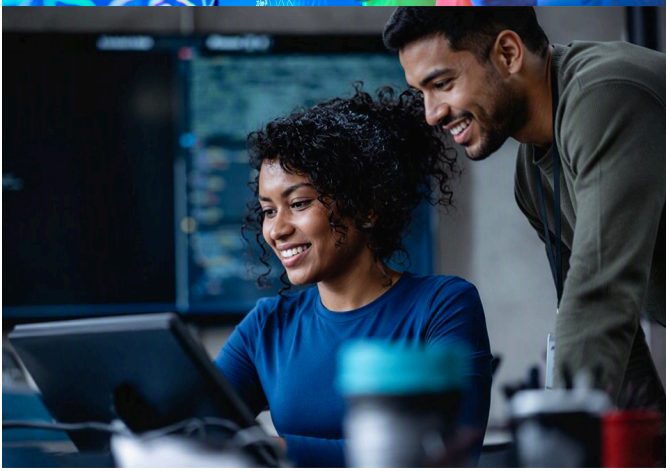
Ways energy and utilities leaders are addressing engineering and R&D capability issues *

78% outsourcing specific engineering or R&D activities

73% establishing owned offshore canters of excellence

33% partnering with external technology vendors, e.g. hyperscalers, platform vendors, innovation firms

*Capgemini Engineering and R&D Pulse 2026[4]



Engineering capacity

What's more, the skills required to operate modern energy systems are evolving. Utilities increasingly need software engineers, AI specialists, data scientists, and cybersecurity experts to build and manage intelligent grids. Accessing these capabilities through global engineering networks can help address local talent shortages, improve cost efficiency, and accelerate digital transformation.

One useful way of thinking about this is through the Core/Context framework. This supports allocating work in ways that benefit from global talent, without creating unnecessary risk. Activities that differentiate an organization, such as those requiring local knowledge and relationships, or those involving protected intellectual property, should remain core to the business. More repeatable engineering activities can be delivered through specialist capability centers, where scale, standardization, and access to deep technical expertise improve both productivity and consistency.

As organizations adopt these models, careful consideration must be given to delivery location strategies. This can help to balance offshore and nearshore approaches to achieve the right mix of skills availability, cost efficiency, language requirements, and time-zone alignment.

The model is becoming increasingly mainstream. Capgemini's Pulse research found that **78% of energy leaders were outsourcing engineering or R&D work packages**, while **73% were establishing offshore Centers of Excellence**. The trend is also visible across the industry. Utilities increasingly invest in global capability centers to support infrastructure delivery and digital transformation across multiple geographies.

When combined with AI and digital engineering, global capability models offer the ability to scale engineering capacity more quickly than traditional recruitment alone. In a world where infrastructure demand is growing faster than the engineering workforce, that may become a significant competitive advantage.

3 Organizational change: Accelerating safely

AI and global delivery models hold huge potential, but for them to succeed, organizations must evolve in ways that make these capabilities part of everyday engineering practice.

For energy companies, that requires a careful balance. These organizations operate critical national infrastructure where safety, reliability, and security will always take precedence over speed. New ways of working, along with the adoption of AI and automation, must therefore earn trust, demonstrate value, and integrate with existing engineering disciplines – rather than seek to replace them.

Learn fast, scale fast

Successful organizations are unlikely to adopt AI or new operating models through large-scale transformation programs. Instead, organizations should identify well-defined operational problems and deploy AI in controlled environments to solve these problems, expanding their use as confidence grows. Each successful deployment creates evidence, builds organizational capability, and provides a foundation for tackling more complex use cases at greater scale.

Building trust

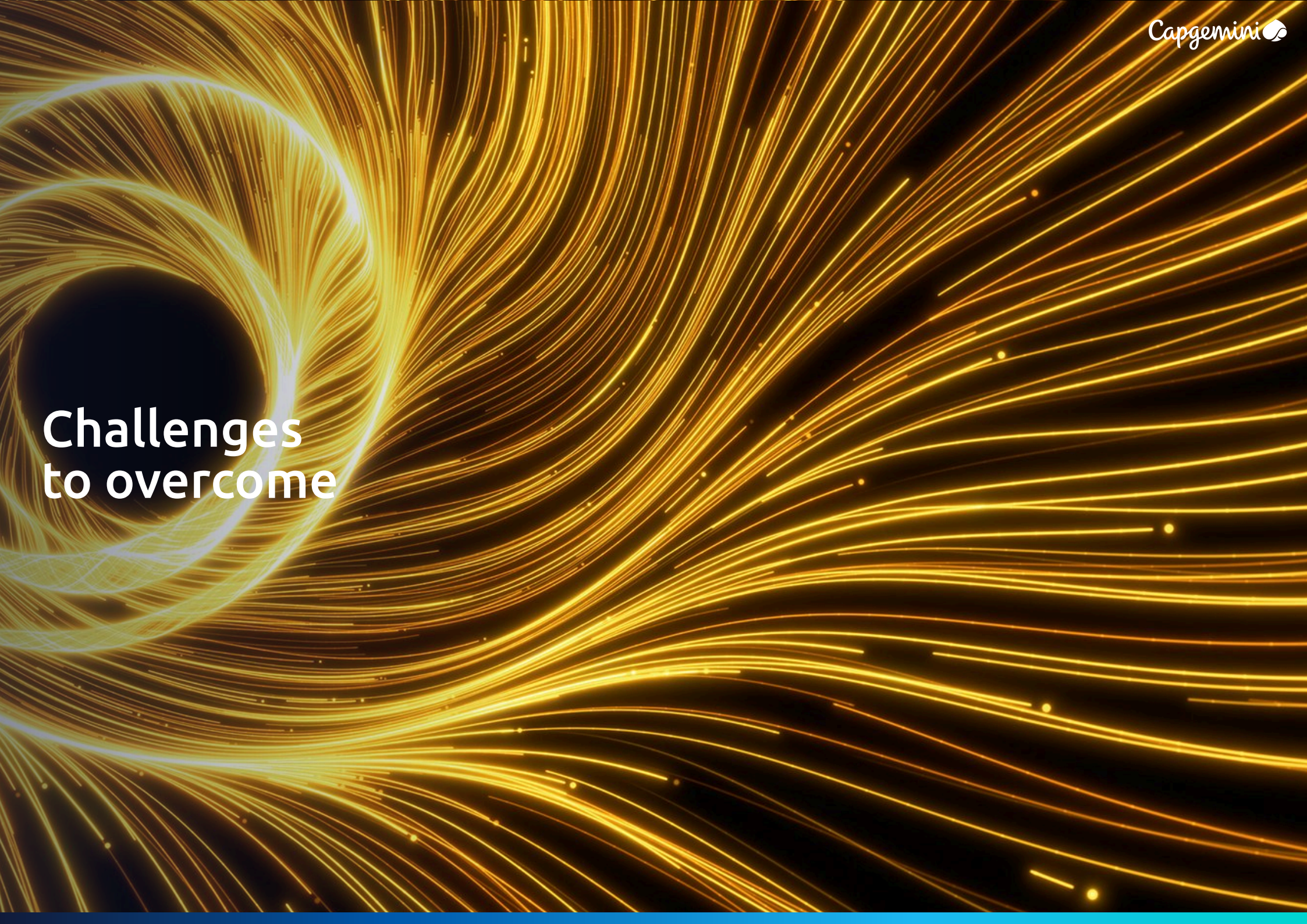
A practical way to build confidence is to start with targeted operational use cases. Use cases like automating vegetation management or predicting equipment deterioration provide operational benefits without putting energy capacity at risk. They also give engineers hands-on experience of working alongside AI. Early deployments like these allow organizations to experiment, learn quickly, and scale successful approaches rapidly.

Along the way, organizations can refine governance, validate outputs and understand failure modes. They can also build familiarity, understanding, and trust amongst operators before applying AI to more critical functions. This staged approach allows AI to move quickly, but in a controlled and accountable way. For example, from assisting engineers with routine operational decisions to supporting (and eventually automating) carefully governed elements of control room operations.

The same principle of progressive adoption applies to people. Engineers do not need to become AI specialists overnight, but they do need to build confidence quickly in working alongside digital tools and understanding how AI arrives at its recommendations. Equally, leaders need to create an environment where experimentation is encouraged within clearly defined governance, safety, and regulatory frameworks.

Capgemini's work with EDP Redes España, as well as several other energy companies, illustrates this point. We have delivered programs that combine AI-enabled inspection and predictive asset management with structured change management. This is helping operational teams adopt new ways of working as new technologies are introduced.

These programs established common industrial data foundations, standardized operating processes, and robust governance. This allowed engineers to progressively incorporate AI into everyday decision-making, building trust while scaling technology across assets and into increasingly complex use cases. The result is not only improved inspection and predictive capabilities, but an organization that is better equipped to adopt future digital innovations.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Challenges
to overcome

Turning opportunity into reality

We hope the above makes clear the scale of the opportunity. But nothing worth doing is ever easy, and there are barriers that will need to be overcome first.

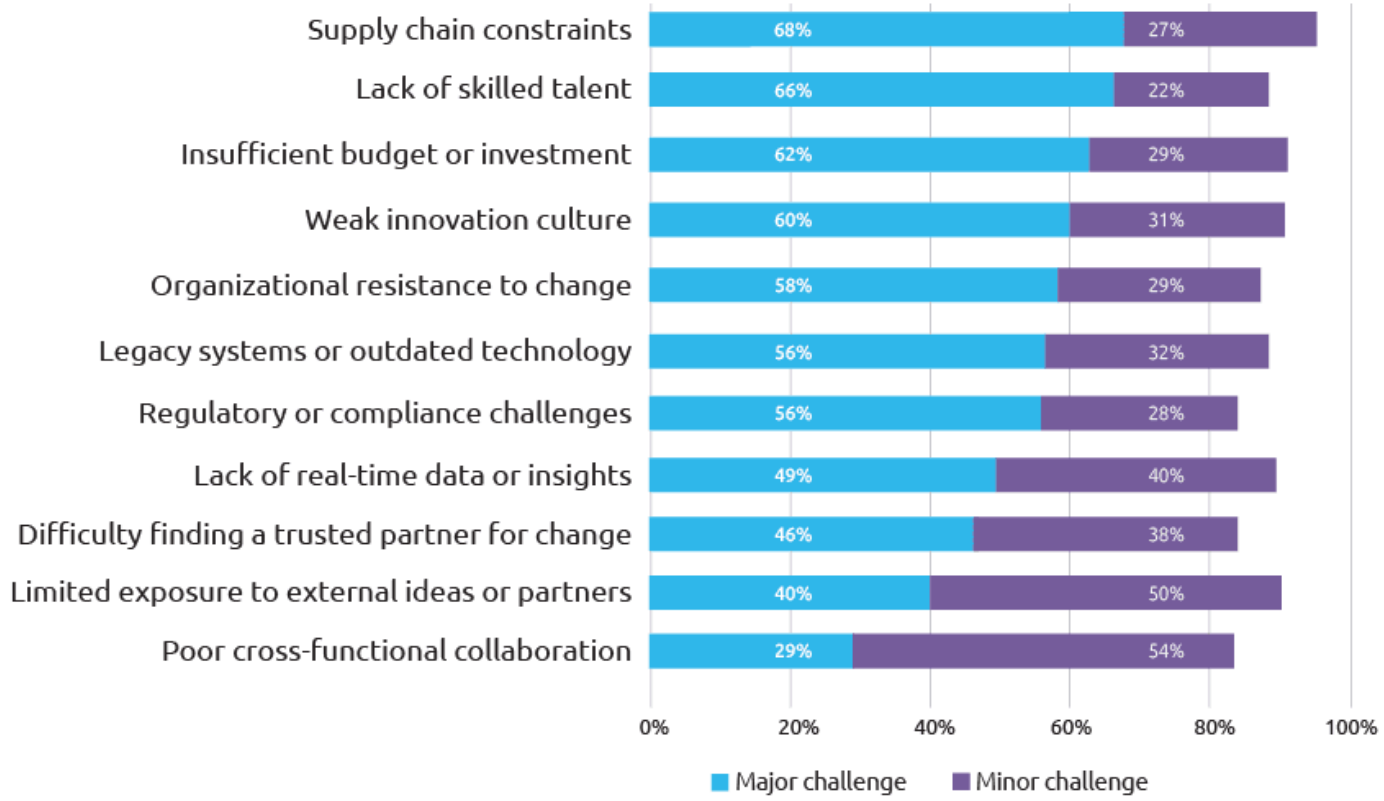
The most immediate challenge is capacity. **Two-thirds of energy and utilities leaders (68%) identify supply chain constraints as a major barrier**, while **66% cite a lack of skilled talent**. These findings reinforce the need for new delivery models that make better use of global engineering capability, AI, and automation, rather than relying solely on local recruitment.

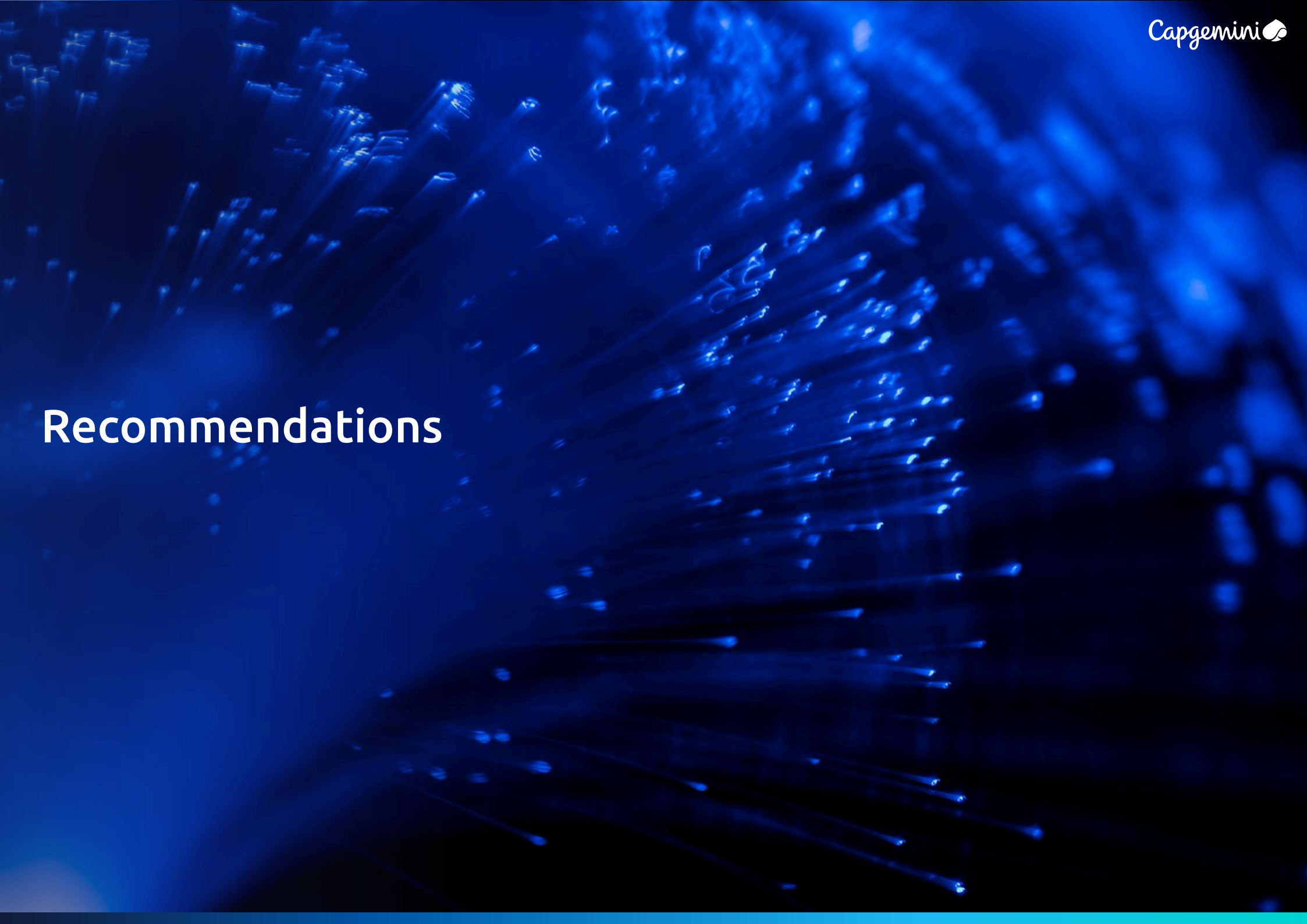
Many organizations are also constrained by the foundations on which they are trying to build. **62% say insufficient investment is a major challenge**, while **56% point to legacy systems and outdated technology**. Without modern digital platforms and connected data, scaling AI and new ways of working is a non-starter.

Perhaps the greatest challenge is cultural. **60% identify a weak innovation culture as a major barrier, 58% cite resistance to change, and 56% highlight regulatory and compliance challenges**. In a safety-critical industry, caution is understandable and necessary. The challenge is not to remove governance, but to modernize how organizations innovate within it.

Taken together, these findings suggest that the sector's biggest obstacle is not a lack of ideas or technology. Rather, it is the ability to build the capabilities, confidence, and operating models needed to deploy them safely, consistently, and at scale. Those organizations that overcome these barriers will be best positioned to meet the unprecedented demands of the energy transition and the AI-driven economy.

What holds back your ability to reduce costs, accelerate time to market, and scale effectively?

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Recommendations

The conservative approach of energy and utilities has served the industry well to date. But, what has worked well so far may not continue to do so in a world that demands unprecedented levels of energy infrastructure on compressed timelines, while access to talent continues to tighten. Organizations will need to be faster and more agile, all while maintaining the industry's commitment to safety and reliability.

We conclude with some practical thoughts on how to succeed.

1. Embrace AI's potential

- **Build the data foundations first.** AI is only as good as the information it can access. Prioritize connected, trusted operational and engineering data, so AI can support decisions across the asset lifecycle, rather than being limited to isolated use cases. For example, Capgemini is working with a global energy company to create a standardized industrial data platform. This platform connects engineering information, eliminates data silos, and enables reusable AI-enabled data products across multiple sites.

- Move from pilots to platforms[7]. Successful AI projects are now commonplace. The challenge is scaling them – across engineering, operations, and asset management – through common governance, reusable tools, and standardized ways of working. The aforementioned data platform makes this possible, but company-wide commitment and support are also critical to scaling AI adoption.

- **Reimagine workflows, not just tasks.** Don’t simply automate existing activities. Instead, redesign end-to-end engineering processes to benefit from AI, from planning and compliance to maintenance and inspections. In safety-critical areas, progress will rightly take a measured approach; elsewhere, be prepared to rethink how work is delivered.

2. Expand engineering capacity through global capability models

- **Separate work by value, not location**. Keep strategic, site-based, and customer-facing activities close to the asset. But leverage global engineering capability centers for repeatable engineering, digital, compliance, and analytical work.

- **Build long-term engineering capability, not short-term capacity.** Develop global Centers of Excellence that accumulate specialist expertise, standardize delivery, and provide scalable support across multiple infrastructure programs.

- **Use global talent to accelerate delivery**. Don't let local labor shortages dictate project timelines. Combine local engineering teams with distributed global capability to expand delivery capacity on the ground.

3. Lead change with confidence

- **Treat change as an engineering discipline.** Prioritize high-impact workflows, prove new approaches through controlled deployments, measure outcomes, and scale what works. Build confidence through evidence, rather than attempting organization-wide transformation.

- Create human-AI chemistry[8]. The future is people and AI working together. Foster a culture where engineers are encouraged to use AI responsibly, with safe places to experiment, supported by trusted tools, clear governance, and practical guardrails. This can create the right 'frame' for the technology: allowing AI to be viewed positively as an enabler that strengthens professional judgment.

- **Balance innovation with assurance.** Maintain the industry's uncompromising commitment to safety and reliability, while recognizing that delivery models – but not engineering standards – must evolve. The organizations that succeed will be those that modernize how infrastructure is planned, delivered, and maintained at greater speed and scale, without compromising the trust on which the sector depends.

Making this real requires more than technology alone

It takes an ecosystem of multidisciplinary capabilities – bringing together energy and engineering expertise, data and AI, technology, talent and partners – and the ability to orchestrate them at scale, from investment decisions through engineering, delivery and operations.

This is how we turn intelligence into execution – and capital ambition into infrastructure that delivers.

> *"The next decade of infrastructure growth will require more than investment. It will demand engineering innovation, scalable talent models, and the responsible yet accelerated adoption of AI. Energy and utilities leaders who successfully bring these elements together will define the next era of industry leadership."*

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