Industrial IOT on land and at sea:
Energy

INTRODUCTION

Humans are consuming more. There are more of us than ever, and we have become accustomed to new technologies and the greater access to information they bring to our lives. For businesses in our major industries — agriculture, energy, maritime, mining and transport — this is having a significant impact. Producers need to optimise their extraction processes, manufacturers need to trace goods from initial extraction to their final destination, and suppliers need to provide more information about the goods that they deliver.

Data, generated by smart technologies like the Industrial Internet of Things (IIoT), is enabling these changes, and for businesses engaged in these industries, it has become the key differentiator. Every business needs to collect data effectively in order to create new efficiencies to pass onto customers, before their competitors beat them to it.
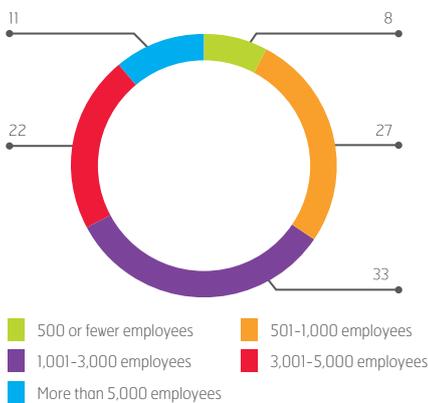
INMARSAT RESEARCH PROGRAMME

The Inmarsat Research Programme is now in its second year. This 2018 research is focused on understanding the ways that the Industrial Internet of Things is affecting the global supply chain and the way in which organisations from the agriculture, energy, maritime, mining and transport sectors operate. In May 2018 Inmarsat commissioned Vanson Bourne, a specialist technology market research company, to interview 750 respondents about their use of, attitude to and predictions for IIoT within their organisation and industry.
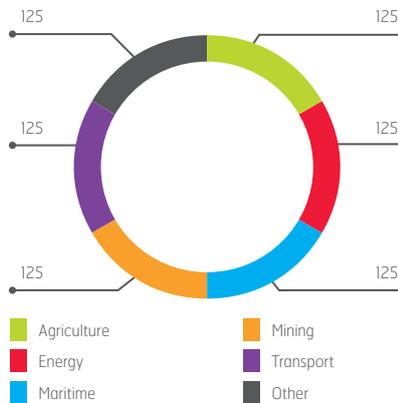
Respondents worked for organisations with at least 500 employees and have either decision-making or influencing responsibilities for IIoT initiatives. However, the profile of maritime respondents is different, in that 46 per cent worked for organisations employing fewer than 500 people.
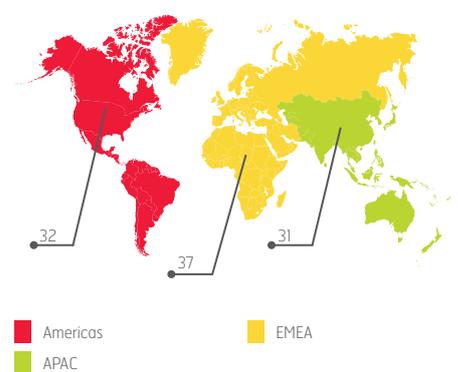
RESEARCH DEMOGRAPHICS
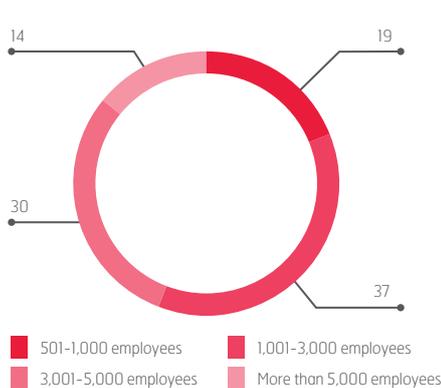
RESPONDENTS BY SIZE OF ORGANISATION (%)

- 500 or fewer employees
- 501-1,000 employees
- 1,001-3,000 employees
- 3,001-5,000 employees
- More than 5,000 employees

RESPONDENTS BY SECTOR (750)

- Agriculture
- Energy
- Maritime
- Mining
- Transport
- Other

RESPONDENTS BY REGION (%)

- Americas
- EMEA
- APAC

ENERGY DEMOGRAPHICS

RESPONDENTS BY SIZE OF ORGANISATION (%)

- 501-1,000 employees
- 1,001-3,000 employees
- 3,001-5,000 employees
- More than 5,000 employees

RESPONDENTS BY SUB-SECTOR (125)

- Distribution
- Exploration
- Extraction

RESPONDENTS BY REGION (%)

- 22 Canada
- 23 USA
- 22 China
- 20 India
- Americas
- EMEA
- APAC

ENERGY

INMARSAT INDUSTRIAL IOT READINESS TOOL

WHAT IS THE ENERGY SECTOR'S OVERALL IIOT READINESS? (%)

— All sectors average (750 respondents)
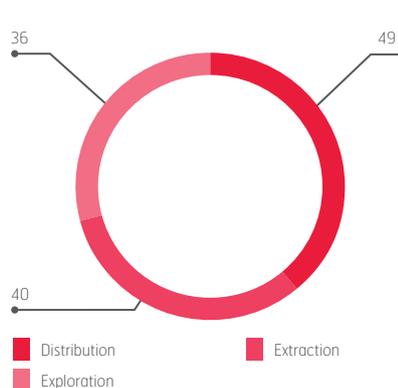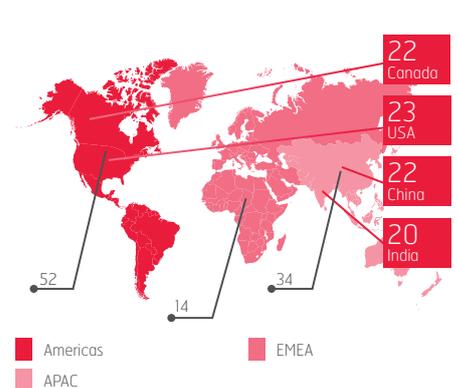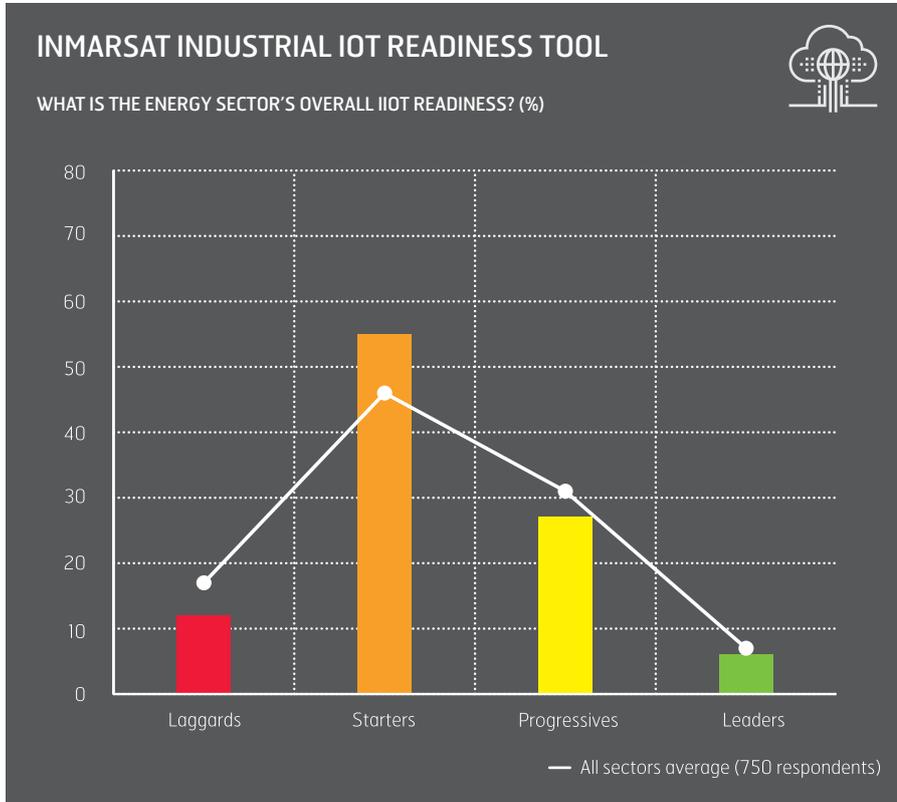
The energy industry is in an unprecedented state of transformation. Ever-increasing pressure from governments, consumers and activists to reduce non-renewable energy consumption and humanity's impact on the environment is putting revenues, profits and margins under severe strain. With renewable energy uptake accelerating and innovations like electric vehicles gaining mainstream attention, traditional oil and gas businesses face an uncertain future.

The sector undoubtedly has a great deal to gain by harnessing smart technologies such as IIoT, which promises to help it increase outputs and profitability. However, our research suggests that while pockets of the industry – chiefly the distribution end of the market – are progressing well towards IIoT, the majority of respondents are closer to the start of their journey.

In the exploration phase, IIoT can help accelerate and enhance seismic data acquisition and analysis to improve production performance, leading to the faster extraction of gas or oil. In the extraction and drilling process, IIoT can enable real-time process monitoring, predictive maintenance and automation, reducing the number of staff needed on site to monitor production equipment.

Energy distributors build and operate vast networks of pipelines, from which they can gather datasets to monitor the integrity of pipes and deploy a rapid response if they detect a leak, through pressure monitoring sensors. IIoT sensors can also help to optimise supply and demand forecasting, as well as pipeline operations.

The energy exploration and extraction businesses that were surveyed in the report are still in the early stages of their IIoT adoption and deployment. While many are at the trial stage (33 and 43 per cent respectively), just 3 per cent of extraction and exploration businesses have fully deployed IIoT, as opposed to 14 per cent from those organisations focused on distribution, which should come as little surprise, given the growth of smart metering in the consumer end of the market.

Where IIoT has been implemented, energy companies are primarily seeing the benefits in areas such as improved health and safety, environmental sustainability and efficiency. While this is encouraging progress, the sector must focus on developing new streams of revenue and improving the profitability of production, if they are to gain the full benefits of IIoT.

A chronic lack of skills still pervades the industry, in part due to the cuts to staffing levels that were made during recent leaner years, which must be overcome if the energy sector is to make best use of IIoT.

Another key roadblock to successful IIoT deployments is security. While some energy businesses are rightly concerned by the threat of kidnappings or piracy attacks, which IIoT can play a role in deterring, the respondents clearly see the threat of IIoT networks exposing energy infrastructure to the malicious intent of cyber-criminals or hostile state actors.

From creating a more connected industry, to radically improving health, safety and sustainability, to developing new revenue generation opportunities that will enable energy businesses to ride the volatility of fluctuating production prices, the respondents to our survey clearly recognise that the potential for IIoT to radically transform the energy industry is immense.

INMARSAT INDUSTRIAL IOT READINESS TOOL

Our tool allows us to benchmark sectors, organisations and industries against each other based on their IIoT readiness.
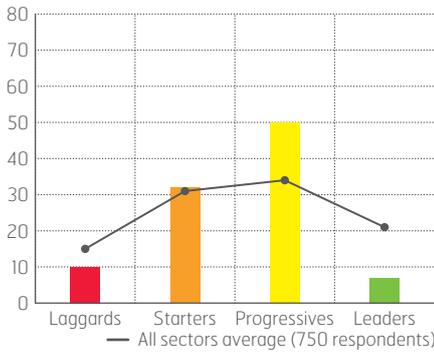
We asked our 750 respondents a series of questions, with points attached to their responses, scoring their IIoT development in six key areas:

- Adoption
- Security
- Connectivity and IIoT technologies
- Skills
- Data
- Investment and ROI

Using the scores, we divided our respondents into categories indicating their IIoT maturity: laggard, starter, progressive and leader.

ADOPTION

HOW MATURE IS THE ENERGY SECTOR IN RELATION TO IIOT ADOPTION? (%)

Bar chart with line showing "All sectors average (750 respondents)"
- Laggards: ~10
- Starters: ~32
- Progressives: ~50
- Leaders: ~7

The energy sector is making solid progress in relation to IIoT adoption, with half of respondents ranking in the IIoT progressive category. Today, 44 per cent of energy companies have deployed IIoT solutions to some extent, and while 84 per cent of these are still in the trial phase, nine in ten expect to have fully deployed IIoT solutions by the end of 2019.

It is interesting to note, however, that distribution companies are somewhat further along their IIoT journey than those engaged in extraction and exploration. As the arm of an industry that is closest to the consumer, and has been developing smart meter and smart grid technologies for a number of years, this is to be expected. However it is clear that energy companies further upstream have some catching up to do in order to ensure the energy supply chain functions with complete transparency and efficiency.

Nine in ten energy companies believe that IIoT will be essential for them to gain a competitive advantage, and a similar proportion (89 per cent) believe that they will be left behind without IIoT, indicating the importance placed upon IIoT in the sector.

The ability of IIoT solutions to improve the health and safety of staff, monitor environmental changes and improve resource efficiency are key drivers of IIoT amongst energy companies, though some interesting differences emerge beneath the surface. Improving the security of sites, for example, was
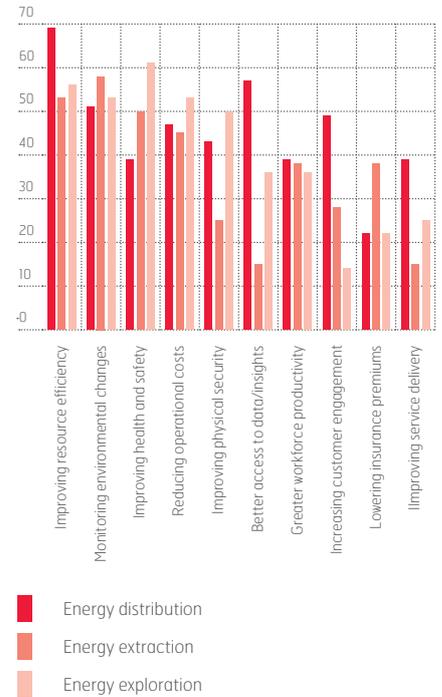
seen as critical for 50 per cent of energy exploration companies — whose remote and embryonic sites may lack the infrastructure of fully-established operations or be located in territories with political instability and conflict.

Driving deployment in the distribution sector is improving resource efficiency within the organisation (69 per cent) and gaining better access to insights and data (57 per cent). These two business activities are critical to the effective and profitable distribution of energy, enabling distributors to do more with less.

With energy extraction and exploration businesses prioritising monitoring health and safety (50 per cent and 61 per cent respectively), and environmental changes (58 per cent and 53 per cent), the focus for these businesses is clearly on the quick wins of IIoT deployment.

However, these projects are delivering results, with over a third (36 per cent) reporting that they have already realised improvements in health and safety, 34 per cent have improved the environmental sustainability of their operations, and while just 10 per cent of energy companies have successfully lowered their insurance premiums to date, a further 35 per cent expect to do so in future.

WHAT ARE THE MOST IMPORTANT DRIVERS FOR THE DEPLOYMENT OF IIOT-BASED SOLUTIONS IN YOUR ORGANISATION? (%)

Legend:
- Energy distribution
- Energy extraction
- Energy exploration

Categories: Improving resource efficiency, Monitoring environmental changes, Improving health and safety, Reducing operational costs, Improving physical security, Better access to data/insights, Greater workforce productivity, Increasing customer engagement, Lowering insurance premiums, Improving service delivery
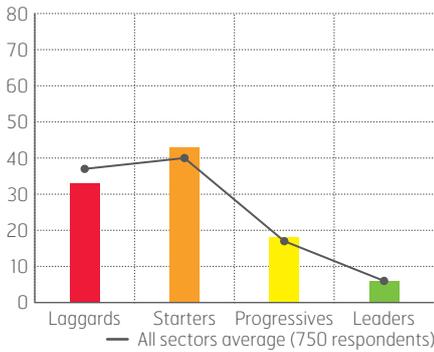
90%

believe that IIoT will be essential to gain a competitive advantage

Improving the health and safety of staff, monitoring environmental changes and improving resource efficiency are key drivers of IIoT

SKILLS

DOES THE ENERGY SECTOR HAVE THE SKLLS IT NEEDS FOR IIOT (%)

Bar chart with values:
- Laggards: ~33
- Starters: ~42
- Progressives: ~18
- Leaders: ~6

— All sectors average (750 respondents)

Like most other sectors examined in this report, the energy sector is lacking when it comes to the skills required to architect, deploy and manage IIoT-based solutions.

As is to be expected, this shortfall in skills is both inhibiting the rate of adoption, and limiting the success of IIoT initiatives once deployed. Around a third (34 per cent) of energy respondents identified a lack of skills as one of the biggest barriers they have encountered in the adoption of IIoT solutions, and 27 per cent stated that they lacked the skills to extract and use the data generated by their IIoT solutions, as efficiently as they would like.

Respondents in both distribution and extraction sectors identified skills shortages in all areas of IIoT deployment, with only around one in five stating that they have all of the skills they need to devise IIoT strategies and manage them once they are up and running.

However, some clear differences between these parties emerge when we examine the specific skills required. Over half (56 per cent) of distribution companies, for example, felt that they required additional data science skills to fully realise their IIoT initiatives, considerably higher than the 41 per cent of extraction respondents that thought the same.

By automating historically mechanical processes, companies focused on the exploration and extraction of oil and gas stand to make considerable gains, enabling them to extract staff from potentially hazardous situations and speed up the rate of production. However, realising these benefits depends heavily on having access to advanced technical support skills to architect and manage these solutions — skills that are currently out of reach for many in the sector.

This decline in skills can be correlated with recent job losses suffered by energy producers, who in the past may have had teams of staff available to analyse data and ensure cyber-security compliance but now find themselves short-staffed and competing with other industries for data security expertise.

With limited internal resources to manage the challenges of IIoT deployment, it is no surprise to see energy businesses reaching out to a growing number of disruptive, tech-driven start-ups, who have established themselves as strategic partners with the niche skills capable of delivering IIoT solutions.

The vast majority of energy companies are using, or planning to use, partners to develop and manage their IIoT initiatives. Some 80 per cent of respondents stated that they will use partners to some extent to develop their IIoT initiatives, while 72 per cent will use partners to manage them. Without this assistance, they will struggle to get their IIoT projects off of the ground.

WHAT ADDITIONAL SPECIFIC SKILLS DO YOU THINK YOUR ORGANISATION NEEDS TO DELIVER IIOT-BASED SOLUTIONS? (%)

- Energy distribution
- Energy extraction
- Energy exploration
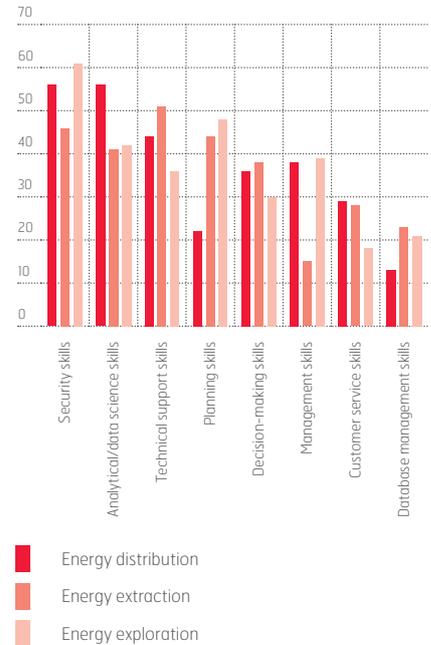
51%

of energy producers need to improve their technical support capabilities to successfully deliver IIoT

In their efforts to acquire new staff with skills in disciplines such as data analysis and cyber-security, energy companies face stiff competition from major technology companies

FUEL FOR THOUGHT

With continued volatility in energy prices, producers are focusing their attention on profitable volume, that which they can extract at minimal cost to retain their margins. IIoT will be critical to this strategy, optimising operations and automating many laborious, manual processes.

EXPLORATION

The most complex element of oil extraction, automated machinery, IIoT-connected technology such as robotics and drones can accelerate this process and reduce costs.

MACHINE MONITORING

With the integration of connected sensors monitoring machine wear, maintenance of complex equipment can be predictive rather than reactive, minimising production downtime.
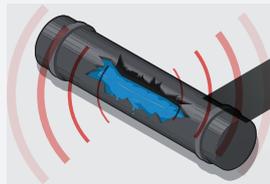
DISTRIBUTION

As oil and gas is distributed across continents through expansive pipelines, IIoT-connected sensors can immediately alert authorities to leaks and accidents, reducing the risk of environmental harm and fines from authorities.

RISE OF THE MACHINES

As more machinery and processes are automated, workers can be removed from potentially dangerous situations and redeployed to monitoring positions in control centres, encouraging an upskilling in the workforce and the digitalisation of the industry.
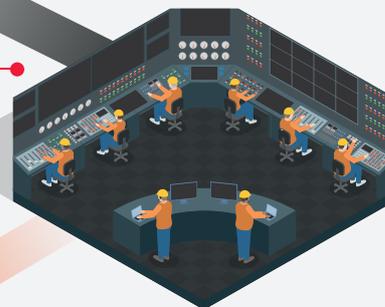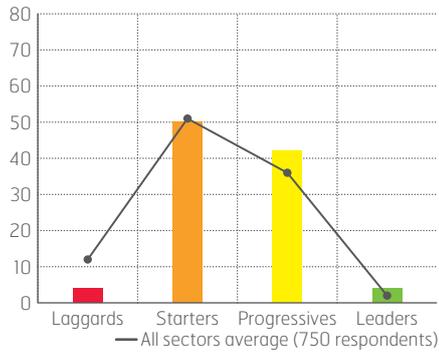
ZERO HARM

Wearable technology can detect if staff suffer impacts or injuries and report this to a control centre, to direct medical attention to the right place and ensure a safer working environment in dangerous rigs or installations.

SECURITY

HOW MATURE IS THE ENERGY SECTOR'S APPROACH TO IIOT SECURITY? (%)

Legend: ━ All sectors average (750 respondents)
(Categories: Laggards, Starters, Progressives, Leaders)

Respondents from the energy sector are more confident than most in their ability to fend off the security threats posed by their IIoT deployments, and the steps to increase the security of IIoT-based solutions place the sector just ahead of the IIoT security index.

This level of maturity, while encouraging, masks some serious challenges for the sector. The energy industry is one that has long been susceptible to cyber-attacks. It is a prime target for criminal elements, though while in the past this may have been for financial gain, the industry is increasingly under threat from terrorists and rogue states.

One of the most famous examples of an energy-related security breach occurred in December 2015, when hackers attacked the Ukrainian power grid leaving 230,000 citizens in the dark by compromising information systems of three energy distribution networks.

However, attacks on the sector are increasingly common. A report in March 2018 from the insurance and risk management group, Marsh (Could Energy Industry Dynamics Be Creating an Impending Cyber Storm?) revealed that about a quarter of respondents from the energy industry knew that their companies had been hit by a cyber-attack in the past year alone.

As a sector that has long been concerned about the implications of network vulnerabilities, IT managers within the energy industry should be well aware of the security pitfalls of IIoT and therefore be able to mitigate the risk.

Despite this, challenges persist and 99 per cent of respondents report facing security challenges of some sort. Around half cited the risk of external cyber-attacks (48 per cent) and the potential for IIoT data to be misused by employees (46 per cent) as a risk, while 42 per cent were concerned about the security of their networks.

Given the historical levels of threats in the industry it would have been a fair assumption that the sector would be well placed to deal with its security challenges, though seven in ten (74 per cent) agreed or strongly agreed that they should be doing more to beef up their protection against cyber-attacks. While this anxiety about cyber-attacks is reported by all parts of the energy industry, energy extractors appear least prepared to deal with the challenge, with 85 per cent stating there was room for improvement.

However, energy companies, are taking remedial action to address their vulnerabilities. 75 per cent of energy respondents reported that they were working with partners to ensure the ongoing security of their IIoT initiatives to some extent, while 55 per cent of extraction companies stated that they would outsource the security of their IIoT solutions as much as possible (compared to just 31 per cent of distribution), in reflection of the deeper skills shortages they face.

Beyond this, looking at some of the specific actions taken to improve security, four in ten have upgraded their security technologies (43 per cent), and a similar proportion has invested training for employees and security policies.

There is good recognition among C-level execs about the potential vulnerabilities of IIoT: 17 per cent of energy respondents (and 29 per cent of distribution companies) say that CISOs (Chief Information Security Officers) are leading their IIoT projects, and they influence them in 38 per cent of cases – the highest reported level of CISO involvement of all the sectors in this report.

WHAT CHANGES TO SECURITY HAS YOUR ORGANISATION MADE, OR DOES IT INTEND TO MAKE, TO ADDRESS IIOT SECURITY CONCERNS? (%)
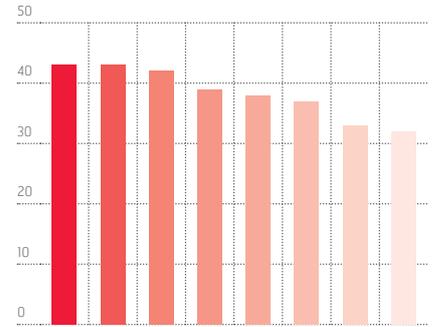
- Investing in new security technologies
- Creation of an internal IIoT security policy
- Training employees on IIoT
- Securing physical assets such as sensor nodes
- Communicating to customers on the use of IIoT
- Upgrading existing security technologies
- Hiring skilled staff
- Creation of an external IIoT security policy for suppliers and partners

75%

are working with partners to ensure the ongoing security of their IIoT initiatives

Energy companies are taking more remedial action than other sectors to address security issues related to IIoT

DATA USAGE

HOW ADVANCED IS THE ENERGY SECTOR'S APPROACH TO IIOT DATA? (%)

— All sectors average (750 respondents)
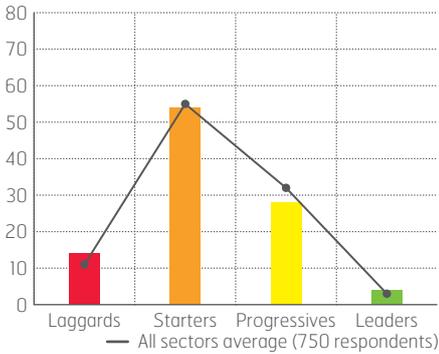
The majority of energy respondents fall into either the laggard or starter categories when it comes to their approach to using IIoT data. While these results are broadly in line with the overall sample, it is clear that many in the sector haven't yet worked out how to use the data generated by their IIoT solutions to the best effect; though this improves toward the distribution end of the chain.

Over half of distribution companies expect to use the data generated by their IIoT solutions to monitor and improve productivity (57 per cent) and identify cost-saving opportunities (53 per cent). Somewhat understandably, extraction companies are chiefly concerned with the opportunity to use IIoT data to better monitor environmental changes (38 per cent) and to improve health and safety (43 per cent).

It is notable that 10 per cent of energy respondents – and 17 per cent of those from energy exploration – have no plans to use their data at all. With these companies not unlocking the value of the potential insights from their accumulated data, it isn't yet the new oil.

However, despite their intentions, it is clear that there are a number of barriers that stand in the way of energy companies' ability to use it effectively. Security is just one of the challenges that must be navigated – 33 per cent of energy respondents overall cited concerns about the security of the data they capture. Interestingly, fears about the misuse of data were the most pronounced in distribution companies, who are grappling with

how to best manage the vast customer data sets that grid management and smart metering systems are furnishing them with.

A lag between the data being collected and it being available is another pressing issue that needs to be addressed, with 40 per cent of energy companies overall and almost 49 per cent of distribution companies citing this as a challenge to being able to use their data effectively. As much of the data generated by IIoT is important for providing real-time insight, this inability to take data and make it actionable, say to redivert power in the grid, stands as a major barrier to the effectiveness of IIoT implementations in the sector.

The security challenges reported go some way to explain why access to IIoT-generated data is heavily restricted in the sector. Taking extraction companies as an example, just 3 per cent of respondents stated that data was readily available to anyone within the organisation to access and use, with 28 per cent reporting that it was strictly the preserve of the IT department and senior management.

By their own admission, it is this restriction of access that is preventing many organisations from using their data as effectively as they could be, with 40 per cent identifying this is a barrier.

Respondents report that they have, on average over 2,000 IIoT sensors in the field, each of which will be a valuable source of real time business intelligence. However, while the sector has great ambitions for its IIoT data, until these challenges are resolved, their initiatives will struggle to meet their full potential.

**WHAT CHALLENGES DOES YOUR ORGANISATION FACE IN USING DATA AS EFFECTIVELY AS POSSIBLE? (%)**
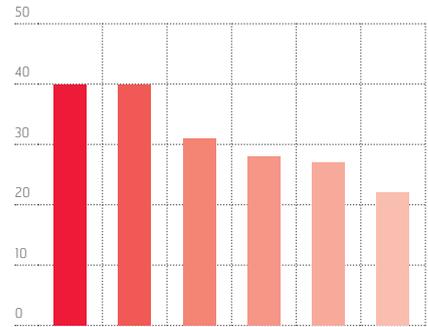
■ Data is only available to certain departments involved in the IIoT deployment

■ There is a lag between data collection and it being available

■ Security/privacy concerns

■ Data is stored in an unusable format

■ We don't have the skills to extract/use data

■ There is such a large volume of data we struggle to utilise it

33%

cited concerns about the security of the data they capture

10 per cent of energy respondents – and 17 per cent of those from energy exploration – have no plans to use their data at all. With these companies not unlocking the value of the potential insights from their accumulated data, it isn't yet the new oil

CONNECTIVITY AND IIOT TECHNOLOGIES

HOW WELL IS THE ENERGY SECTOR ADAPTING TO THE CONNECTIVITY REQUIREMENTS OF IIOT? (%)

— All sectors average (750 respondents)
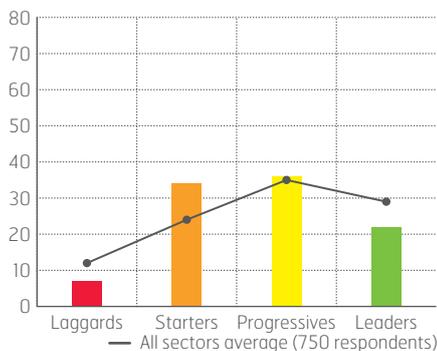
Energy respondents are – generally speaking – able to secure the reliable connectivity they need to support their IIoT initiatives. Just a quarter of respondents identified connectivity as one of the biggest challenges facing their IIoT deployments and only around a third (32 per cent) thought that connectivity issues could hold them back – numbers that are significantly lower than those reported by other sectors.

However, looking deeper at the subsectors that we surveyed, we can see marked differences, with some achieving better connectivity levels than others. Distributors led the way here, a trend that can in some part be attributed to their in-built advantage in accessing the necessary connectivity for their IIoT deployments via grid systems and their distribution linking them to connected urban areas.

On the other hand, extraction and exploration companies struggled more with their connectivity levels, which no doubt factors into the relatively low levels of IIoT adoption in these segments of the market. 43 per cent of extraction businesses stated that connectivity was one of their biggest IIoT challenges – significantly higher than the 14 per cent of distribution companies that thought the same. Additionally, over half (51 per cent) of extraction respondents reported that they struggle to access reliable connections.

Satellite is playing a critical role in enabling energy extraction businesses to transmit IIoT data from remote locations. 70 per cent of these organisations stated that satellite was essential for delivering their IIoT-based solutions, while on average 38 per cent of IIoT data was transmitted via satellite within these organisations – considerably higher than satellite usage seen in the energy distribution market (where this figure sat at 25 per cent).

However, satellite is just one part of the connectivity mix, and most organisations will find themselves using satellite in conjunction with a range of cellular, fibre and radio networks to support their IIoT deployments. Fibre is playing a particularly significant role in the connectivity mix, with 57 per cent of respondents citing it as key to supporting their IIoT networks, with radio networks following close behind with 54 per cent, cellular on 49 per cent.

Connectivity is, however, just one part of the picture as the effectiveness of IIoT initiatives depends upon users' ability to take the data generated by sensors and action it to drive better business outcomes. This is where the new wave of wireless data collection technologies, which enable edge processing and real time data routing, come in to the frame and bring these solutions to life. It is notable then, that over a third (37 per cent) of energy companies are not using any such technologies at all.

Where they are being deployed, however, RFID came out as the most commonly-used in the sector, selected by 30 per cent of respondents to support their IIoT initiatives, followed by Bluetooth Low Energy (BLE) (20 per cent). LoRaWAN is particularly popular amongst the energy distributors we surveyed, with 16 per cent using the technology, compared to just 8 per cent of extraction companies.

DOES YOUR ORGANISATION STRUGGLE WITH RELIABLE CONNECTIVITY WITH ITS IIOT DEPLOYMENTS? (%)
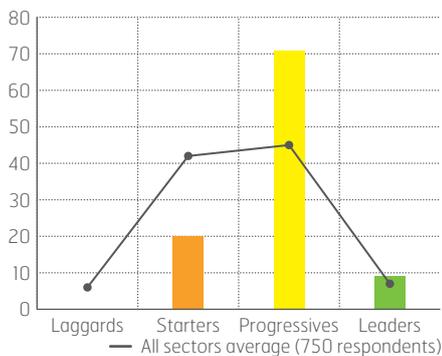

■ Strongly agree
■ Agree
■ Disagree
■ Strongly disagree
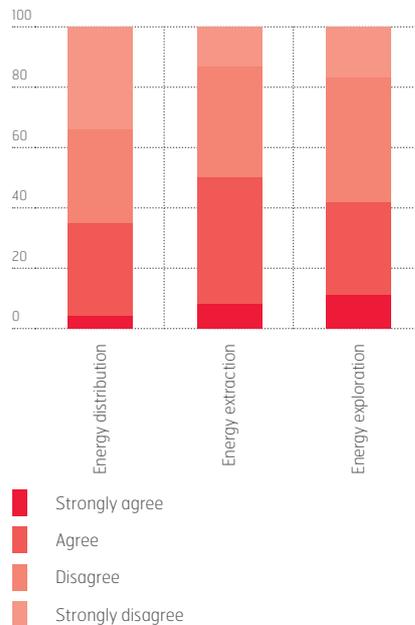
42%

of energy companies struggle to access reliable connections for their IIoT deployments

As IIoT deployment accelerates, extraction businesses will have an ever-increasing demand for reliable data transmission, and it is satellite connectivity that will meet this demand

INVESTMENT AND ROI

HOW WILL THE ENERGY SECTOR INVEST IN IIOT? (%)

Legend:
— All sectors average (750 respondents)

Bar chart categories: Laggards, Starters, Progressives, Leaders
Y-axis: 0, 10, 20, 30, 40, 50, 60, 70, 80

The current and planned investment in IIoT-based solutions by energy respondents points to a higher level of maturity than witnessed in all of the sectors in this report, with 80 per cent of respondents falling into the IIoT progressive or IIoT leader category. Respondents expect to invest an average of $4 million in IIoT initiatives over the next three years, amounting to a not insignificant 9 per cent of their overall IT budgets.

There are, however, clear differences in the planned spend on IIoT at a subsector level. Energy distributors expect to devote 12 per cent of their IT budgets to IIoT over the next three years, around double the amount of those involved in extraction and exploration (6 per cent respectively).

While smart grids will fundamentally change the way that energy is consumed, there is significant opportunity for IIoT further upstream at the point of production. This disparity in spend therefore suggests that those involved in extraction and exploration are limiting the scope of their transformations.

This plays out in the data when we look at how respondents expect IIoT technologies to impact their revenues. Distribution companies expect their investments in IIoT to deliver an additional 11 per cent to their turnover over the next five years; extraction companies by contrast expect to increase their revenues by 8 per cent during the same timeframe. While this is still a respectable figure, it does beg the question of what these companies could achieve by upping their investments in IIoT.

Cost savings are also high on the agenda, and energy respondents expect to shave around 19 per cent off of their operating costs from their use of IIoT within the next five years. Such a saving could be a boon for oil companies in particular, enabling them to streamline their operations and insulate themselves from the impact of commodity price shocks in the sector.

The high level of cost saving that the energy industry expects from its IIoT deployments reflects the key drivers influencing the development of IIoT solutions. Improving resource efficiency ranked as the highest-rated driver for IIoT deployments (60 per cent), with reducing costs in business operations (48 per cent) also motivating many energy businesses to develop and deploy IIoT.

While the potential for IIoT to improve the efficiency of operations and cut costs is well understood, energy businesses should also be investing in this potentially revolutionary technology to develop new streams of revenue. Energy businesses cannot go on operating as they have before, with the price of oil unlikely to reach the heady days of $140 barrel, so new streams of revenue will be essential.

However, just 3 per cent and 6 per cent of energy extraction and exploration businesses are using IIoT to generate new revenue streams, while 27 per cent of distribution business are doing so. This perhaps explains the lower expectations in the upstream for turnover increase due to IIoT, while also reflecting an inability to analyse the data they have.

WHAT OPERATIONAL COST SAVINGS AND TURNOVER INCREASES IS YOUR ORGANISATION LIKELY TO ACHIEVE THROUGH ITS USE OF IIOT? (%)
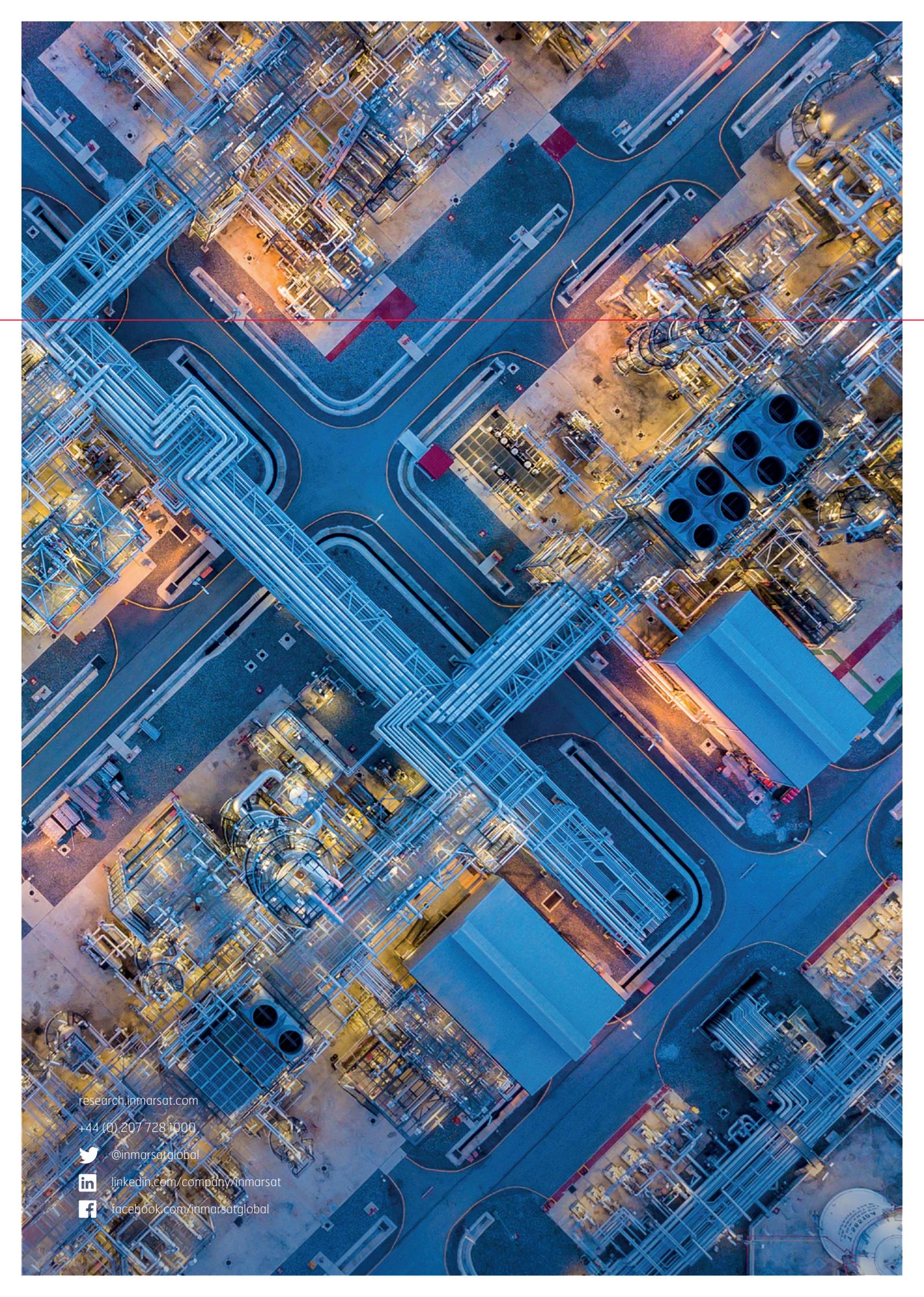

X-axis: Currently, In 12 months, In 3 years, In 5 years
Y-axis: 0, 4, 8, 12, 16, 20
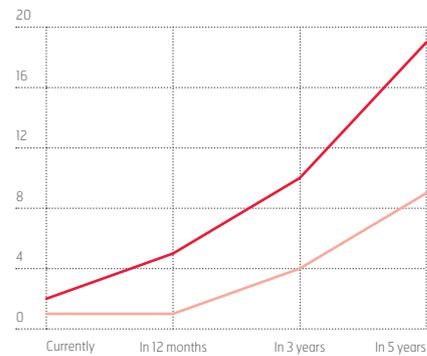
Legend:
■ Average cost savings
■ Average turnover increase

11%

increase in turnover expected over the next five years due to IIoT

Upstream energy businesses should look beyond cost savings and follow the lead of their downstream counterparts, investing in IIoT to develop new streams of revenue

research.inmarsat.com

+44 (0) 207 728 1000

@inmarsatglobal

linkedin.com/company/inmarsat

facebook.com/inmarsatglobal