KPMG

A Galaxy of Opportunities

Next generation utilities

Next generation utilities will increasingly be managed from space.

The commercial space revolution is already well underway. SpaceX alone has launched thousands of satellites in recent years. Published company proposals suggest there will be well over 100,000 in orbit by the end of the decade, up from around 2000 in late 2018, as private companies seek to exploit the wealth of commercial opportunities in the new space economy. With such technology fast becoming the commercial norm, new space data sources are opening up novel possibilities to innovate products and services every week, creating opportunities few sectors can afford to ignore. Utilities, with their sprawling networks of large, remote and complex assets, have more to gain than most.

The utilities transition

Utilities are the life support of the modern state. The production, storage, and distribution of energy and water are literally mission critical for domestic, business and government operations. And yet, they are not only frequently reliant on depreciated assets but highly vulnerable to compromise by a range of natural or deliberate events. Above-ground energy distribution lines are exposed to trees and flying debris. Underground pipes and lines are easily dislocated by earth movements. Leaks and breakages are inevitable. Given their vast scale, utility grids are also indispensable to global efforts to reduce environmental impacts — especially through decarbonization.

As a result, energy utilities find themselves under growing pressure to increase efficiency and reliability. The cost of leaks — whether of energy, water, or any other primary resource — grows higher year by year. At the same time, they face a net-zero inspired energy production revolution, requiring them to simultaneously grow network capacity and integrate distributed energy technologies such as electric vehicles (EVs), local and household renewable production, modular reactors, and battery storage systems and microgrids. This revolution is set to vastly amplify grid complexity compared to the current operational reality, and will all take place in a context of heightened public awareness and scrutiny. Accommodating these changes amounts to a major challenge for the sector, which can only be met through the adoption of new technologies.

"Where we think there's a winning play is in industrial activity monitoring. Emissions in the supply chain are really hard to measure, but we can help monitor activity and verify some of the claims your supplier might be making."

Anthony Baker
Founder and CEO
Satellite, the Thermal Imaging company

How space technology can help

The rapid emergence of new space-for-earth technologies is therefore both timely and consequential for utilities. Space tech, especially the fast-growing capabilities and number of satellites, is a new tool in the arsenal for utilities looking to revolutionise efficiency, output, disaster risk reduction, grid management, and response. Specifically, we think there are four key areas where they can help:

1. Predictive maintenance — Asset management

New asset-monitoring capabilities offer vast potential. Earth observation (EO) satellites allow operators to cost-effectively monitor assets anywhere on earth, in multiple wavelength bands of the electromagnetic spectrum. Optical, multispectral, hyperspectral, synthetic apperture radar (SAR) and thermal capabilities allow operators to determine a wide range of operationally important phenomena in their networks. Real-time understanding of asset condition, damage, or leaks, as well as encroaching hazards such as vegetation, floodwater or fire can revolutionise situational awareness, allowing operators to deploy highly accurate risk mitigation responses, while remote sensors allow continuous performance monitoring across the gamut of relevant metrics. Such insight can help enhance grid operation and reliability and allow companies to optimise resource allocation, dramatically reducing the need for costly manual inspections, often in remote and hazardous areas.

> **"With hyperspectral imagery you get an extra layer of information. You're really diving into the chemistry of what you're looking at."**
>
> **Kshitij Khandewal**
> CTO
> Hyperspectral Imagery company Pixxel

2. Load forecasting/Disaster risk reduction and response

Extreme weather events and natural disasters are a huge cost for utilities, which space tech can vastly reduce. EO data is no less useful for mapping the environment around assets than for the assets themselves. Soil erosion, flooding, weather patterns, water movement, wildfire location and direction of travel are among the many data points that can predict damaging natural phenomena, buying time for utilities to anticipate their response as well as helping them optimise the placement of assets to minimise future risk. In the aftermath of damaging natural events or human attacks, satellites and sensors can allow operators to identify those assets in need of repair more quickly and so minimise downtime.

3. Grid optimization

With the advent of localized generation at scale through the roll-out of residential solar power, balancing the electricity grid becomes more challenging, to ensure that power input equals power output. These space capabilities will play an important role in understanding the efficiency and output of solar assets and as a result managing the safety and capacity of this more modular grid.

Increased understanding of asset performance and risks through these datasets is also enabling better planning of the location of future networks and renewable generation assets.

4. Power generation

Having been the subject of speculation for decades, solar power from space may become a commercial reality in the coming decade, with space agencies such as the European Space Agency (ESA) already evaluating practical plans for space-based renewable energy generation. Even relatively small-scale deployment of this technology has the potential to power hard-to-reach locations and specific high-energy use facilities, which can help operators smooth the load on grids.

But proponents of the technology foresee much wider impacts, with space solar eventually meeting a game-changing proportion of the world's future energy needs.

What does the market opportunity look like?

Based on simple assumptions, KPMG International has made high-level estimates of the value and revenue from Earth Observation technologies for energy and gas utilities. The value generated by 2040 is expected to grow four-fold to $1.19b USD across the G20.

Revenue and value across G20 countries	Total EO revenue ($b USD)	Utilities Revenue ($b USD)	Utilities Value ($b USD)
2023	10.7	0.2	0.36
2030	25.6	0.4	0.65
2040	67.8	0.9	1.19

> **"You want to get involved with EO and analytics because, with new sensors and new technology on the horizon, Earth Observation applications are going to progress exponentially. So if you're not involved you're going to be behind."**
>
> **Alisa Starkey**
> Founder Chief Science Officer
> Ozius

What could go wrong?

Adoption of space tech by utilities remains in its infancy. For the sector to make the most of the huge potential on offer, it will need to address at least three clear choke points:

1. **Lack of sectoral awareness:** While these capabilities exist already, many of them are novel and fast-evolving. Utility companies are often simply unaware of what space tech can offer, unsure of its application in their particular service or product suite, or unclear of how to integrate it into their operations.
2. **Technology gap:** Operators may wish to integrate EO data but lack appropriate technical readiness and governance to ensure the data isn't purchased, ingested, and integrated to no useful end. Most operators will need a significant upfront investment in both time and capital to be properly prepped to receive EO data and make use of it.
3. **Skills gap:** Operators may wish to integrate EO data but lack human resource to properly interpret and exploit it. EO data is complicated and likely to remain opaque to companies without specialist EO scientists available, whether in-house or on contract. For providers of the data, greater data accessibility will be a key differentiator, rapid uptake will only occur when the relevant data can

be integrated with existing platforms and systems, a capability which is strongly in the interest of platform owners to develop.

Regulatory challenge: using space data for power and utility (P&U) applications may be subject to regulatory approval and compliance. P&U may comply with national and international regulations related to data privacy, security, and transmission.

"Some of the challenges are around making use of the data. It's a pretty unique data set and when you have something for which there is not enough precedent and companies don't have teams of scientists to work on the data itself, we have to put the effort into solutioning it ourselves."

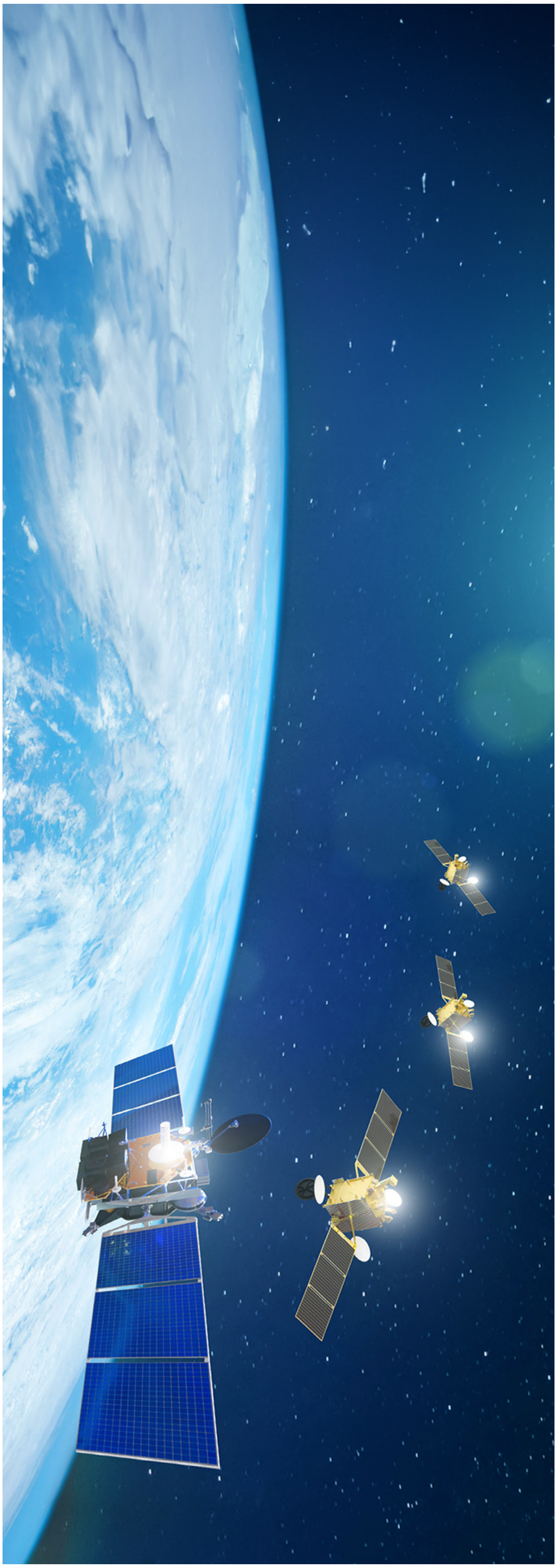
Kshitij Khandewal
CTO
Hyperspectral Imagery company Pixxel

The time is now

The new space economy is already a commercial reality. Its services are live and expanding rapidly, and are likely to impact many sectors. Those players who can understand space tech's potential early and identify positive cost-benefit use cases for their business model are likely to gain an edge over their competition, which will only compound as the technology evolves. EO companies stand ready to support them on this journey.

"EO can provide utilities with critical information and insights that can be used to optimize operations, improve efficiency, reduce cost, and increase reliability. By leveraging EO data, utilities can better manage their assets, monitor environmental impacts, respond to disasters, plan, and design new infrastructure, and in the case of power utilities they also can manage energy consumption."

Franceli Jodas
Global Leader, Power & Utilities
KPMG in Brazil



How KPMG professionals can help

Strategy

Government space — Collaborating with state and federal governments on key space matters including policy and program design, implementation, and economic analysis.

Defence space — Working with defence space organizations and strengthening relationships between defence and other government departments, international partners and allies in support of access to the space domain. Developing defence space policy and architecture and supporting the current and future growth of a skilled space workforce and industry.

Cross-sector capabilities — Helping to perform a whole-of-space-sector analysis and assessing the various capabilities that can support government, industry and academia.

Deals and funding — Supporting cross-functional due diligence, mergers, acquisitions and divestitures as well as introducing and educating investor communities looking to engage in the space sector.

Data and Technology

Engineering and asset management — Performing engineering and asset management assessments of complex space systems, enabling reliability, maintainability, compliance, and cost- effective operations.

Technology and cyber security — Defining informational, operational and emerging technology strategies, architectures and roadmaps across critical infrastructure, space and non-space technologies.

Space data — Translating the potential benefits and use cases of space-based remote sensing and communications data to enable downstream on-Earth applications.

Operations

Supply chain optimization — Collaborating with organizations strategically and operationally to help analyze, plan, build, model, and run optimized wide-ranging operations.

Legal and regulatory — Helping to navigate the complexities of the legal and regulatory compliance requirements of operating in space.

Human capital and workforce development — Understanding the dynamic labor market to help deliver insights and decision support to shape the incoming and outgoing workforce.

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Designed by Evalueserve | Publication name: A galaxy of opportunities — Next generation utilities | Publication number: 138798-G | Publication date: June 2023