The metaverse at work

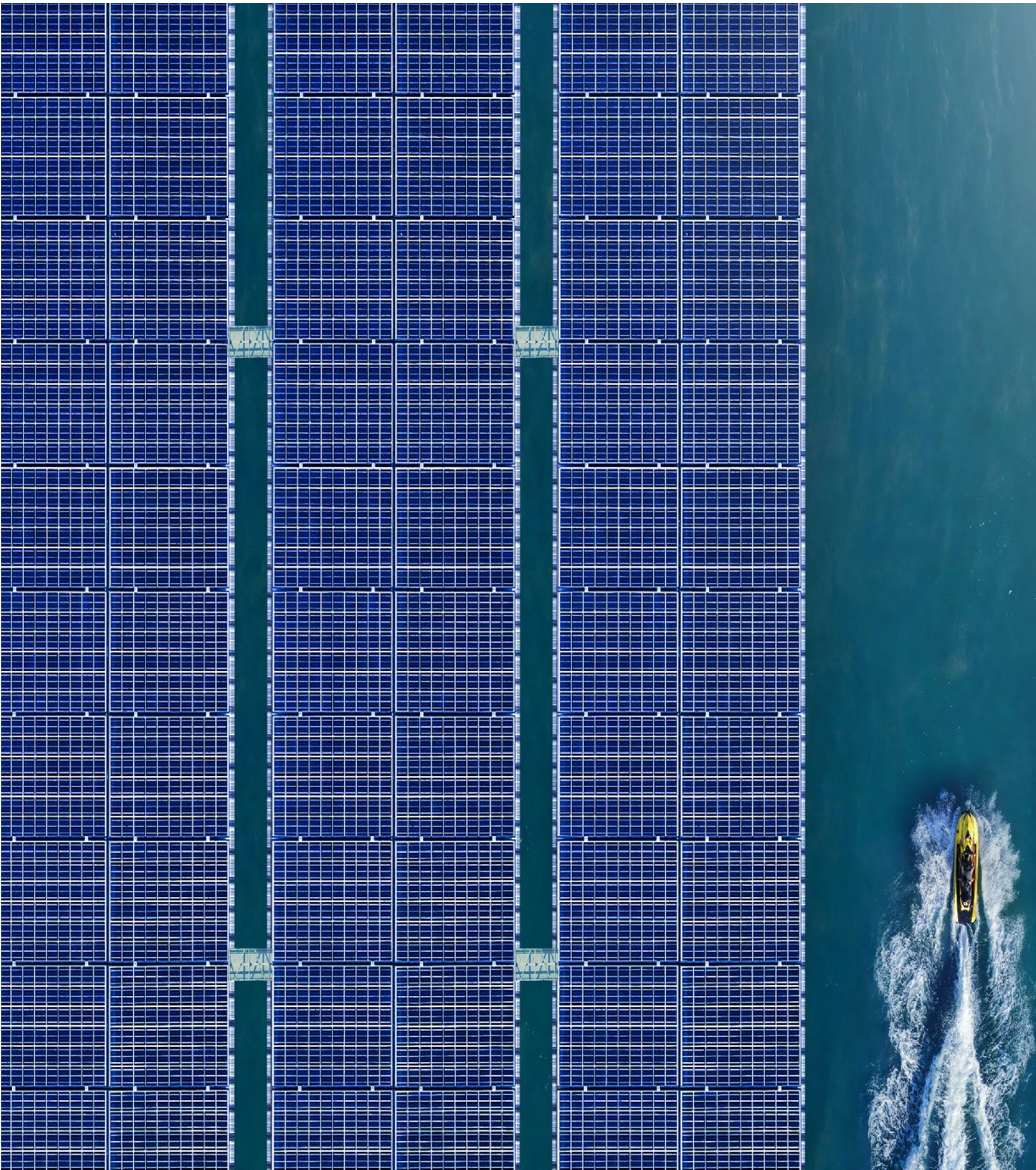**Power and utilities industry deep dive**

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EY
Building a better working world

NOKIA

The metaverse at work

Contents

About this study

This report is based on qualitative interviews, independent research and 240 survey responses from the power and utilities industry. This research represents a subset of the overall research conducted by the EY organization and Nokia in creating the executive report "The Metaverse at Work."

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1 The state of the industrial and enterprise metaverses today

Power and utilities companies today are undergoing revolutionary change – from integrating emerging technologies and advancing infrastructure to rethinking the future business model to adapt to disruption from electric vehicles (EVs), renewables and more. The burgeoning demand for change has spurred investment and acceleration of industry 4.0 capabilities, from AI to improved data management. Leaders are now looking to metaverse as an expansion of these efforts, to enable immersive and simulated virtual experiences to improve safety and efficiency and strengthen collaboration.

Although power and utilities falls slightly behind other industries like automotive and transportation, supply chain and logistics in speed of adoption, there is notable activity around metaverse in the industry and an expectation of growth in the near future, with 53% of power and utilities respondents having piloted or deployed one or more use cases to date [Figure 1].

For the 47% of inexperienced respondents in power and utilities, plans to use the metaverse will come to fruition in the next two years. Ninety-two percent of inexperienced respondents today plan to pilot or deploy a use case within that timeframe [Figure 2].

Power and utilities in the US and South Korea appear to be outpacing other countries in use of the industrial and enterprise metaverses. In South Korea, generally, there are demonstrated efforts at a public and private level to bring emerging technologies to businesses and consumers in these countries. Specifically in power and utilities, Daesung Private Equity, a subsidiary of Daesung Group, an industrial energy conglomerate, formed an US$83m metaverse fund, based on the expectation that the technology will be an "industry-wide gamer changer." At a public level, the infusion of large subsidies for metaverse at the local, state and enterprise levels to promote early adoption is notable. In 2022, South Korea invested nearly US$200m in metaverse technology development.

Our survey polled business leaders with interest in using the metaverse. Within this population, 53% overall are experienced – having already deployed or piloted a metaverse use case today.

Figure 1: Hands-on metaverse experience today, by subsector in power and utilities

	Experienced companies 1+ use cases deployed, piloted	Inexperienced companies Planning to deploy
All respondents	53%	47%
USA	61%	39%
South Korea	60%	40%
Germany	53%	47%
UK	52%	48%
Brazil	50%	50%
Japan	49%	51%
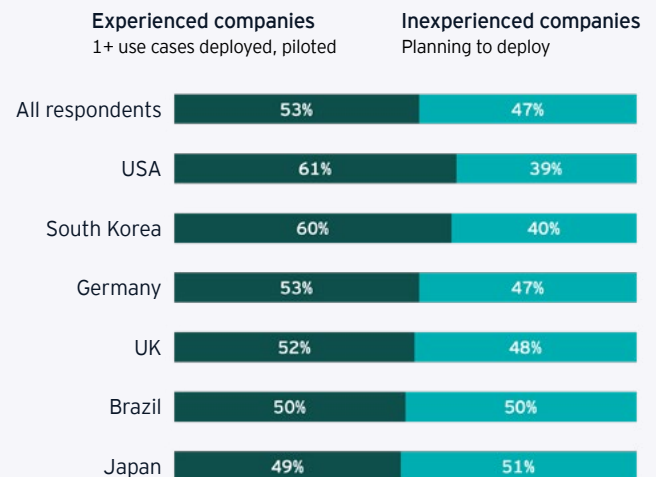
Figure 2: Estimated time to use the metaverse, among power and utilities respondents with no pilots or deployments

Metaverse use today

53% have 1+ use cases deployed, piloted

47% have not deployed a use case to date

Time to deploy, among non-users today

Of the 47% of respondents who have not deployed or piloted a use case to-date,

92%

92% plan to use the metaverse or related technologies in the next two years
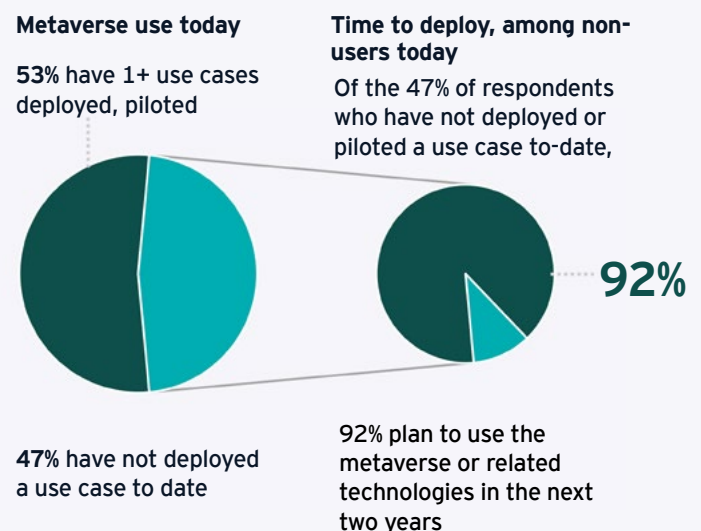
2 Top industrial use cases

based on the expected impact reported by respondents in the power and utilities industry

The power and utilities industry has an opportunity to intertwine digital and physical worlds using the metaverse across the value chain, from more immersive technical training using data to simulate realistic scenarios, to collaborative design in the metaverse and grid optimization using high-fidelity digital twins. Based on our survey, respondents have identified three industrial use cases with the greatest potential opportunity to impact their business:

Field XR

The use of XR technology to augment the capabilities of technicians working within facilities and on equipment and machinery in open and remote locations was seen as the highest impact application of metaverse technology for power and utilities companies. Respondents in operations functions at power and utilities companies reported greater confidence in the potential for transformative change, although leaders across other functions were also overwhelmingly positive about the promise of field XR.

6% Deployed

39% Planned use this year

Figure 3: Key benefits of field XR

Process efficiency	37%
Enhanced service and CX	35%
Safety improvement	30%

Figure 4: Impact of field XR

	Total	Operations function	Other functions
Significant Impact	34%	25%	36%
Transformative impact	39%	44%	38%

■ Significant Impact   ■ Transformative impact
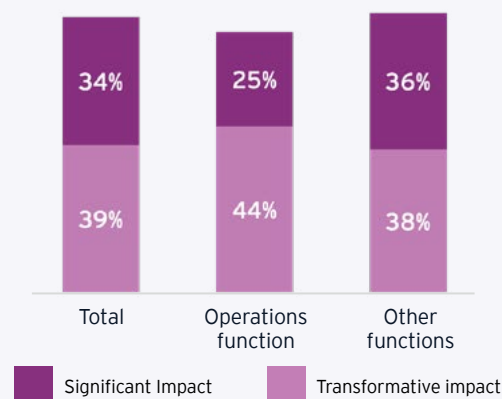
Virtual grid optimization

For power and utilities companies, the opportunity to better plan and track the grid in a high-fidelity, virtual setting was seen as having the second-highest potential impact of the industrial metaverse use cases. One reason may be the large risk involved with any changes to the grid, given any failure can have a real impact on the lives of customers. The use case was seen as having huge potential by power companies but was even stronger for other utilities like water and waste management.

> " You don't need the metaverse and VR for this. There are other traditional ways to run different grid scenarios, but they are 2D and can be hard to interpret."

Director of Digital Innovation, US-based utility

7% Deployed

29% Planned use this year

Figure 5: Key benefits of virtual grid optimization

Process efficiency — 42%
New offerings and business models — 42%
Enhanced service and CX — 37%
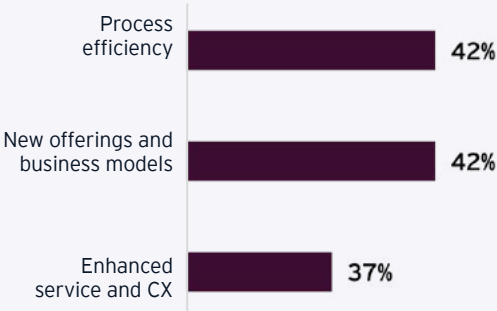
Figure 6: Impact of virtual grid optimization

	Total	Power subsector	Utilities subsector
Significant Impact	47%	47%	50%
Transformative impact	34%	33%	40%
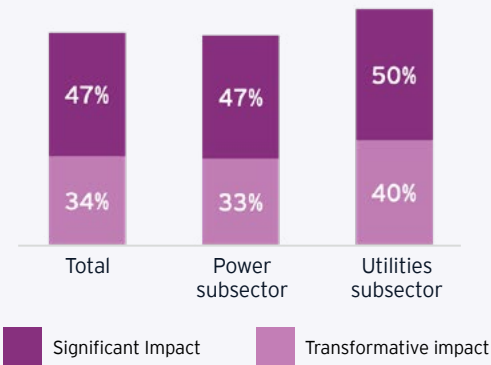
Virtual R&D, prototyping and testing

Like other industries, the ability to enhance virtual design and engineering tools using metaverse technology is seen as a key application of metaverse technologies and a relatively straight forward next step in overall digitalization efforts. This application is the most deployed to date in the power and utilities industry, with companies like Gamesa using the technology to significantly improve the accuracy and speed of programs used in designing renewable energy capture devices.

9% Deployed

34% Planned use this year

Figure 7: Key benefits of virtual R&D

Sustainability — 47%
Enhanced service and CX — 47%
New offerings and business models — 45%

Figure 8: Impact of virtual R&D

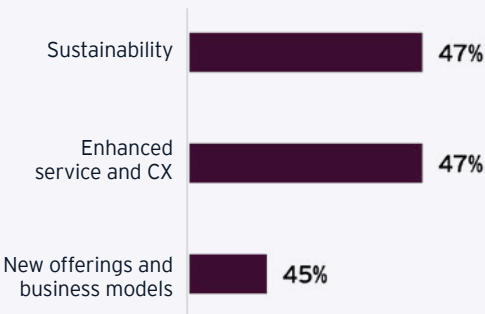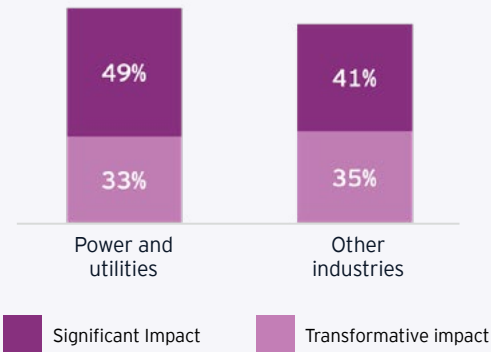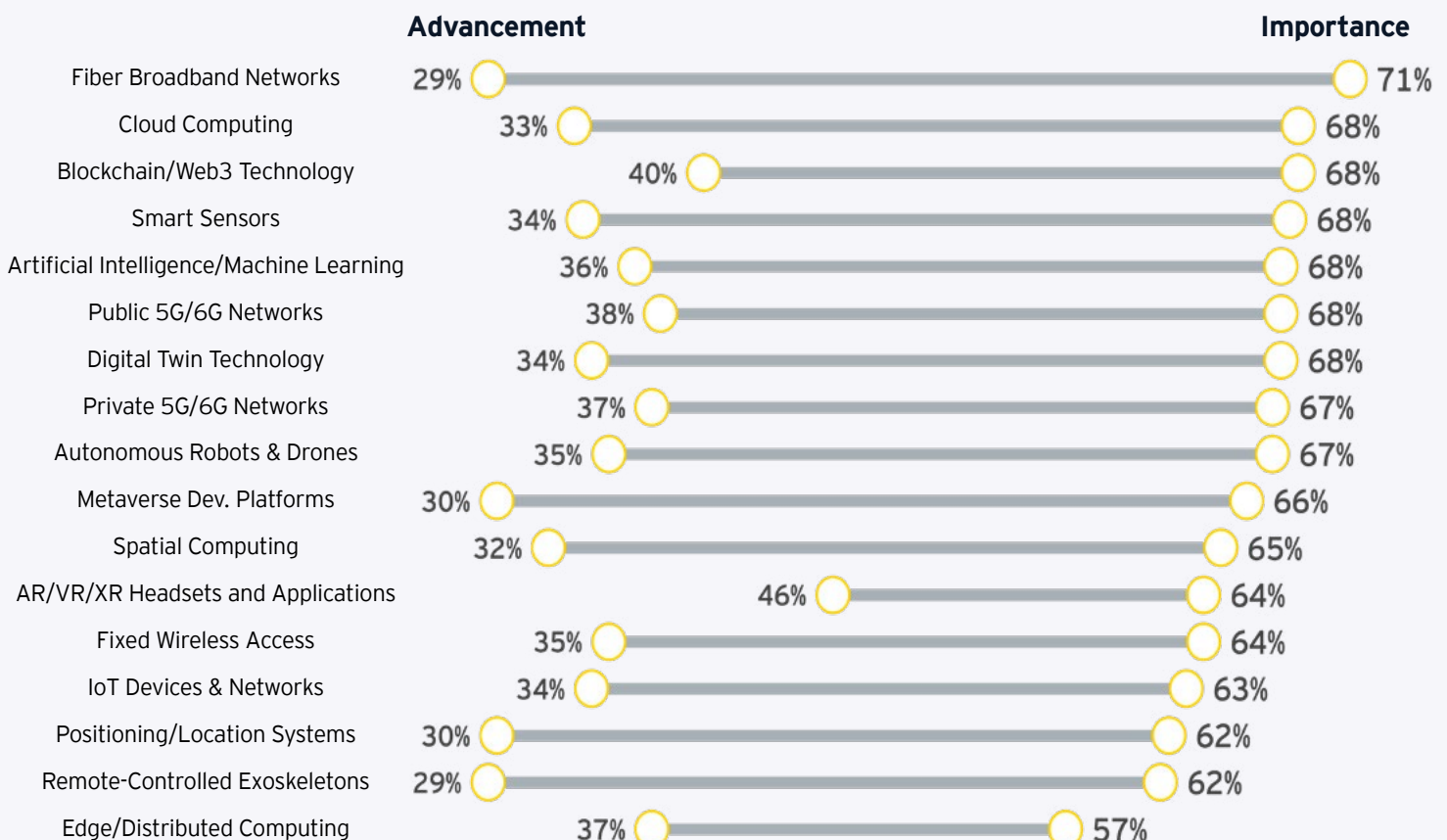|	Power and utilities	Other industries
Significant Impact	49%	41%
Transformative impact	33%	35%

3 Key enablers and partners to deploying the metaverse

Across all industries, there are a clear set of enablers that stand out as highly critical, underpinning the success of metaverse use cases. Connectivity (fiber, public and private networks), cloud computing, AI, machine learning and IoT capabilities are essential building blocks to creating low-latency experiences and simulations with effective data capture, processing and storage capabilities as the backbone.

There are some enablers that power and utilities respondents rank slightly higher than respondents across other industries – like Web3/blockchain and digital twins. Power and utilities companies are driving forward use cases like virtual grid optimization, in which the essential metaverse enabling technologies around data, connectivity, sensors and AI are key, but also may benefit from the use of additional technologies like blockchain to aid the tracking of data transactions and maintain a single source of truth. Similarly, digital twin technology must be highly precise to allow for realistic, accurate scenario planning and testing of the power grid.

Figure 9: Top-ranked enablers by importance, compared to the level of advancement in using them

	Advancement	Importance
Fiber Broadband Networks	29%	71%
Cloud Computing	33%	68%
Blockchain/Web3 Technology	40%	68%
Smart Sensors	34%	68%
Artificial Intelligence/Machine Learning	36%	68%
Public 5G/6G Networks	38%	68%
Digital Twin Technology	34%	68%
Private 5G/6G Networks	37%	67%
Autonomous Robots & Drones	35%	67%
Metaverse Dev. Platforms	30%	66%
Spatial Computing	32%	65%
AR/VR/XR Headsets and Applications	46%	64%
Fixed Wireless Access	35%	64%
IoT Devices & Networks	34%	63%
Positioning/Location Systems	30%	62%
Remote-Controlled Exoskeletons	29%	62%
Edge/Distributed Computing	37%	57%

Today, companies across industries rely heavily on partners to drive the deployment of metaverse use cases.

Figure 10: Key partners for most impactful power and utilities use cases

	Ranked most important: Partners to deploy use case	**Ranked 2nd:** Partners to deploy use case	**Ranked 3rd:** Partners to deploy use case
Field XR	Network/networking equipment providers	XR/metaverse platform providers	Professional services firms
Virtual grid optimization	Big tech	Gaming companies/engines	AI/ML providers
Virtual R&D, prototyping and testing	Industrial equipment/tech providers	Network/networking equipment providers	Professional services firms

When asked which partners are critical for deploying key use cases, power and utilities either already, or plan to, rely on providers of essential enabling technologies to drive success. A wide variety will be leveraged, from network providers to ensure low-latency speed within data pipelines and visualized experiences, to industrial equipment and technology providers to ensure smart sensor capabilities capture data in real-time to drive simulations in the metaverse. Like other industries, power and utilities are already leaning on big tech partners to deploy transformative use cases. In New Zealand, Vector Limited and X, the Moonshot Factory (Alphabet-owned), are working together on grid network virtualization and simulation technologies to reimagine the design,

management and operation of electricity networks and get ahead of increasing energy demands.

At this stage, partnerships can be a hurdle to overcome in beginning or scaling metaverse use cases, as the partner landscape is scattered, with most partners equipped to offer specialized services or technologies. Companies are often tasked to curate a group of partners, all of whom must integrate solutions to drive a use case or metaverse ecosystem to success. More than other industries surveyed, power and utilities companies report a preference to depend on professional services firms, likely to aid in planning partnerships and tactical strategy in use case development, as they have for past digital deployments.
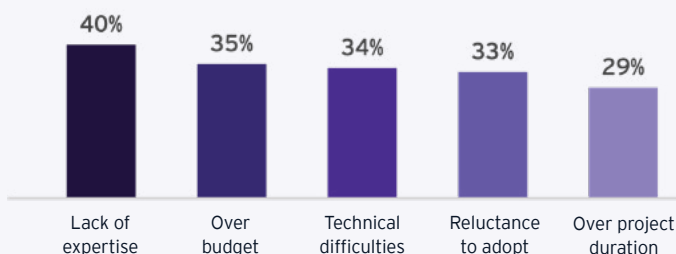
4 Challenges in the industrial and enterprise metaverses

Power and utilities companies face similar headwinds in employing the metaverse as other industries, like struggling to find the right internal expertise to drive business cases for the metaverse, as well as to execute and track the value of use cases.

Figure 11: Top challenges for power and utilities companies already piloting or deploying 1+ use case

| 40% | 35% | 34% | 33% | 29% |
| Lack of expertise | Over budget | Technical difficulties | Reluctance to adopt | Over project duration |

There are some unique nuances that may stall momentum in power and utilities. For example, one utility reported in research interviews that even as a large company, they lack the specialized knowledge internally to deploy and, in particular, scale use cases and worry lack of expertise could trail even more at smaller utilities. At a functional level, those in operations functions at power and utilities companies are slightly less worried about expertise than those in other functional areas, like IT or digital innovation. This is likely because of their length of experience with key technical enablers like smart sensors, IoT and AI, which have been critical technologies in the operational space for years.

Securing and staying within budget is a concern overall, but especially in geographies like the US, where, in some markets (e.g., California), regulators require companies to prove the value of internal initiatives to the end customer before securing investment. Across industries, leaders have expressed challenges in quantifying the benefits of metaverse, especially in addition to industry 4.0, and power and utilities is no different. This is potentially a barrier for some to take initial steps and for first movers to scale.
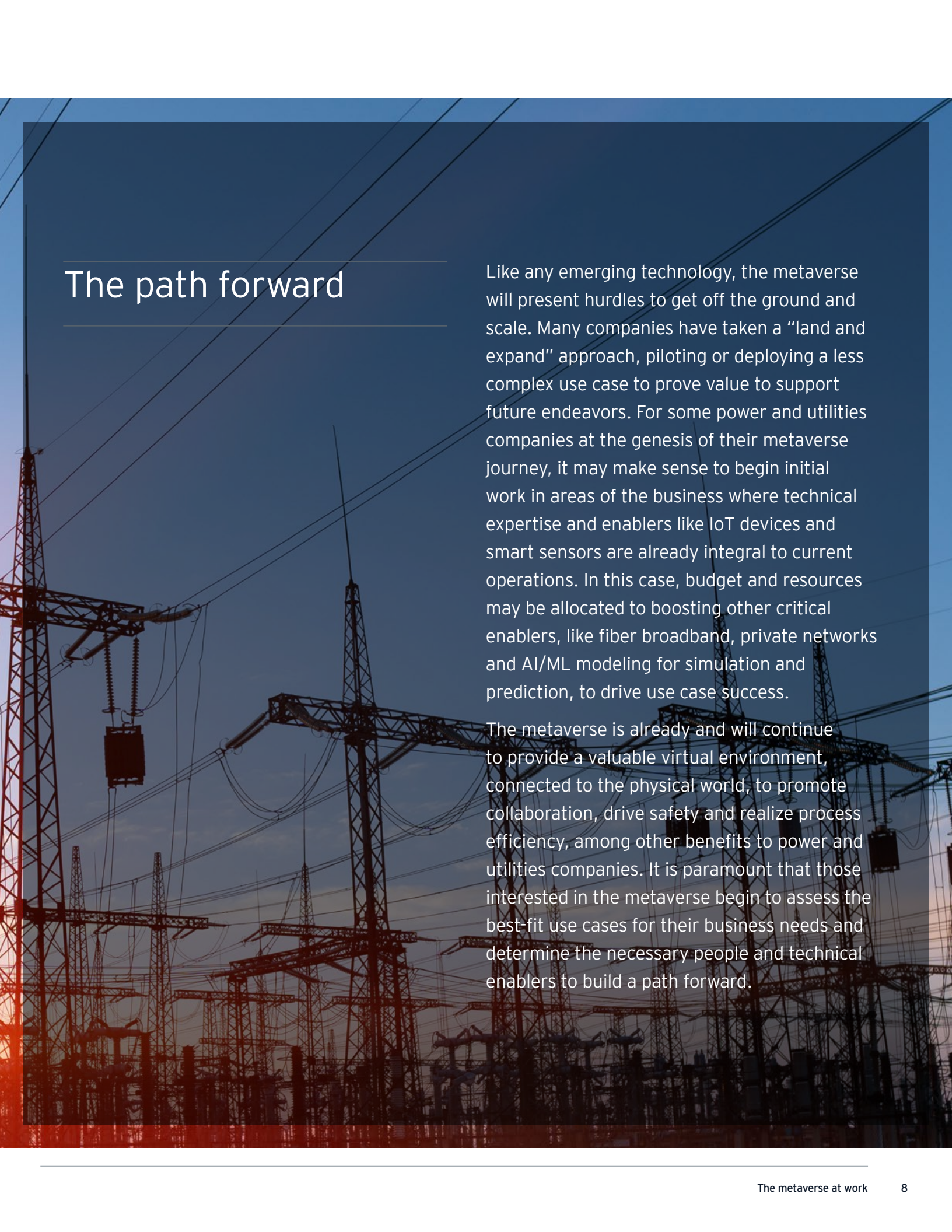
"

We will have to stand in front of regulators and justify the investment by how it benefits customers. Safety is an option, but we would again have to quantify the benefits."

Director of Digital Innovation, US-based utility

The path forward

Like any emerging technology, the metaverse will present hurdles to get off the ground and scale. Many companies have taken a "land and expand" approach, piloting or deploying a less complex use case to prove value to support future endeavors. For some power and utilities companies at the genesis of their metaverse journey, it may make sense to begin initial work in areas of the business where technical expertise and enablers like IoT devices and smart sensors are already integral to current operations. In this case, budget and resources may be allocated to boosting other critical enablers, like fiber broadband, private networks and AI/ML modeling for simulation and prediction, to drive use case success.

The metaverse is already and will continue to provide a valuable virtual environment, connected to the physical world, to promote collaboration, drive safety and realize process efficiency, among other benefits to power and utilities companies. It is paramount that those interested in the metaverse begin to assess the best-fit use cases for their business needs and determine the necessary people and technical enablers to build a path forward.

Appendix: other use cases

While power and utilities respondents have found field XR, virtual grid oprimization and virtual R&D, prototyping & testing to be the most impactful use cases overall, there are a range of other use cases companies are considering.

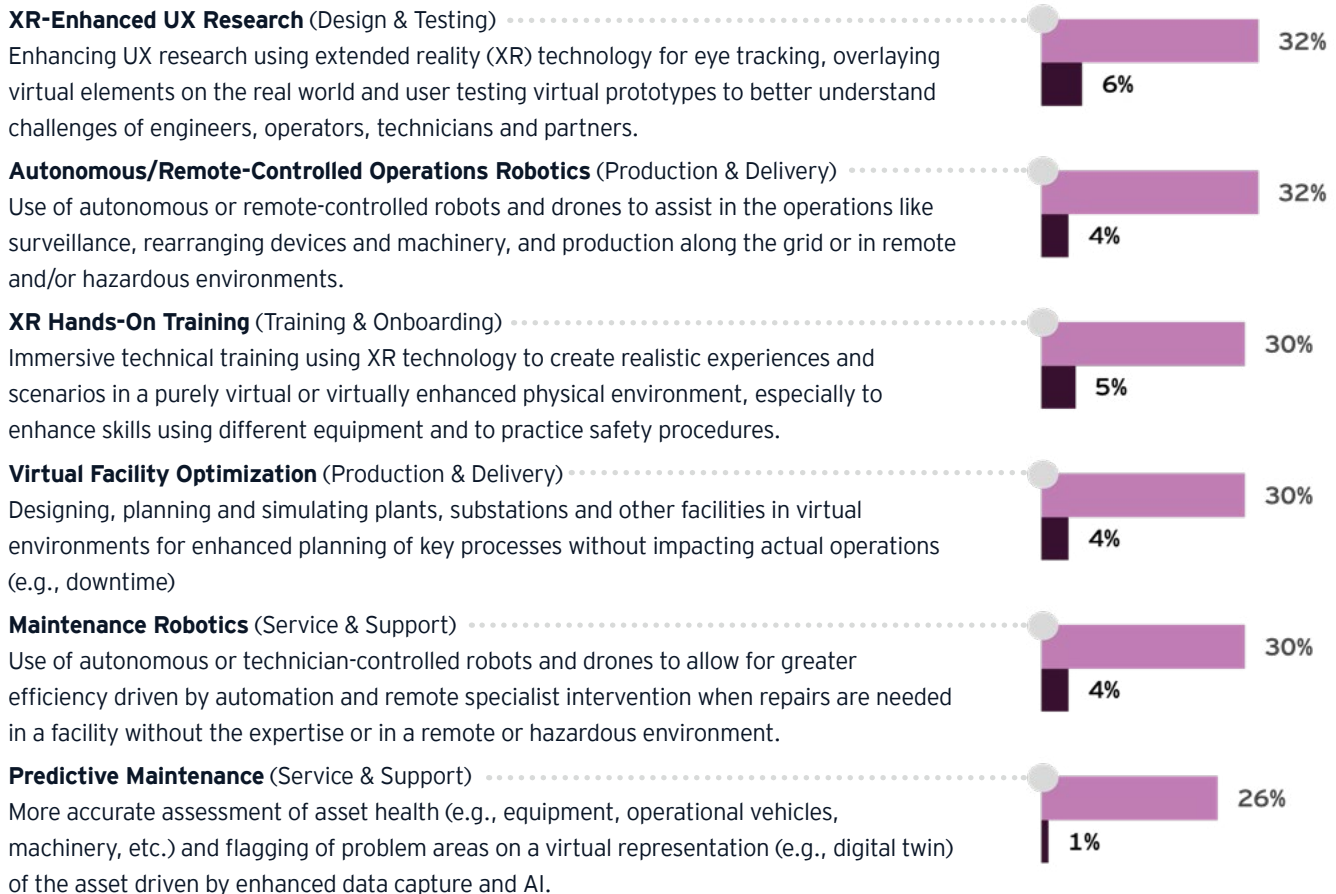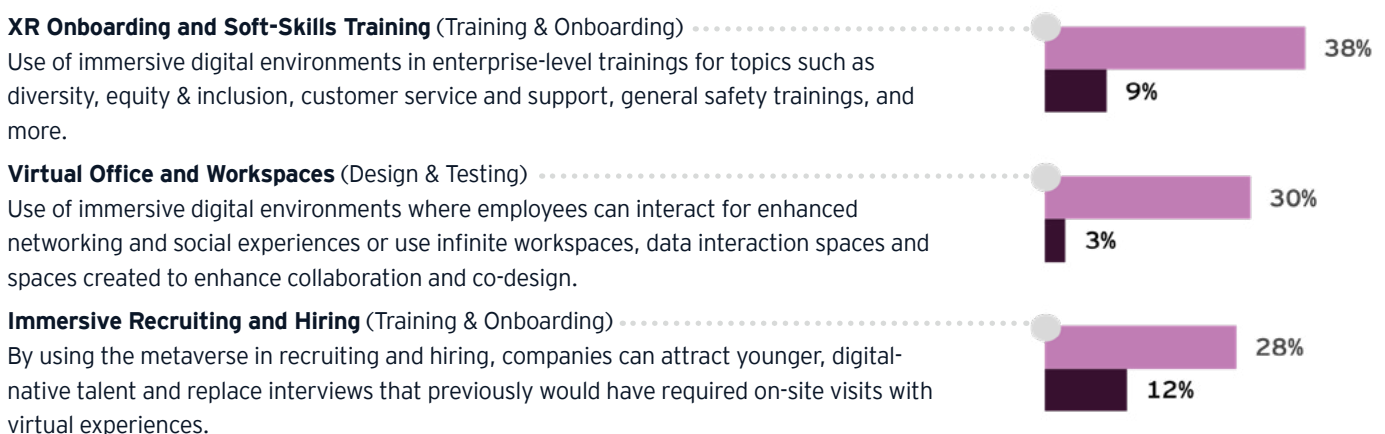**Figure 12:** Impact and deployment of other industrial metaverse use cases (ranked 4-9)

XR-Enhanced UX Research (Design & Testing)
Enhancing UX research using extended reality (XR) technology for eye tracking, overlaying virtual elements on the real world and user testing virtual prototypes to better understand challenges of engineers, operators, technicians and partners.

32%
6%

Autonomous/Remote-Controlled Operations Robotics (Production & Delivery)
Use of autonomous or remote-controlled robots and drones to assist in the operations like surveillance, rearranging devices and machinery, and production along the grid or in remote and/or hazardous environments.

32%
4%

XR Hands-On Training (Training & Onboarding)
Immersive technical training using XR technology to create realistic experiences and scenarios in a purely virtual or virtually enhanced physical environment, especially to enhance skills using different equipment and to practice safety procedures.

30%
5%

Virtual Facility Optimization (Production & Delivery)
Designing, planning and simulating plants, substations and other facilities in virtual environments for enhanced planning of key processes without impacting actual operations (e.g., downtime)

30%
4%

Maintenance Robotics (Service & Support)
Use of autonomous or technician-controlled robots and drones to allow for greater efficiency driven by automation and remote specialist intervention when repairs are needed in a facility without the expertise or in a remote or hazardous environment.

30%
4%

Predictive Maintenance (Service & Support)
More accurate assessment of asset health (e.g., equipment, operational vehicles, machinery, etc.) and flagging of problem areas on a virtual representation (e.g., digital twin) of the asset driven by enhanced data capture and AI.

26%
1%

Figure 13: Impact and deployment of enterprise metaverse use cases

XR Onboarding and Soft-Skills Training (Training & Onboarding)
Use of immersive digital environments in enterprise-level trainings for topics such as diversity, equity & inclusion, customer service and support, general safety trainings, and more.

38%
9%

Virtual Office and Workspaces (Design & Testing)
Use of immersive digital environments where employees can interact for enhanced networking and social experiences or use infinite workspaces, data interaction spaces and spaces created to enhance collaboration and co-design.

30%
3%

Immersive Recruiting and Hiring (Training & Onboarding)
By using the metaverse in recruiting and hiring, companies can attract younger, digital-native talent and replace interviews that previously would have required on-site visits with virtual experiences.

28%
12%

Expect transformative impact   Deployed

Endnotes

1. Kaaru, Steve, "The global metaverse hub: Why South Korea is investing $200M in its metaverse ecosystem," Coin Geek, 5 Jan 2023, https://coingeek.com/the-global-metaverse-hub-why-south-korea-is-investing-200m-in-its-metaverse-ecosystem/.

2. Park, Danny, "South Korea launches online metaverse replica of capital city Seoul to improve public services," 17 Jan 2023, https://forkast.news/headlines/south-korea-metaverse-capital-city-seoul/.

3. Goschenki, Sergio, "Korean VC Firm Daesung Private Equity Announces $83 Million Metaverse Fund," Bitcoin.com, 3 Dec 2022, https://news.bitcoin.com/korean-vc-firm-daesung-private-equity-announces-83-million-metaverse-fund/.

4. Vector, "Vector collaborates with X, the moonshot factory, to virtualise Auckland electricity network and support energy decarbonisations," 28 September 2021, https://www.vector.co.nz/news/vector-collaborates-with-x.

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