# 2022 CIGRE Conference Impression


**by Mike Sheppard, Saqib Saeed, and Greg Sheppard – at Power Technology Research**

**Headline:** A mix of optimism and anxiety this year greeted CIGRE attendees as a global energy crisis and urgency to move towards clean energy solutions leads to massive grid investment. Can the current regulatory framework support or inhibit what will be the largest grid investment since its inception?

# Overview

The CIGRE Paris session, which ended just four weeks ago, was a mix of optimism and anxiety. The conference was attended by more than 9,000 attendees from 120 counties, out of which 35% were from the electrical utilities and 25% from the manufacturing sector. In past sessions, attended by PTR, focus was on optimization and improvements to make the grid more efficient, communicative, and more secure. These themes, though still present, took a back seat as much of the world faces an unprecedented energy crisis. As all attendees in CIGRE already know, this will only be possible with massive investments made to existing and new infrastructure, at a scale never seen. According to IEA, global electricity grid investments reached USD 290 billion in 2021. However, all stakeholders at the conference agreed this investment needs to increase several fold to ensure that the power grid is ready for clean energy transition.

*Source: CIGRE*

Four members from the PTR team attended CIGRE 2022 session: Mike Sheppard, Chris Burg, Saqib Saeed, and Greg Sheppard. Below is their take on the conference and a summary of the key findings:



**Mike Sheppard, CEO**
of Power Technology Research,

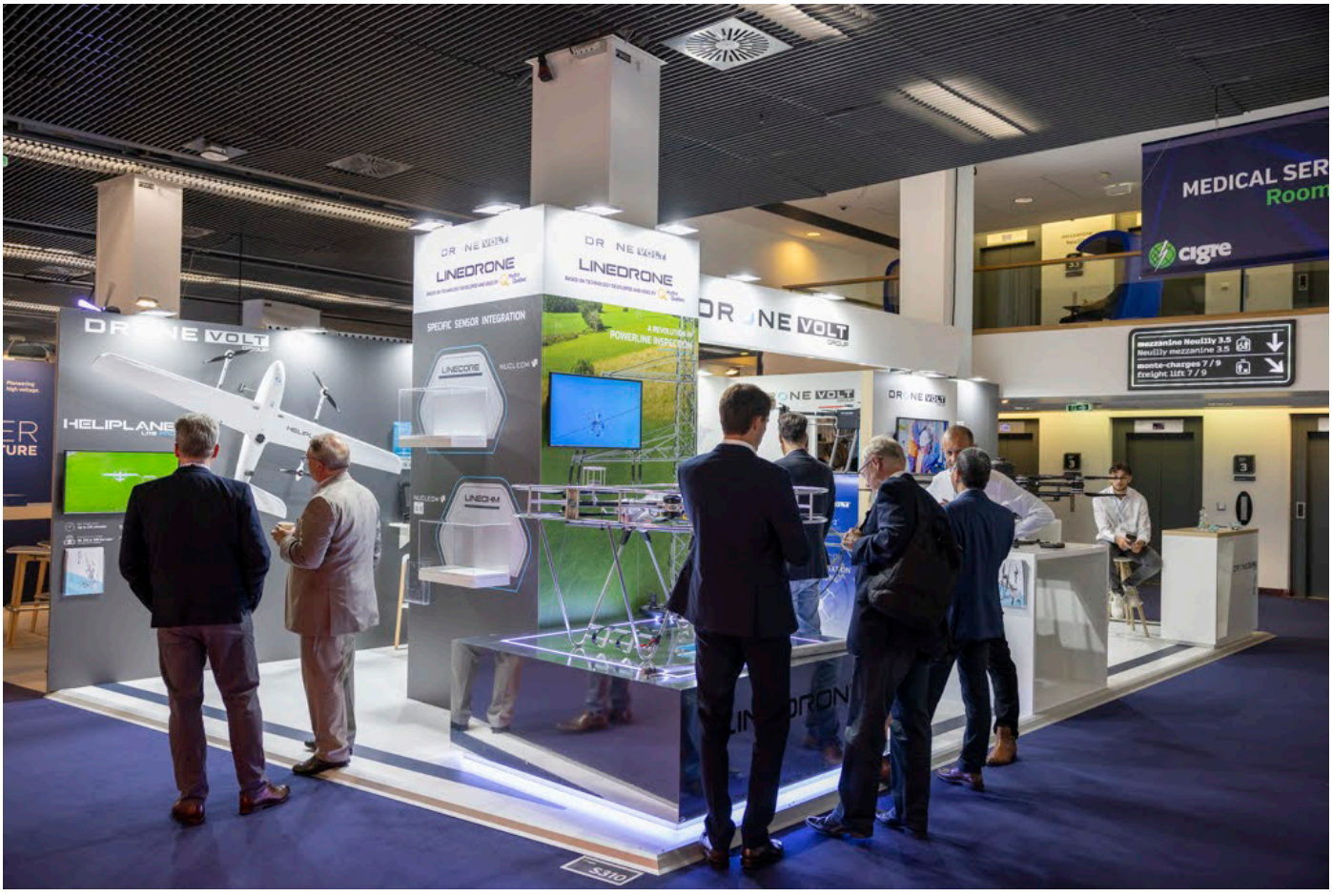
talks about the importance of redesigning regulatory frameworks, especially the ones which can support the introduction of new technological solutions.

## Catalyzing Regulation

Both suppliers and buyers of power equipment see the need for regulation as they continue to provide stable energy to the end-customer, but lingering troubles such as a sluggish regulatory environment and the rate of new technology adoption, are now in the forefront. The good news in this sector is that one of the main catalysts of change, political will is already changing. This translates into new, and even more relaxed policies to be implemented to support the larger power generation objectives already stated. In the coming months, new working groups are likely to be designed to better address this most important aspect for the industry.

## The Right Kind of Infrastructure

Just more capacity is not the only objective as recent announced bans on $SF_6$ means this new infrastructure should be as green as possible. For many switchgear suppliers, this has been a long-time effort, and it was great to see smiling faces from product managers that have invested what seems equal parts policy/regulatory investment and technology to make it a reality. A result is that we saw many $SF_6$ alternatives, which had a large presence at the session, with specific product offerings reaching the 400kV level which is the highest AC transmission voltage in many European countries. The critical aspect here is the speed at which systems operators and utilities can get through testing and start deploying these systems into their networks. PTR will certainly be keeping a close eye on this technology deployment.




*Source: CIGRE*




**Saqib Saeed, Chief Research Officer**
of Power Technology Research,

writes about his take on technology readiness and CIGRE's crucial role in clean energy transition.

## Technology is Here, it's Just Matter of Policy and Adaptation

One of the most common themes of the technical sessions at CIGRE Paris meeting was that technology is ever evolving, and we already have enough technological innovation to cultivate carbon neutral solutions. If we keep waiting, thinking technology is not mature enough, the grid will eventually become a bottleneck to energy transition - instead of being a tool to accelerate it. Although there is urgency, we need long term results instead of quick fixes and a patchwork of solutions. In fact, several new products have been introduced in the market with the aim to support carbon neutrality. With regards to technology, the focus is two-fold; products or solutions which can accelerate energy transition and reducing the carbon footprint of existing solutions.

## Voices of Collaboration Across the Industry

Previously, some companies were not fully onboard with the idea of energy transition and supported solutions that were not very environmentally friendly. Now they realize that it is futile to push against the momentum of energy transition and there seems to be a harmonious collection of voices, thinking and strategy in the power system industry. With that harmony, there was a clear call of collaboration among all industry players. Even some giants of industry, which have always competed head-to-head, seemed to be on the same page on energy transition and environmentally friendly products and solutions.
Additionally, PTR observed that the environmentally friendly solutions already available for commercial use, or in the process of being developed, are not unidimensional and have diverse technological base. For example, eradicating $SF_6$ from the power systems industry was a major topic this year and the proposed solutions included $SF_6$ alternative gases, vacuum, and pressured air (Nitrogen). This is excellent for the industry as addressing a problem through a diverse set of solutions can cover a boarder spectrum of applications/end-uses. PTR believes that this mind set of collaboration is going to function as a catalyst for the power system industry to become an accelerator for energy transition.

## Reaching the Policy Makers

CIGRE is a fantastic platform that brings all the industry players under one roof and as discussed above, the echo of collaboration was heard at the conference. However, it is important that CIGRE ensures this voice does not stay limited to the confines of the conference but makes its way to the key decision and policy makers. Recently, the European Commission announced a proposal to put a ban on the use of $SF_6$ in electrical equipment. The proposal lays out a step-by-step timeline for discontinuing the use of $SF_6$ in different types of electrical switchgear (see figure below). At the Paris session, different market players also proposed roadmaps of new $SF_6$-free products which seem to have a shorter realization period than what the Commission has proposed.
Therefore, the question is, can CIGRE act as a bridge between industry and policy makers so that the transition towards net zero emissions is fast-tracked?

## EU's proposal to ban $SF_6$ usage in electrical equipment

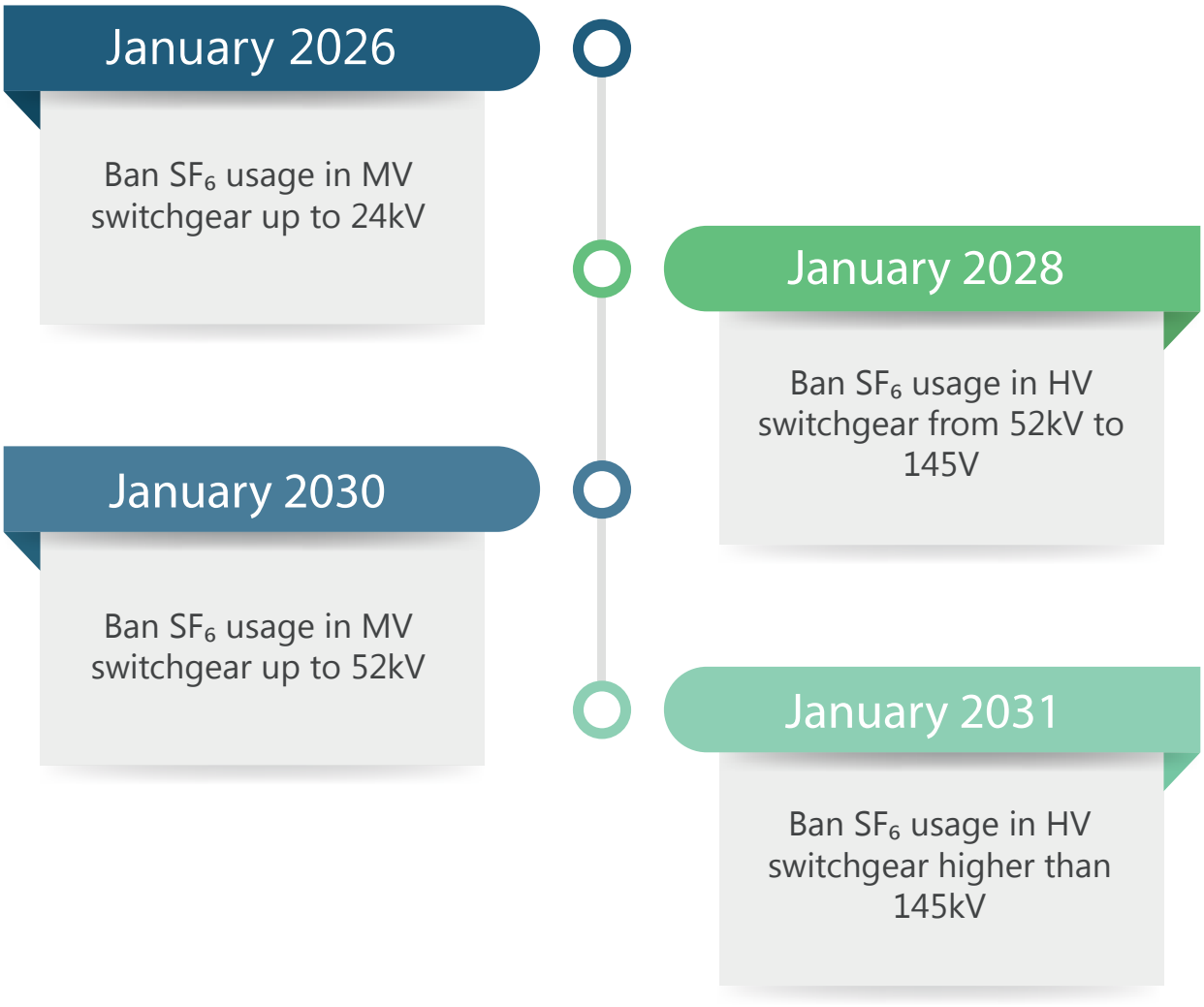



*Figure 1: EU's proposal to ban $SF_6$ from power grid equipment.*

**Greg Sheppard, Research Director**
of Power Technology Research,

found the discussion on Artificial Intelligence and its role in power grid sector very interesting. Here is a detailed analysis of the topic from Greg.

## AI in the Power Sector

Artificial Intelligence (AI) was a hot topic at this year's CIGRE conference. There was a tutorial session dedicated to it hosted by a cross section of stake holders including operators, power technology suppliers, and academicians.
As it turns out, AI has a bipolar personality in the power sector, as it does in other sectors. The promise of improved performance, economics, and safety are what excites, but a lack of a trust track record keeps adoption moderated in an already conservatively adopting sector. There are data analysis and customer interface applications of AI gaining traction in the sector, however, adoption into operations and maintenance are on a slow roll as suitability is being evaluated.

## AI: Buzz Word or Legitimate Solution

There was a range of discussion at CIGRE about whether AI is either a welcome problem solver, too unproven, or even necessary. Why use AI when a simple algorithm such as a linear regression (curve fitting through data points) could do the job for example? The arguments in favor of continuing to pursue AI applicability emanate from solving the overwhelming problems associated with the two big technical trends of the power industry: energy transformation and digitization. As traditional technology struggles to meet the goals of performance, grid stability, and optimized economics AI could potentially help deal with the emerging flood of data and the need to make increasingly complex command, control, and market decisions in shorter time frames.

## 50 Shades of AI

AI is in fact a superset of decision support and decision-making tools. A combination of tool components can be used to implement an AI application. Implementations vary from AI tailored hardware with specialized software frameworks, to smart algorithms running on endpoints and edge computers. Some AI applications are recommendation engines to humans, who use the input to make decisions, and some applications have autonomy to take actions independently. Machine Learning (ML) is one way to educate an AI based process make informed decisions using historical data sets.
A variety of tools to implement AI are being evaluated by groups like CIGRE and EPRI. The toolbox includes different software platforms, algorithms, AI computing hardware, and Internet of Things (IoT) technology. In addition, specific input/output technologies like smart sensors, computer vision, voice recognition, and Natural Language Process (NLP) are used. Some notable AI software frameworks being evaluated include TensorFlow and PyTorch.

## Potential Applications

The range of potential applications identified at CIGRE for AI in power is large and include the following:

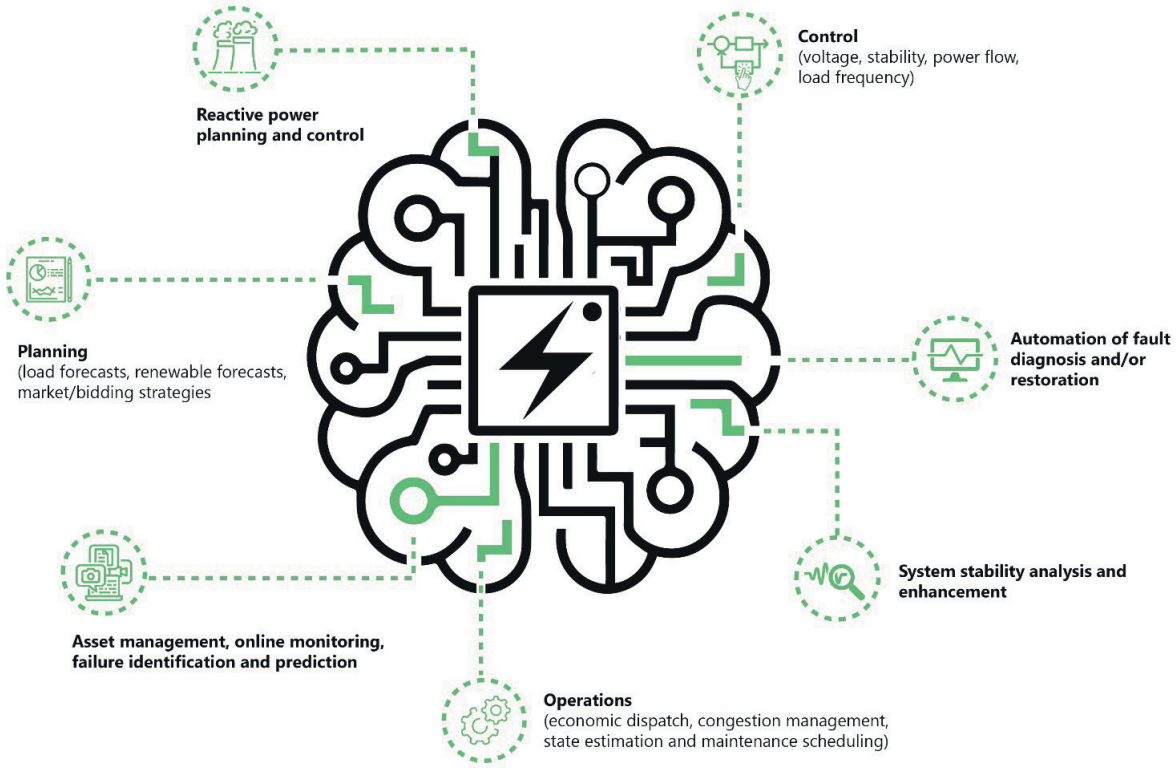



*Figure 2: Potential applications of AI in power sector.*

## Evaluating the Effectiveness of AI

At the conference there were discussions of the suitability of AI for certain applications. Benchmarking against current methods was the most common method of assessing suitability. One example was an evaluation of a set of transformer performance data (1000 transformers with 24 values measured on each) to proactively determine repair or replacement needs. The AI process had a 97% fidelity compared with a human-centric approach to the same data set. Many similar benchmarking efforts are underway by research teams around the world.

## The Trust Thing

Like in in other sectors AI is already being looked at with a wary eye. The power industry is evaluating the technology to see if it really does help with improved operations and economics while public and government entities worry about fairness and privacy. A key trust issue revolves

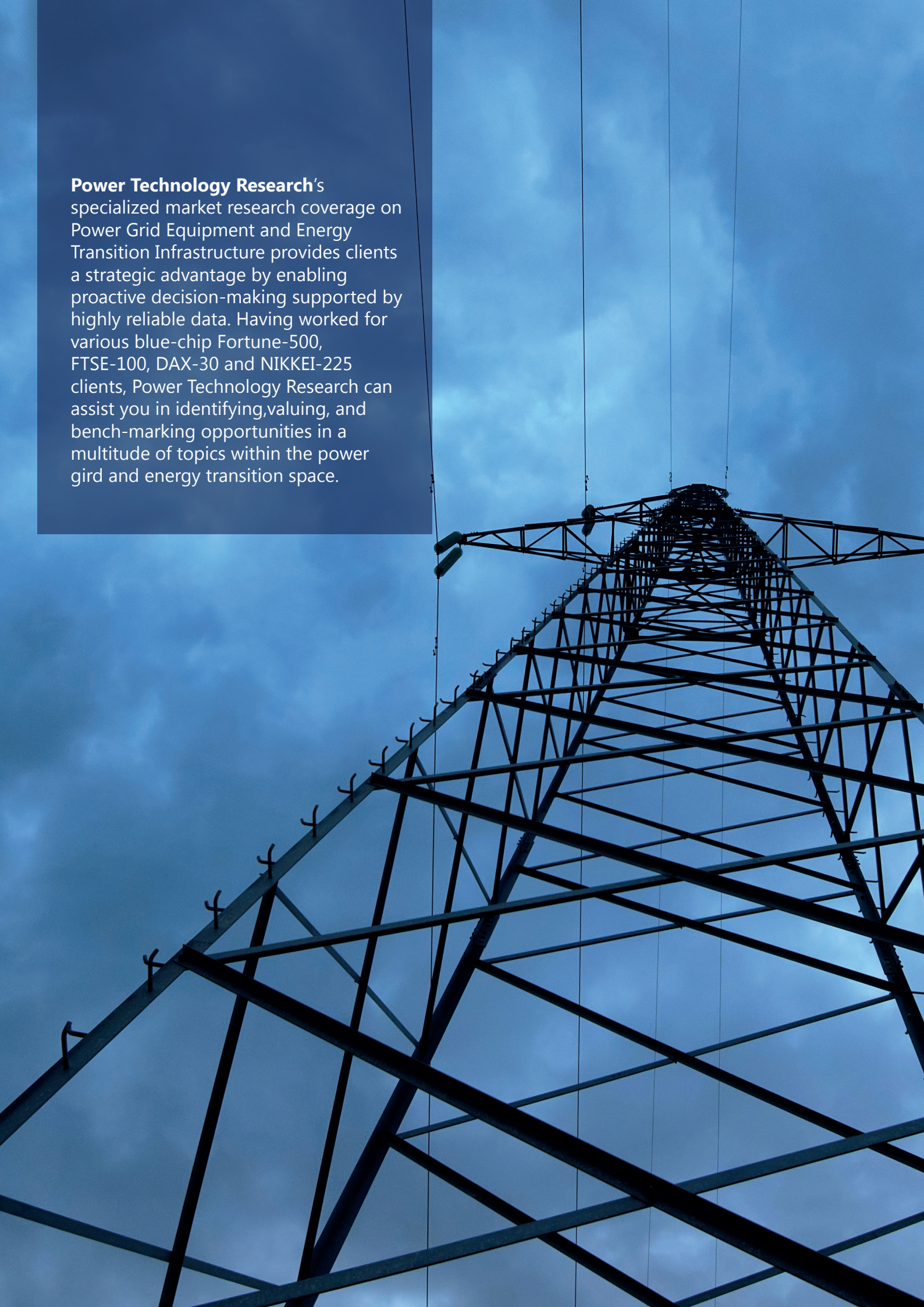
around the ML used to train AI processes and how to avoid the so-called GIGO – Garbage In, Garbage Out trap. To address the trust issue moving forward, extensive outcome testing (back tests and simulations) is being conducted. Another factor in trust building is work being done to increase the transparency within the black box of AI process so that people can trace how the outputs are derived.

## Status of Use

AI applications in the power sector are emerging. Early applications include load and renewables forecasting and visual inspection data analysis (with drones, etc.). Early candidate applications are usually offline and data rich, and which can be benchmarked against traditional methods of analysis to confirm suitability and performance. Another application is in utility customer service operations which are now testing and using AI-based chat bots to help serve customers more effectively and efficiently.

## The Future

More testing, training, simulating, and results evaluation. Work is just beginning as the power sector's technical community starts to dig into AI's toolbox. Almost every entity in the sector is working on evaluation and small-scale implementation of AI in some form.
One of the interesting problems that has occurred is getting access to AI technology experts. It's one of the hottest jobs in the world these days. It's reasonable to expect outsourcing, contracting, and partnering to be critical to evaluating AI suitability moving forward.



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## Specialized Power Grid & New Energy Market Research

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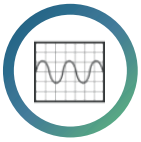
**Switchgear**
(HV, MV)

**Flexible AC Trans. Systems**
(SVCs, STATCOMs)

**Synchronous Condensers**
(4 - Pole, 6 - Pole,...)

**Substation Automation**
(Dist. vs Cent.)

**DC Power Grid**
(Shore to Ship, MVDC)



**Power Factor Correction**
(Active, Passive)

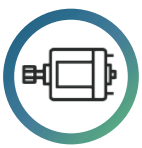
**Grid Communication**
(Private LTE, 5G)

**Industrial Motors & Drives**
(MV/LV - Custom)

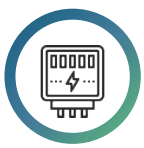
**Comm. & Off-Highway Vehicles**
(BEVs, PHEVs, ICEs)

**Storage Value Chain Monitor**
(Utility Scale, C&I)

**EV Charging Infrastructure**
(Public, Private, Passenger/Comm.)



**EV Traction Motors**
(ACIM, PMSM, HTM)



**Smart Meters**
(Power Quality, AMI)

**HVDC Market Analysis**
(VSC, LCC)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