



Hitachi Energy is the global technology and market leader for transformers, including distribution (liquid-filled and dry-type) and traction transformers

In conversation with

STEPHANE SCHAAL

Global Product Group Manager for Distribution and Traction Transformers at Hitachi Energy's Transformers Business

With more than 100 years of pioneering leadership, Hitachi Energy is a global technology leader that is advancing a sustainable energy future for all. It serves customers in the utility, industry and infrastructure sectors with innovative solutions and services across the value chain. Hitachi Energy is also the global technology and market leader for transformers, including distribution (liquid-filled and dry-type) and traction transformers. It operates this business in about 90 countries and has 25 manufacturing plants of distribution and traction transformers across the world, supporting customer requirements of high reliability, quality and efficiency.

Here is a conversation that we had with Stephane Schaal, who is the Global Product Group Manager for Distribution and Traction transformers at Hitachi Energy's Transformers Business.

Stephane, you have been in the transformer domain for close to two decades – right from a scientist to now leading the global distribution & traction transformers product group for Hitachi Energy's Transformer Business. Tell us about your journey.

After starting my career in the automotive industry, I joined ABB at their Corporate Research Center in Switzerland as a scien-

tist. That was a great opportunity to be part of a truly global, diverse and cutting-edge technology company. Since I was assigned the role to develop insulation materials, I was fortunate to be exposed to a wide range of power products like bushings, instrument transformers, gas-insulated switchgear (GIS), and, more particularly, the dry-type transformers.

After a few years in the research domain, I moved on to lead the product development, initially for dry-type transformers, and subsequently took over the leadership of the global R&D organization for the company's transformers business before stepping into my current role in 2020 – which, by the way, coincided with the transition of the business from ABB to Hitachi Energy. Over the years, I have closely observed the changes that this industry has gone through. I believe these changes are primarily driven by:

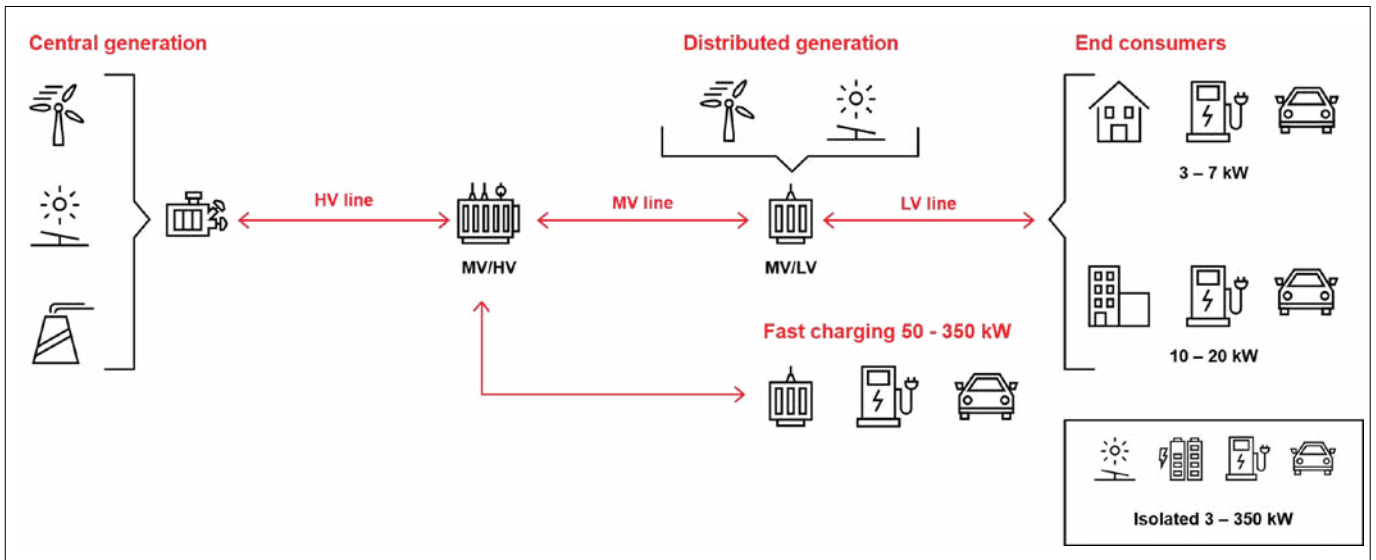
- increased energy efficiency regulations across geographies,
- the transition from fossil fuels to renewable energy generation in addition to increasing digitalization,
- and their impact to both the transmission and (even more) the distribution grids.

Consequently, there is now a paradigm shift in how (and how much) energy we produce and consume.

As you mentioned, you have closely observed the evolution of the grid over the past several years. How do you visualize the future of power distribution grids?

Projections show that electricity generated from renewables will grow from about 20 % today to more than 60 % of the total power generation by 2050 [1].

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Evolution of the power distribution grid

As technology and market leaders, it is our duty to turn these challenges into opportunities through innovation, partnerships and co-creation with our customers and partners

Surely, electricity will be the backbone of the entire energy system. A major contributor to this will be the rapid increase in renewable energy generation. The accelerated shift from fossil-based power to renewable power generation is based largely on the integration of renewable energy sources (Eolic / Wind, photovoltaic, hydro) into the existing distribution grid.

On days when the wind blows strong, or the sun shines hard, the extra power gen-

erated from wind and solar energy installations is injected into the grid. This may create voltage fluctuations, which need to be regulated. At the same time, renewable energy generation has led to the emergence of prosumers, i.e., individuals or institutions that may generate power and sell it into the grid (via rooftop solar, for example) and / or consume it as well. Such is the characteristic of a modern distribution grid that is getting more and more decarbonized but at the same time more

decentralized and bidirectional. Thus, requiring greater levels of control. In other words, much more complex.

And with this complexity come challenges and opportunities.

As you said, the shift in the landscape of the distribution grid will pose challenges as well as open opportunities. How is Hitachi Energy's portfolio of distribution transformers positioned to support customers in this transition?

Today, at Hitachi Energy, it is our role to support our customers and partners through this transition. As technology and market leaders, it is our duty to turn these challenges into opportunities through innovation and co-creation with our customers and partners.



Transformers by Hitachi Energy for distribution and rail traction application (indicative representation)

The distribution transformers business (be it dry-type or liquid-filled) is a very exciting place to be. Energy efficiency standards, decarbonization and digitalization, are creating a very dynamic and challenging environment. These are megatrends and as such, are here to stay for the long term: only the most agile and innovative players will be able to transform the challenges into opportunities. Even in the shorter term, we have to face other challenges like the pandemic, the commodity crunch, geopolitical situations etc.

One needs strong assets to face these kinds of challenges. We at Hitachi Energy are well-positioned for this with:

- a critical and substantial business size with large scale operations
- widest and most comprehensive portfolio in the industry
- global footprint that ensures product availability and cost competitiveness
- our superior innovation capability to develop new solutions.

These assets allow us to best serve our customers across the world.

Furthermore, we have observed that customers from certain industries and seg-

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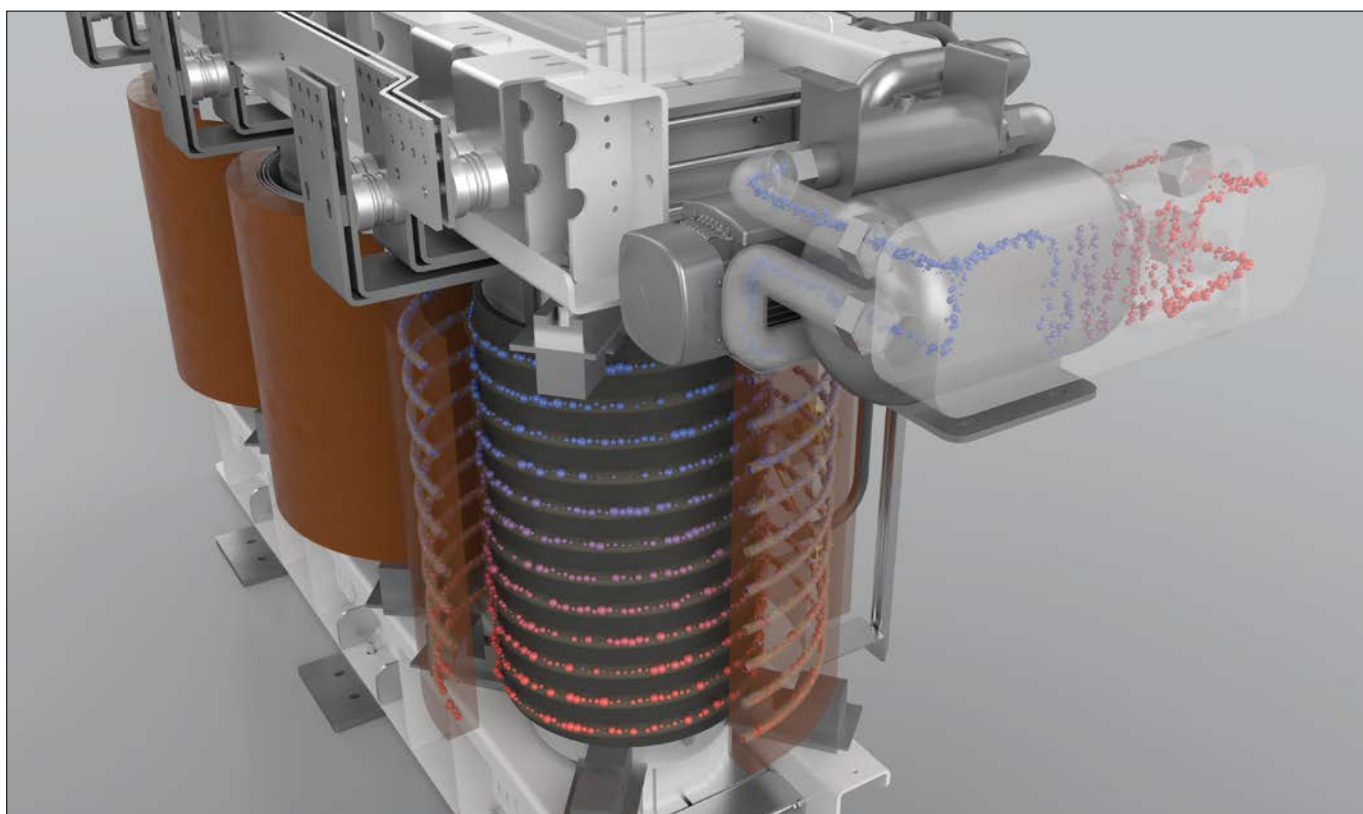
ments face unique challenges with this shift, and we are focusing on them to support them with specific solutions for those challenges.

What are these focused segments, and what special solutions do you have to help them address their specific challenges?

Today, many companies are striving to reduce their carbon footprint. Some of them go so far to change not only their business model but also who they are at their core. We can take the example of

major Oil and Gas (O&G) companies massively investing into renewables and/or Hydrogen, transforming themselves (at least partly) into utilities. Another aspect to consider is that to successfully drive decarbonization, renewable energy needs to be affordable. This means a high pressure on its efficiency and its production cost. Practically, this translates into larger and more powerful wind turbines and larger solar parks and, at the same time, higher cost-control pressure on the components that constitute them - transformers being one of the most critical building blocks.

For example, our transformer technologies like CompactCool™ is a boon for wind power, solar power and data centers with their compact footprint and enhanced safety.



CompactCool™ technology for dry-type transformers by Hitachi Energy



TVP™ (Transient Voltage Protection) technology for transformers by Hitachi Energy

Each and every transformer supplied from any of our global production sites is designed, manufactured, and tested according to world-class standards and built on state-of-the-art platforms and systems

Now, while the wind and solar markets are very dynamic, it is also important to acknowledge that the journey towards decarbonization will be accompanied by nuclear generation (as per the new EU Taxonomy [2]), which has its own requirements and characteristics.

With these changing dynamics of the distribution grid, we are closely focusing on our customers in these segments to support them with new solutions to meet new challenges:

- Off-shore and on-shore wind power generation
- Solar PV generation with battery storage
- Data Centers
- Rail infrastructure

For example, our transformer technologies like CompactCool™ is a boon for wind power, solar power and data centers with their compact footprint and enhanced safety. Our TVP™ (Transient Voltage Protection) technology offers complete protection from transient voltages that occur

in applications with frequent switching. These transient voltages can damage the transformer and cause unplanned outages due to switching failure.

In all of the above solutions and applications, customer intimacy is the key enabler for co-creation.

While you are creating customer value with your solutions, what quality controls do you follow and what are the values with which you drive your business?

As was the case with ABB in the past, Hitachi also stands for top quality. We ensure best practice sharing across our 25 factories through our global technology platforms. This ensures that each and every transformer supplied from any of our global production sites is designed, manufactured, and tested according to world-class standards and built on state-of-the-art platforms and systems.

We drive our business around 3 core values: (1) ambition, (2) courage and (3) humility.

We have the ambition to further improve our customers' experience by better understanding their needs and pain points to see how we can further contribute to making them successful, not only by improving the ease of doing business together but also by partnering to jointly develop and shape the solutions of the future.

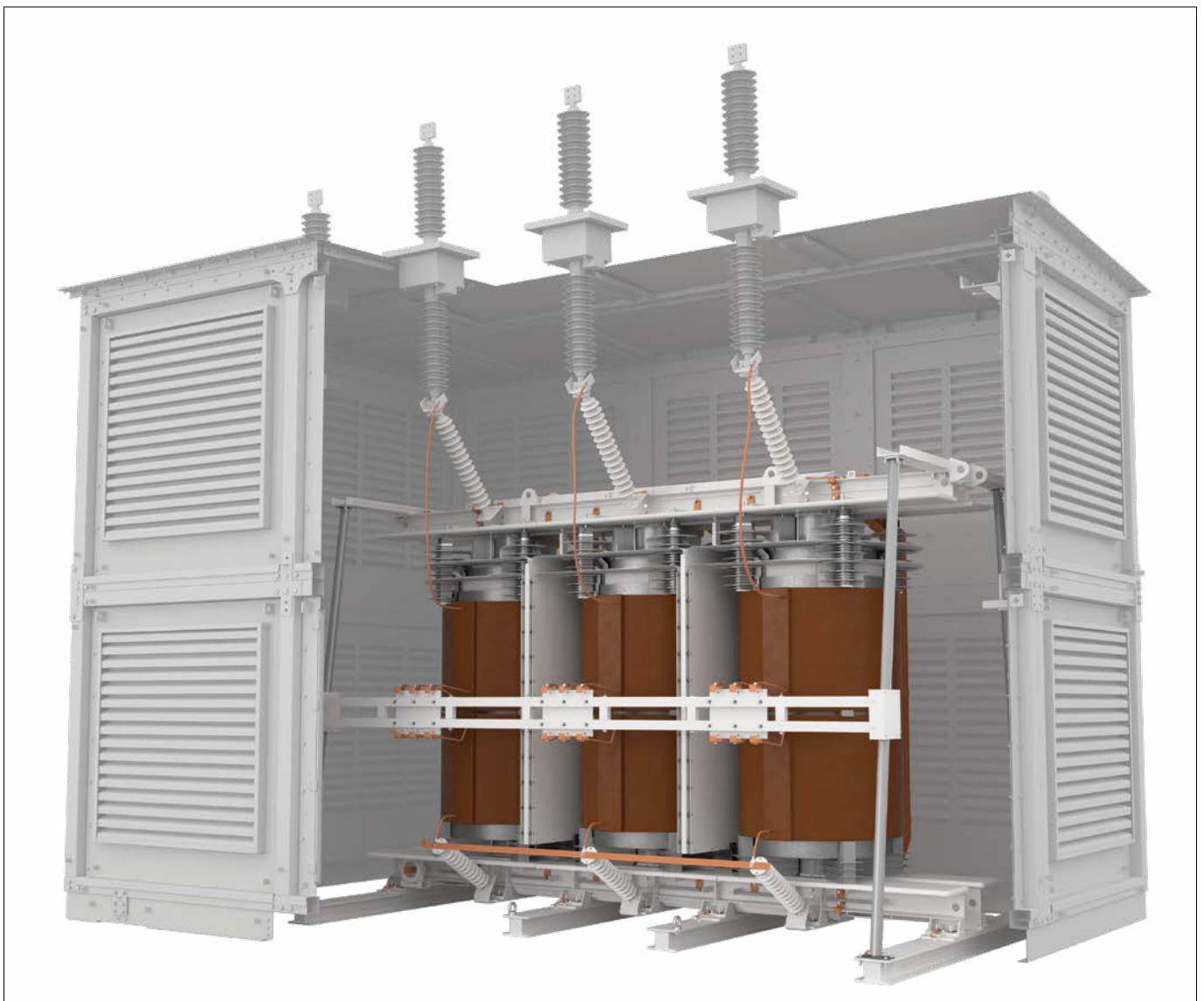
Being part of this exciting journey towards an advanced sustainable energy future makes Hitachi Energy a great place to be with both purpose and challenge

We have the courage of driving innovation and pushing the technology envelope further. For example, drastically reducing the footprint of dry-type transformers with our CompactCool™ technology or piloting dry-type transformers up to 145 kV with HiDry, even partnering with world-recognized institutions. Likewise, we have digitalized our transformers with the TXpert™ Ecosystem, which is our intelligent digital technology to maximize the transformer's return on investment.

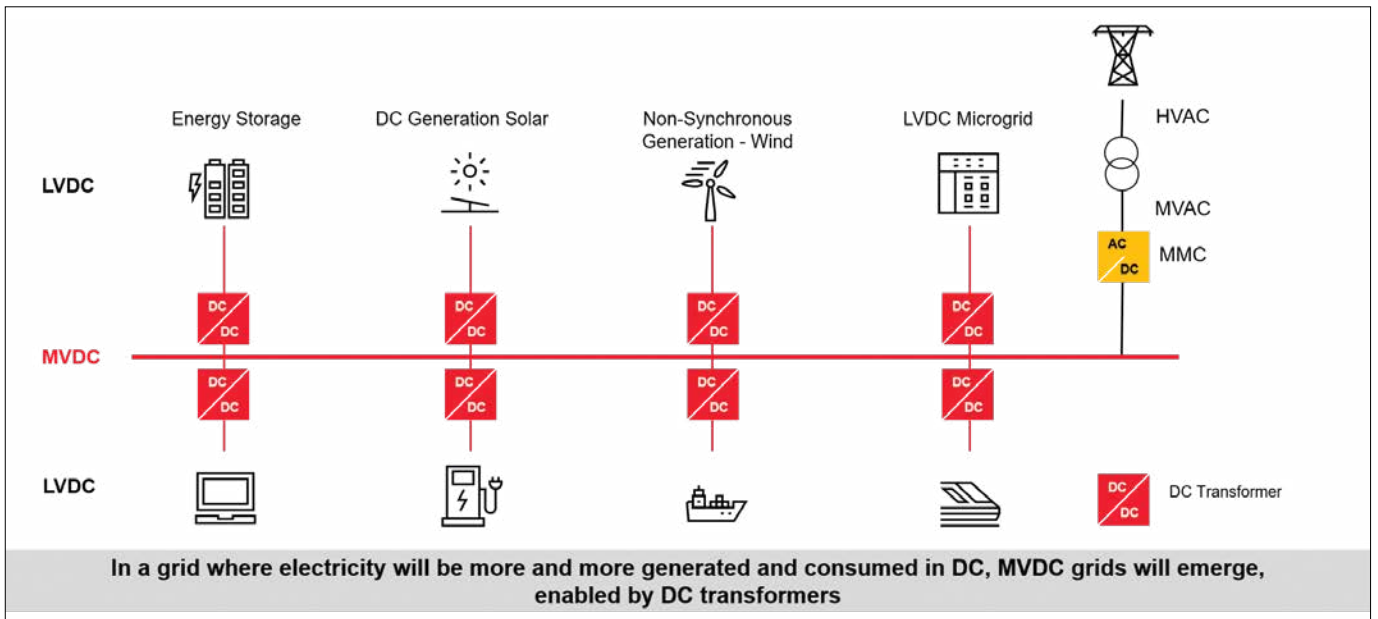
These are just a few of the many innovative solutions that we have introduced.

Last but not least, we have the humility to listen to our customers and partners on how we can better collaborate, understanding that there are always ways to improve and learn from each other.

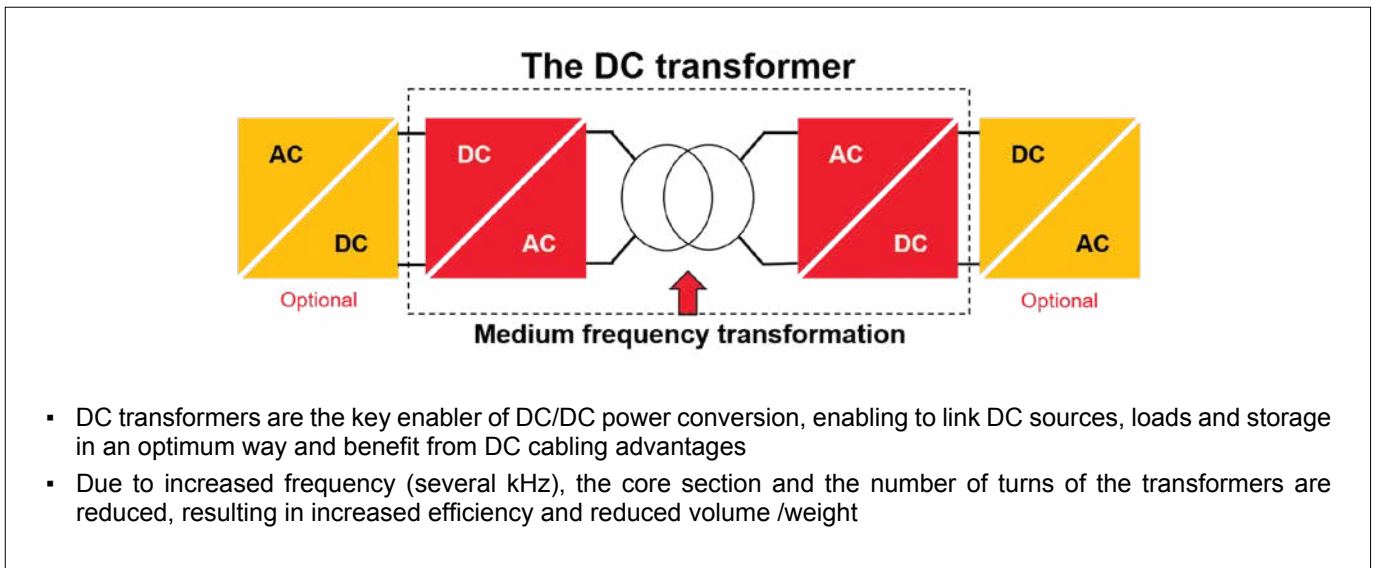
With our strong assets, along with these core values, I am sure we will continue to be our customers' partner of choice.



HiDry™ dry-type transformer up to 145 kV rating by Hitachi Energy



Vision of next-gen MVDC grid



- DC transformers are the key enabler of DC/DC power conversion, enabling to link DC sources, loads and storage in an optimum way and benefit from DC cabling advantages
- Due to increased frequency (several kHz), the core section and the number of turns of the transformers are reduced, resulting in increased efficiency and reduced volume /weight

DC / Solid-state transformer

Lastly, as a person with a strong technological background, what are your thoughts on next-generation technologies for distribution grids or transformers?

We discussed earlier the evolution of the distribution grids. One can also observe that the consumption patterns are evolving, driven mostly by sustainability and digitalization.

It is interesting to observe that the power distribution grid is characterized by more and more DC generation (eolic, solar) and, at the same time, more and more DC consumption (e-mobility, datacenters, batteries, hydrogen etc.). In this context, one may reconsider the process of converting electricity from DC to AC for transmitting

it from the point of generation to the point of consumption and then again converting it from AC to DC for consumption. Going forward, it may become viable to overcome this repeated conversion process by replacing the MVAC grid with a possibly more energy efficient MVDC grid.

This is a vision that requires investing in innovation, leveraging technologies like solid-state transformers, including power electronics, artificial intelligence, additive manufacturing and software, among others. As a market and technology leader, we aim to attract and retain the best talents to team up with customers and partners to build together the distribution grids of the future. Let me cite the example of our current collaboration with NTU Singapore on SST [3], where we are

developing the Grids 2.0 for Smart Cities.

Being part of this exciting journey towards an advanced sustainable energy future makes Hitachi Energy a great place to be with both purpose and challenge.

Bibliography

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