



TRANSFORMERS MAGAZINE'S  
**INDUSTRY NAVIGATOR**

## SUSTAINABILITY AND DIGITALIZATION

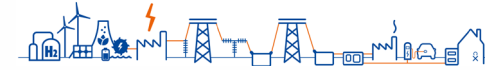
# Harnessing the Power of Digitalization Concepts in Transformer Design Tools for Sustainability

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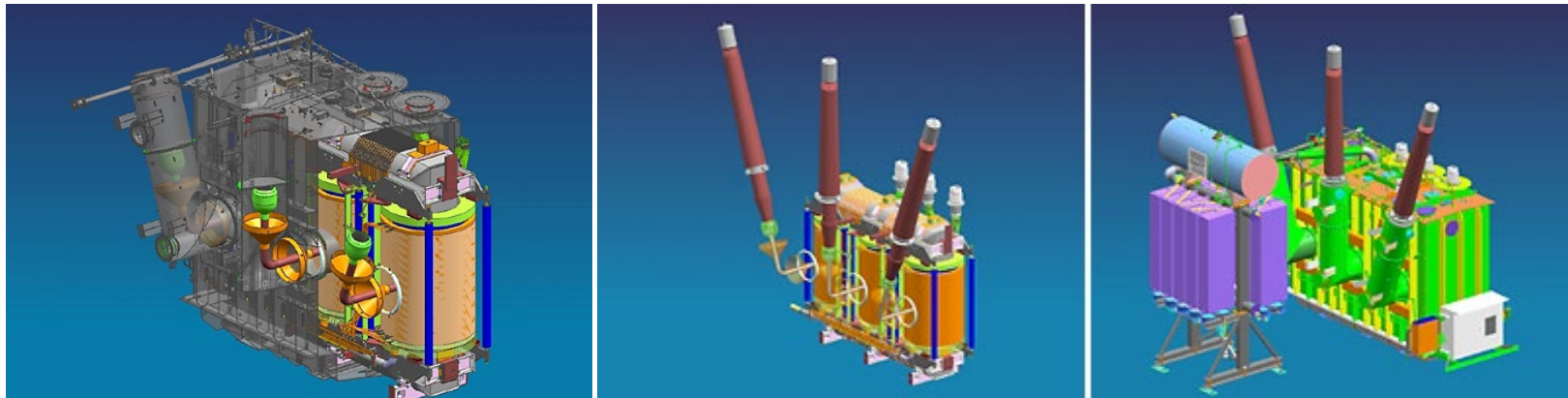


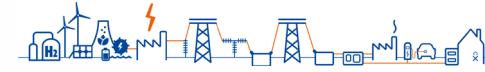


# Potential of digitalization in power transformer industry - 1

Digitalization

Integration of advanced digital technologies into operational processes and systems of an industrial entity — also known as digitalization — has a significant positive impact on the power industry. Advanced sensing, machine learning, digital twins, big data analytics, and cloud computing have become an essential part of the engineering, research and development work at SGB-SMIT Group.





# Potential of digitalization in power transformer industry - 2

Digitalization

In the context of a power transformer manufacturer, digitalization has the potential to cover a wide range of aspects, including design, engineering, manufacturing, supply chain management, operations, and maintenance. In summary, for the power transformer industry, digitalization has the potential to \_

- Improve and harmonize performance: efficiency, losses, noise, weight, footprint
- Enable design tools and platforms to capitalize on synergies, improve design efficiency, reduces human efforts, reduces risks of mistakes
- Enable the selecting, testing, and adopting of new materials
- Increase equipment reliability (monitoring and control)
- Assist in reaching sustainability goals (enables reuse of materials, reduces waste, allows for better control and reduced use of dangerous substances)

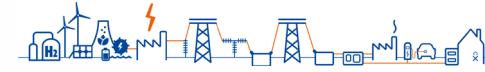






# Digitalization for Achieving Sustainability Goals





# Reaching Sustainability Goals – 1

At SGB-SMIT Group, digitalization is routinely used to achieve UN sustainability goals by reducing power losses, improving efficiency, and reducing the environmental impact of the manufacturing process.

In this context, digitalization plays a key role in the optimization of processes related to:

- Reuse of materials used in manufacturing (copper)
- Assessment of CO<sub>2</sub> footprint of company products over their lifetime
- Optimization of processes reducing waste (e.g., water) and emissions
- Better control and reduced used of dangerous substances
- Optimization of manufacturing processes leading to reduced energy use

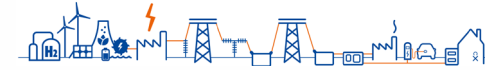






# Digitalization in Operation, Research and Development





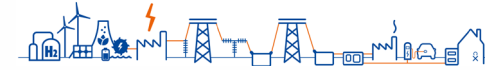
# Improved and harmonized performance – 1

At SGB-SMIT Group, digitalization also helps in streamlining the operations of power transformer manufacturing by relying on digital tools to track inventory, manage orders, and optimize supply chain logistics. These activities allow the reduction of costs and improve operational efficiency.

In addition, digitalization enables the company to conduct more advanced engineering and R&D work. For instance, digitalization enables using simulations and digital prototyping to test designs before they are physically built, allowing for quicker iteration and optimization.





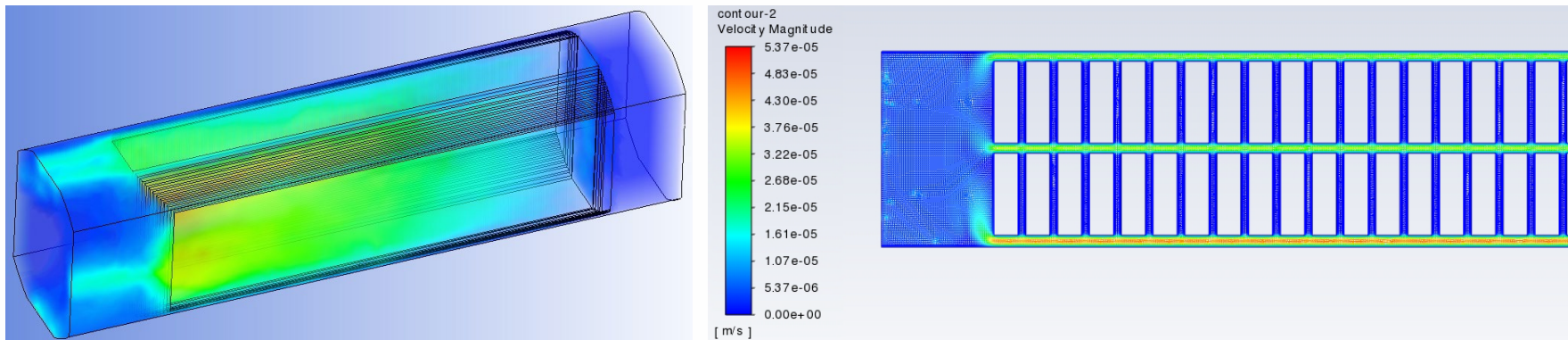


## Improved and harmonized performance – 2

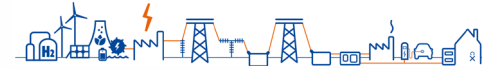
Digital twins are routinely used to model the behavior of the transformer in real-world conditions, allowing for more accurate predictions and simulations.

In transformer manufacturing, digitalization is used to automate and optimize the processes involved.

More specifically, this includes using sensors and monitoring systems to track the performance of the manufacturing equipment, as well as utilizing robotics and automation to improve overall efficiency and reduce manufacturing costs.







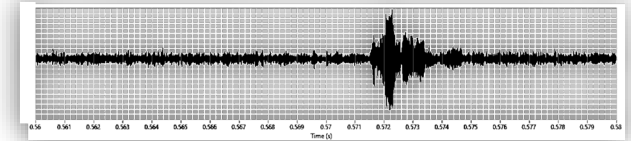
## Improved and harmonized performance – 3

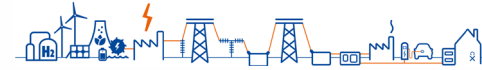
PD localization

A recent R&D initiative deployed digitalization to reduce the costs and to increase the accuracy and reliability of localization of the induced voltage with partial discharge measurements (IVPD). The shortcomings of the conventional measurement setup are:

- Slow process followed by slow post-processing
- Outcome might be unreliable
- Requires several engineers

By relying on modern sensors, advanced real-time signal processing algorithms, 3D-modeling, and an augmented reality system, SGB-SMIT Group could develop a framework for IVPD measurement which would allow completing the measurement within 4 hours and obtaining high-fidelity results.



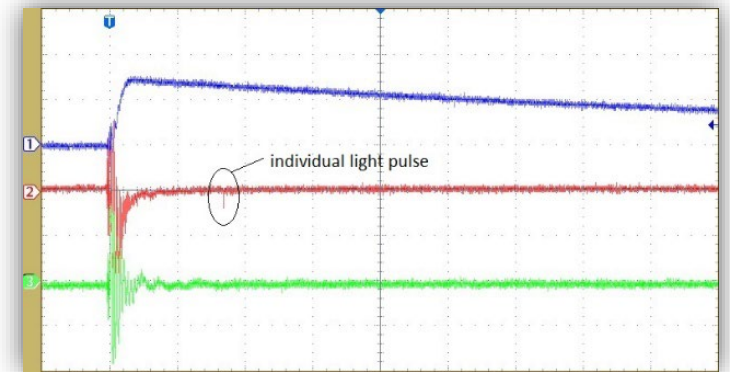


## Improved and harmonized performance – 4

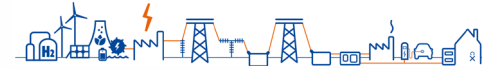
Motivated by the Group's sustainability goals, the company started a strategic initiative to explore the alternatives to the insulating liquids that are currently used.

A number of R&D projects were successfully completed by the researchers at SGB-SMIT Group in collaboration with research labs of leading European Universities in order to explore the properties of new alternative liquids.

Digitalization played a key role in conducting and executing the projects. Interfacing with sensing equipment, data collection and processing allowed for seamless conduction of the experiments, interpreting of the results and developing heuristic formulas for assessing the Lightning Impulse breakdown curves for oil gaps.







## Improved and harmonized performance – 5

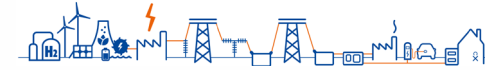
To improve the efficiency of transformers and accelerate the meeting of sustainability goals, SGB-SMIT Group has an active role in building a consortium which aims at the development of a distribution transformer with high energy efficiency using advanced laser-treated technique for electrical steel.

The initial goal of the consortium is to develop the technology that improves the magnetic properties of steel through material optimization and advanced laser magnetic domain refinement techniques.

In the long run, SGB-SMIT Group seeks to develop and implement the manufacturing process of highly efficient and low-noise transformers. The primary energy efficiency goal is the reduction of no-load losses in a range between 3% to 10%.

To achieve project goals, the company will extensively deploy digitalization concepts in all phases of the project.





## Improved and harmonized performance – 6

Testing new materials is a part of the Group's innovation strategy which assists in reaching the sustainability goals that the Group has put forward.

To facilitate the adoption of the new bio-based, biodegradable and low viscosity insulating liquid, substantial efforts are being invested in type testing an 80 MVA ONAF 115/21 kV power transformer filled with the new liquid.

The combination of robust and flexible design allowed the fast introduction to the market of a new and more sustainable bio based lower environmental impact fluid.

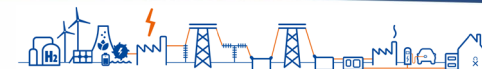
First indication, confirmed by FAT results, shows that the new fluid can be used without any modification in current insulation design made for GTL fluid.





# Digitalization in Electrical Design Tools and Platforms





# Electrical Design Tools and Platforms – 1

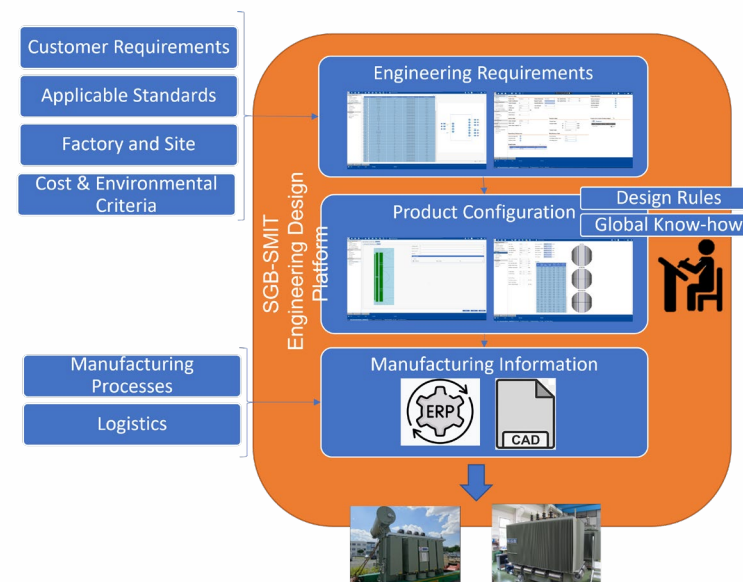
SGB-SMIT Group operates multiple factories worldwide, each with its own set of design rules and practices and working with multiple suppliers.

The Group recognized the potential for synergy and cost savings that could be achieved by deepening the level of digitalization in transformer design and manufacturing processes and set a strategic goal to develop a Design Platform.

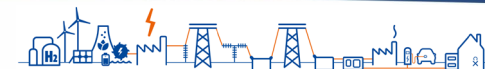
Design Platform will streamline our design and procurement processes by standardizing design rules, practices, documentation, and materials across all factories, allowing us to capitalize on the benefits of scale and to reduce costs while maintaining the highest quality standards.

By creating a unified approach to electrical design, SGB-SMIT Group aims to increase efficiency, reduce waste, and provide better value to the customers.

Design platform







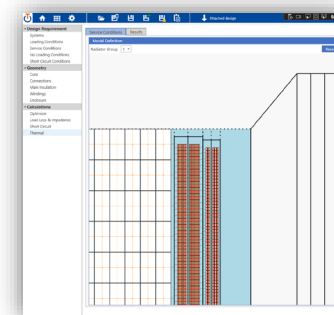
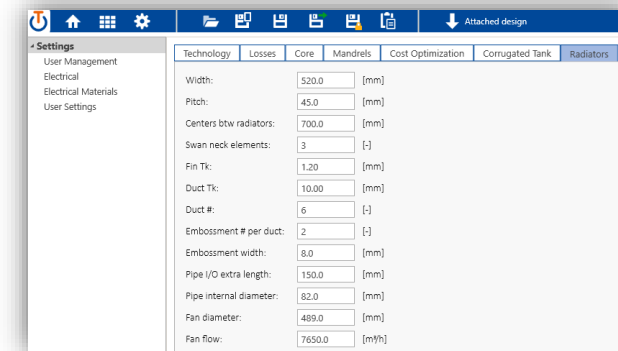
## Electrical Design Tools and Platforms – 2

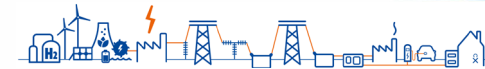
Design platform

As of today, SGB-SMIT Group deploys advanced digitalization solutions for creating advanced design software and tools to create more efficient and optimized designs.

The company is already testing its advanced Design Platform, which offers Group-wide functionality, for designing and optimizing power transformers by relaying on simulating their electrical and magnetic behavior, performing thermal analysis, and optimizing the design for weight, footprint, and noise reduction. In part, the tests are enabled by **Artificial Intelligence**.

In addition to the goals outlined before, Design Platform aims to create transformer designs that are compliant with all national and international standards and regulations and are ready for more energy-efficient and sustainable future.



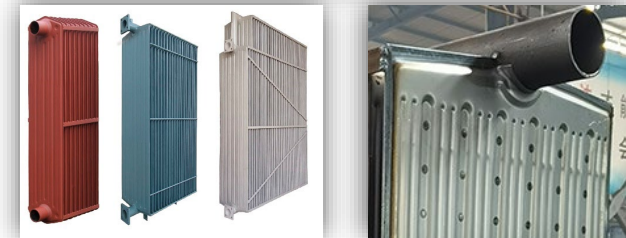
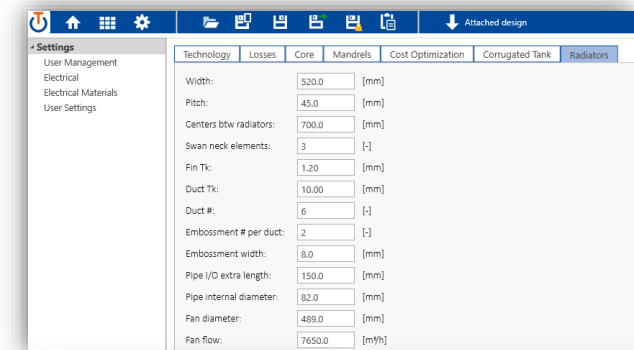


# Electrical Design Tools and Platforms – 3

Design platform

The functionality of EDP covers – but is not limited to – the following design phases:

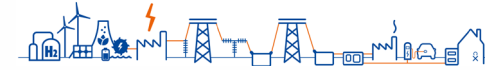
Design platform functionality	Sustainability goal
Design optimization	Reduction of CO <sub>2</sub> emissions
Development of advanced computation techniques for losses, short circuit currents, and transient calculations	Increase of energy efficiency and optimized material use and implementation of new core grades
Thermal calculations	Verification of new insulating fluids



All the above design phases are either automatic or semi-automatic.







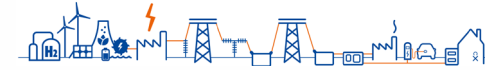
# Digitalization for sustainable professional development

Human capital

At SGB-SMIT Group, digitalization is routinely deployed for training and retaining new talents through:

- Physical and online Project Leadership Training
- Training on the job
- Internal expert training
- External expert training





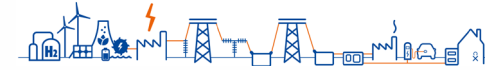
# Collaboration with Universities for sustainability

Collaboration with Universities plays an important role for SGB-SMIT Group's sustainable development.

- Testing and validation of alternative insulation fluids (TU Delft)
- Modeling of magnetic fields in large power transformers and the characterization of grain-oriented electrical steels (TU Eindhoven)
- Verification of the influence of voltage harmonics on the electrical insulation system in oil-immersed transformers (TU Dresden)
- Application of laser technology for transformer core manufacturing (Fraunhofer Institute for Material and Beam Technology)
- Research on condition assessment, asset management, thermal modelling, discharge and breakdown mechanisms (Manchester University)
- Magnetostriction measurements with 3rd harmonic component and with mechanical pressure (Cardiff University)



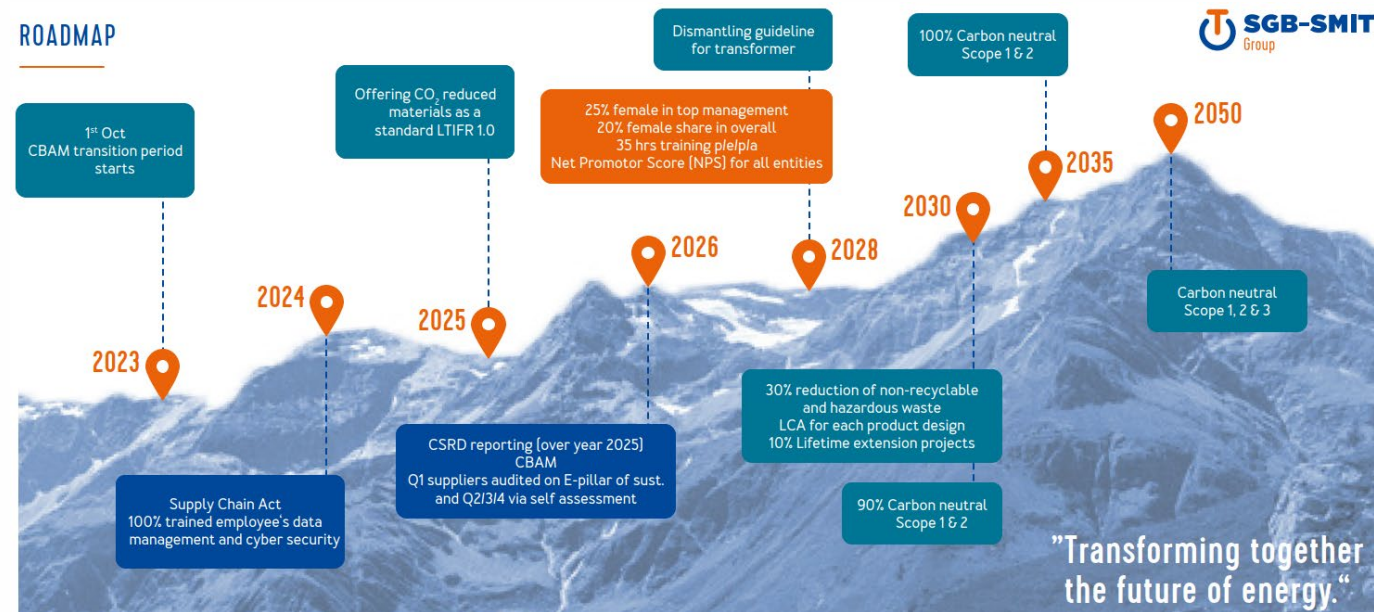




# Conclusion

## Conclusions

Digitalization, careful material selection, and advanced design optimization can contribute to meeting the sustainability goals of the power transformer industry.







# Thank you for your attention!

