



## TRANSFORMERS MAGAZINE

ISSN 1849-3319 (Print) ISSN 1849-7268 (Digital)

### EDITORIAL BOARD

#### Editor-in-Chief:

Mladen Banovic, PhD, Merit Services Int., Croatia  
mladen.banovic@transformers-magazine.com

### EXECUTIVE EDITORS

Michel Duval, PhD, Hydro Quebec, Canada  
Jean Sanchez, PhD, EDF, France  
Michael Krüger, PhD, OMICRON electronics, Austria  
Jin Sim, Jin Sim & Associates, Inc., USA  
Juliano Montanha, SIEMENS, Brazil  
Craig Adams, TRAFIX, Australia  
Arne Petersen, Consulting engineer, Australia  
Zhao Yongzhi, Shandong Electrical Engineering & Equipment Group Co., Ltd, China  
Barry M. Mirzaei, LargePowerTransformers Inc., Canada  
Bhabha P. Das, PhD, Hitachi Energy, Singapore

### EDITORS

Daosheng Liu, Jiangxi University of Science and Technology, China  
Mislav Trbusic, University of Maribor, Slovenia  
Dr. Mohammad Yazdani-Asrami, University of Strathclyde, United Kingdom  
Dr. Shuhong Wang, Xi'an Jiaotong University, China  
Nam Tran Nguyen, PhD, Hitachi Energy, USA

### ASSISTANT EDITOR

Pedro Henrique Aquino Barra, MSc,  
EESC/USP - University of São Paulo, Brazil

Art Director: Momir Blazek  
Photo: Shutterstock.com  
Front page image: MR/RHONA  
Language Editor: Ena Tomičić

### ADVERTISING AND SUBSCRIPTION

+385 1 7899 507  
sales@merit-media.com

### SUBSCRIPTION RATES:

**Print edition: \$130** (1 year, 4 issues)

**Digital edition: \$60** (1 year, 4 issues)

**Online edition - full access: \$20** (1 year, 4 issues)

**Online edition - free access:** free of charge for registered users

www.transformers-magazine.com

### TRANSFORMERS MAGAZINE

Transformers Magazine is published quarterly by Merit Media Int. d.o.o., Setaliste 150, brigade 10, 10 090 Zagreb, Croatia. Published articles do not represent official position of Merit Media Int. d.o.o. Merit Media Int. d.o.o. is not responsible for the content. The responsibility for articles rests upon the authors, and the responsibility for ads rests upon advertisers. Manuscripts, photos and other submitted documents are not returned.

### REPRINT

Libraries are permitted to photocopy for the private use of patrons. Abstracting is permitted with credit to the source. A per-copy fee must be paid to the Publisher, contact Subscription. For other copying or republication permissions, contact Subscription. All rights reserved. Publisher: Merit Media Int. d.o.o.

Setaliste 150, brigade 10,  
10 090 Zagreb, Croatia  
Contact: +385 1 7899 507  
VAT number: HR09122628912  
www.transformers-magazine.com  
Bank name: Revolut  
Bank IBAN: LT343250038251836452  
SWIFT / BIC: REVOLT21  
Intermediary BIC: CHASDEFX  
Director: Mladen Banovic, PhD

## Dear readers,

Welcome to this special edition of Transformers Magazine.

I have just returned from Dubai, where I was due to attend the **Middle East Energy** trade show. Instead, thanks to a bit of rain and an infrastructure more surprised by water than a cat in a bathtub, I got a front row seat to the city's impromptu swimming gala.

## The rain transformed one transformer into a pile of copper and iron, which promptly cut the power

Server rooms doubled as aquariums, and with the internet down, it was like stepping back into a pre-digital dark age.

The streets, without drainage, morphed into charming Venetian canals, minus the gondolas. Electric vehicles, having never signed up for submarine duty, met their untimely demise in these newfound lakes, adding to the general sense of chaos. Even the metro stations got in on the action, flooding to the point where trains refused to run.

With the metro at a standstill, we all turned to taxis, which struggled valiantly but vainly against the tide. In the end, we found ourselves trekking through the urban rivers, feeling more like participants in a jungle safari than guests at a world-class energy fair.

Caught in a tricky spot, **Transformers Magazine** stepped in to save the day with a "**Transformers meeting day**", an event that brought together industry enthusiasts for a day of networking with the peers, forging valuable alliances, scouting new business ventures, and catching up on the latest buzz and breakthroughs.

Air travel wasn't spared either - flooding at the airport meant my flight was delayed for days, not hours. Nevertheless, we hitched a ride back home on a budget airline, crammed into seats that could have been comfortable on a tram. It was a six-hour flight I'll remember for a long time.

Anyway, let's focus on the content of this edition, where we delve deep into the innovations and challenges that are shaping the future of power transformers. In our quest to provide a comprehensive overview of the sector's latest developments in the industry, this issue brings together expert insights, cutting-edge research, and forward-looking strategies from leaders in the field.

In three insightful interviews, we learn about the strategic initiatives underway to digitalise

transformers, improve their efficiency and integrate them more seamlessly into modern energy systems. We also explore the environmental impact of electrical infrastructure, highlighting the delicate balance between operational reliability and environmental stewardship. Discussions extend to the role of women in power engineering, highlighting diversity and inclusion in the field.

Technical discussions in this issue range from the importance of transformer bushings for system durability to the challenges of noise and vibration control in residential areas. We delve into the intricacies of dissolved gas analysis, showcasing the latest methods and their applications in maintaining transformer health.

We also examine the evolving landscape of transformer design and management, focusing on high-temperature superconducting transformers and their potential to revolutionise power density and efficiency. We discuss the impact of new European regulations on sustainability, underscoring the industry's role in meeting global energy efficiency and carbon reduction targets.

In addition, this edition examines the seismic resilience of dry-type transformers and offers a detailed review of a century's worth of research into transformer insulation, providing valuable insights into aging power transformer fleets and lifecycle management.

## This edition examines the seismic resilience of dry-type transformers and offers a detailed review of a century's worth of research into transformer insulation

Through these articles, we aim to provide our readers with a sound understanding of the technological, regulatory, and environmental factors at play in the transformer industry today.

We hope that this edition will serve as a valuable resource, inspiring innovation and informed decision-making in the ever-evolving world of power engineering.

Yours sincerely,

Mladen Banovic, Editor-in-Chief