



# **PowerTech** Belgrade 2023

**LEADING INNOVATIONS FOR RESILIENT  
& CARBON-NEUTRAL POWER SYSTEMS**

# PROGRAM



**25-29 JUNE, 2023, BELGRADE, SERBIA**



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<b>WELCOME WORDS .....</b>	<b>5</b>
<b>CONFERENCE COMMITTEES.....</b>	<b>6</b>
INTERNATIONAL STEERING COMMITTEE .....	6
LOCAL ORGANIZING COMMITTEE .....	6
INTERNATIONAL ADVISORY COMMITTEE .....	8
BASIL PAPADIAS AWARD COMMITTEE .....	8
<b>VENUE   ABOUT BELGRADE.....</b>	<b>9</b>
<b>FACULTY OF ELECTRICAL ENGINEERING   UNIVERSITY OF BELGRADE.....</b>	<b>11</b>
THE UNIVERSITY OF BELGRADE .....	11
SCHOOL OF ELECTRICAL ENGINEERING.....	11
<b>CONFERENCE LOCATIONS .....</b>	<b>12</b>
CONFERENCE VENUE .....	12
CONFERENCE REGISTRATION .....	12
WELCOME RECEPTION COCKTAIL.....	12
GALA DINNER .....	12
<b>TRAVEL INFORMATION .....</b>	<b>13</b>
VISA REQUIREMENTS .....	13
ARRIVAL BY PLANE .....	13
ARRIVAL BY CAR.....	13
<b>BELGRADE MAP .....</b>	<b>14</b>
<b>GETTING AROUND CITY .....</b>	<b>16</b>
BY TAXI.....	16
BY PUBLIC TRANSPORTATION .....	16
<b>MEETING ROOMS FLOOR PLAN .....</b>	<b>17</b>
<b>SOCIAL PROGRAM .....</b>	<b>18</b>
WELCOME RECEPTION COCKTAIL.....	18
COCKTAILS .....	18
GALA DINNER .....	18
<b>TUTORIALS   GENERAL INFORMATION .....</b>	<b>19</b>
<b>TUTORIALS   OVERVIEW.....</b>	<b>20</b>
TT01   UTILITY-SCALE HYDROGEN ELECTROLYZERS: FUNDAMENTALS, MODELLING, GRID SUPPORT SERVICES, AND OPERATION.....	20
TT02   AI-DRIVEN DECARBONIZATION FOR POWER SYSTEMS .....	21
TT03   DIGITAL ENERGY SYSTEMS – TECHNOLOGIES, USE CASES AND POLICY OPTIONS .....	23
TT04   STABILITY AND HARMONIC POWER FLOW IN CONVERTER-DOMINATED GRIDS UNDER CONSIDERATION OF CONVERTERS CONTROL NONLINEARITIES.....	24
TT05   INNOVATIVE TRAINING AND EDUCATION ON RENEWABLE ENERGY SYSTEMS: TOWARDS THE FUTURE RESILIENT, SUSTAINABLE AND CARBON- NEUTRAL POWER SYSTEMS .....	26
TT06   GRID FORMING CONVERTERS CONNECTED TO THE TRANSMISSION SYSTEM – INFLUENCE OF THE TYPE OF GRID FORMING CONTROL ON THE SMALL SIGNAL STABILITY .....	28
TT07   INTEGRATED ELECTRICITY-GAS-HYDROGEN SYSTEMS: AN INTRODUCTION.....	29
TT08   MODELLING, OPERATION, CONTROL, AND STABILITY ANALYSIS OF LOW-INERTIA POWER SYSTEMS .....	31
<b>SPECIAL SESSIONS   OVERVIEW .....</b>	<b>33</b>
SS01   GLOBAL PERSPECTIVES ON UTILITY OF THE FUTURE .....	33
SS02   A ROLE OF FLEXIBILITY IN ENABLING NET-ZERO ENERGY SYSTEMS .....	35
SS03   THE FUTURE OF POWER FLEXIBILITY.....	37
SS04   OBJECTIVE-BASED MACHINE LEARNING FOR LOW-CARBON POWER SYSTEMS.....	38
SS05   DER OPERATING ENVELOPES AND THEIR APPLICATIONS IN ENERGY MARKETS AND PLANNING.....	39
SS06   TRANSFER OF KNOWLEDGE: DISCUSSING WITH THE EDITORS IN CHIEF.....	40

SS07	RECENT ADVANCES AND TRENDS IN ACTIVE DISTRIBUTION NETWORKS .....	41
SS08	GRID RESILIENCE AND DECARBONIZATION OF ELECTRIC POWER SYSTEM .....	44
SS09	MODELING, OPERATION AND CONTROL OF MULTI-ENERGY SYSTEMS .....	45
SS10	WHAT’S NEW IN CASCADING FAILURE ANALYSIS? .....	47
SS11	POWERING TOGETHER: INSIGHTS INTO TWINNING AND CAPACITY BUILDING PROJECTS FOR SUSTAINABLE POWER SYSTEMS .....	49
SS12	ENERGY STORAGE WORLDWIDE: INSIGHTS AND APPLICATIONS (SESSION SUPPORTED BY IEEE PES WOMEN IN POWER) .....	51
SS13	PANEL ON POWER SYSTEMS IN SOUTH-EAST EUROPE.....	53
SS14	UI-ASSIST: INTERNATIONAL RESEARCH COLLABORATION.....	55
SS15	SYSTEM INTEGRITY PROTECTION SCHEMES IN MODERN POWER SYSTEMS .....	57
SS16	LEADING INNOVATIONS AND TECHNOLOGICAL SOLUTIONS FOR A SUSTAINABLE FUTURE – TRANSIT PROJECT .....	58
SS17	OFFSHORE ENERGY ISLANDS/HUBS.....	60
SS18	CHALLENGES AND DEMANDS OF MEDIUM VOLTAGE TECHNOLOGIES FOR RENEWABLE INSTALLATIONS AND ENVIRONMENT IMPACT .....	62
SS19	CONTEMPORARY AND EMERGENT METHODS FOR PLANNING AND ANALYSIS OF DISTRIBUTION NETWORKS .....	64
SS20	OPEN-SOURCE TOOLS FOR FUTURE POWER SYSTEMS – ATTEST PROJECT .....	65
SS21	YOUNG PROFESSIONALS PANEL SESSION ON FUTURE POWER SYSTEM WORKFORCE .....	67
SS22	THE ROLE OF BIG DATA AND AI FOR THE SECURE OPERATION OF TRANSMISSION SYSTEMS .....	69
SS23	INTERNATIONAL COLLABORATIVE PROJECTS FOR THE ENERGY TRANSITION AND RURAL ELECTRIFICATION IN INDIA.....	70
<b>INFORMATION FOR PRESENTERS .....</b>		<b>73</b>
TECHNICAL SESSION PRESENTERS .....		73
POSTER SESSION PRESENTERS.....		73
<b>PROGRAM AT A GLANCE.....</b>		<b>75</b>
SUNDAY, JUNE 25 .....		75
MONDAY, JUNE 26 .....		76
TUESDAY, JUNE 27 .....		77
WEDNESDAY, JUNE 28.....		78
THURSDAY, JUNE 29 .....		79
<b>DETAILED PROGRAM   MONDAY, JUNE 26 .....</b>		<b>80</b>
<b>DETAILED PROGRAM   TUESDAY, JUNE 27 .....</b>		<b>86</b>
<b>DETAILED PROGRAM   WENESDAY, JUNE 28 .....</b>		<b>94</b>
<b>DETAILED PROGRAM   THURSDAY, JUNE 29 .....</b>		<b>101</b>


**Prof. Predrag Stefanov | General Chair**

University of Belgrade, School of Electrical Engineering, Belgrade, Serbia

Welcome to the IEEE PowerTech Conference 2023 in Belgrade, Serbia!

I am thrilled to extend a warm welcome to all participants of the IEEE PowerTech Conference 2023 in Belgrade, Serbia. After a challenging period, due to the global pandemic, we are delighted that this year's conference will be held in person, allowing us to gather together and engage in fruitful discussions and collaborations.

Building upon the success of previous conferences, we are committed to exceeding expectations and delivering an exceptional experience. We have meticulously planned a comprehensive program that includes keynote speeches, technical sessions, poster sessions, and special sessions, all designed to foster insightful discussions and facilitate collaboration among participants.

The theme for this year's conference is "Leading innovations for resilient and carbon-neutral power systems." We understand the urgent need to address the challenges posed by climate change and create sustainable energy solutions for a better future. The conference theme emphasizes the importance of leading-edge technologies, strategies, and policies that pave the way for resilient and carbon-neutral power systems. At PowerTech 2023, we invite you to join us in exploring the challenges, technological solutions, and regulatory frameworks that will drive this transformative journey towards a greener and more sustainable future.

I extend our heartfelt appreciation to all the authors who have contributed their valuable research and insights. We received more than **425** submissions from **46** different countries worldwide. A rigorous review process involving the International Advisory Committee and reviewers ensured the selection of **333** top-quality papers that will be published in the conference proceedings and submitted to IEEE Xplore®. I would like to thank **383** reviewers and the International Advisory Board members for their dedicated efforts in the review process.

In addition to the technical and poster sessions, PowerTech 2023 will feature engaging keynote sessions and special sessions that delve into critical topics and emerging trends. Esteemed experts from academia, industry, and government sectors will share their knowledge and experiences, fostering thought-provoking discussions and inspiring new ideas.

Networking is an essential part of any conference, and PowerTech 2023 offers ample opportunities to connect with colleagues, collaborators, and industry leaders. We encourage you to actively engage in discussions, exchange insights, and establish valuable connections that may lead to future collaborations and research partnerships.

Belgrade, with its vibrant culture, warm hospitality, and scenic beauty, offers a wonderful backdrop for both intellectual and social interactions. I encourage you to take some time to explore the city and immerse yourself in its rich history and traditions.

I express our sincere gratitude to the International Steering Committee of PowerTech for their invaluable support in bringing this conference to Serbia for the first time. A massive thanks goes to all the hardworking members of our Local Organizing Committee. They've put in countless hours and effort to ensure that every tiny detail of this event is well taken care of. I also cannot leave out our friends at BBN, who have been an incredible supporting company throughout the organization process. I would also like to acknowledge and extend my sincerest appreciation to our sponsors, partners, and volunteers who have generously contributed their time, resources, and expertise to make this conference possible. Your support has played a pivotal role in ensuring the success and impact of this event. Finally, I want to express our heartfelt appreciation to all the participants. Your presence at PowerTech is of utmost importance in making this event a resounding success. Thank you for being a part of this exciting journey.

I am confident that PowerTech 2023 will provide a platform for valuable discussions, insights, and collaborations that will shape the future of resilient and carbon-neutral power systems. Together, let us drive innovation, foster sustainability, and make a positive impact on the global energy landscape.

We look forward to welcoming you in person to the IEEE PowerTech Conference 2023 in Belgrade!

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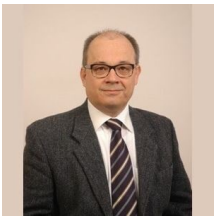
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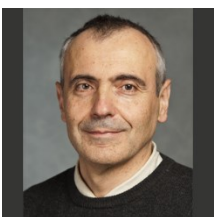


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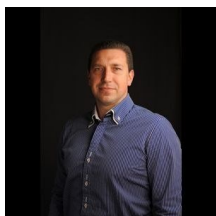
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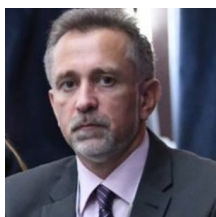
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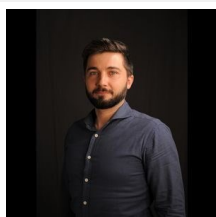
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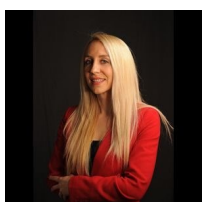


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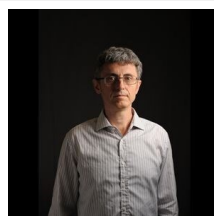
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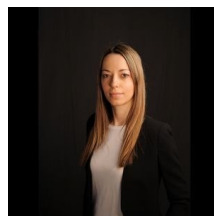
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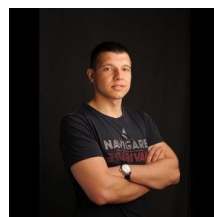


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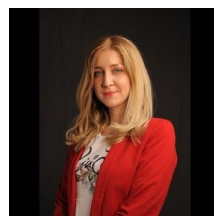
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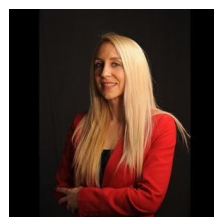
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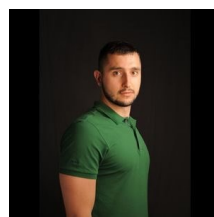
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Belgrade, the „white city“, is the **capital of Serbia**, and its largest city, with **around 1,6 million residents**. It is situated on the **confluence of Danube and Sava** rivers, and where the Pannonian Plain meets the Balkans. It's a city where worlds collide, where prehistoric history fuses with medieval times, which again merge with the contemporary age. Evolving from its ruthless past and the collapse of communism, Belgrade is now becoming one of the foremost travel centres in south-eastern Europe. With rich culture, a buzzing nightlife and an easy-going Mediterranean pace, it's not hard to see why.

The “white city” has taken many forms since the beginnings of its settlement between 50,000 and 20,000 years ago. Thanks to its strategic location, Belgrade has been fought over in 115 wars and razed to the ground 44 times, including by Attila the Hun, who had his way with the area in A.D. 442. In 1521 Belgrade was conquered by the Ottomans, and there followed a period of tug-of-war between the Ottoman and Austro-Hungarian Empires, who took turns destroying the city, each leaving behind a cosmopolitan legacy. Belgrade was also the capital of Yugoslavia from its inception as a kingdom in 1918, throughout the post World War II socialist era, right up until Serbia was the last man standing in 2006.

Belgrade is an **administrative, political and cultural center** of the country. It has the greatest concentration of institutions of national importance in the field of science and art. There is the **Serbian Academy of Sciences and Arts**, established in 1886 as the Serbian Royal Academy; the **National Library of Serbia**, established in 1832; the **National Museum**, established in 1841 and the **National Theatre**, established in 1869. The city is also the seat of the **Belgrade University**, founded in 1808 as the Great School, and the seat of the **University of Art**.

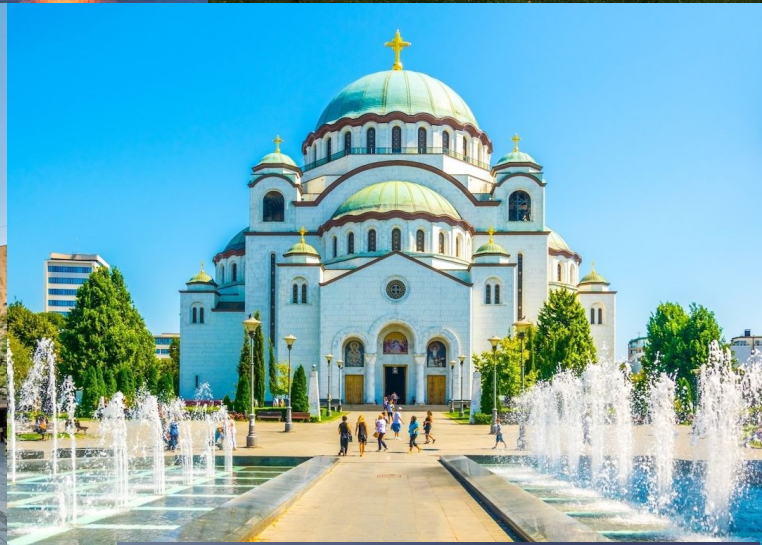
The city never stops growing, and when it has crossed the river Sava, it became “new”. **New Belgrade (Novi Beograd)** is the Belgrade's business center. It is a seat of numerous international companies, but also major shopping malls and the Belgrade **Arena** – the largest hall in the Balkans – that has already hosted some world famous events like the Eurosong contest, Summer Universiade, Davis cup finals, etc. It is also where the conference venue, **Crowne Plaza Hotel**, is located.

Regardless of its rich cultural and historic content, Belgrade is most famous for its vibrant lifestyle, especially its nightlife. Here you can find your own place of joy no matter what kind of music you prefer, how much money you have or what kind of food you like to eat. There is something for everybody: from modern restaurants, “**splavs**” (floating river clubs), alternative music clubs and theatres to famous “**kafanas**” (traditional Serbian taverns) of Skadarlija, and throughout the entire city. Things not to miss:

- ✓ **Drinking coffe** – The first “kafana” (coffee house) in Europe was opened in Belgrade in the 1522, long before it happened in London, Paris and Vienna – „domaća kafa“ in kafanas, or many great coffe shops such are D59B, Hotel Beograd, etc.
- ✓ **Rakija** – local very well consumed brandy, made from pure fruit, usually plum, with no added sugar, and double distilled - many Serbs make their own, swearing on its health benefits, and drinking a small glass alongside a coffee and sweetened fruits, for breakfast
- ✓ **Burek** - shattering crunch of layers of flaky pastry usually filled with cheese or meat
- ✓ **Ćevapčići and pljeskavica** – minced meat local specialties, famous around the world – consumed with national sauces **kajmak** and **ajvar**

Belgrade is interesting every time of year, but it is most beautiful in springtime – the temperature being around 20 degrees Celsius, everything is just flourishing and providing a perfect setting for long walks and sightseeing:

- ✓ The Belgrade fortress – **Kalemegdan**, the symbol of Belgrade
- ✓ The Church of **Saint Sava** - one of the largest Orthodox churches in the world, also ranking among the largest church buildings in the world
- ✓ **Knez Mihajlova street** – central pedestrian area - the ornate facades of the many 19th and early 20th century buildings form a textbook of architectural styles, including neo-Classical, Neo-Renaissance and Romantic
- ✓ Belgrade Bohemian quarter – **Skadarlija**, offering national food specialites in one of the kafanas
- ✓ Zemun quay walk to **Gardoš** where the remainder of the Zemun fort is - The beautiful tower of Sibiljanin Janko
- ✓ Kosančićev venac and **Dorćol neighbourhood** - stretching from the lower half of the old city right down to the Danube, with biggest clusters of historic buildings, many restaurants and cafes





## The University of Belgrade

The University of Belgrade is the oldest and the largest university in Serbia. Its predecessor was a Higher School founded in 1808 that in 1838 became a Lyceum.

The University of Belgrade consists of 31 schools, 11 research institutes, and 8 centers. The University Library "Svetozar Marković", with more than 3,500,000 volumes, is also a member of the University. The University disposes of 11 endowments provided by affluent citizens of Serbia and 7 funds for supporting 200 best students of the University of Belgrade. As the largest learning community in this part of Europe, with 432 study programs, of which: 172 undergraduates, 194 master, 66 doctoral studies (with 712 successfully defended doctoral theses), 94,458 students (of which 4,171 international) and 6,174 academic and research staff, 3,105 papers on SCIE and SSCI lists, numerous publications and scientific and research projects, the University of Belgrade has unique responsibilities and opportunities toward the society.

The University of Belgrade has also a great experience in cooperation with international organizations focusing on higher education. This is clearly shown by the bilateral agreements of cooperation concluded with more than 180 universities on every continent, membership in the European University Association (EUA), the Network of Universities from the Capitals of Europe (UNICA), the Black Sea Universities Network (BSUN), the Danube Rectors' Conference (DRC), the University Network of the Adriatic and Ionian Basin (UNIADRION), Association des Universités Francophones (AUF) and others. Having signed the Bologna Declaration, the University of Belgrade has shown its commitment to joining European Higher Education Area in the nearest future. For more information about the University of Belgrade please visit <http://www.bg.ac.rs>.



## School of Electrical Engineering

The School of Electrical Engineering is a top educational and scientific institution in the field of electrical engineering and computer science. There are four study programs - two BA programs, one MS program, and one PhD program. More than 1,000 students enroll in these programs every year.

The activities of the School of Electrical Engineering are regulated by Serbia's state law on higher education, Belgrade University regulations and School's bylaws. All study programs undergo regular checks by the National Accreditation and Quality Control Committee and they are accredited by Serbia's Ministry of Education, Science and Technological Development.



## Conference Venue



### Hotel Crowne Plaza 4\*

Vladimira Popovica 10, 11070 Belgrade, Serbia

Crowne Plaza® Belgrade is stylish hotel with conference facilities, fine dining and an indoor pool, in the heart of the New Belgrade business district. It is an ideal venue for convention guests, with a largest meeting area as well as the largest foyer most suitable for exhibition, stands or show space with natural day light. The city center can be reached by a 5-minute drive, while the International Belgrade Airport Nikola Tesla is set only 13 km from it.

## Conference Registration

Tutorials:

**Sunday, June 25 | 08:00-18:00**

Conference

**Sunday, June 25 | 14:00-18:00**

**Monday, June 26 to Thursday, June 29 | 08:30 - 18:00**

@Crowne Plaza Hotel, at the **registration desk**

Vladimira Popovica 10

11070 Belgrade, Serbia

<https://goo.gl/maps/CGWNjBHSd27EnMvi6>

## Welcome Reception Cocktail

**Sunday, June 25 | 18:00-19:00**

@Faculty of Electrical Engineering (Technical Faculties Building)

Ceremonial Hall of the Faculty of Civil Engineering, 1st floor

73 Kralja Aleksandra Boulevard, 11000 Belgrade

<https://goo.gl/maps/TDy9t6RVZhB8WWT26>

**Transfer from the Crowne Plaza Hotel to the welcome cocktail has been organized, as well as the return route after the reception.**

If necessary, the Welcome Reception cocktail venue can be reached by buses: **26, 27, 74, EKO1**  
(From Crowne Plaza Hotel – EKO1, 74)

Dress code: **business formal**

## Gala Dinner

**June 28, 2023 | 20:00-00:00**

@Restaurant Jezero by Azzaro

Ada Ciganlija bb, 11000 Belgrade

<https://goo.gl/maps/zUiTnQ7umQT6FMv46>

**Transfer from the Crowne Plaza Hotel to the restaurant has been organized, as well as the return route after the event.**

Dress code: **formal, cocktail**

## Visa Requirements

On October 30, 2014, the Government of the Republic of Serbia adopted the Decision on visa free entry to the Republic of Serbia for holders of foreign national passports having a valid Schengen, UK and other Member States' visa, or visa of the United States of America, and for holders of foreign national passports having residence permit in the countries of the Schengen area, EU or the United States of America.

## Arrival by Plane

Belgrade Airport is located some 18km west of the city centre, near a place called Surcin. The arrivals hall houses car rentals, a 24-hour exchange office, several ATMs, and a currency exchange machine available in Terminal 1. The Belgrade Airport official web page <https://beg.aero/eng>

Arriving to the hotel Crowne Plaza from the Belgrade Airport:

### Option 1 – Mini Bus

**Two mini buses** provided by **PowerTech 2023** organizers will be available for transfer during **June 24** and **June 25, free of charge**.

Buses are available from **08:00 – 23:00, every 30 minutes**.

### Option 2 – Taxi ride

First option is a Taxi ride to hotel. There is a Taxi information stand at the international arrivals hall of the Belgrade airport. If you wish to take a taxi to your destination, go to this stand and state your destination. You will be given a voucher with the price you will have to pay the taxi driver once you get to your destination. There are 6 zones with prices ranging from RSD 2.300 to 9.900 (around €20-85). Hotel Crowne Plaza is located in the Zone 1, RSD 2.300 (around €20). Apart from the voucher you will be given a leaflet with information on what to do if the taxi driver charges you more than the amount stated on the voucher. Once you obtain the voucher, exit the building and get the taxi. When you get to your destination, pay the taxi driver the fee stated in the voucher. More info [https://beg.aero/eng/parking\\_access/transport/taxi\\_service](https://beg.aero/eng/parking_access/transport/taxi_service)

### Option 3 – Public Transportation

Bus line: **72**

Route: **Airport-Zeleni venac Square**

Ticket price: **RSD 50 (€0,4)**, tickets can be purchased by SMS only, but as it is a new system that is still in its implementation period, you are not obliged to buy the ticket being foreigners)

Approximate travel time: 30-40 minutes

**Stop "Sest kaplara"** is 1.000 meters away from hotel Crowne Plaza.

### Option 4 – Shuttle bus A1 Mini bus

Route: Airport – Slavija Square (Kralja Milutina Street) – Airport

Ticket price: **RSD 400 (€3,20)**, tickets can be purchased on the bus)

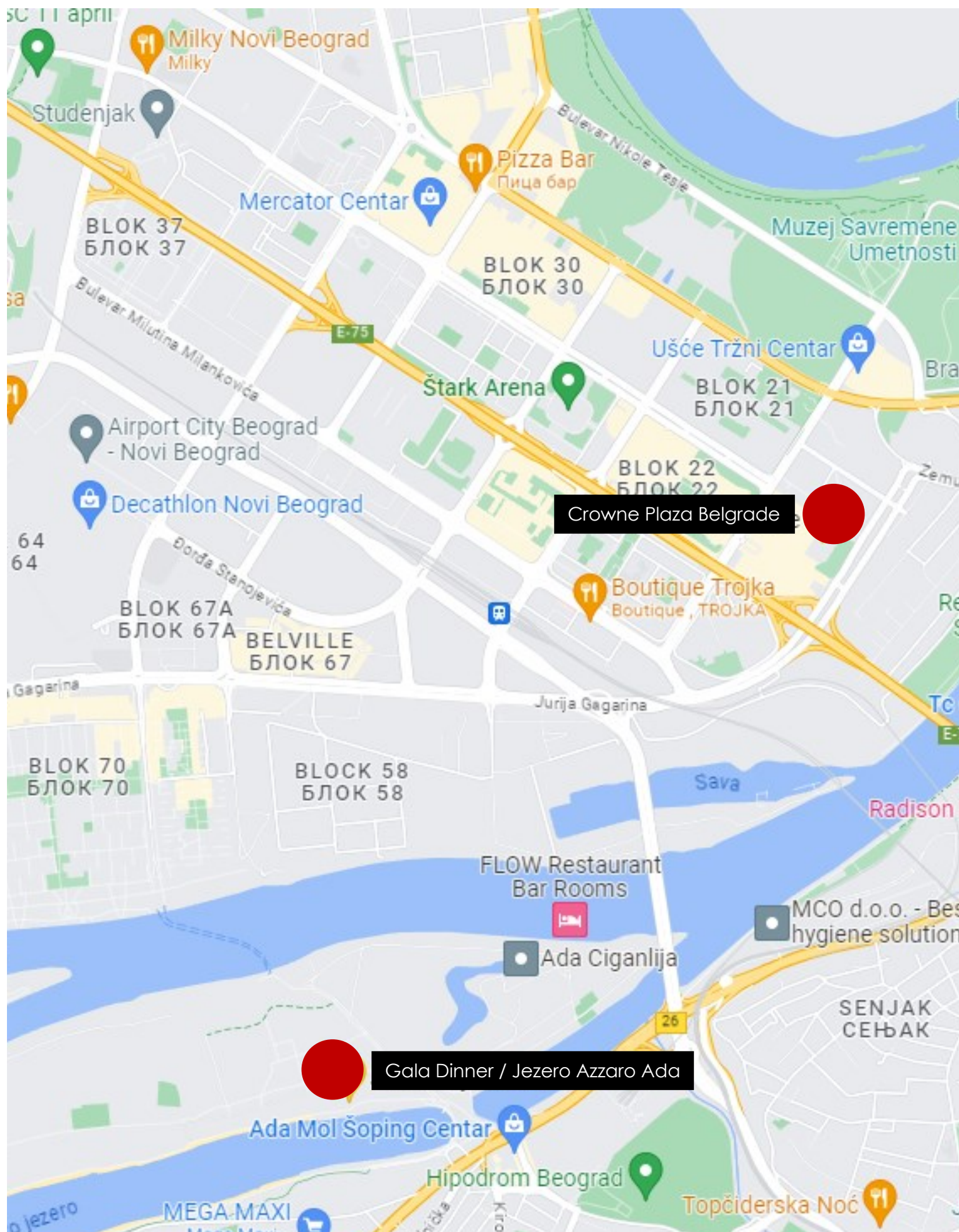
Approximate travel time: 30 minutes

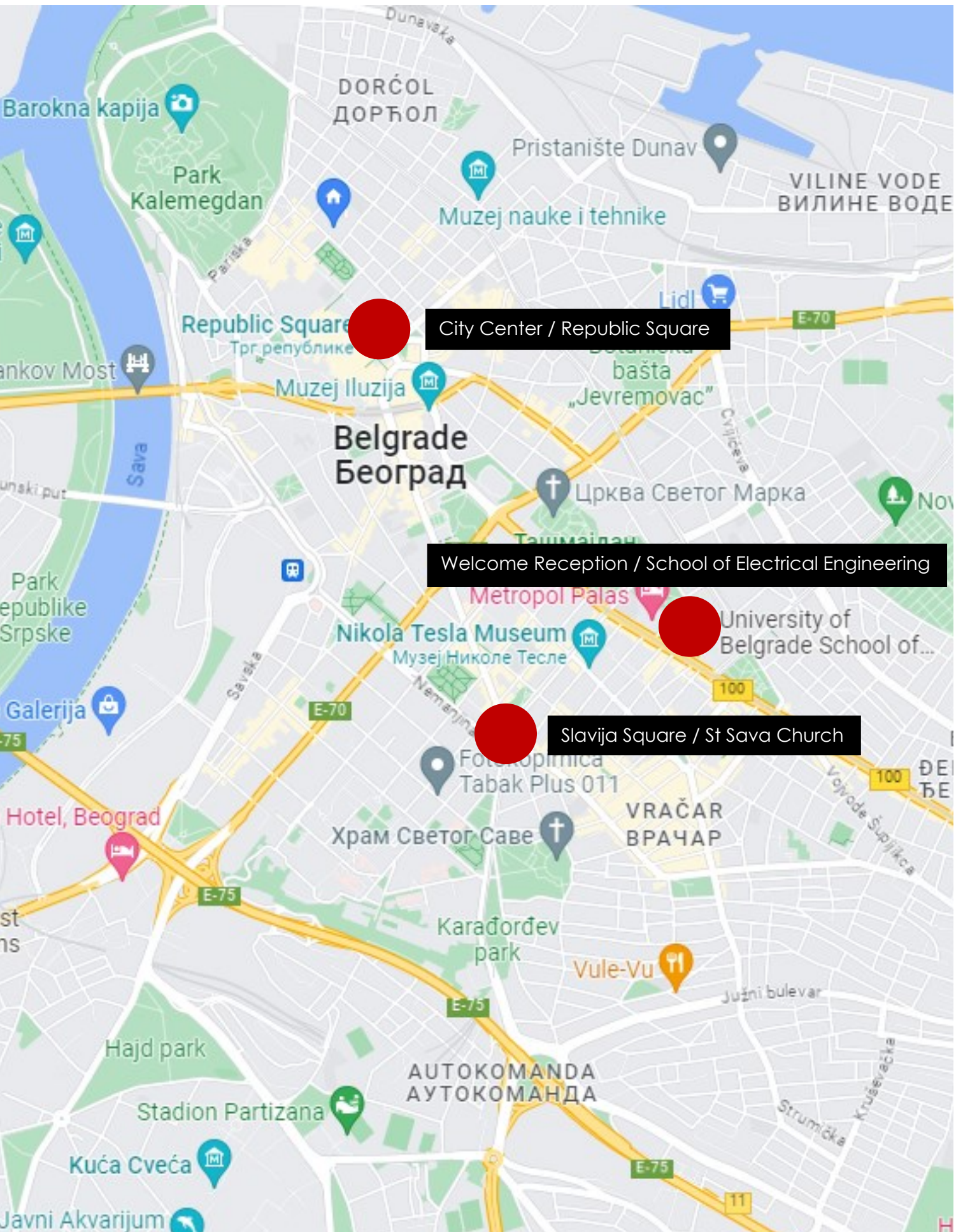
**Stop "Staro sajmište"** is 600 meters away from hotel Crowne Plaza.

## Arrival by Car

Belgrade lies at the intersection of E-70 and E-75 motorways. Foreign drivers in Serbia need an international driving license, vehicle registration certificate and insurance policy. The valid insurance policies are issued by the signatory countries of the Vehicle Insurance Convention and citizens of other countries are required to buy an insurance policy on entering Serbia. You cannot miss Belgrade, because the motorway runs through the city. The speed limit in the city is set at 50 km/h unless otherwise indicated by speed signs. Permitted Blood Alcohol Level is 0.2 g/l.

## BELGRADE MAP





## By Taxi

### Rates / working days and Saturday, 06:00 – 22:00:

Start rate, written on a taxi meter: 270 RSD

RSD per km / 96

### Rates / night, 22:00 – 06:00, and Sunday:

Start rate, written on a taxi meter: 270 RSD

RSD per km / 125

**Crowne Plaza Hotel to Trg Republike (central square) / around 700 RSD.**

**Crowne Plaza Hotel to Slavija Square (roundabout near city center, close to St. Sava Church) / around 800 RSD**

**Crowne Plaza to Welcome Reception / around 900 RSD**

**Crowne Plaza to Gala Dinner / around 900 RSD**

**IMPORTANT: PLEASE, BE AWARE OF THE FRAUDS. AVOID STOPPING TAXIS ON THE STREET OR GETTING THEM ON TAXI STATIONS. IT IS BEST TO CALL ONE.**

### Pink taxi



**Viber / +381604889979** – Send your location to given number, and operators will provide you a vehicle number and arrival time

**Call / 19803**

**App / Pink Taxi Beograd / Google Play, Apple Store**

All vehicles have the possibility of paying by card, but it doesn't hurt to ask before entering the vehicle.

### Naxi taxi



**Twitter / @NaxisTaxi** – send location and desired number of vehicles, and operators will provide you a vehicle

**Call / 19804**

**App / Naxis Taxi / Google Play, Apple Store**

All vehicles have the possibility of paying by card, but it doesn't hurt to ask before entering the vehicle.

### Lux taxi



**Call / 19944**

**App / Lux Taxi Beograd / Google Play, Apple Store**

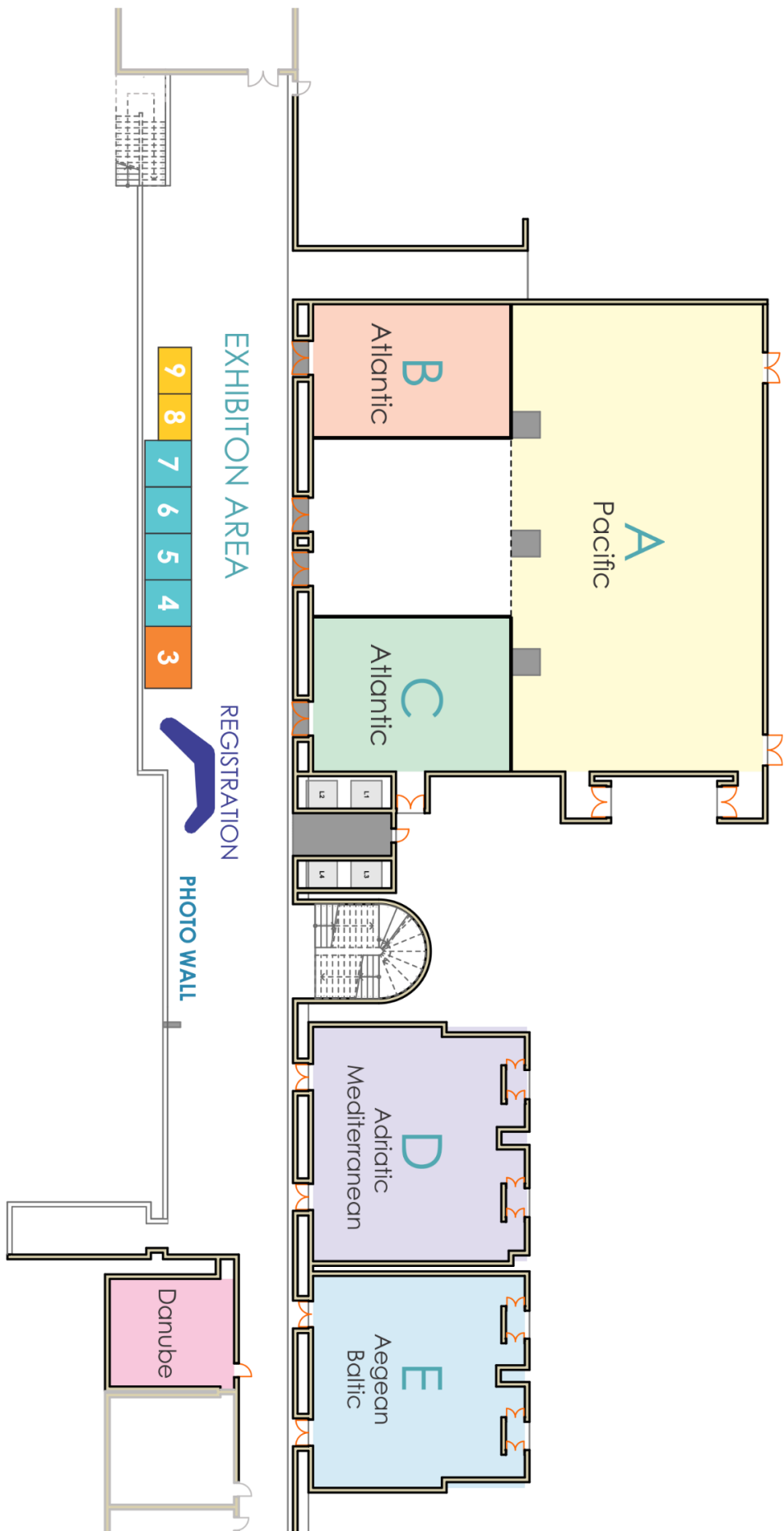
All vehicles have the possibility of paying by card, but it doesn't hurt to ask before entering the vehicle.

## By public transportation

Ticket price: **RSD 50 / €0,4**

Tickets can be purchased by SMS only, but as it is a new system that is still in its implementation period, you are not obliged to buy the ticket being foreigners.

**Night buses are free of charge / 00:00 – 04:00.**



## Welcome Reception Cocktail

June 25, 2023 | 18:00-19:00

### Faculty of Electrical Engineering (Technical Faculties Building)

Ceremonial Hall of the Faculty of Civil Engineering, 1st floor

73 Kralja Aleksandra Boulevard, 11000 Belgrade

<https://goo.gl/maps/TDy9t6RVZhB8WWT26>



Transfer from the Crowne Plaza Hotel to the welcome cocktail has been organized, as well as the return route after the reception.

Dress code: **business formal**

## Cocktails

June 26, 2023 | 18:00-19:00

Including Wine Tasting by **ABB**

June 27, 2023 | 18:00-19:00

Including Rakia Tasting by **SATURN ELECTRIC**

## Gala Dinner

June 28, 2023 | 20:00-00:00



### Restaurant Jezero by Azzaro

Ada Ciganlija bb, 11000 Belgrade

<https://goo.gl/maps/zUiTnQ7umQT6FMv46>

Transfer from the Crowne Plaza Hotel to the restaurant has been organized, as well as the return route after the event.

Dress code: **formal, cocktail**

All tutorials will be held on **June 25, 2023, Sunday**.

**TT01** | Utility-Scale Hydrogen Electrolyzers: Fundamentals, Modelling, Grid Support Services, and Operation

**TT02** | AI-driven Decarbonization for Power Systems

**TT03** | Digital energy systems – Technologies, Use cases and Policy Options

**TT04** | Stability and harmonic power flow in converter-dominated grids under consideration of converters control nonlinearities

**TT05** | Innovative Training and Education on Renewable Energy Systems: Towards the Future Resilient, Sustainable and Carbon-Neutral Power Systems (**full day**)

**TT06** | Grid forming converters connected to the transmission system – Influence of the type of grid forming control on the small signal stability (**full day**)

**TT07** | Integrated electricity-gas-hydrogen systems: an introduction

**TT08** | Modelling, operation, control, and stability analysis of low-inertia power systems

	E1   Baltic	D1   Adriatic	D2   Mediterranean	E1   Aegean	Danube
08:30-10:30	TT01	TT02	TT08	TT05	TT06
10:30-10:45	Coffee Break				
10:45-12:45	TT01	TT02	TT08	TT05	TT06
12:45-13:30	Lunch				
13:30-15:30	TT04	TT07	TT03	TT05	TT06
15:30-15:45	Coffee Break				
15:45-17:45	TT04	TT07	TT03	TT05	TT06

## TT01 | Utility-Scale Hydrogen Electrolyzers: Fundamentals, Modelling, Grid Support Services, and Operation

### Abstract

There are major discussions worldwide on how the production of clean fuels, such as hydrogen, could facilitate the whole-energy system decarbonization. From a power system perspective, green hydrogen production results in massive grid integration of electrolyzers, that needs to be considered in power system analysis. This tutorial presents the modelling foundations of utility-scale hydrogen electrolyzers with alkaline and proton exchange membrane (PEM) technology, including electrolysis stack models, power electronics interface (PEI) and control, thermodynamics, hydrogen production formulations, and operational constraints in downstream hydrogen process/buffer, required for system-level dynamic studies in both transmission and distribution grids. Possible PEIs for grid integration of electrolyzers will be discussed, along with the associated control schemes in particular grid-forming load control. Finally, it will be discussed how and to what extent electrolysis plants could contribute to system stability and resilience, along with potential challenges and requirements in the context of real-life events and systems.

### Course Outline (duration 4h)

1. Hydrogen electrolyzers in power system studies: Introduction (15 minutes)
2. Modelling of electrolysis stack (PEM and alkaline technologies) (30 minutes)
  - a. Electrolysis stack modelling
  - b. Hydrogen production sub-model
  - c. Thermodynamics of electrolysis technologies
  - d. Stack voltage-current-efficiency nonlinearities *10 minutes Q&A followed by 5 minutes break*
3. Power-electronics interface and control of electrolyzers (45 minutes)
  - a. Grid-following control
  - b. Virtual synchronous machine control
  - c. Grid-forming load concept and its application to hydrogen electrolyzer control *10 minutes Q&A followed by 5 minutes break*
4. System dynamic support from electrolyzers: modelling, benefits, and challenges (45 minutes)
  - a. Frequency support services, including virtual inertia, fast frequency response, and frequency regulation
  - b. Voltage control and reactive power support
  - c. Grid-forming services *10 minutes Q&A followed by 5 minutes break*
5. Real-life examples and numerical/simulation-based exercises (45 minutes)
6. Concluding remarks (15 minutes)

### Instructors

#### Mehdi Ghazavi Dozein

The University of Melbourne, Australia  
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#### Oriol Gomis-Bellmunt

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#### Marc Cheah Mañé

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**Mehdi Ghazavi Dozein** received M.Sc. degree from University of Tehran and Ph.D. degree from The University of Melbourne. He is currently an Associate Lecturer in Power Systems at The University of Melbourne. His research interests include power system dynamics and stability, and modelling and control of inverter-based technologies.



**Oriol Gomis-Bellmunt** received the degree in industrial engineering from the School of Industrial Engineering of Barcelona (ETSEIB), Technical University of Catalonia (UPC), Barcelona, Spain, in 2001 and the Ph.D. degree in electrical engineering from the UPC in 2007. In 1999, he joined Engitrol S.L. where he worked as Project Engineer in the automation and control industry. Since 2004, he has been with the Electrical Engineering Department, UPC where he is a Professor and participates in the CITCEA-UPC Research Group. Since 2020, he is an ICREA Academia researcher. In 2022, he co-founded the start-up eROOTS focused on the analysis of modern power systems. His research interests include the fields linked with electrical machines, power electronics, and renewable energy integration in power systems.



**Marc Cheah Mañé** received the degree in industrial engineering from the School of Industrial Engineering of Barcelona (ETSEIB), Universitat Politècnica de Catalunya (UPC), Barcelona, Spain, in 2013, and the PhD degree in electrical engineering from Cardiff University, Cardiff, the U.K. in 2017. From 2017 to 2020 he was a research associate in CITCEA-UPC, Barcelona, Spain. Since March 2020 he is a Lecturer under the Serra Hunter program at the Electrical Engineering Department of UPC. Since April 2022, he is also a co-founder of eRoots, which is a spin-off company of CITCEA-UPC specialized in innovative tools for modern power system analysis. His research interests include power systems with power electronics, high-voltage direct current systems, wind and photovoltaic generation.

## TT02 | AI-driven Decarbonization for Power Systems

### Abstract

The ongoing decarbonization of power systems is altering the fundamental structure of system planning and operation by increasing the penetration of renewable energy resources (RESs), while forecasting an increase in the asset utilization of high electrification of transportation and efficient heating facilities. To meet the carbon budgets, the pace of decarbonization in deregulated markets needs to be significantly accelerated. These transitions, however, present crucial techno-economic challenges. More flexibilities are required to balance the less predictable and controllable RESs. A large number of small-scale distributed energy resources (DERs) are located and operated in a distributed manner, which may increase the challenges of managing them. Furthermore, privacy concerns need to be addressed due to the massive amount of data communicated by the decentralized power systems. In this context, this tutorial will first overview various kinds of approaches for power system decarbonization, then introduce advanced artificial intelligence (AI) tools, and finally focus on the applications of peer-to-peer (P2P) energy trading and electric vehicles (EVs).

### Course Outline (duration 4h)

1. Background (1 hour)
  - a. Power and energy systems (20 mins)
  - b. Decarbonization framework (20 mins)
  - c. Electricity market design (20 mins)
2. AI-driven tools (1 hour)
  - a. Data-driven reinforcement learning methods (20 mins)
  - b. Markov decision process and Markov game (10 mins)
  - c. Single-/Multi-agent reinforcement learning methods (30 mins)
3. Energy system applications (1 hour and 30 mins)
  - a. P2P energy trading for large-scale prosumers (30 mins)
  - b. P2P energy trading for multi-vector microgrids (30 mins)
  - c. EV ancillary-service provisions in transport-power networks (30 mins)
4. Conclusion and future work (30 mins)
  - a. Conclusion (10 mins)
  - b. Future work (10 mins)
  - c. Questions and answers (10 mins)

**Dawei Qiu**

The Imperial College London, UK  
[d.qiu15@imperial.ac.uk](mailto:d.qiu15@imperial.ac.uk)

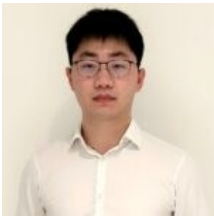
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[hanzhu22@gmail.com](mailto:hanzhu22@gmail.com)

Short Bio



**Dawei Qiu** (S'18-M'20) received the Ph.D. degree in Electrical Engineering from Imperial College London, UK, in 2020. He is currently employed as a Research Associate in the Department of Electrical and Electronic Engineering at Imperial College London. His research focuses on the development and application of decentralized and market-based approaches for the electricity market, peer-to-peer energy trading, multi-energy system, microgrid resilience, and vehicle-to-grid flexibility. In particular, he also has a strong background in game theoretic modeling and data-driven reinforcement learning approaches. Dr. Qiu has strongly contributed to several European Commission and EPSRC research projects, focused on energy market modelling and resilience analysis: EU's Horizon 2020 projects "TradeRES", "MERLON"; EPSRC projects including "NetworkPlus", "IDLES", "Technology Transformation to Support Flexible and Resilient Local Energy Systems".



**Shengrong Bu** (S'05-M'12) received her Ph.D. degree in Electrical and Computer Engineering from Carleton University, Canada in 2012. From 2014 to 2021, she was a Lecturer with the James Watt School of Engineering, University of Glasgow, UK. Currently, she is an Associate Professor at Brock University, Canada. Her research interests include multi-energy microgrids, smart grids, future wireless networks, cyber security, deep reinforcement learning, and big data analytics. Dr. Bu was a recipient of three best paper awards at IEEE International conferences. Her work has been supported by EPSRC (UK) and NSERC (Canada). Highlights of her professional activities include duties as a peer reviewer for EPSRC and Carnegie Trust, an Associate Editor for Wireless Networks (Springer), a Topic Editor for Energies and the TPC Co-Chair for seven international conferences/workshops or conference symposiums. Dr. Bu was featured in the Women in Energy Transformation Series 2022-2024, as one of Canada's most inspiring climate leaders. Promoting engineering to younger girls and supporting junior female researchers are a passion of hers, and she has been involved with Ontario Go Eng Girl in Canada, Monster Confidence in UK, and N2Women as a Mentoring Co-Chair.



**Zhu Han** (S'01-M'04-SM'09-F'14) received the B.S. degree in electronic engineering from Tsinghua University, in 1997, and the M.S. and Ph.D. degrees in electrical and computer engineering from the University of Maryland, College Park, in 1999 and 2003, respectively. From 2000 to 2002, he was an R&D Engineer of JDSU, Germantown, Maryland. From 2003 to 2006, he was a Research Associate at the University of Maryland. From 2006 to 2008, he was an assistant professor at Boise State University, Idaho. Currently, he is a John and Rebecca Moores Professor in the Electrical and Computer Engineering Department as well as in the Computer Science Department at the University of Houston, Texas. Dr. Han's main research targets on the novel game-theory related concepts critical to enabling efficient and distributive use of wireless networks with limited resources. His other research interests include wireless resource allocation and management, wireless communications and networking, quantum computing, data science, smart grid, security and privacy. Dr. Han received an NSF Career Award in 2010, the Fred W. Ellersick Prize of the IEEE Communication Society in 2011, the EURASIP Best Paper Award for the Journal on Advances in Signal Processing in 2015, IEEE Leonard G. Abraham Prize in the field of Communications Systems (best paper award in IEEE JSAC) in 2016, and several best paper awards in IEEE conferences. Dr. Han was an IEEE Communications Society Distinguished Lecturer from 2015-2018, AAAS fellow since 2019, and ACM distinguished Member since 2019. Dr. Han is a 1% highly cited researcher since 2017 according to Web of Science. Dr. Han is also the winner of the 2021 IEEE Kiyo Tomiyasu Award, for outstanding early to mid-career contributions to technologies holding the promise of innovative applications, with the following citation: "for contributions to game theory and distributed management of autonomous communication networks."

### Abstract

Digitalization is a megatrend that affects and transforms societal, economic, and environmental processes on a global scale.

Driven by a combination of technological advances and evolving energy policy and regulation, digitalization also affects the operation and planning of the energy sector.

This tutorial provides a comprehensive, detailed overview over digitalization effects with emphasis on power systems, including data markets, emerging technologies, use cases, and challenges.

### Course Outline (duration 4h)

1. Background: Digitalization phenomena, drivers and its value proposition.
2. Data and infrastructure: Components, energy demand and efficiency.
3. Applications: Use cases, risks and benefits of digital technologies and business models, data valuation and markets.
4. Perspectives: Current decision-maker perceptions on digital energy systems: outcomes of an international UN survey.
5. Policy design: e.g., for cyber security, artificial intelligence, digital platforms and regulatory sandboxes.

### Instructors

**Fabian Heymann**

Swiss Federal Office of Energy / École polytechnique fédérale de Lausanne  
[fabian.heyman@bfe.admin.ch](mailto:fabian.heyman@bfe.admin.ch)

**Andrei Covatariu**

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**Carla Gonçalves**

Senior Researcher at the Centre for Power and Energy Systems in INESC TEC, Portugal  
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**Davide Fioriti**

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**Hrvoje Keko**

KONČAR Digital  
[Hrvoje.keko@koncar.hr](mailto:Hrvoje.keko@koncar.hr)

### Short Bio



**Dr. Fabian Heymann** is Lecturer on “Digitalization in electricity systems” at École polytechnique fédérale de Lausanne (EPFL) and Digital Innovation Specialist at the Swiss Federal Office of Energy. He is a selected member of the UN ECE Taskforce on Digitalization in Energy and CIGRE WG C2.42. Before, he held positions as Advisor at the European Network of Transmission System Operators for Electricity (ENTSO-E) in Brussels and as researcher at INESC TEC (Porto, Portugal) as well as the MIT Institute for Data, Systems, and Society (IDSS, Cambridge, MA).



**Andrei Covatariu** is the Co-Chair of the Task Force on “Digitalization in Energy” at the United Nations Economic Commission for Europe (UNECE). In the past he was the Digital Manager at Enel Romania, promoting digitalization across the companies’ business lines. He is a consultant for Public Power Corporation, acting as a Climate Policy Advisor for the CEO. Andrei is a Non-resident Scholar in the Climate and Water Program, at the Middle East Institute (US), a Senior Research Associate at Energy Policy Group (Romania), and an Associate Lecturer at the Bucharest University of Economic Studies. Andrei holds bachelor's

and master's degrees in nuclear engineering, a master's in business administration, and a master's in public policy at the Blavatnik School of Government.



**Dr Carla Gonçalves** is a Senior Researcher at the Centre for Power and Energy Systems in INESC TEC (Porto, Portugal). She holds Ph.D. and M.Sc. degrees in applied mathematics. From 2015 to 2019, she was involved in a wide range of energy forecast consulting collaborations between INESC TEC and the industry. Since then, she was part of the H2020 Smart4RES project, and more recently the European ENERSHARE project. Her research has been focused on probabilistic and collaborative forecasting methods, with a special emphasis on renewable energies, data privacy, and data markets.



**Davide Fioriti** is Assistant Professor at the University of Pisa on Energy Economics and Technologies and co-director of the PyPSAmeetsEarth initiative. He is expert in large- and small-scale energy modelling, started with a doctoral thesis on planning and operation methods for rural electrification by mini-grids, continued ever since, and then including global scale energy modelling using PyPSA-based tools. He is active in the EU-funded LEAP-RE project on microgrid modelling and in 2018 he was a visiting scholar at Massachusetts Institute of Technology.



**Hrvoje Keko** is an experienced engineer, researcher, consultant and developer. His work and life path spans several countries and continents and his career is a blend of academic, consulting and industry experience. Currently, he leads R&D projects in KONČAR Digital. He is passionate in open source, open standards, semantic interoperability, cyber security and energy democratization and firmly holds digitalization as a key pillar of energy transition.

## TT04 | Stability and harmonic power flow in converter-dominated grids under consideration of converters control nonlinearities

### Abstract

As largely acknowledged, the widespread integration of converter-interfaced distributed energy resources (DERs) has triggered fundamental changes in the operation of power systems and, as a matter of fact, the integration of power electronic devices is at the base of fundamental research on the topics of power systems' stability, power quality and control. In a traditional power system, dynamics are mainly associated with synchronous generators and their controls responsible to maintain frequency and voltage through speed governors and automatic voltage regulators. Increased penetration of converter-interfaced DERs has a considerable impact on these controls requiring realistic, sophisticated and computationally-tractable DERs models as essential tools for the study of the stability and power quality of converter-dominated grids.

Within this context, the tutorial discusses the most recent developments regarding modeling strategies and frameworks applied to converter-dominated grids with particular focus on static analysis, harmonic power flow, small-signal stability and AC/DC interactions in converter-interfaced resources.

### Course Outline (duration 4h)

#### Part 1: Modeling and stability in converter-dominated grids – 1 hours and 30 minutes

- A. Fundamentals of modeling and control of grid-connected converters – 30 minutes
- B. Nonlinear state-space modeling of power electronics-based power systems – 30 minutes
- C. Stability analysis of power electronics-based power systems considering static and dynamic aspects – 30 minutes

*Coffee break – 15 minutes*

#### Part 2: Harmonic Power Flow in converter-dominated grids – 1 hours and 30 minutes

- A. Harmonic power flow analysis in converter-dominated grids – 45 minutes
- B. Impact of converter synchronization and DC voltage dynamics on harmonic propagation – 45 minutes

*Questions and answers – 15-30 minutes*

**Federico Cecati**

Fraunhofer ISIT

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**Marco Liserre**

Chair of Power Electronics, Kiel University, Germany

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**Mario Paolone**

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**Johanna Becker**

Chair of the Distributed Electrical Systems Laboratory, EPFL, Swiss

[johanna.becker@epfl.ch](mailto:johanna.becker@epfl.ch)

Short Bio



**Federico Cecati** received the B.Sc and M.Sc. (Hons.) degree in Automatic Control Engineering from the University of L'Aquila, L'Aquila, Italy in 2015 and 2017, respectively. Since 2018 he is a PhD researcher at the Chair of Power Electronics, Kiel University, Kiel, Germany. From September 2020 to February 2021 he was a guest researcher at the Institute of Energy Technology, Aalborg University, Aalborg, Denmark. His research interests include nonlinear modelling, stability analysis, harmonic propagation and control in power electronics-based power systems.



**Marco Liserre** is Full Professor and he holds the Chair of Power Electronics at Kiel University (Germany). He has published 500 technical papers (1/3 of them in international peer-reviewed journals) and a book, receiving more than 35000 citations. Marco Liserre is listed in ISI Thomson report "The world's most influential scientific minds" from 2014. He has been awarded with an ERC Consolidator Grant for the project "The Highly Efficient And Reliable smart Transformer (HEART), a new Heart for the Electric Distribution System". He is member of IAS, PELS, PES and IES. He has been serving all these societies in different capacities. He

has received the IES 2009 Early Career Award, the IES 2011 Anthony J. Hornfeck Service Award, the 2014 Dr. Bimal Bose Energy Systems Award, the 2011 Industrial Electronics Magazine best paper award in 2011 and 2020 and the Third Prize paper award by the Industrial Power Converter Committee at ECCE 2012, 2012, 2017 IEEE PELS Sustainable Energy Systems Technical Achievement Award and the 2018 IEEE-IES Mittelman Achievement Award.



**Mario Paolone** received the M.Sc. (Hons.) and Ph.D. degrees in electrical engineering from the University of Bologna, Italy, in 1998 and 2002. From 2005 to 2011, he was an Assistant Professor in power systems with the University of Bologna. Since 2011, he has been with the Swiss Federal Institute of Technology, Lausanne, Switzerland, where he is Full Professor and the Chair of the Distributed Electrical Systems Laboratory. His research interests focus on power systems with particular reference to real-time monitoring and operational aspects, power system protections, dynamics and transients. Dr. Paolone's most significant

contributions are in the field of PMU-based situational awareness of active distribution networks (ADNs) and in the field of exact, convex and computationally efficient methods for the optimal planning and operation of ADNs. Dr. Paolone is Fellow of the IEEE and was the founder Editor-in-Chief of the Elsevier journal Sustainable Energy, Grids and Networks.



**Johanna Becker** received her B.Sc. degree in Microsystems Engineering from Freiburg University, Germany in 2015 and the M.Sc. degree in Electrical Engineering from the Swiss Federal Institute of Technology of Lausanne (EPFL), Lausanne, Switzerland in 2019. She is currently pursuing a Ph.D. degree at the Distributed Electrical System Laboratory, EPFL, with a focus on robust control and stability assessment of active distribution systems in presence of harmonics.

## TT05 | Innovative Training and Education on Renewable Energy Systems: Towards the Future Resilient, Sustainable and Carbon-Neutral Power Systems

### Abstract

The proliferation of renewable energy resources in transmission and distribution networks towards resilient carbon-neutral power systems highlights the growing need for well-rounded training and education of a large workforce of engineers to tackle the emerging challenges and needs of renewable-rich power systems. This tutorial brings together experience and expertise from several European partners of the newly funded Horizon Europe “Transition to sustainable future through training and education” (TRANSIT) project to provide novel training and education methodologies, tools and technological solutions on renewable energy systems. It will first introduce the challenges and needs of renewable-dominated power systems in the context of the European Green Deal for clean energy transition, and then it will provide holistic training on innovative approaches using state-of-the-art tools and solutions based on a wide range of power system software platforms (such as Typhoon HIL, DIgSILENT PowerFactory, and Matlab/Simulink), offering a unique opportunity to the participants for hands-on experience on renewable energy system simulation, modelling and planning.

### Course Outline (duration 8h)

09:00-09:15

Topic: Introduction to Tutorial: Outline, Aims and Objectives

Presenter: Mathaios Panteli, University of Cyprus

Delivery Mode: PowerPoint Slides

09:15-09:45

Topic: Towards Resilient Carbon-Neutral Power Systems: Challenges, Needs and Opportunities

Presenter: Prof Jovica Milanovic, The University of Manchester, United Kingdom

Delivery Mode: PowerPoint Slides

09:45-10:30

Topic: The European Green Deal for clean energy transition: Design and Integration of Renewable Energy Sources

Presenter: Dragan Vuckovic, University of Nis, Faculty of Electronic Engineering, Serbia

Delivery Mode: PowerPoint Slides

10:30-10:45

Topic: Summary and Questions

Moderator: Mathaios Panteli, University of Cyprus

Delivery Mode: Open Discussion

*10:45-11:00 – Coffee Break*

11:00-12:30

Topic: Introduction to Real-Time Simulations with Typhoon HIL: Schematic Editor, HIL SCADA, analog and digital IOs

Presenter: José Miguel Riquelme, Polytechnic University of Madrid

Delivery Mode: Hands-on demonstration in Typhoon HIL Control Center software

*12:30-13:00 – Lunch break*

13:00-14:00

Topic: EMT simulation and modelling of grid-following inverters for renewable energy systems Presenter:

Lenos Hadjidemetriou, University of Cyprus

Delivery Mode: Hands-on demonstration in Matlab/Simulink

14:00-15:30

Topic: EMT modelling and simulation of grid-forming converter control

Presenter: Matej Krpan, University of Zagreb, Croatia

Delivery Mode: Hands-on demonstration in DIgSILENT PowerFactory

*15:30-15:45 – Coffee Break*

15:45-16:45

Topic: Transmission expansion planning under long-term uncertainty: stochastic optimization and the role of smart investment options

Presenter: Stefan Borozan, Imperial College London and Ss. Cyril and Methodius University in Skopje

Delivery Mode: PowerPoint Slides & Interactive Activities

16:45-17:00

Topic: Questions and Closing Remarks

Moderator: Mathaios Panteli, University of Cyprus

Delivery mode: Open Discussion

## Instructors

### **Jovica Milanovic**

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## Short Bio



**Prof Jovica V. Milanović** (Fellow, IEEE) is a Professor of Electrical Power Engineering and Deputy Head of Department with the Department of Electrical and Electronic Engineering, The University of Manchester, Manchester, U.K.



**Dragan Vuckovic** is the Head of the Laboratory of Electrical Installations and Illumination at the Faculty of Electronic Engineering, University of Nis. He is a member of the Serbian Standardisation Institute and a member of the executive board of the Serbian Lighting Association. He participated in several international and national research projects in energy efficiency and renewable energy domains. His research activities are in the areas of lighting, energy efficiency, renewable energy and power quality.



**Jose Miguel Riquelme-Dominguez** received the degree in electrical engineering from the Universidad de Sevilla, Seville, Spain, in 2015. He is currently pursuing the Ph.D. degree with the Universidad Politécnica de Madrid, Madrid, Spain. His research interests include grid connected photovoltaic systems and power system stability and control.



**Lenos Hadjidemetriou** is currently a Research Lecturer at the KIOS Research and Innovation Center of Excellence, University of Cyprus. He received the Diploma in Electrical and Computer Engineering in 2010 from the National Technical University of Athens, Greece, and his Ph.D. degree in Electrical Engineering in 2016 from the University of Cyprus, Cyprus. His research interests include smart grids, grid integration of renewable energy systems, energy storage systems, control of power electronics, micro-grids, smart buildings, digital twins, and cyber-security aspects in smart grids.



**Matej Krpan** received the bachelor's and master's degrees in electrical power engineering from the Faculty of Electrical Engineering and Computing, University of Zagreb, in 2014 and 2016, respectively, where he is currently pursuing the Ph.D. degree in electrical engineering with the Department of Energy and Power Systems. His research interests include power system dynamics, stability, and control of low-inertia power systems.



**Stefan Borozan** received the B.Sc. degree in electrical engineering and information technologies from Ss. Cyril and Methodius University in Skopje in 2017 and the M.Sc. degree in future power networks from Imperial College London in 2018. He is currently pursuing the Ph.D. degree in the Control and Power group at Imperial College London. Stefan also holds a visiting research associate position with the Faculty of Electrical and Electronic Engineering in Skopje and has previous experience in low and medium voltage distribution grid planning at the DNO Elektro distribucija DOOEL (part of EVN Group) in North Macedonia.



**Mathaios Panteli** holds an Assistant Professor position within the Department of Electrical and Computer Engineering, University of Cyprus, since January 2021. Prior to joining UCY, he was a Lecturer at the Power and Energy Division of The University of Manchester, serving as the Deputy Lead of the Sustainable Energy Systems research cluster. His academic qualifications include an M.Eng. degree from Aristotle University of Thessaloniki, Greece, in 2009, and a Ph.D. degree in Electrical Power Engineering from The University of Manchester, U.K., in 2013.

## TT06 | Grid forming converters connected to the transmission system – Influence of the type of grid forming control on the small signal stability

### Abstract

Today, a major share of the electronic converters is controlled under the presumption that they are connected to a strong AC voltage with a given magnitude and frequency in such a way that the converter can exchange an active and reactive power thanks to a current control. This control strategy of the converter is known as the grid-following control. The limitation of this solution has been well documented in the literature such as the challenge related to synchronization in weak grid. The grid forming control is proposing a new way to connect the power electronic converters which is supposed to solve these issues. The proposed tutorial is covering a wide overview about this type of control starting from the origin of the grid forming control in order to define a strong classification for the various types of control. A clear distinction will be made between grid forming control with or without current loop and the consequence in term of small signal stability will be addressed.

### Course Outline (duration 8h)

#### First part: Theoretical presentation 4h

- 1 – Introduction (15 minutes)
- 2 – Description of the main types of control (30 minutes)
- 3 – Small signal stability analysis of different types of grid forming control (30 minutes)
- 4 – Current limitation in a converter driven by a grid-forming control – Transient stability (15 minutes)
- 5 – Implementation of the grid-forming converter on a VSC and an MMC (20 minutes)
- 6 – Different types of grid-forming application (20 minutes)
- 7 – Testing grid forming capability, pilot projects and barriers for an industrial deployment (30 minutes)
- 8 – The integration of grid forming capabilities into connection network codes (40 minutes)
- 9 – Conclusion and perspectives (10 minutes)

#### Second part: Practical exercises 4h

- Practical exercise 1: Study of the inertial effect brought by a grid forming converter (45 minutes)  
 Practical exercise 2: Study of an HVDC link (45 minutes)  
 Practical exercise 3: Small signal stability analysis (1h30)

**Xavier Guillaud**

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Short Bio



**Xavier Guillaud** received his Ph.D from University of Lille in 1992 and joined the Laboratory of Electrical Engineering and Power Electronic (L2EP) in 1993. He has been professor in Ecole Centrale of Lille since 2002. First, he worked on modeling and control of power electronic systems. Then, he studied the integration of distributed generation and especially renewable energy in the power system. Nowadays, he is focused on the integration of high voltage power electronic converters in the transmission system. He is involved on several projects about power electronic on the grid within European projects and a large number of projects with French electrical utilities.



**Frederic Colas** received a PhD in control system in 2007 from Ecole Centrale de Lille (France). Frédéric Colas is a member of the Laboratory of Electrical Engineering (L2EP) in Lille and is a Research Engineer at Arts et Métiers. His field of interest includes the integration of dispersed generation systems in electrical grids, advanced control techniques for power system, integration of power electronic converters in power systems and hardware-in-the-loop simulation.



**Carmen Cardozo** holds an electrical engineering degree from Simon Bolivar University, Venezuela, and a M.S. in Energy Physics from ENS Cachan, France. She received a PhD in Electrical Eng. in 2016, before joining the R&D department of RTE, the French TSO. Her research topics include the modelling and control of power electronic interfaced resources and HVDC link for power system stability assessment.

## TT07 | Integrated electricity-gas-hydrogen systems: an introduction

Abstract

As countries worldwide accelerate their efforts to meet net-zero carbon emission targets, integrated energy systems and sector coupling are seen as a key means towards whole-system decarbonization. In particular, hydrogen and especially “green” hydrogen obtained from electrolysis and renewable electricity could play a major role thanks to its versatility to operate across multiple energy sectors. Besides direct applications of green hydrogen for industry and export, promising applications are as a form of both short-term and long-term storage options to accommodate more and more electricity from variable renewable energy sources, in case by injection of green hydrogen into existing gas networks, or development of new, dedicated hydrogen transport and storage infrastructure.

Overall, integrated electricity, gas and hydrogen systems (IEGHS) will interact with each other with greater and greater complexity, which calls for advanced models, frameworks, and solution techniques for the operation and planning of such future integrated energy systems and the underlying multi-energy infrastructure.

Based on the extensive experience of the authors with research and industry projects around the world, this tutorial will explore the techno economic modelling of IEGHS from transmission to distribution, with a closer look into their integrated operation and planning. This tutorial will also introduce state-of-the-art solution techniques to solve such complex problems in a scalable fashion.

#### Course Outline (duration 4h)

1. Introduction and motivation (15 minutes)
2. Mathematical modelling of IEGHS (50 minutes)

Q&A (5 minutes)

3. Sequential linear programming for operational problems in IEGHS (30 minutes)

Q&A (5 minutes)

4. Optimal integrated planning of electricity and hydrogen infrastructure for large-scale renewable energy transport and storage (30 minutes)
5. Live demo of an IEGHS Modelling Tool developed by the presenters (20 minutes)

Q&A (5 minutes)

6. Aggregated flexibility from multiple electrolyzers in distribution-level IEGHS (30 minutes)

Q&A (5 minutes)

7. Techno-economic modelling of integrated electricity-hydrogen energy hubs and virtual power plants (30 minutes)

Q&A (5 minutes)

8. Concluding remarks (10 minutes)

#### Instructors

##### **Sleiman Mhanna**

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#### Short Bio



**Dr. Sleiman Mhanna** received his PhD in electrical engineering from the University of Sydney in 2016 and is now a Senior Research Fellow at The University of Melbourne working on designing mathematical models and scalable algorithms for the operation and planning of integrated electricity, gas, and hydrogen systems. The studies he has conducted over the past three years, which include electrification of residential heating demand and modelling of hydrogen blending in gas transmission networks, are currently used by Future Fuels Cooperative Research Centre (FF CRC) and its industry partners in their policy initiatives and decarbonisation roadmaps. He is also a senior member at IEEE and an associate editor for IEEE Transactions on Smart Grid and for IEEE Power Engineering Letters.



**Prof. Pierluigi Mancarella** is Chair Professor of Electrical Power Systems at the University of Melbourne, Australia, and Professor of Smart Energy Systems at the University of Manchester, UK. His key research interests include techno-economic modelling and analysis of multi-energy systems, grid integration of renewables and distributed energy resources, energy infrastructure planning under uncertainty, and security, reliability, and resilience of low-carbon networks. Pierluigi is a Fellow of the IEEE, an IEEE Power and Energy Society Distinguished Lecturer, and an Editor of the IEEE Transactions on Power Systems and of the IEEE Transactions on Energy Markets, Policy and Regulation.

### Abstract

The module discusses the dynamic analysis and operation of low-inertia grids, that grid with high penetration of converter-interfaced generation. The module is organized into two parts. The first part focuses on operation and control, whereas the second part deals with modelling and stability analysis. The module blends industry experience and recent trends in academic research. The industry point of view is represented by EirGrid that operates the Irish grid up to 75% non-synchronous instantaneous power generation and DlgSILENT that will share their experience with the implementation of converter and their controllers in a power system software tool. The academic presentations discuss state-of-the-art concepts on the modelling of security constrained optimal power flow problems for low-inertia systems; as well as recent advances in the synchronization stability and modelling of grid-connected converters and their controllers. All presentations include several illustrative examples based on both benchmark and real-world systems.

### Course Outline (duration 4h)

#### *Introduction (5 min)*

Blending optimization methods with dynamic analysis for low-inertia power systems (45 min)

Dynamic Response of Inverter-based Resources in Ireland and Northern Ireland Power Systems (45 min)

#### *Break (10 min)*

Distributed generation modeling, simulation and system studies using DlgSILENT PowerFactory (45 min)

Synchronization stability of grid-connected converters (45 min)

Complex modelling of converter-interfaced generation (40 min)

#### *Closure (5 min)*

### Instructors

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### Short Bio



**Petros Aristidou** got his Diploma from the Department of Electrical & Computer Engineering at the National Technical University of Athens (Greece) in 2010 and his PhD at the University of Liege (Belgium) in 2015. During his PhD, he worked on domain decomposition methods for real-time dynamic security assessment of transmission systems. He took a position as a Postdoctoral Researcher at the Power Systems Laboratory at ETH Zurich (Switzerland) for one year, working on developing new control algorithms for future low-inertia power systems. Between 2016-2019 he was a Lecturer at the University of Leeds (UK), where he led the Smart Grids Lab. Since January 2020, he has been a Lecturer in Sustainable Power Systems at the Cyprus University of Technology. His expertise is in power system dynamics, planning, and control, and he has participated in several working groups looking into the challenges of low-inertia systems. Recent projects and publications can be found at <https://sps.cut.ac.cy>



**Junru Chen** (S'17, M'19) received the Ph.D. in 2019 and the ME Electrical Energy Engineering in 2016 from University College Dublin, Dublin, Ireland. He was a Senior Researcher in University College Dublin and visiting scholar in Aalborg University, Denmark in 2020. He was a visiting doctoral student in Kiel University, Germany in 2018 and Tallinn University of Technology, Estonia, in 2019. Since 2020 he is an Associate Professor at Xinjiang University, China. He has been honored with the 2019 Chinese Government Award for Outstanding Self-financed Students Abroad. His current research interests include power electronics control, modeling, stability, and application.



**Ahsan Murad** received a B.Sc. degree in electrical engineering from IUT, Bangladesh, in 2009 and a double M.Sc. degree in Smart Electrical Networks and Systems from KU Leuven, Belgium, and KTH, Sweden, in 2015. He completed his Ph.D. with the Department of Electrical and Electronic Engineering, University College Dublin, Ireland, in 2019. He is currently working with DIgSILENT GmbH, Germany as an application engineer.



**Taulant Kërçi** received the B.Sc. and M.Sc. degrees in electrical engineering from the Polytechnic University of Tirana, Albania, in 2011 and 2013, respectively, and the Ph.D. degree in electrical engineering from University College Dublin, Ireland, in November 2021. From June 2013 to October 2013, he was with the Albanian DSO with the metering and new connection department. From November 2013 to January 2018, he was with the Albanian TSO at the SCADA/EMS office. In September 2021, he joined the Irish TSO, EirGrid plc, where he is currently a senior lead engineer. He is (co-)author of 1 book chapter and

more than 20 journals/conferences papers. His research interests include power system operations and dynamics, as well as co-simulation of power systems and electricity markets.



**Federico Milano** received from the University of Genoa, Italy, the Ph.D. in Electrical Engineering in 2003. In 2013, he joined the UCD School of Electrical and Electronic Engineering, where he is currently a full professor. He has authored more than 300 publications, and 8 books. He is an IEEE Fellow, an IET Fellow, a member of the IEEE PES Distinguished Lecturer Program, the chair of the IEEE Power System Stability Controls Subcommittee, Chair of the Technical Programme Committee of the PSCC 2024, Senior Editor of the IEEE Transactions on Power Systems, a member of the Cigré Irish National Committee, and Editor in Chief of the IET Transmission, Generation & Distribution.

## SS01 | Global Perspectives on Utility of the Future

## Abstract

The electric power industry is being transformed and reshaped with renewable, clean, and more resilient energy solutions. Robust decarbonization goals are being set along with more pressure to increase reliability and become more resilient. This is coupled with the challenges of an aging infrastructure and changing workforce. Power utilities are at the center of this challenge; tasked with integrating record levels of new, renewable, energy assets while accommodating dramatically increased multidirectional power flows, and hardening the grid to prepare for increasingly severe weather events exacerbated by climate change. This panel is made up of international industry executives who will present and discuss ideas and initiatives driving Decarbonization, Grid Modernization, Electrification, and the Utility of the Future.

## Chair

**Wayne Bishop Jr.**, IEEE PES Vice President, Meetings and Conferences, and Vice President Industry Outreach and Strategy at Quanta Technology

## Speakers

**Dr. Shay Bahramirad**, Senior Vice President, Engineering and Asset Management at LUMA Energy in Puerto Rico and IEEE PES President Elect (incoming President)

**Dr. Damir Novosel**, Founder and President, Quanta Technology

**Dr. Luka Strezoski**, Professor and the Head of the Power Engineering and Applied Software Department, University of Novi Sad, Serbia.

**Mr. Nikola Obradović**, Director for International and Regulatory Affairs at the EMS – the Serbian TSO.

## Short Bio



**Wayne Bishop Jr.** is Vice President of Industry Outreach and Strategy at Quanta Technology, a subsidiary of Quanta Services. He has worked in the electric power industry for over 30 years. Wayne is also IEEE PES Vice President of Meetings and Conferences, a member of the IEEE Power and Energy Society Governing Board and a member of the IEEE PES Executive Committee. He helped write and implement the Long-Range Strategic Plan for IEEE PES and is a Senior Member of IEEE. In addition, Wayne currently serves as a Senior Advisor to LUMA Energy, the electric utility in Puerto Rico.

Previously, Wayne worked at OMICRON electronics for 13 years where he was the Head of Marketing for North America. Prior to that, Wayne was employed at Doble Engineering Company for nearly 20 years in several senior management positions. In 2007, he was appointed by Doble's Board of Directors to serve on the Executive Committee to broker the sale of Doble Engineering to ESCO Technologies.

Wayne is a graduate of Merrimack College, Harvard University, and the Executive MBA Program at Suffolk University in Boston, graduating with honors. Wayne speaks regularly at industry conferences and has published several articles and papers in industry publications including IEEE Power and Energy Magazine and T&D World Magazine.

Wayne and his family live in the suburbs of Boston, Massachusetts.



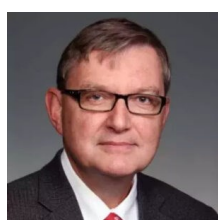
**Dr. Shay Bahramirad** is the Senior Vice President of Engineering, Asset Management, and Capital Programs at LUMA Energy, the power company responsible for electric service in Puerto Rico. In this role, she is responsible for the oversight, planning, and execution of plans to modernize the power infrastructure. This includes a foundation of developing local engineering talent, teams and processes, and the prudent application of new technology. Her primary goals are the safe, reliable, sustainable, and cost-effective delivery of electricity to the people of Puerto Rico.

Shay has held several positions in the sector including Vice President of Climate and Resilience at Quanta Technology, where she was responsible for assisting cities and utilities with climate change risk assessments for their assets, operations, and services and for developing investment strategies to mitigate and adapt to climate change. Prior to that, she was Vice President of Engineering and Smart Grid at ComEd, the electric utility serving Chicago and Northern Illinois, where she had led efforts to demonstrate and deploy technologies to ensure that the distribution system meets strategic goals related to reliability, resiliency and sustainability, while developing and implementing a broader community of the future vision including a focus on industry-informed STEM education for underrepresented communities in the industry including girls. She has been an expert witness testifying on several state and federal regulatory proceedings around microgrids, energy storage, investment strategies, and the interconnection of distributed energy resources.

Dr. Bahramirad is a leading figure in the industry. She is the President-elect of IEEE Power and Energy Society, an editorial board member of the Electricity Journal, US CIGRE Executive member, an adjunct professor at the Illinois Institute of Technology, and a founder of IEEE Women in Power.

She is a contributor to the United Nations SG7, Affordable and Clean Energy.

Shay completed her PhD in electrical engineering at the Illinois Institute of Technology, and has published more than many academic articles, as well as being the recipient of multiple US patents.



**Dr. Damir Novosel** is president and founder of Quanta Technology, a subsidiary of Quanta Services, a Fortune 250 company. He was also president of Quanta Energized Services which achieved a perfect safety record during his tenure. Previously, he was vice president of ABB Automation Products and president of KEMA T&D US. Dr. Novosel is also an adjunct professor of Electrical Engineering at North Carolina State University. Damir was elected to US National Academy of Engineers in 2014. He served as president of the IEEE Power and Energy Society, VP of Technical Activities, and received the Patrick P. Ryan Meritorious

Service Award. Damir is a secretary of IEEE PES Executive Advisory Council and member of the IEEE Standards Association Standards Board and chair of Strategic and Emerging Standards Committee. He is a member of the CIGRE US National Committee and received the CIGRE Attwood Associate and the Distinguished Member awards. Damir holds 18 US and international patents, published over 200 articles and reports, and contributed to 7 books. Dr. Novosel served on various boards and is presently member of the Sandia National Laboratories Energy and Homeland Security External Advisory Board and Mississippi State University Industry Advisory Board. Damir, an IEEE Fellow since 2003, holds PhD, MSc, and BSc degrees in electrical engineering from Mississippi State University (where he was a Fulbright scholar), the University of Zagreb, Croatia, and the University of Tuzla, Bosnia and Herzegovina, respectively. Dr. Novosel was selected as Mississippi State University Distinguished Engineering Fellow in 2015.



**Dr. Luka V. Strezoski** received the B.S., M.Sc., and Ph.D. degrees (with honors) in Power Engineering from the University of Novi Sad, Serbia, in 2013, 2014, and 2017 respectively. His Ph.D. research was conducted in a joint supervision between University of Novi Sad, Serbia and Case Western Reserve University, Cleveland Ohio, USA.

Dr. Strezoski is with the Faculty of Technical Sciences, University of Novi Sad since 2014, and currently serves as an Assistant Professor and the Head of the Power Engineering and Applied Software Department, as well as the Director of the Smart Grid Laboratory. Dr. Strezoski is also a Founder and Principal Consultant at DerMag Consulting International where, with his team of experts, he provides consulting and R&D services to worldwide clients in the areas of smart grid applications; renewable generation modeling; integration and active management of high penetration of renewable generation; distribution system modeling and protection; Advanced Distribution Management System (ADMS) and Distributed Energy Resources Management Systems (DERMS) development and deployment; as well as microgrid modeling, management, and protection.

Dr. Strezoski serves as a member of the Industrial Advisory Board for National Renewable Energy Laboratory (NREL), Golden, CO, USA, regarding NREL's research projects in the ADMS and DERMS domain, as well as with Case Western Reserve University as an Academic Affiliate.

From 2017 to 2022, Dr. Strezoski was also with Schneider Electric, first as a Business Analyst, then as a Product Manager for ADMS and DERMS, and finally as a Principal Consultant to Solutions Engineering (ADMS and DERMS) and a Member of the Technology Board.

Dr. Strezoski has led or has been involved in numerous academic and industrial projects in the Smart Grids area, including academic projects funded by the EU, National projects funded by the Serbian Government, as well as industrial projects regarding implementation of ADMS and DERMS solutions, worldwide.

Dr. Strezoski serves as an Editor in several international journals, including Guest Editorial positions for IEEE Systems Journal, Elsevier's International Journal of Electrical Power and Energy Systems and Topic Editor for MDPI's Electronics journal. Dr. Strezoski was the General Chair of the 2022 IEEE PES Innovative Smart Grid Technologies Europe (IEEE PES ISGT Europe) conference and is a member of IEEE and PES, as well as a member of the Assembly of the Serbian CIGRE section. Dr. Strezoski is laureate of the "Dr. Zoran Djindjic Award" for the best scientist and researcher under the age of 35 in Serbia, in December of 2020.



**Nikola Obradović**

Corporate director for international and regulatory affairs, EMS – Serbian TSO

Nikola Obradović was born in 1963 in Belgrade, Serbia, where he received the B.S., and M.S., degrees from the University of Belgrade, Belgrade, Serbia, both related to Automatic Generation Control.

His career in electricity sector started in 1990 when he was employed by the Yugoslav Electric Power Company (JUGEL) as a dispatcher. In 1993 he joined Electric Power Industry of Serbia and in 2005 he moved to EMS – Serbian TSO. He is co-convenor of ENTSO-E RG Continental Europe SG System Frequency, convenor of the SMM Block (Serbia, North Macedonia and Montenegro) WG and the chairman of STK C2 CIGRE Serbia. He participated in the UCTE team that implemented Turkey's connection to the interconnection Continental Europe and ENTSO-E TF for the urgent synchronization of the Ukraine and Moldova power systems to the interconnection Continental Europe. He led the development of a study for TSOs of the Baltic countries with the aim of preparing them for Continental Europe LFC operation and was a member of the ENTSO-E reporting teams following the major disturbances, e.g. 9-11th January 2019 event, 8th January 2021 and 24th July 2021 events. He is the author of several dozens of professional papers published mostly at CIGRE Serbia conferences as well as in CIGRE Paris conferences, and European Transactions on Electrical Power.

## SS02 | A role of flexibility in enabling net-zero energy systems

### Abstract

The shift in how we generate and consume electricity has a significant impact on the operation of energy systems, including power networks, which are becoming a backbone for the integration of renewable resources at all voltage levels. In order to harness this renewable energy generated by variable resources, it is necessary to rely on provision of flexibility by various participants in order to maintain secure network operation, while keeping reinforcement an operational cost at bay. This panel will look into a role of flexibility in enabling net-zero energy systems and will investigate different solutions applied to manage integration of new devices both from technical and economic aspects. This will include investigation of how to manage flexibility in the system, including of battery energy systems owned by prosumer, as well as organization of the local energy markets as one of the novel ways to trade flexibility. Furthermore, the panel will look into integration of different energy vectors and aggregation of smaller providers via Virtual Power Plants to help with system operation as well as ways to provide new business opportunities to various market participants. The panel will also present and discuss solutions applied in different parts of the world.

### Chair

**Ivana Kockar**, University of Strathclyde, UK

### Speakers

**Gregor Verbic**, University of Sydney, Australia

**Dimitrios Papadaskalopoulos**, University of Patras, Greece

**Vedran Peric**, Technical University Munich, Germany

**Ivana Kockar**, University of Strathclyde, UK



paradigm shift in power system operation, from generation following load to load following generation.

**Gregor Verbic** is an Associate Professor in the Centre for Future Energy Networks based in the School of Electrical and Information Engineering. Prior to this, he was an assistant professor in Laboratory of Power Systems at University of Ljubljana, where he is now an adjunct professor and where he received his PhD in electrical engineering. In 2005, he was a NATO-NSERC Postdoctoral Fellow at the University of Waterloo, Canada under supervision of Prof Claudio Cañizares. Between 2008 and 2010 he was head of the investment department in Interenergo, Ljubljana, Slovenia. The company invests in renewable energy in the Balkans region, with a particular focus on small hydro. His current research is motivated by the evolution of power systems to future grids, dominated by intermittent renewable energy sources, aiming to develop tools and methods that will enable a



and flexible demand technologies, and employing optimisation, game-theoretic and machine learning principles. Dimitrios has been involved in over 20 national and international research and consultancy projects conducted in close collaboration with the energy industry, governments and regulators. Dimitrios is a Member of the Institute of Electrical and Electronic Engineers (IEEE) and the International Association for Energy Economics (IAEE).

**Dimitrios Papadaskalopoulos** received his Diploma in Electrical and Computer Engineering from the University of Patras, Greece, in 2008 and his Ph.D. degree in Electrical Engineering from Imperial College London, United Kingdom, in 2013. He was then employed by Imperial College London, firstly as a Postdoctoral Research Associate (2013-2017) and later as a Research Fellow in Decentralised Energy Systems (2017-2022). In 2022, he joined the Department of Electrical and Computer Engineering of the University of Patras, as Assistant Professor in Economic Operation and Analysis of Advanced Electricity Systems. His research focuses on modelling, analysis and design of national and local electricity markets, including assessment of the role of renewable and distributed generation, energy storage



related to power systems dynamic stability, operation and control of smart grids, with the particular focus on integration of electric systems with district heating/cooling grids.

**Vedran S. Perić** received the master's degree from the University of Novi Sad, Serbia, and the Ph.D. degree from the KTH Royal Institute of Technology, Stockholm in 2016.

He was a Research and Teaching Assistant with the University of Novi Sad and Visiting Researcher with the Delft University of Technology. He held positions of Senior Power System Engineer with GE Grid Solutions Research and Development Department, Senior Power System Consultant at GE Energy Consulting, and as a Senior Business Analyst with Regional Security Coordinator, TSCNET Services GmbH. He is currently a Head of Research Center for Combined Smart Energy Systems (CoSES) at the TUM Institute of Integrated Materials, Energy and Process Engineering (MEP). His research interests include a wide range of topics

**Ivana Kockar** received her MEng from University of Belgrade (Serbia) and MSc and PhD degrees from McGill University (Montreal, Canada), all in Electrical Engineering. Currently, she is a Reader within the Institute for Energy and Environment at the University of Strathclyde, Glasgow, UK.

Her research is in the area of power system operation, planning and economics, including new centralised and decentralised tools for integration of Distributed Energy Resources into networks and markets. Her work also extends to assessment of a transition towards a DSO, as well as interactions between TSOs and DSOs, as well as development of Virtual Power Plant modeling and tools for small energy pools. This includes a number of research projects funded by EPSRC, Royal Academy of Engineering, as well as EU Hor2020 projects on TSO-DSO interactions and associated market designs, as well as on implementation of VPPs. The industrial work includes funding to look into energy solutions related to various aspects of Distributed Energy Resources integration as well as whole

### Abstract

This session will provide an overview of the future of flexibility in power grids and established power markets, as seen through the lens of the Horizon Europe projects STREAM, X-FLEX and OPENTUNITY. Speakers will share their experiences and insights from their respective projects, highlighting some of the key findings and innovations that are emerging in the field of flexibility. Below, we list the projects that will be involved and their brief description:

- Horizon Europe project STREAM (<https://stream-he-project.eu/>): The ambition of the STREAM project (STREAM) is the creation of an innovative and robust flexibility ecosystem ("STREAM Ecosystem") on the low voltage (LV) grid side of existing power markets connecting data, technologies, stakeholders and markets, thus facilitating the flexibility provision.
- Horizon Europe project OPENTUNITY: OPENTUNITY aims to create a flexibility ecosystem reducing interoperability barriers and favouring the use of standards in order to decarbonize EU grids and put the end-user in the spotlight. It will support grid operators, prosumers, market actors via innovative methodologies, backed by advanced, interoperable software modules, in order to provide them with new features and related to boosting flexibility in prosumer's environment and improving the grid operation management for grid operators. OPENTUNITY will adapt and integrate an energy specialized blockchain as a distributed, fast and reliable energy dataspace in which actors from different fields will share services and find synergies among them in order to create a reliable energy system in which different verticals (electromobility, gas, OEM etc.) will be able to seamlessly collaborate with each other.
- Horizon 2020 project X-FLEX (<http://xflexproject.eu/>): X-FLEX project will design, develop and demonstrate a set of tools in order to integrate the emerging decentralized ecosystem of Renewable Energy Sources (RES) and flexibility systems into the existing European energy system, in an efficient and cost-effective manner, in order to create more stable, secure and sustainable smart grid, with special attention to extreme weather conditions.

An opportunity for attendees to ask questions and engage in a dialogue with the experts. Overall, this session will provide attendees with a comprehensive overview of the future of flexibility in power grids and power markets, as seen through the eyes of the Horizon Europe projects. The session will be of interest to anyone working in the energy industry, including utilities, technology providers, policy makers, and academics. Attendees will leave with a deeper understanding of the challenges and opportunities facing the industry, and the latest trends and technologies that are driving innovation and growth.

### Chair

**Tomi Medved**, UL FE

### Speakers

**Tomi Medved**, UL FE

**Bojan Stojanović**, PETROL

**Jan Jeriha**, UL FE

**Edin Lakić**, IRI UL

### Short Bio



**Tomi Medved** did his PhD studies at the Faculty of Electrical Engineering, the University of Ljubljana. He is Head of the Laboratory of Energy Policy (LEST) where he leads several industrial and EU projects. His vision for successful energy transformation is in collective actions of all stakeholders as there is no "one solution fits all" and flexibility in all fields is necessary. Therefore, he is focussing on connecting LEST with various industries, policy makers, universities, and other stakeholders and developing and testing new solutions that will enable an energy transition and sustainable development. His main research topics are Smart Grids, renewable integration, demand response optimization, electricity markets modelling and policy design.



**Bojan Stojanović** has more than 15 years of experience in the international sustainability arena working on nature protection, sustainable business practices, renewable energy sources and mitigating and adapting to climate change. Currently working in Petrol d.d., Ljubljana as Head of EU projects, Bojan is responsible for developing and managing innovative energy projects (Horizon 2020, Horizon Europe) and ensuring that developed solutions find their way to the market. Bojan holds a Master in Business Administration (MBA) and is representative of Petrol d.d. in different associations such as TECES and CER.



**Jan Jeriha** completed his master's study at the Faculty of Electrical Engineering, University of Ljubljana in 2018. Jan joined the Laboratory of Energy Policy (LEST) in March 2018 as a researcher and as a PhD student later in 2018. In the first years of his professional career he was active in two international research projects CROSSBOW and COMPILE and since October 2022, he is the Deputy coordinator of the Horizon Europe project STREAM. In his research, he focuses on the common European balancing markets and local flexibility markets. Since 2018 he is also the president of the Slovenian Chapter of the IEEE PES (Institute of Electrical and Electronics Engineers, Power & Energy Society).



**Edin Lakić**, M.EE, got his Master's degree at the Faculty of Electrical Engineering, University of Ljubljana in 2012 and is employed as the Assistant Director of Innovation Institute for Innovation and Development of University of Ljubljana. He is active in projects with the EU Agency for the Cooperation of Energy Regulators (ACER) and Horizon Europe projects EBENTO, OPENTUNITY, 3DIVERSE and STREAM. Previously he worked at the power exchange BSP SouthPool as a Trading supervisor, Head of Key Account & Sales Management, and market specialist on several projects. Later on, as a senior researcher at Laboratory of Energy Policy, he was working on topics of smart grids, RES integration, operation of power systems, energy markets, and energy efficiency and was involved in EU projects CONSEED, COMPILE, CROSSBOW and X-FLEX.

## SS04 | Objective-based Machine Learning for Low-carbon Power Systems

### Abstract

With the trend of digitalization, machine-learning techniques will be widely applied in the planning and operation of power systems. Traditionally, machine learning and decision-making models are independent. The objective of machine learning is usually based on statistical metrics while decision-making models usually aim at lower cost and higher reliability.

An underlying assumption here is that a more statistically accurate result generated by machine learning will guarantee more effective decision-making. However, recent research shows different results. For example, the forecasting error might have an asymmetric impact on the system operational cost. The clustering error may have a distributional influence on network expansion decisions. Therefore a series of objective-based machine learning models have been proposed to address specific objectives of power system decision making such as the cost-oriented forecasting model, the closed-loop clustering model and the reliability-based expansion model.

Supported by authors of these recent emerging papers, this panel will further explore how objective-based machine learning could support more effective planning and operation of low-carbon power systems. These are essential ingredients to smart decisions which will increase the operating efficiency of the system. The panel will discuss the following topics: 1). Theory: What is the fundamental science of objective-based machine learning models? How are they compared to other decision-making approaches such as probabilistic models and uncertainty optimisations? 2). Techniques: What algorithm and data innovations are required to implement objective-based machine learning models? Could the models truly reflect the objectives of the system? In reality, when the data is limited, what is the practical value of this approach? Is there a practical approach to manage the data in real-time or is there an alternative rule-based/AI-based solution? 3). Applications: What are the potential applications of this approach to different sectors and tasks in generators, networks, customers and markets? How flexible is the approach when the system is of high uncertainty? How transferrable is the approach to different systems and markets?

### Chair

**Ran Li**, Shanghai Jiao Tong University

## Speakers

**Dr. Fei Teng**, Imperial College  
**Prof. Ran Li**, Shanghai Jiao Tong University/University of Bath  
**Prof. Salvador Pineda Morente**, University of Málaga

## Short Bio



**Fei Teng** (Senior Member, IEEE) received the B.Eng. degree in electrical engineering from Beihang University, China, in 2009, and the M.Sc. and Ph.D. degrees in electrical engineering from the Imperial College London, U.K., in 2010 and 2015, respectively. He is currently a Senior Lecturer with the Department of Electrical and Electronic Engineering, Imperial College London. His research focuses on the power system operation with high penetration of inverter-based resources (IBRs) and the cyber-resilient and privacy-preserving cyber-physical power grid.



**Ran Li** received the B.Eng. degrees in electrical power engineering from the University of Bath, Bath, U.K., and North China Electric Power University, Beijing, China, in 2011, and the Ph.D. degree in electrical engineering from the University of Bath in 2014. He is currently an Associate Professor with the Department of Power Electrical Engineering, Shanghai Jiao Tong University, Shanghai, China. His major interests include big data in power system and power economics.



**Salvador Pineda** received the Ingeniero Industrial degree from the University of Malaga, Malaga, Spain, in 2006, and the Ph.D. degree in electrical engineering from the University of Castilla-La Mancha, Ciudad Real, Spain, in 2011. He is currently an Associate Professor with the University of Malaga. His research interests are in the fields of power system operation and planning, decision-making under uncertainty, bilevel programming, machine learning and statistics

## SS05 | DER operating envelopes and their applications in energy markets and planning

### Abstract

The addition of large-scale renewable energy in power systems has led to increased volatility in supply that can negatively affect the reliability of the distribution grid. The flexibility offered by demand-side resources has shown promise but requires careful coordination and communication with possibly hundreds of thousands of such resources, which is a daunting task. Traditional operating envelopes for distributed energy resources (DERs), including hosting capacity methods, tend to be piecemeal, static, and hence overly conservative, underutilizing the distribution network capacity.

This panel aims to present recent works that go beyond the traditional methods of static hosting capacity and toward the dynamic concept of operating envelopes for DERs. These operating envelopes allow DERs and aggregators to participate in wholesale markets without sacrificing network reliability and security.

### Chair

**Prof Gregor Verbic**, Professor, The University of Sydney, Australia

### Speakers

**Gregor Verbic**, The University of Sydney, Australia  
**Johann Mathieu**, The University of Melbourne, Australia  
**Frederik Geth**, GridQube, Brisbane, Australia  
**Masood Parvania**, University of Utah, USA



**Gregor Verbič** received the B.Sc., M.Sc., and Ph.D. degrees in electrical engineering from the University of Ljubljana, Ljubljana, Slovenia, in 1995, 2000, and 2003, respectively. In 2005, he was a NATO-NSERC Postdoctoral Fellow with the University of Waterloo, Canada. He is currently a Professor at the School of Electrical and Information Engineering, The University of Sydney and Director of the Centre for Future Energy Networks. His expertise is in power system operation, stability and control, and electricity markets. His current research focuses on grid and market integration of distributed energy resources and large-scale renewables, future grid modelling and scenario analysis, and demand response. He was a recipient of the IEEE Power and Energy Society Prize Paper Award in 2006. He is an Associate Editor of the IEEE Transactions on Power Systems.



control, and optimization of distributed energy resources.

**Johann Mathieu** received the B.S. degree in ocean engineering from the Massachusetts Institute of Technology, Cambridge, MA, USA, in 2004 and the M.S. and Ph.D. degrees in mechanical engineering from the University of California, Berkeley, USA, in 2008 and 2012, respectively. She is an Associate Professor with the Department of Electrical Engineering and Computer Science, the University of Michigan, Ann Arbor, MI, USA. Prior to joining the University of Michigan, she was a Postdoctoral Researcher with the Swiss Federal Institute of Technology (ETH) Zurich, Switzerland. Her research interests include modeling, estimation,



**Frederik Geth** (Member, IEEE) received the B.Sc., M.Sc., and Ph.D. degrees from the University of Leuven, Belgium, in 2007, 2009, and 2014, respectively. From 2008-2012 he was a Research Scientist working with the CSIRO, Newcastle, Australia, in the energy systems program. Currently, he is the Principal Power System engineer at GridQube, Brisbane, Australia. His current research focus is applications of optimization models in distribution network operations, including unbalanced state estimation and optimal control of battery storage systems.



**Masood Parvania** (SM' 2019) is an Associate Professor and the Associate Chair for Research and Advancement at the Department of Electrical and Computer Engineering at the University of Utah. His research interests include the operation, economics, and resilience of power and energy systems, as well as modeling and operation of interdependent critical infrastructures. Dr. Parvania currently serves as an Associate Editor for the IEEE Transactions on Power Systems, the IEEE Transactions on Smart Grid, and the IEEE Transactions on Sustainable Energy. He is currently the Chair of the IEEE Power and Energy Society (PES) Utah Chapter, Chair of the IEEE PES Bulk Power System Operation Subcommittee, and Chair of the IEEE PES Reliability, Risk and Probability Application (RRPA) Subcommittee.

Utah Chapter, Chair of the IEEE PES Bulk Power System Operation Subcommittee, and Chair of the IEEE PES Reliability, Risk and Probability Application (RRPA) Subcommittee.

## SS06 | Transfer of knowledge: Discussing with the Editors in Chief

### Abstract

EiCs will provide a presentation to introduce their journal, including:

- nature of your journal (e.g., sponsored by IEEE, number of issues published per year, impact factor...),
- topics of interest, technical areas with the highest growth in readership and manuscript submission,
- number of submitted papers per year, acceptance rates, how papers are assigned to editors/associate editors, sub-to-pub period, open access publication and related issues
- list of participating countries with the highest number of papers
- mix of editorial board members, how editors are selected, length of appointment, a few words about yourself, your EIC job, your sorrows and excitements about the job
- issues of concern for authors, editors, publishers (messages to session participants and prospective authors)
- etc.

## Chair



**Nikos Hatziaargyriou**, National Technical University of Athens

## Speakers



**Dionysios Aliprantis**, Editor-in-Chief for the IEEE Transactions on Energy Conversion



**Claudio Canizares**, Editor-in-Chief for the IEEE Transactions on Smart Grid



**Maria Teresa Correia de Barros**, Editor-in-Chief for the ELSEVIER International Journal of Electrical Power Systems Research



**Gianfranco Chicco**, Editor-in-Chief for the ELSEVIER Sustainable Energy Grids and Networks



**Antonio Gomez Exposito**, Vice Editor-in-Chief for the Journal of Modern Power Systems and Clean Energy



**Vladimir Terzija**, Editor-in-Chief for the International Journal of Electrical Power and Energy System



**Jovica Milanovic**, Editor-in-Chief for the IEEE Transactions on Power Systems

## SS07 | Recent Advances and Trends in Active Distribution Networks

### Abstract

In the context of the long-lasting effects introduced by the smart grid paradigm, several new trends are emerging, changing the way distribution system operators (DSOs) conceive and operate their distribution networks. In the past, distribution system infrastructure aimed to connect the upper level (high-voltage) system to customers, while self-generation was limited to large generation units at the high-voltage system. Recently, innovations in the generation and demand-side have changed dramatically the idea of distribution systems operation, giving them a more active role in the whole operation of the electricity system. An active distribution network is composed of a large number of energy-related innovations and players that actively cooperate to ensure a cost-effective and reliable operation. Active distribution networks enable the co-

existence of a large number of distributed energy resources (DERs) and flexible consumers within the same electricity network. To ensure a reliable operation, all involved players (DSOs, large and small consumers, prosumers) must coordinate their operation by properly managing the uncertainties typical of sources based on solar and wind power, as well as other energy-intensive resources such as electrical vehicles; shifting towards a more flexible operation. These new operational conditions require the introduction of new planning models and control approaches that enable the connection of new DERs without compromising the reliable operation of the network. To achieve this, information is fundamental, not only from sources already available in the past (e.g., network measurements units) but also new sources coming from the prosumers, for instance, through the installation of smart meters and use of IoT. In a later stage, all the available data can be used to understand prosumers' behavior aiming to exploit their energy flexibility potential to support the distribution network operation. In this panel, we will discuss with experienced researchers, with different background and expertise, recent trends in active distribution networks, ranging from digitalization, to planning, control and operation.

#### Chair

**Charalambos Konstantinou**, KAUST

**Pedro Vergara Barrios**, TU Delft

#### Speakers

**Nikos Hatziaargyriou**, National Technical University of Athens

**Peter Palensky**, Delft University of Technology

**Jelena Ponocko**, Lead Engineer, Scottish Power Energy Networks

**Florin Capitanescu**, Luxembourg Institute of Science and Technology

**Marija Ilic**, MIT

#### Short Bio



**Charalambos Konstantinou** is currently an Assistant Professor of Electrical and Computer Engineering (ECE) and an Affiliate Professor of Computer Science (CS) with the Computer, Electrical and Mathematical Science and Engineering Division (CEMSE), King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia. He is the Principal Investigator (PI) of the Secure Next Generation Resilient Systems Laboratory (SENTRY), a co-PI of the Advanced Grid Laboratory for Cyber-Physical Energy System Applications (ANGLE) Group, and a member of the Resilient Computing and Cybersecurity Center (RC3), KAUST. He received the M.Eng. degree in ECE from the National Technical University of Athens (NTUA), Greece, in 2012, and the Ph.D. degree in Electrical Engineering from New York University (NYU), NY, USA, in 2018. Before joining KAUST, he was an Assistant Professor with the Center for Advanced Power Systems (CAPS), Florida State University (FSU). His research interests include critical infrastructures security and resilience with special focus on smart grid technologies, renewable energy integration, and real-time simulation. He is the Chair of the IEEE Task Force on Resilient and Secure Large-Scale Energy Internet Systems (RSEI) and the Co-Chair of the IEEE Task Force on Cyber-Physical Interdependence for Power System Operation and Control (CPS). He serves as an Associate Editor of the IEEE Transactions on Industrial Informatics (TII). Konstantinou is a Senior Member of IEEE, a member of ACM, and an ACM Distinguished Speaker (2021-2024).



**Dr. Pedro P. Vergara** was born in Barranquilla, Colombia, in 1990. He received the B.Sc. degree (with honors) in electronic engineering from the Universidad Industrial de Santander, Bucaramanga, Colombia, in 2012, and the M.Sc. degree in electrical engineering from the University of Campinas, UNICAMP, Campinas, Brazil, in 2015. In 2019, he received his Ph.D. from the University of Campinas, UNICAMP, Brazil, and the University of Southern Denmark, SDU, Denmark. In 2019, he joined the Eindhoven University of Technology, TU/e, in The Netherlands as a Postdoctoral Researcher. In 2020, he was appointed as Assistant Professor at the Intelligent Electrical Power Grids (IEPG) group at Delft University of Technology, also in The Netherlands. His main research interests include the development of methodologies for the control, planning, and operation of electrical

distribution systems with high penetration of low-carbon energy resources (e.g. electric vehicles, PV systems, electric heat pumps) using optimization and machine learning approaches. Dr. Vergara received the Best Presentation Award in the Summer Optimization School in 2018 organized by the Technical University of Denmark (DTU), and the Best Paper Award at the 3rd IEEE International Conference on Smart Energy Systems and Technologies, Turkey, in 2020.



**Nikos D. Hatziargyriou** (Life Fellow, IEEE) is a Full Professor of power systems with the Electrical and Computer Engineering School, National Technical University of Athens. He has authored the book "Microgrids: Architectures and Control" and more than 250 journal publications and 500 conference proceedings papers. He is included in the 2016, 2017, and 2019, Thomson Reuters lists of the top 1% most cited researchers. From 2015 to 2019, he was the Chair and the CEO of the Hellenic Distribution Network Operator. From 2007 to 2012, he was an Executive Vice-Chair and the Deputy CEO of the Public Power Corporation, responsible for the Transmission and Distribution Divisions. He was the Chair of the Power System Dynamic Performance Committee of IEEE and currently he is Editor in Chief of the IEEE Transactions on Power Systems. He is honorary member of CIGRE and was the Chair of CIGRE SC C6 "Distribution Systems and Distributed Generation." He was the Chair and he is currently Vice-Chair of the EU Technology and Innovation Platform on Smart Networks for Energy Transition (ETIP SNET). He has participated in more than 60 R&D projects funded by the EU Commission, electric utilities and manufacturers.



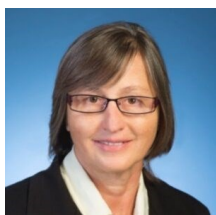
**Peter Palensky** (Senior Member, IEEE) received the M.Sc. degree in electrical engineering and the Ph.D. and Habilitation degrees from the Vienna University of Technology, Austria, in 1997, 2001, and 2015, respectively. He co-founded Envidatec, a German startup on energy management and analytics. In 2008, he joined the Lawrence Berkeley National Laboratory, Berkeley, CA, USA, as a Researcher, and the University of Pretoria, South Africa. In 2009, he became appointed as the Head of the Business Unit, Austrian Institute of Technology (AIT) in sustainable building technologies, where he was the first Principal Scientist of Complex Energy Systems. In 2014, he was appointed as a Full Professor in intelligent electric power grids with TU Delft, The Netherlands. He is active in international committees, such as ISO or CEN. His research interests include energy automation networks, smart grids, and modeling intelligent energy systems. He also serves as an IEEE IES AdCom Member-at-Large in various functions for IEEE. He is the past Editor-in-Chief of IEEE Industrial Electronics Magazine and an associate editor of several other IEEE publications and regularly organizes IEEE conferences.



**Dr Jelena Ponoćko** is a Lead Engineer at Scottish Power Energy Networks, UK, and is also affiliated with the Department of Electrical and Electronic Engineering at The University of Manchester, UK, where she worked as a Lecturer. Jelena has authored or coauthored over 40 research papers and technical reports. Her research has focused on data analytics-based assessment of demand-side flexibility and the effects of demand-side management on power network performance. She has been an active IEEE PES member since 2015 and currently acts as the IEEE Power and Energy Society Women in Power Representative for Region 8 (Europe, Middle East and Africa).



**Florin Capitanescu** (Member, IEEE) received the Electrical Power Engineering degree from the Politehnica University of Bucharest, Bucharest, Romania, in 1997, and the Ph.D. degree from the University of Liège, Liège, Belgium, in 2003. Since 2015, he has been a Senior R&T Associate with Luxembourg Institute of Science and Technology, Esch-sur-Alzette, Luxembourg. His main research interests include the application of optimization methods to operation of transmission and active distribution systems, particularly security-constrained optimal power flow approaches, voltage instability, and smart sustainable buildings.



**Marija Ilić** is a Professor Emerita at Carnegie Mellon University (CMU). She currently holds a joint appointment of an Adjunct Professor in EECS Department and of a Senior Research Scientist at the Laboratory for Information and Decision Systems (LIDS) at the Massachusetts Institute of Technology (MIT). She is an IEEE Life Fellow and an elected member of the US National Academy of Engineering, and the Academia Europaea. She was the first recipient of the NSF Presidential Young Investigator Award for Power Systems in the US. She has co-authored several books on the subject of large-scale electric power systems, and has co-organized an annual multidisciplinary Electricity Industry conference series at Carnegie Mellon (<http://www.ece.cmu.edu/~electricconf>) with participants from academia, government, and industry. She was the founder and co-director of the Electric Energy Systems Group (EESG) at Carnegie Mellon University (<http://www.eesg.ece.cmu.edu>). Currently she is building EESG@MIT <https://eesg.mit.edu/>, in the same spirit as EESG@CMU. Most recently she has offered an open EdX course at MIT entitled "Principles of Modeling, Simulations and Control in Electric Energy Systems". She is founder and chief scientist at New Electricity Transmission Solutions (NETSS), Inc, currently SmartGridz, Inc <https://smartgridz.com/>

### Abstract

Climate change makes extreme weather events increasingly more common and more severe. Electric utilities around the globe, together with industry, corporate R&D organizations, and academia strive to address and minimize the negative impact of severe weather events to operation of power grid and to improve its resilience. The issues arising due to power outages most times propagate to non-grid factors, including the health of the local community, access to critical facilities and other economic, social and community aspects.

This panel will include talks and range of aspects from experts utilities, industry and academia, to provide insight on current and emerging activities to increase resilience to major events, such as hurricanes, floods, and wildfires. The panel will convey the a wide range of aspects and approaches in addressing the relationship between decarbonization of electric power system and its societal impact of the energy not served, and how the development and integration of new technologies can improve

### Chair

**Dr Muhidin Lelic**, Quanta Technology – Dir. Applied R&D, and Dir. Grid Advancement LUMA Energy

### Speakers

**Dr. Emanuel Bernabeu**, Sr. Director, Applied Innovation & Analytics, PJM Interconnection, USA

**Dr. Muhidin (Dino) Lelic**, Dir. Applied R&D, Executive Advisor, Quanta Technology, USA

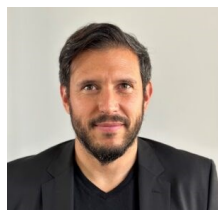
**Dr. Martina Joševski**, Regional Leader, Eaton Research Labs, Germany

**Dr. Masood Parvania**, University of Utah, USA

**Jeff Schlegelmilch**, Director, National Center for Disaster Preparedness, Columbia Climate School, Columbia University, USA

**Dr Ninel Čukalevski**, Mihajlo Pupin Institute, Belgrade, Serbia

### Short Bio

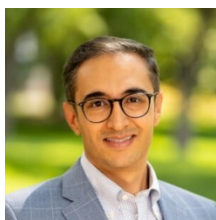


**Dr. Emanuel Bernabeu** received a M.S. in Applied Economics, M.S. in Power Systems, and Ph.D. in Power Systems from Virginia Tech, USA, and his B.S. in Electronics from "Universidad Catolica de Córdoba", Argentina. Currently, Dr. Bernabeu is a Sr. Director in the Markets division of PJM Interconnection. He previously worked for Dominion Virginia Power.



**Dr. Muhidin (Dino) Lelic** is the Director of Grid Advancement at LUMA Energy. He has over 40 years of experience in academia, corporate R&D centers, product development, electric power system consulting, and utilities. Dr. Lelic was granted over 35 US and international patents, published numerous journal and conference papers and co-authored four books, and three book chapters, two of the books being university textbooks in Modern Control Systems Engineering. Dr. Lelic holds a Ph.D., M.Sc. and Dipl. in Electrical Engineering, and Executive MS degree in Management. He is also a Senior Member of IEEE.

**Martina Joševski** is a Regional Leader of Eaton Research Labs based in Aachen, Germany. She also hold affiliation as External Lecturer at the RWTH Aachen University, Faculty of Electrical Engineering where she teaches the courses on Modeling and Control of Low-Inertia Power Systems. She received her B.Sc. and M.Sc. degree in Electrical Engineering from the University of Novi Sad, and Ph.D. degree from RWTH Aachen University, Germany. Before joining Eaton, she was engaged as a Research Associate and Teaching Assistant at the Institute of Control Engineering at RWTH Aachen University, as a Postdoctoral Researcher at the Institute Automation of Complex Power Systems at RWTH Aachen University and as a Team Leader of the Research Group for Advanced Control Methods in Power System Applications & HIL at the E. ON Energy Research Center. Her research interests include control and optimization of converter-based systems with particular focus of optimal and passivity-based control methods.



**Masood Parvania** (SM' 2019) is an Associate Professor and the Associate Chair for Research and Advancement at the Department of Electrical and Computer Engineering at the University of Utah. His research interests include the operation, economics, and resilience of power and energy systems, as well as modeling and operation of interdependent critical infrastructures. Dr. Parvania currently serves as an Associate Editor for the IEEE Transactions on Power Systems, the IEEE Transactions on Smart Grid, and the IEEE Transactions on Sustainable Energy. He is currently the Chair of the IEEE Power and Energy Society (PES) Utah Chapter, Chair of the IEEE PES Bulk Power System Operation Subcommittee, and Chair of the IEEE PES Reliability, Risk and Probability Application (RRPA) Subcommittee



**Jeff Schlegelmilch** is a Research Scholar and the Director of the National Center for Disaster Preparedness, Columbia Climate School, at Columbia University. In this role he oversees the operations and strategic planning for the center. Before becoming director, he served as the center's deputy director for more than five years. He also oversees projects related to the practice and policy of disaster preparedness, including the multi-award winning Resilient Children / Resilient Communities Initiative. His areas of expertise includes public health preparedness, community

resilience and the integration of private and public sector capabilities. Prior to his work at Columbia, he was the Manager for the International and Non-Healthcare Business Sector for the Yale New Haven Health System Center for Emergency Preparedness and Disaster Response. He was also previously an epidemiologist and emergency planner for the Boston Public Health Commission. He has advised leaders on preparedness systems and policy at all levels of government. He is an Opinion Contributor with The Hill and is frequently utilized as a subject matter expert for numerous media outlets. He is also the author Rethinking Readiness: A brief guide to twenty-first-century megadisasters published by Columbia University Press. He holds a Master's degree in Public Health from UMASS Amherst in Health Policy and Management, and a Master's degree in Business Administration from Quinnipiac University.



**Ninel Ćukalevski** is with Mihajlo Pupin Institute, Belgrade, Serbia. Areas of his expertise and professional interest include analysis and control of electric power systems, and information and control technologies applications in electric power industry. Over 40+ years, Dr Ćukalevski has made outstanding contributions to development and leadership in the domain of technical information systems and real-time control systems for the utility industry while simultaneously contributing to engineering education at the University of Belgrade. He published 230+, of which 90+ international, journal and conference papers, monographs and technical brochures. He is an active member of IEEE and CIGRE TF/working groups.

## SS09 | Modeling, operation and control of multi-energy systems

### Abstract

Energy networks have been traditionally decoupled for operation and planning, with their design and implementation being independent, due to regulatory and market arrangements. However, interactions among networks have always existed. In a Multi-Energy System (MES), different energy vectors are connected through distributed coupling technologies. Through MES analysis, a holistic approach may enable a flexible operation of the energy networks where additional renewable intermittent generation can be incorporated. Although an electric power system could be seen as the backbone of an integrated MES, coupling between energy vectors may impose challenges in the operation of traditional power systems. This special session will discuss these aspects with a special focus on modelling, energy efficiency, sustainability, coupling technologies, and dynamic operation. The special session will consists of following speakers and their topics: 1) Carlos Ugalde, Cardiff University, "Flexibility provision from thermal stores to energy systems" 2) Vladimir Terzija, University of Newcastle, "Multi Energy Systems: From Advanced Monitoring to Data Science-based Solutions" 3) Thomas Hamacher, TUM "Optimal structure of the future carbon free energy systems" 4) Milos Cvetkovic, TU Delft "Electricity grids with heat and hydrogen: how do we make it happen?" 5) Zhao Haoran, Shandong University "Digital solutions of multi-energy systems"

### Chair

**Vedran Peric**, Technical University of Munich

## Speakers

**Carlos Ugalde-Loo**, Cardiff University

**Vladimir Terzija**, Newcastle University

**Thomas Hamacher**, Technical University of Munich

**Aihui Fu**, TU Delft

**Zhao Haoran**, Shandong University

## Short Bio



**Carlos E. Ugalde-Loo** was born in Mexico City, Mexico. He is currently Professor of Electrical Power Systems at the School of Engineering, Cardiff University. He is Deputy Director of the Centre for Integrated Renewable Energy Generation and Supply (CIREGS). Prior to his academic role, he was a Research Assistant at Cardiff from 2010 until December 2012. Prof Ugalde received the B.Sc. degree in Electronics and Communications Engineering from Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM, Monterrey Institute of Technology and Higher Education), Mexico City, Mexico (2002), the M.Sc. degree in Electrical Engineering from Instituto Politécnico Nacional (IPN, National Polytechnic Institute), Mexico City, Mexico (2005), and the Ph.D. degree in Electronics and Electrical

Engineering from the University of Glasgow, Scotland, U.K. (2009). His research interests and academic expertise include power system stability and control, grid integration and control of renewables, HVDC transmission, DC technologies, modelling and control of integrated energy systems, modelling of dynamic systems, and multivariable control. He actively contributes to the 'Power Electronics and HVDC', 'Energy Infrastructure', and 'Smart Grids' research groups. He has supervised 13 PhD students to completion and is very active disseminating research through conference and journal papers. He has published over 115 peer-reviewed articles—several in top-tier Transactions-grade journals. He is an Associate Editor of IET Energy Systems Integration, IET Generation, Transmission & Distribution, and has been Guest Editor for a number of journals.



My research is focused on electrical power systems, their optimal planning, operation, monitoring, protection and control. Recently, I started a speculative research on integration of different energy systems. My career is predominantly linked to academia, however, in the past I have also spent 6 years working in industry (Asea Brown Bowery – ABB, Germany). Consequently, now I am combining both theoretical and experimental research, targeting complex research questions related to e.g. integration of renewable energy resources into existing power systems and reducing CO2 emission, as well as leading research on utilization of novel sensor and communication technology, application of complex science, data analytics, control and optimization theory, for optimal exploitation

of future power systems. Finally, I am focused on validation of Smart Grid solutions using advanced hardware in the loop testing facilities. My research career gave me the opportunity to lead national and international research projects with a total value of 50+m US\$. By joining Skoltech in 2021, I look forward to converting speculative ideas into practical solutions, contributing to reliable operation of energy systems/networks, the capital infrastructure ensuring a social prosperity at both national and international level.



**Thomas Hamacher** studied physics at Bonn University, at RWTH Aachen and at Columbia University, New York. He received his Doctorate in Natural Sciences (Dr. rer. nat.) from the University of Hamburg in 1994 for his work on baryonic beta decay.[1] He worked between 1996 and 2010 at the Max Planck Institute of Plasma Physics in Garching bei München and was head of the Energy and System Studies Group. Since 2010, he has been a professor at the Department of Electrical Engineering and Computer Science at the Technical University of Munich. In 2013, he was appointed Full Professor for the Chair of Renewable and Sustainable Energy Systems. Thomas Hamacher takes part frequently in public debates

about the German Energy transition in Germany, nuclear power and fusion power as an expert. His main research focus lies on the modeling, analysis, and design of energy systems in the context of disruptive technologies such as nuclear fusion, renewable energy, smart cities, or electromobility.

**Aihui Fu**, TU Delft



**Vedran S. Perić** received the master's degree from the University of Novi Sad, Serbia, and the Ph.D. degree from the KTH Royal Institute of Technology, Stockholm in 2016. He was a Research and Teaching Assistant with the University of Novi Sad and Visiting Researcher with the Delft University of Technology. He held positions of Senior Power System Engineer with GE Grid Solutions Research and Development Department, Senior Power System Consultant at GE Energy Consulting, and as a Senior Business Analyst with Regional Security Coordinator, TSCNET Services GmbH. He is currently a Head of Research Center for Combined Smart Energy Systems (CoSES) at the TUM Institute of Integrated Materials, Energy and Process Engineering (MEP). His research interests include a wide range of topics related to power systems dynamic stability, operation and control of smart grids, with the particular focus on integration of electric systems with district heating/cooling grids.



**Zhao Haoran**, Shandong University

## SS10 | What's new in cascading failure analysis?

### Abstract

This session will outline some of the latest advances in cascading failure analysis and resilience assessment of modern power systems. For many years, cascading failure analysis has largely been dominated by the use of static (power flow based) approaches as they provide huge computational benefits. However, these methods are increasingly coming under question as dynamic phenomena become more dominant in system failures. This session will cover a variety of techniques currently emerging at the forefront of cascading failure analysis and resilience assessment from dynamic modelling of the full system, the use of machine learning to predict cascading processes, and the consideration of probabilistic aspects to produce more accurate and meaningful statistics about the potential outcomes.

- Talk 1 (20 minutes, including direct Q&A): M. Panteli & S. Hashemi, University of Cyprus. Title: Integrated resilience and cascading modelling: quantification, mitigation and blackstart strategies This presentation will introduce novel cascading algorithms seamlessly integrated with spatial and temporal resilience analysis tools for quantifying the cascading impacts of large disturbances. It will then describe different mitigation strategies, such as preventive and corrective islanding while accounting for blackstart restoration, focusing on the critical decision-making on when and where to apply such strategies during the cascading propagation and restoration phase.
- Talk 2 (20 minutes, including direct Q&A): R. Preece, The University of Manchester Title: Benefits and challenges of dynamic modelling of cascading failures in power systems Time-based dynamic models of cascading failures have been recognized as one of the most comprehensive methods of representing detailed cascading information and are often used for benchmarking and validation. This talk will provide an overview of the progress in the field of dynamic analysis of cascading failures in power systems and outline the benefits and challenges of dynamic simulations in future grids. The benefits include the ability to capture temporal characteristics of system dynamics and provide timing information to facilitate control actions for blackout mitigation. The greatest barriers to dynamic modelling of cascading failures are the computational burden, and the extensive but often unavailable data requirements for dynamic representation of a power system.
- Talk 3 (20 minutes, including direct Q&A): G. Jihad, Université Libre de Bruxelles. Title: Probabilistic dynamic methodologies for resilience assessment considering distributed energy resources. This talk will present probabilistic dynamic methodologies relevant to cascading failure analysis. Following this, their applicability will be demonstrated in the case of a resilience study by comparing the results obtained for a dynamic methodology to a static one.
- Talk 4 (20 minutes, including direct Q&A): P. Papadopoulos & T. Ahmad, University of Strathclyde. Title: Using machine learning to predict upcoming cascading events The evolution of cascading failures, especially at later stages before a system collapse are influenced by complex power system dynamics as well as the action of protection devices. This talk will discuss aspects related to modelling, sensitivity analysis, on the evolution of cascades as well as the use of machine learning (time-series based methods

- using LSTMs and Temporal Convolutional Networks) for predicting the onset and reason of upcoming cascading events and understanding the effect of topology (through Graph Convolutional Networks).
- General Q&A (10 minutes).

## Chair

**Dr Robin Preece**, The University of Manchester

## Speakers

**Robin Preece**, The University of Manchester

**Mathaios Panteli**, University of Cyprus

**Jihad Guenaou**, Université Libre de Bruxelles

**Panagiotis Papadopoulos**, University of Strathclyde

**Tabia Ahmad**, University of Strathclyde

## Short Bio



**Dr Robin Preece** is a Reader in Future Power Systems in the Department of Electrical and Electronic Engineering at The University of Manchester, where he has been an academic since July 2014. Since then, he has helped to secure over £6 million in research funding for The University of Manchester. Dr Preece has published more than 90 international peer-reviewed papers in numerous different top-tier journals. His research is focussed on the dynamic stability of power systems with large quantities of power electronics and in quantifying the impacts of uncertainties and variability on network performance. He has presented his research at major international conferences hosted by the IET, IEEE, IFAC, and Cigré.



**Mathaios Panteli** is currently an Assistant Professor with the Department of Electrical and Electronic Engineering, University of Cyprus. His main research interests include techno-economic reliability, resilience and flexibility assessment of future low-carbon energy systems, grid integration of renewable energy sources and integrated modelling and analysis of co-dependent critical infrastructures. Mathaios is an IEEE Senior Member, IET Chartered Engineer (CEng), the Chair of the CIGRE Working Group C4.47 "Power System Resilience" and CIGRE Cyprus National Committee and an active member of multiple IEEE working groups. He is also the recipient of the prestigious 2018 Newton Prize and was selected in the top 12 innovators for 2022 by the Innovation Radar Prize competition of the European Commission.



**Sina Hashemi** currently works as a Post-Doctoral Research Fellow at the Department of Electrical and Computer Engineering, University of Cyprus. His current project is 'Power System Black Start Restoration from Distributed Energy Resources (DERs)'. His research interest includes power system modelling, analysis, and control along with the application of machine learning and evolutionary optimization algorithms into electric power system issues.



**Jihad Guenaou** is a teaching assistant and third year PhD student at Université Libre de Bruxelles in Brussels, Belgium. Her research explores the possibilities to use renewable energy resources to enhance power system resilience. This work combines transmission system analysis and the use of probabilistic dynamic methods to capture the impact and relevant dynamics of renewable energy resources.



**Panagiotis Papadopoulos** is a Senior Lecturer and UKRI Future Leaders Fellow at the University of Strathclyde, working in the area of electric power systems. Panagiotis has received the Dipl. Eng. and Ph.D. degrees from Aristotle University of Thessaloniki, Greece, followed by a post-doctoral position at the University of Manchester. His research area is power system stability and dynamics and the application of data-driven methods and machine learning on power system online and offline dynamic security assessment. He has authored more than 60 papers in international journals and conferences and has been involved in 21 projects in collaboration with industrial partners.



**Tabia Ahmad** is working as a Research Associate at the EEE department of University of Strathclyde, Glasgow (UK) working on the UKRI project, "Addressing the complexity of future power systems dynamic behaviour". Her research interests include power system dynamics, WAMS based analytics, signal processing techniques in power systems and interpretable machine learning for power system applications. Prior to this she completed her Ph.D. thesis (with doctoral thesis distinction award) in electric power systems from the Indian Institute of Technology Delhi, India, and her BS and MS in Electrical Engineering, in 2014 and 2016, respectively, from India too

## SS11 | Powering Together: Insights into Twinning and Capacity building Projects for Sustainable Power Systems

### Abstract

This special session will focus on the benefits and challenges of implementing Twinning projects in the context of capacity building. Twinning projects involve partnering two or more organizations of different countries, to work together on a project that aims to strengthen the capacity of the beneficiary organization. Various aspects of twinning capacity building projects will be presented, including the objectives, implementation process, and key success factors. The benefits of twinning projects, such as knowledge sharing, skills transfer, and improved collaboration, are highlighted, along with some of the challenges, such as cultural differences, language barriers, and sustainability.

Knowledge transfer can take many forms, including formal training sessions, workshops, coaching, mentoring, and on-the-job training. The goal of knowledge transfer is to ensure that individuals or organizations have the information and skills they need to perform a particular task or function effectively. Capacity-building projects are essential because they can help individuals, organizations, and communities build the skills and knowledge they need to achieve their goals, respond to challenges and opportunities, and promote sustainability over the long term.

This special session will count on the expertise of the following speakers that will present several Twinning capacity building projects, all funded by the European Union:

- 1) Prof. Leposava Ristic, will present the SUNRISE project, which aims to support the University of Belgrade in improving excellence in power system decarbonisation through the development of a Real-Time Simulation Laboratory, research staff training and mobility, and new exploratory research projects with partners.
- 2) Dr. Valentina Janev, will be presenting the SINERGY project, which aims to develop effective energy service concepts to unlock untapped demand-side resources for energy efficiency and flexibility, with the objective of strengthening the research capacity of the Institute Mihajlo Pupin in Belgrade, Serbia.
- 3) Dr. Brian Azzopardi, will be presenting the PROMISE project, which aims to promote research excellence and growth for photovoltaic researchers by bringing together a group of technological innovators, universities, and partners to find a place for photovoltaic research. The project will also focus on gender balance and sustainable development in the sector.
- 4) Dr. Derek Baker, will present the SolarTwins project, which aims to train early-stage researchers in solar energy and catalyze joint research between Turkish and European research centers. This project emphasize interdisciplinary collaboration and co-developing solutions to decarbonize industry.
- 5) Dr. Paulo Brito, will be presenting the Waste2H2 project, funded by the European Union, focuses on producing sustainable hydrogen from residual biomass through thermal gasification and gas purification. The project aims to strengthen the scientific and technological capacity of the Polytechnic Institute of Portalegre in Portugal by enhancing their research profile, promoting a circular economy.

Overall, the presentations will provide a comprehensive understanding of twinning capacity building projects, their benefits and challenges, and best practices for successful implementation.

### Chair

**Dr. Oihane Abarrategi**, University of the Basque Country (UPV/EHU)

### Speakers

**Prof. Leposava Ristic**, School of Electrical Engineering, University of Belgrade, Serbia

**Dr Valentina Janev**, Mihajlo Pupin Institute, University of Belgrade, Serbia

**Dr Ing. Brian Azzopardi**, , Malta College of Arts, Science and Technology (MCAST) | The Foundation for Innovation and Research Malta (FiR.mt)

**Dr. Derek Baker**, Middle East Technical University (METU / ODTU)

**Dr. Paulo Duque de Brito**, Polytechnic Institute of Portalegre (IPP)

## Short Bio



**Dr. Leposava Ristić**, associate professor at the Department of Power Converters and Drives, School of Electrical Engineering, University of Belgrade, has achieved BSc, MSc and PhD at the same faculty. Her research interests are: energy-efficient application and control of electrical drives; multi-motor and multi-phase electrical drives and power converters in industry and renewable energy sources. She is a member of the IEEE and Industrial Electronics Society, a member of the Management Board of the Society for Power Electronics in Serbia and a member of the working group KS N009 / RG-2, „Electrical equipment and systems on railways” of the Institute for Standardization of Serbia. She has been a member of the Program Committees of several international conferences, the organizer of several special sections at these conferences. She is engaged as a lecturer in more than 10 subjects at all three levels of study, she is the author of more than 80 conference papers, eight papers in journals on the JCR list, eight papers in journals not on the JCR list, one chapter in a book in English, one chapter in a book in Serbian, as well as four books in Serbian. Dr. Leposava Ristić has been the mentor of numerous master's and graduate theses, a reviewer of scientific papers for many reputable journals, as well as for conferences. She participated in more than 15 national projects financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia, as well as in many commercial projects with the Serbian industry (<https://www.etf.bg.ac.rs/en/faculty/staff/leposava-ristic-2504>).



**Dr Valentina Janev** is a Senior Researcher at the Mihajlo Pupin Institute, University of Belgrade, Serbia; Associated Professor at the Belgrade Metropolitan University and IEEE Senior Member. She has extensive experience in research, software systems development and maintenance in different industrial domains for clients from Europe. Since 2018, Valentina Janev serves as an external expert engaged by the European Commission, Research Executive Agency for evaluation of EU research proposals and projects. She was a Coordinator of the EU project LAMBDA (Learning, Applying and Multiplying Big Data Analytics, July 2018 – June 2021, <https://project-lambda.org/>) and she currently serves as Project manager of the SINERGY project (Capacity building in Smart and Innovative eENERGY management, January 2021 – December 2023, <https://project-sinergy.org/>).



**Dr Ing. Brian Azzopardi (BA)** is co-Founder and Chairman of The Foundation for Innovation and Research – Malta (FiR.mt), Senior Lecturer II at the Malta College of Arts, Science and Technology (MCAST) and Visiting Senior Lecturer at the University of Malta (UM). Since 2011, he has held senior academic and research positions in the United Kingdom, Lithuania and Malta. He has also served the industry, government agencies and ministries and research centres since 1998. He is the Coordinator of the Horizon 2020 / Horizon Europe projects: JUMP2Excel (finalised), NEEMO (current), TRANSIT (launched in Oct 2022) and PROMISE (launched in Oct 2022) and contributed directly to over €10M to affiliated institutions on projects with over €30M budget over the past decade. He is a Senior Member of IEEE and a member of The IET, EI, RSC and Chamber of Engineers. He is also the recipient of the MCST-JRC Young Scientist Award and 3rd Place in the STEM Young Researchers Award. In 2008 he received the Eur. Ing. title followed by the CEng and the EI Chartered Energy Engineer titles in 2012. In 2002, he received a BEng(Hons) from UM and a PhD from The University of Manchester in 2011. He also received teaching and pedagogical qualifications from MCAST (2008) and PGCHE from Oxford Brookes University (2012). Dr Ing. Azzopardi is the editor and co-author of two books, 100+ research papers in peer-reviewed impact-listed journals and conferences, and invited speaker and the Chair of MEDPOWER2022 Conference. He has supervised over 10+ postgraduates Masters and Doctoral Candidates and Postdocs.



**Derek Baker** is a Prof. Dr. in Mechanical Engineering at Middle East Technical University (METU / ODTU) and a Lead Researcher in the Concentrating Solar Thermal (CST) research division “ODAK” of Türkiye's Solar Energy Center of Excellence ODTU-GUNAM in Ankara, Türkiye. He is coordinating two EU Widening Projects. The first is the 3.5 year Horizon 2020 (H2020) “SolarTwins” Twinning Project that ends on 30 June 2023. SolarTwins aims to step-up the scientific excellence and innovation capacity of METU and ODTU-GUNAM in the area of CST through Twinning with the globally leading CST institutions CIEMAT-PSA (ES) and DLR

(DE). The second is the follow-up 4 year Horizon Europe (HE) "SolarHub" Excellence Hub project that started on 01 Jan. 2023. SolarHub aims to strengthen connections between and scale-up 2 Greek (Thessaloniki and Athens) and 3 Turkish (Ankara, Istanbul, and Izmir) solar energy innovation ecosystems as a single, hybrid, cross-border, and interconnected Solar Energy Excellence Hub with an emphasis on agriculture applications. Derek Baker is also the institutional Principle Investigator for the H2020 GeoSmart and HE CST4ALL projects, and a researcher on the H2020 SFERA-III project, all of which are strongly coupled to SolarTwins and SolarHub.



**Paulo Sérgio Duque de Brito** has a degree in chemical engineering, Processes and Industry specialization, in the Technical Superior Institute; has a master's degree in "Corrosion Science and Engineering" by UMIST, Manchester University; is a PhD in Chemical Engineering, by the Superior Technical Institute in the electrochemical – on fuel cells. He has also an MBA –Master of Business and Administration. Currently, he is a Coordinator Teacher in the Superior School of Technology and Management of the Polytechnic Institute of Portalegre (IPP). Is coordinator of the research centre VALORIZA – Research Centre for Endogenous Resource Valorization and the Coordinator of the Master Technologies for Environmental Valorization and Energy Production. The main areas he investigates are related with Bioenergy, waste environmental treatments, materials corrosion and energy galvanic production. He has published more than 250 works, in books, articles and conferences presentations. (<http://orcid.org/0000-0002-2581-4460>)

## SS12 | Energy Storage Worldwide: Insights and Applications (Session supported by IEEE PES Women in Power)

### Abstract

Energy storage is vital towards the transition to a decarbonised power system. Currently, there exist various energy storage systems with different characteristics that can fit different power system applications, from a domestic scale to bulk-connected energy storage systems. In this panel, various aspects of energy storage will be examined, with specific focus on applications of energy storage systems, electricity markets, government policy, regulation, as well as emerging energy storage technologies across various European countries and power systems. In addition, discussion will be made around the decarbonization of transport and the role that energy storage systems can play in this area. The importance of co-optimisation of various services for specific energy storage systems will be examined, as well as the co-optimisation of hybrid energy storage systems, where for example one system can provide fast response services and the other one can play the role of either acting as a buffer or performing price arbitrage across one or more markets. Especially for battery storage systems, the importance of a clever battery management system will be discussed aiming at respecting the battery's warranty and protecting the lifetime of the battery storage system, while ensuring sufficient provision of multiple market services. Finally, geographical constraints, lead times, capital costs and other specific techno-economic energy storage characteristics will be discussed towards the deployment of specific energy storage systems, as well as the circular economy in energy storage (secondary life of battery, recycling of end-of-life batteries, remanufacturing of other energy storage materials).

Each of the panelists will give a 10-minute presentation (with or without slides) highlighting the main drivers and barriers behind energy storage deployment in the respective country/region. Then, a 30-minute panel discussion will take place on some of the following topics:

- Applications of energy storage systems
  - Applications from domestic to grid-connected level
  - Highlight specific characteristics of energy storage systems
- Role of energy storage to transport decarbonisation
- Electricity markets for energy storage systems
  - Co-optimisation of multiple services for one energy storage system
  - Hybrid energy storage systems for one or more services
- Government policy and support mechanisms
  - Mechanisms to support energy storage deployment
- Regulation around energy storage
- Emerging energy storage technologies

### Chair

**Dr Jelena Ponocko**, Lead Engineer, Scottish Power Energy Networks

## Speakers

**Carmen Lucia Tancredo Borges**, Federal University of Rio de Janeiro, Brazil  
**Kyriaki-Nefeli Malamaki**, Independent Power Transmission Operator, Greece  
**Anne Blavette**, Ecole Normale Supérieure (ENS), Rennes, France  
**Elena Gryazina**, Skolkovo Institute of Science and Technology (Skoltech), Moscow, Russia

## Short Bio



**Dr Jelena Ponoćko** is a Lead Engineer at Scottish Power Energy Networks, UK, and is also affiliated with the Department of Electrical and Electronic Engineering at The University of Manchester, UK, where she worked as a Lecturer. Jelena has authored or coauthored over 40 research papers and technical reports. Her research has focused on data analytics-based assessment of demand-side flexibility and the effects of demand-side management on power network performance. She has been an active IEEE PES member since 2015 and currently acts as the IEEE Power and Energy Society Women in Power Representative for Region 8 (Europe, Middle East

and Africa).



**Prof. Carmen Lucia Tancredo Borges** (SM'06) obtained a B.Sc. from the Rio de Janeiro State University (UERJ) in 1984 and M.Sc. (1991) and D.Sc. degrees (1998) from the Federal University of Rio de Janeiro (UFRJ). She has been a professor of Electrical Engineering at UFRJ since 1996 and is a Full Professor since 2015. She was the PES Chapter Chair of the Rio de Janeiro IEEE Section from 2012 to 2014. She is the former Head of the Electrical Engineering Department and Leader of the Power Systems Group at UFRJ. Currently, she is working as an Invited Researcher at the Politecnico di Torino, Italy (POLITO). Her general research interests are in the area of power system analysis and optimization, reliability, renewable generation, probabilistic methods and high performance computing.



**Nefeli (or Dr. Malamaki)** received the Diploma and Ph.D. degree in Electrical and Computer Engineering from the Department of Electrical and Computer Engineering (DECE), Aristotle University of Thessaloniki (AUTH), in 2012 and 2020, respectively. Currently, she is a post-doctoral researcher at DECE, AUTH. She works also as a freelance researcher in EU-funded projects for the Greek TSO, Independent Power Transmission Operator. She has a 6-year experience as a researcher in EU H2020 and national research projects. From 2013-2020, she was a Teaching Assistant and in 2021- 2022, she was an adjunct Lecturer at DECE of AUTH in the Power Electronics and Electrical Machines courses. Her research interests include distributed generation and storage, power quality, interface of renewable energy sources and energy storage systems integration in smart grids.



**Dr Anne Blavette** obtained her PhD from University College Cork, Ireland in 2013 on grid integration of marine renewables. Following this, she obtained a Marie Skłodowska-Curie Actions (MSCA) fellowship to pursue her research at the SATIE lab at ENS Rennes, France. Recruited in 2015 as a permanent researcher by the French National Centre for Research (CNRS), she expanded her research interests to the wide topic of the optimal energy management in power systems with a growing share of renewables and flexible entities (electric vehicles, etc.). She is currently the leader of several projects including the ANR national « EDEN4SG » project on the management of large-scale fleets of electric vehicles in power systems through efficient, scalable and resources-sober methods. (Pronunciation EDEN4SG: EDEN for Smart Grids).



**Dr Elena Gryazina** is an Assistant Professor with the Center for Energy Science and Technology at Skolkovo Institute of Science and Technology (Skoltech), Moscow, Russia. She is also a director of "Energy systems" Master program. Dr Gryazina graduated with honors from Moscow Institute of Physics and Technology and got her Candidate of Sciences degree from the Institute for Control Sciences, Russian Academy of Sciences, under supervision of Prof. Boris Polyak. In 2022 Elena obtained Doctor of Science academic degree (habilitation degree in Russia) in computer science. Prior to Skoltech, Elena was a visiting researcher in Politecnico di Torino (Italy), Universite Joseph Fourier (France) and Massachusetts Institute of Technology (USA). At Skoltech, Elena is developing

a mathematical framework for the optimal functioning of smart energy systems of the future, as well as load identification and control algorithms, including energy-efficient indoor climate control and coordinated EV charging protocols.

### Abstract

The panel will focus on power systems in South-East Europe. It will discuss educational exchanges and intellectual flows, past and present. A number of widely used foundational books and educational exchanges have set the stage for the rapid evolution of regional educational programs over the last 50 years. The pace of change in modern power systems has picked up recently, driven by the desire to reduce the environmental impact by integrating renewable sources and power electronic loads. The panel will discuss how the changes in the electric power industry affect power engineering education and how we should change the curricula to prepare our students for the rapidly changing future. There is a clear need to prepare young professionals for lifelong learning, as domain-specific education was way more comprehensive in the past than what can be afforded today because of time and breadth constraints. The panelists will also comment on other challenges that educators share in all countries in the region, such as unsteady enrollments and limited domestic manufacturing.

### Chair

**Prof. Aleksandar Stankovic**, Tufts University, School of Engineering, Electrical and Computer Engineering Boston, USA

### Speakers

**Prof. Nikola Rajaković**, School of Electrical Engineering, University of Belgrade, Serbia

**Prof. Vesna Borozan**, University of Sts. Cyril and Methodius in Skopje, Faculty of Electrical Engineering and Information Technologies (UKIM/FEIT)

**Prof. Igor Kuzle**, University of Zagreb Faculty of Electrical Engineering and Computing

**Prof. Gregor Verbič**, University of Sydney, Australia

**Prof. Amir Tokić**, University of Tuzla, Bosnia and Herzegovina

### Short Bio



**Aleksandar M. Stanković** (Fellow, IEEE) received the Ph.D. degree in electrical engineering from the Massachusetts Institute of Technology, Cambridge, MA, USA, in 1993. He is currently an A.H. Howell Professor with Tufts University, Medford, MA, USA. From 1993 to 2010, he was with Northeastern University, Boston, MA, USA. He has held visiting positions with the United Technologies Research Center, and with L'Universite de Paris-Sud and Supélec. He is a Co-Editor of book series on power electronics and power systems for Springer. He was an Associate Editor for the IEEE Transactions on Power Systems, IEEE Transactions on Smart Grid, and IEEE Transactions on Control System Technology for more than 20 years.



**Prof. Nikola Rajaković**, Ph.D., has been a prominent figure in the field of power systems at the Faculty of Electrical Engineering in Belgrade for several decades. His extensive experience includes teaching various courses and serving as a mentor for numerous graduate and postgraduate theses. Specifically, he has supervised the preparation of over 150 graduate theses, more than 25 master theses, and has been involved in 14 PhD dissertations as a mentor.

Furthermore, Professor Rajaković has held significant leadership roles throughout his career. He served as the vice-dean of the Faculty of Electrical Engineering and held the positions of president of the Board of JP TE "Kostolac" and president of the Board of JP Elektroprivreda Serbia from 2002 to 2004. From 2008 to 2011, he served as the State Secretary of the Ministry of Mining and Energy, where he played a crucial role in introducing a tariff system that incentivized the increased utilization of renewable energy sources in Serbia.

In addition to his academic and governmental contributions, Professor Dr. Nikola Rajaković has served as a consultant for the World Bank. Currently, he holds the esteemed position of president of the Serbian Energy Association, a leading professional organization in the energy sector since 2004. He also provides valuable consultancy services for energy projects, with a focus on renewable energy sources.

Professor Rajaković's expertise and extensive involvement in the energy sector make him a highly respected authority in his field.



**Vesna Borozan** – Professor, University of Sts. Cyril and Methodius in Skopje, Faculty of Electrical Engineering and Information Technologies (UKIM/FEIT)

Prof. Vesna Borozan received her PhD in 1996 from University of Belgrade. She was a Postdoctoral Fellow at North Carolina State University in 1997, Visiting Professor at Pontificia Universidad Catolica de Chile in 1999 and Honorary Professor at Vienna University of Technology in 2010 – 2012. Prof. Borozan was Member of Parliament of North Macedonia during the mandate period 2002 – 2006 and Ambassador to Austria, Czech Republic, Slovak Republic and Japan from 2006 to 2010.

Presently she is a Professor in Power Systems at UKIM/FEIT.

Beside her scientific achievements and publications, Prof. Borozan has been involved in many projects and studies related primarily to the liberalisation of electricity markets in South East Europe.

She was an important contributor in the initial restructuring of the energy sector in her home country including coordination of the reform policy, establishing National Regulatory Authority and Energy Agency and drafting the necessary legal framework. She was a Special Envoy of the Prime Minister of North Macedonia in negotiation of the Energy Community Treaty in 2002 – 2005, as well as, Member of the Energy Community Reflection Group in 2014.

In the recent years, continuing her contribution to the Regional Electricity Market development and Energy Transition, she has participated in a number of projects financed by various programs of the European Commission as a leading member of the UKIM/FEIT team.

She is a Senior Member of IEEE/PES and Member of CIGRE.



**Igor Kuzle** (<http://igorkuzle.org/>) is a Full Professor and the Head of the Smart Grids Laboratory at the University of Zagreb Faculty of Electrical Engineering and Computing. He is member of two scientific councils of the Croatian Academy of Sciences and Arts (Scientific Council for Technological Development and Scientific Council for Crude Oil and Gas Economy and Power Supply). Since 2022, he has been a full member of the Croatian Academy of Engineering.

Prof. Kuzle was awarded the highest Croatian National Science Award for the year 2018 for his outstanding contribution in the field of smart grid applications in the transmission system. He was given by Croatian Academy of Sciences and Arts the award for his excellence in the technical field in the year 2019. The Award recognizes the work in the field of application of different control concepts to increase power system flexibility and enable further integration of renewable energy sources. The Croatian Academy of Engineering awarded him with annual award "Rikard Podhorsky" for the year 2020 for his contribution in the field of smart grid development and implementation.

His scientific interests include problems in electric power systems dynamics and control, maintenance of electrical equipment, as well as smart grids and integration of renewable energy sources. Prof. Kuzle is (co)author more than 300 technical studies for utilities and companies. He was the project leader for more than 80 technical projects for industry and electric power companies. Since 2012, he has been a member of Advisory expert committee of the Ministry of Environmental and Nature Protection in the evaluation of environmental impact of the RES and a member of Croatia TSO Coordination Group for Connection of renewable energy sources. He is a member of Croatian Chamber of Electrical Engineers and a Licensed Engineer since 1994.



**Gregor Verbic** is an Associate Professor in the Centre for Future Energy Networks based in the School of Electrical and Information Engineering. Prior to this, he was an assistant professor in Laboratory of Power Systems at University of Ljubljana, where he is now an adjunct professor and where he received his PhD in electrical engineering. In 2005, he was a NATO-NSERC Postdoctoral Fellow at the University of Waterloo, Canada under supervision of Prof Claudio Cañizares. Between 2008 and 2010 he was head of the investment department in Interenergo, Ljubljana, Slovenia. The company invests in renewable energy in the Balkans region, with a particular focus on small hydro. His current research is motivated by the evolution of power systems to future grids, dominated by intermittent

renewable energy sources, aiming to develop tools and methods that will enable a paradigm shift in power system operation, from generation following load to load following generation.



**Amir Tokic** (M'09) received the M.Sc. and Ph.D. degrees in electrical engineering and computing from Zagreb, Croatia, in 2001 and 2004, respectively. Currently, he is a Professor at the University of Tuzla, Tuzla, Bosnia and Herzegovina. His areas of interest include power system transients, power quality, as well as applied numerical and optimization methods.

## SS14 | UI-ASSIST: International Research Collaboration

### Abstract

The US-India team behind this proposal represents the strongest universities, national laboratories, electrical utilities, and vendors in the field of clean energy. The project is co-sponsored by US Department of Energy and the Government of India. Washington State University and the Indian Institute of Technology Kanpur are leading 30 collaborating entities, each of which has an established track record of contributing to the significant changes already occurring in electric distribution system. The formation of this strong team was possible because these organizations have years of collaboration nationally, as well as across geographic borders. India's high electric load growth is projected to continue for the near future, while rapidly increasing generation capacity. In the US, the load growth is modest, and DER will mostly replace existing generation capacity. This difference is recognized here by integrating research in societal value to anticipate that the policies adopted in the two countries may be quite different.

The fundamental approach of the project is to bridge the gap between smart grid, storage, and renewable energy research and facilitate its subsequent adoption by utilities around the world in their distribution system operation and planning. There will be six different phases with multiple objectives. Some of the major outcomes from our research include:

- 1) Open-source test feeders for urban, semi-urban and rural, in India and US.
- 2) Storage models with advanced analytical techniques for optimal operation;
- 3) Operational and control algorithms as well as analysis tools, to integrate DER control with Advanced Distribution Management System (ADMS) and Microgrid Management System (MEMS);
- 4) Cyber-Physical Analysis tools and Cyber Security Measures for smart operations with high DER;
- 5) Lab scale testing and real-world field demonstration; and
- 6) Recommendations to address socio-political issues for adopting these technologies and the needed workforce development.

### Objectives

- To evolve future distribution grid that will allow the continuing increase of Distributed Energy Resources (DER) penetration towards a carbon-free electricity system.
- To develop and demonstrate the DSO functions for optimal utilization and management of DER by interfacing with DER control and microgrid control system with high penetration of energy storage.
- Scope
- R&D Activities on Microgrid and Active Distribution Network Concepts, Storage Optimization and Management, Electric Vehicle and Renewable Integration, Microgrid and Advance Distribution Management Systems, Cyber-security Measures, Market and Policy Issues.
- Lab scale pilots for proof of concepts, and 5 field pilots, each in US and India, for demonstration in rural, semi-urban and urban areas.
- Manpower training in Smart Grid area.

The 90-minute panel session at 2023 PowerTech conference will present a brief history of the 6-yr collaborative project, which was jointly funded by US and Indian Governments and includes over 30 collaborating entities. The presentations are going to cover a broad spectrum of UI-ASSIST various activities, and will also shed light on some aspects of research performed by the four presenters' groups at Washington State University, Texas A&M University, West Virginia University, and MIT.

### Chair

**Prof. Miroslav M. Begovic**, Texas A&M University, USA

## Speakers

**Prof. Miroslav M. Begovic**, Texas A&M University, USA  
**Prof. Anurag Srivastava**, West Virginia University, USA  
**Prof. Anuradha Annaswamy**, MIT, USA  
**Prof. Chanan Singh**, Texas A&M University, USA

## Short Bio



**Miroslav M. Begovic** (LFIEEE, CIGRÉ) is former Department Head of Electrical and Computer Engineering, currently the Moore Professor at Texas A&M University. Prior to that, he was Professor and Chair of the Electric Energy Research Group in the School of Electrical and Computer Engineering, and an affiliated faculty member of the Brook Byers Institute for Sustainable Systems and University Center of Excellence in Photovoltaic Research at Georgia Institute of Technology. For the Centennial Olympic Games in 1996 in Atlanta, Drs. Begovic and Rohatgi designed and oversaw construction of a 340 kW PV system on the roof of Aquatic Center at Georgia Tech, the largest roof-mounted PV system in the world at the time.

Prof. Begovic has been a member of the IEEE PES Power System Relaying Committee for two decades and chaired several of its working groups. Dr. Begovic delivered over 110 keynote and invited presentations worldwide. Dr. Begovic served in technical and administrative functions over 35 years of his membership at IEEE, among others as Chair of the IEEE PES Emerging Technologies Coordinating Committee, IEEE PES Treasurer (2010-2011), IEEE PES Distinguished Lecturer from 2011, and served as President-Elect, President and Immediate Past President of the IEEE Power and Energy Society (2012-2018). He is the recipient of 2019 IEEE PES Meritorious Service Award and 2022 Ramakumar Family Renewable Energy Excellence Award.



**Dr. Anurag Srivastava** is Chairperson and Professor at Lane Department of Computer Science and Electrical Engineering, West Virginia University. Anurag Srivastava's research interests include data-driven algorithms for power system operation and control including resiliency analysis. In past years, he has worked at the Réseau de Transport d'Électricité in France; RWTH Aachen University in Germany; PEAK RC, Idaho National Laboratory, Pacific Northwest National Lab, PJM Interconnection, Schweitzer Engineering Lab (SEL), GE Grid Solutions, Washington State University, Massachusetts Institute of Technology and Mississippi

State University; Indian Institute of Technology Kanpur in India; as well as at Asian Institute of Technology in Thailand. Dr. Srivastava is a senior member of the Institute of Electrical and Electronics Engineers (IEEE), chair of the IEEE Power and Energy Society's PEEC committee, past vice-chair of the IEEE synchrophasor conformity assessment program and member of CIGRE C4C2-58 Voltage Stability, C4.47/ C2.25 Resilience WG, CIGRE 2.18 Wide Area Monitoring Protection and Control Systems – Decision Support for System Operators, CIGRE D2.52 AI Application and Technology in Power Industry. He has delivered 30+ keynotes/tutorials/IEEE distinguished lectures in more than 15 countries. He is the author of more than 300 technical publications including a book on power system security and four patents.



**Dr. Anuradha Annaswamy** received her Ph.D. in Electrical Engineering from Yale University in 1985. She has been a member of the faculty at Yale, Boston University, and MIT where currently she is the director of the Active-Adaptive Control Laboratory and a Senior Research Scientist in the Department of Mechanical Engineering. Her research interests pertain to adaptive control theory and applications to aerospace, automotive, and propulsion systems, cyber physical systems science, and CPS applications to Smart Grids, Smart Cities, and Smart Infrastructures. She is the author of a hundred journal publications and numerous conference publications, co-author of a graduate textbook on adaptive control (2004).

Dr. Annaswamy has received several awards including the George Axelby and Control Systems Magazine best paper awards from the IEEE Control Systems Society (CSS), the Presidential Young Investigator award from NSF, the Hans Fisher Senior Fellowship from the Institute for Advanced Study at the Technische Universität München, the Donald Groen Julius Prize from the Institute of Mechanical Engineers, a Distinguished Member Award, and a Distinguished Lecturer Award from IEEE CSS. Dr. Annaswamy is a Fellow of the IEEE and IFAC and member of NAE. She has served as the Vice President for Conference Activities (2014-15), and is currently serving as the VP for Technical Activities (2017-18) in the Executive Committee of the IEEE CSS.



**Chanan Singh** is professor in the Department of Electrical and Computer Engineering, Texas A&M University. His titles include Irma Runyon Chair Professor and Texas A&M System Regents Professor. Dr. Singh got his M.S. and Ph.D. in electrical engineering from the University of Saskatchewan, Canada and B.Sc. (honors) from the Punjab Engineering College, Chandigarh, India. From 1997 to 2005 he served as the Department Head of Electrical and Computer Engineering at Texas A&M and later, from 2012 to 2015, he served as Interim Head.

He has also served as Program Director at the National Science Foundation of USA. He is also a principal and Vice-President of Associated Power Analysts Inc. a firm that specializes in developing software and conducting reliability studies of the electric power grid. Before joining Texas A&M University he worked in the R&D Division of Ontario Ministry of Transportation and Communications on the development of innovative public transit systems. Dr. Singh is known for his contributions to electric power system reliability evaluation, particularly in developing the theoretical foundations for frequency and duration methods, non-Markovian models, modeling of interconnected power systems, integration of renewable resources and machine learning method for reliability analysis of large power systems. He is author/co-author of four books, several book chapters, and over 400 technical articles, IEEE Life Fellow and member of NAE.

## SS15 | System Integrity Protection Schemes in Modern Power Systems

### Abstract

Despite all the efforts made so far, reaching ambitious NetZero targets in electricity grids seems far-fetched due to stability-related challenges brought about by limitations, volatility and intermittency of renewables. The behaviour of inverter-based resources (IBRs) in response to system disturbances is fundamentally different than that of synchronous generating units. Recent examples and expected trends demonstrate that the operation of system integrity protection schemes (SIPS) will be adversely affected by the increasing integration of renewables into power systems. This is why it is essential to understand the nature of IBR's impact and its consequences. The MIGRATE (Massive InteGRATION of power Electronic devices) project was a Horizon-2020 EU-funded research project, carried out by a consortium of 24 partners (eleven TSOs, twelve universities/labs and one manufacturer) aimed at finding solutions to technological challenges brought about by renewables. Work package 4 of MIGRATE focused on "Protection schemes in transmission networks with high penetration of IBRs". The main aim of the work package was to investigate the performance of existing SIPSs that are deemed more vulnerable to high penetrations of renewables. Based on responses from MIGRATE TSO partners, three SIPSs were identified as important and chosen for further scrutiny by the work package. These protection schemes were:

- Under frequency load shedding (UFLS)
- Under voltage load shedding (UVLS)
- Power swing tripping (PST)

In this special session, we will show that holding onto legacy SIPSs can greatly contribute to falling behind NetZero solutions. The panellists will present the main project results in terms of challenges, opportunities and future of SIPSs as well as a series of SIPSs solutions proposed in the Project. Conclusions drawn from our research will be presented to share our views on how best we can upgrade existing SIPSs in order to reduce the risk of catastrophic blackouts and push toward future low-carbon networks.

### Chair

**Dr Sadegh Azizi**, University of Leeds

### Speakers

**Dr Sadegh Azizi**, University of Leeds

**Vladimir Terzija**, Shandong University

**Marjan Popov**, Delft University of Technology

**Rubén Andrino Gallego**, Red Eléctrica de España

### Short Bio

**Sadegh Azizi** received his Ph.D. degree in Electrical Power Engineering from the University of Tehran, Iran, in 2016. He is currently a Lecturer in Smart Energy Systems in the School of Electronic and Electrical Engineering,



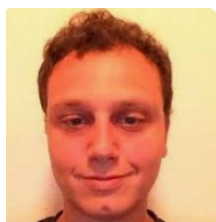
University of Leeds. From June 2016 to January 2019, he was with The University of Manchester as a Postdoctoral Researcher leading their work on the protection Work Package of the EU H2020 MIGRATE project. Prior to this, he was with the Energy and System Study Center, Monenco Iran Consulting Engineers Co., and then with the Iran Grid Management Co., Tehran, Iran. Dr Azizi is an Associate Editor of the IJEPES and a task leader of Cigre WG B5.57 which is investigating new challenges of frequency protection in modern power systems. His research interests include wide-area monitoring, protection and control systems and applications of power electronics in power system



**Vladimir Terzija** received his Ph.D. degrees in electrical engineering from the University of Belgrade, Belgrade, in 1997. From 1997 to 1999, he was an Assistant Professor at the University of Belgrade, Belgrade, Serbia. From 2000 to 2006, he was a senior specialist for switchgear and distribution automation with ABB, Ratingen, Germany. He was the Engineering and Physical Science Research Council (EPSRC) Chair Professor in Power System Engineering with the Department of Electrical and Electronic Engineering, The University of Manchester from 2006 to 2020. His current research interests include smart grid applications; wide-area monitoring, protection and control, multi-energy systems, switchgear and transient processes, ICT, data analytics and digital signal processing applications in power systems. Prof. Terzija is the Editor in Chief of the International Journal of Electrical Power and Energy Systems, Alexander von Humboldt Fellow, as well as a DAAD and Taishan Scholar.



**Marjan Popov** obtained the Ph.D. degree in Electrical Power Engineering from Delft University of Technology, Delft, Netherlands, in 2002. He is also a Chevening alumnus and in 1997, he was an Academic Visitor with the University of Liverpool, Liverpool, UK, working in the Arc Research Group on modeling SF6 circuit breakers. His major fields of interest are future power systems, large-scale power system transients, intelligent protection for future power systems, and wide-area monitoring and protection. Prof. Popov is a member of Cigre and actively participated in WG C4.502 and WG A2/C4.39. In 2010 he received the prestigious Dutch Hidde Nijland Prize for extraordinary research achievements. He is an IEEE PES Prize Paper Award and IEEE Switchgear Committee Award recipient for 2011 and an Associate Editor of Elsevier's International Journal of Electrical Power and Energy Systems.



**Rubén Andrino Gallego** received his Bachelor. degree in Electronic and Automatic from the University Carlos III de Madrid, Spain, in 2005. He has worked in ABB and Siemens as control and protection engineer taking part in national and international projects. In 2015 joined REE in the System Security Department as senior protection engineer participating in ENTSO-E protection subgroup and Work Package 4 of the EU H2020 MIGRATE project.

## SS16 | Leading innovations and technological solutions for a sustainable future – TRANSIT project

### Abstract

The urgent goal of decarbonisation of the world's economies involves a global shift of the energy sector from fossil fuel-based systems to renewable energy sources.

This energy transition requires societal awareness, but it also requires the development of new technologies that can speed up the process, as well as the necessary expertise and training to apply them. Such technologies include the development of more flexible systems, energy storage, the electrification of certain sectors or their digitalisation, for example. Furthermore, the environmental repercussions of such widespread use of new technologies must be considered. All these aspects will be addressed in this Special Session as part of the TRANSIT project's activities.

TRANSIT (which stands for TRANSITION to sustainable future through training and education) is a project funded by the European Union and UKRI under the program Horizon Europe that aims to provide sustainable training and re-skilling programmes for current and future generations on a multidisciplinary approach in renewable energy. In achieving this, TRANSIT seeks to enable the societal changes that will encompass the high ambitions of deployment and transformation of the energy sector in the following decades through the design and delivering of an overall educational, retraining and social engagement programme covering different sectoral strategies and stakeholders.

## Chair

**Araceli Hernandez Bayo** – Universidad Politecnica de Madrid

## Speakers

**Brian Azzopardi**, Malta College of Arts, Science and Technology (MCAST) | The Foundation for Innovation and Research Malta (FIR.mt)

**Vladimir Shiljkut (Šiljkut)**, Public Enterprise Electric Power Industry of Serbia

**Lidija M. Korunović**, University of Niš, Faculty of Electronic Engineering (UNI-FEE)

**Aleksandra Krkoleva Mateska**, Ss Cyril and Methodius University in Skopje (FEIT)

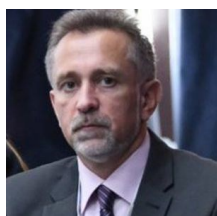
**Lenos Hadjimetriou**, University of Cyprus, KIOS Research and Innovation Center of Excellence

**Pablo Rodríguez-Pajarón**, Universidad Politécnica de Madrid

## Short Bio



**Dr Ing. Brian Azzopardi** (BA) is co-Founder and Chairman of The Foundation for Innovation and Research – Malta (FIR.mt), Senior Lecturer II at the Malta College of Arts, Science and Technology (MCAST) and Visiting Senior Lecturer at the University of Malta (UM). Since 2011, he has held senior academic and research positions in the United Kingdom, Lithuania and Malta. He has also served the industry, government agencies and ministries and research centres since 1998. He is the Coordinator of the Horizon 2020 / Horizon Europe projects: JUMP2Excel (finalised), NEEMO (current), TRANSIT (launched in Oct 2022) and PROMISE (launched in Oct 2022) and contributed directly to over €10M to affiliated institutions on projects with over €30M budget over the past decade. He is a Senior Member of IEEE and a member of The IET, EI, RSC and Chamber of Engineers. He is also the recipient of the MCST-JRC Young Scientist Award and 3rd Place in the STEM Young Researchers Award. In 2008 he received the Eur. Ing. title followed by the CEng and the EI Chartered Energy Engineer titles in 2012. In 2002, he received a BEng(Hons) from UM and a PhD from The University of Manchester in 2011. He also received teaching and pedagogical qualifications from MCAST (2008) and PGCHE from Oxford Brookes University (2012). Dr Ing. Azzopardi is the editor and co-author of two books, 100+ research papers in peer-reviewed impact-listed journals and conferences, and invited speaker and the Chair of MEDPOWER2022 Conference. He has supervised over 10+ postgraduates Masters and Doctoral Candidates and Postdocs. ([brianazzopardi.eu](http://brianazzopardi.eu) | [jump2excel.eu](http://jump2excel.eu) | [neemo-project.eu](http://neemo-project.eu) | [pvpromise.eu](http://pvpromise.eu) | [transitproject.eu](http://transitproject.eu))



**Vladimir Shiljkut** earned his Dipl.Ing. and Ph.D. degrees at University of Belgrade – School of Electrical Engineering, Republic of Serbia. Since 2017 he is scientific associate, too. He had his entire career in electricity distribution and power industry. He is currently the Adviser for Business System of EPS General Manager. He is the author and co-author of more than 75 articles and papers, published in national (Serbian) publications, four in international journals, and in the proceedings of numerous national, regional and international conferences. These works deal with load forecasting methods, optimal network planning, power losses estimation, renewable

energy sources, power transformers, metrology, demand response and demand side management, etc. He is also the co-author of one practical book in electricity distribution and retail, in Serbian language.



**Lidija M. Korunović** received the Dipl.Ing., M.Sc., and Ph.D. degrees from the University of Niš, Faculty of Electronic Engineering, Niš, Republic of Serbia. She is currently Full Professor and Head of the Department of Power Engineering, Faculty of Electronic Engineering, University of Niš. She is the author/co-author of over hundred research papers, four books and two reports of CIGRE working groups. She participated in ten research projects and studies supported by the Ministry of Science of Serbia. Her research interests are distribution networks, load modelling, renewable energy sources and power quality. She is a Senior Member of IEEE, and a member of: CIGRE Serbia and CIRED Serbia.



**Aleksandra Krkoleva Mateska** is associate professor at the Ss Cyril and Methodius University in Skopje, Faculty of Electrical Engineering and Information Technologies (UKIM/FEIT). She works in the field of power systems, focusing on Smart Grids, renewable sources integration in distribution grids and Microgrids, electricity markets and regulation related to these areas. She has had a number of study visits to other universities, including at the University of Manchester, UK, University of Rostock, Germany, National Technical University in Athens, Greece. She is an author and co-author of more than sixty research papers. She has participated in several research projects financed by various programs of the European

Commission as a member of the UKIM/FEIT team. She is a member of IEEE and CIGRE.



**Lenos Hadjidemetriou** is currently a Research Lecturer at the KIOS Research and Innovation Center of Excellence, University of Cyprus. He received the Diploma in Electrical and Computer Engineering in 2010 from the National Technical University of Athens, Greece, and his Ph.D. degree in Electrical Engineering in 2016 from the University of Cyprus, Cyprus. His research interests include smart grids, grid integration of renewable energy systems, energy storage systems, control of power electronics, micro-grids, and cyber-security aspects in smart grids. Dr. Hadjidemetriou has published more than 95 papers in scientific journals and international conference proceedings.



**Pablo Rodríguez-Pajarón** received the Ph.D. in electrical engineering from Universidad Politécnica de Madrid (UPM), Madrid, Spain, in 2022. He is now Lecturer at the Department of Automatics, Electrical and Electronics Engineering and Industrial Computing at the Universidad Politécnica de Madrid (UPM), Madrid, Spain.

## SS17 | Offshore Energy Islands/Hubs

### Abstract

Offshore energy hubs are a hot topic in the energy sector. Governments and investors alike have high expectations for offshore energy hubs as crucial for the energy transition.

The world's first energy islands will be constructed in Danish and Belgian waters, exploiting the immense wind resources in the North and the Baltic Seas. They will serve as offshore hubs that can create optimal conditions for the establishment, operation, and innovation with respect to offshore wind and provide better and cost-effective connections between the offshore wind farms and the energy systems in the region. As such the energy hubs will enable large-scale sector coupling in the region and will function as green power plants at sea.

High voltage direct current (HVDC) technology is indispensable for the deployment of offshore energy hubs. With its high-power transmission capabilities, different technological options, applicable topologies and precise power flow controllability, HVDC systems are key for designing reliable power grids. To fully exploit the potentialities of HVDC, more research, innovation and demonstration actions (R&I&D) are needed. The session will introduce the concept of offshore energy islands/hubs, present the status of their development, and discuss the main challenges in designing and operating these electron metropolises, as addressed by the two TSOs. At the same time, the session will also present European Union's Strategic Energy Technology HVDC Implementation plan, introducing and discussing the identified actions in key areas: (i) Technology; (ii) Control and Protection; (iii) Operation and (iv) Planning. Finally, the very timely topic of HVDC interoperability will be introduced, with references to the only European operating multi-vendor HVDC link and one of the largest EU projects on the topic, InterOpera.

The agenda :

- Welcome and introduction, Prof. Nicolaos A. Cutululis, DTU, Denmark – 5 min
- Offshore Energy Islands in Fitim Kryezi, Denmark, Energinet – 15 min
- Offshore Energy Islands in Belgium, TBD, Elia, Belgium – 15 min
- HVDC technology for the Mediterranean area, Dr. Angelo L'Abbate, RSE, Italy – 15 min
- SET Plan HVDC Implementation plan, Prof. Dirk Van Hertem, KU Leuven, Belgium – 15 min
- Panel discussion – 25 min

### Chair

**Nicolaos A. Cutululis**, Technical University of Denmark (DTU)

### Speakers

**Prof. Dirk Van Hertem**, KU Leuven, Belgium

**Prof. Nicolaos A. Cutululis**, DTU, Denmark

**Fitim Kryezi**, Energinet, Denmark

**Dr. Angelo L'Abbate**, RSE

**Clement Hardy**, Elia, Belgium



**Nicolaos A. Cutululis** (M'06, SM'16) is Professor in Offshore Wind Power Integration, based in the Department of Wind and Energy Systems at the Technical University of Denmark. His main research area is integration and operation of wind power moving towards 100% RES power systems, with a special focus on offshore wind and HVDC. He is active in shaping the wind power research agenda at European level, being a MB member of EERA JP Wind and Ex-co member for ETIPWind. He has co-chaired the SET Plan TWG drafting the first Implementation Plan for HVDC.



**Dirk Van Hertem** (S'02-SM'09) graduated as a M.Eng. in 2001 from the KHK, Geel, Belgium and as a M.Sc. in Electrical Engineering from KU Leuven, Belgium in 2003. In 2009, he has obtained his PhD, also from KU Leuven. In 2010, Dirk Van Hertem was a member of EPS group at the Royal Institute of Technology (KTH), in Stockholm. Since spring 2011 he is back at the University of Leuven where he is an associate professor in the ELECTA group. His special fields of interest are decision support for grid operators, power system operation and control in systems with FACTS and HVDC and building the transmission system of the future, including offshore grids and the supergrid concept



**Fitim Kryezi** is Senior Lead of the electrical design: North Sea Energy Island at Energinet the Danish TSO. He holds a Master of Engineering (MEng) in Electrical Power Systems and High Voltage Engineering from Aalborg University back in 2015. Employed at Energinet since 2015 mainly involved in HVDC project both as technical lead and Project Manager. Chairman of the The project "MULTI-DC: Innovative Methods and Optimal Operation of Multiple HVDC Connections and Grids" (MultiDC), an international program were 3 universities, 2 TSO and Hitachi collaboration. Has worked with Energy Islands for 5 years has part of the team who started the North Sea Wind Power Hub Consortium (NSWPH). Currently has the overall responsibility of developing the electrical design: North Sea Energy Island as Project Manager.



**Angelo L'Abbate** graduated in Electrical Engineering at the Politecnico di Bari, Italy, in 1999. In 2003–2004 he received his PhD in Electrical Energy Systems at the Politecnico di Bari, Italy, in partnership with the University of Dortmund, Germany. In 2004–2005 he was active researcher at Mediterranean Agency for Remote Sensing (MARS), Benevento, Italy, and at the University of Ljubljana, Slovenia, as CNR-NATO Fellow. In 2005-2008, he was at the European Commission – Joint Research Centre – Institute for Energy, Petten, the Netherlands. Since 2009 he has been working with RSE – Ricerca sul Sistema Energetico (former CESI RICERCA/ERSE), Milan, Italy, where he is now a Senior Research Engineer in the Transmission Planning and Operation Group of the Energy Systems Development Department. His fields of interest include modeling and planning of power T&D grids and systems, FACTS, HVDC, RES and DG integration, innovative technologies, overlay and global grid. He has been and is currently involved in several Italian and European projects. He is an IEEE PES and CIGRE Member and actively contributes to CIGRE and IEEE activities: he is currently involved and Task leader in CIGRE WG C1.44 "Global interconnected and sustainable electricity system: Effects of storage, demand response and trading rules". He is one of the two Italian representatives in the European SET Plan WG on HVDC and DC.



**Clément Hardy** is Project Leader for the Princess Elisabeth Island (PEI) HVDC Substations at Elia, the Belgian TSO. He holds a Master's degree in Electro-Mechanical Engineering (Energy focus) from the UCL-EPL school in Louvain-la-Neuve (BE). After graduating in 2017, Clément directly started at Elia as Project Leader for the onshore substations, with an ever-growing portfolio ranging over 80+ substations, from small distribution to the largest interconnection substations. In 2022, Clément was selected to join the ambitious PEI infrastructure project team in the early development stage as technical lead for the HVDC Substations. Keen to continue developing his large projects management skills and master the many technical challenges of HVDC and offshore projects, his fields of interest are the development and implementation of the necessary technical solutions to today's major energy challenges.

## SS18 | Challenges and demands of medium voltage technologies for renewable installations and environment impact

### Abstract

Large centralized power plants continue to play a role in providing alternating current (AC) power to the wholesale power grid; however, there is growing momentum at the medium voltage (MV) level to diversify power offerings and pursue hybrid solutions that incorporate more direct current (DC). Given significant political and stakeholder support for inverter-based native DC power sources, such as solar PV and battery storage, utilities and solutions providers seek to reduce DC-AC-DC conversion losses. Today, HVDC systems of different suppliers are not interoperable: a converter station of vendor A can't be connected to a converter station of vendor B as they use different proprietary specifications and standards. To enable large-scale exploitation of offshore wind energy, there is a need to unlock the interoperability of multi-vendor, multi-terminal and multi-purpose HVDC systems with grid forming control capability. To achieve these goals, some important issues of converter control and current protection will be addressed. The lecture also contains a description of the main trends (new materials, approaches, concepts) in designing and operating components (voltage transformers, switches, etc.) at the transmission and distribution levels of the power grid, especially related to renewables and energy storage applications. After that the review upon the different profile needs in the industry is presented (ranging from simulation engineers to arc physicists), especially considering the systemic transformation that the power sector has been and will be experiencing in light of renewable penetration.

This lecture will also present topics of new insulating materials for power transformers, in terms of compatibility, high performance properties, resilience for operation in stressed conditions (high temperatures, electrical stresses, transient, DC applications). Recycling of conventional materials will be briefly presented, as one part of the Green deal objectives to decrease power transformers carbon footprint. New products are intensively being launched on the market and applied. More thermally upgraded papers are used, including Aramid insulation, but testing techniques are not yet developed and standardized. This is important task of R&I community.

Finally, the topic of human exposure to electromagnetic fields will also be addressed. The main provisions of the legislation related to exposure of the general public and workers to electromagnetic field will be presented. The results of electromagnetic field measurements and the field levels that usually occur in the vicinity of the most relevant sources (overhead power lines, cable lines, substations) will be given. Different methods for electric and magnetic field mitigation, that could be applied in the case when the field levels exceed the prescribed reference levels will also be explained and demonstrated on practical cases.

The list of presentations follows:

- 1) Medium Voltage DC Technologies Bring New Opportunities for Renewable Installations and Energy Storage Facilities, Slobodan N. Vukosavić, SANU, ETF (20 minutes)
- 2) Enabling Interoperability of Multi-Vendor HVDC Grids, Aleksandra Lekić, TU Delft (20 minutes)
- 3) Transmission & Distribution equipment trends in Energy Transition, Nenad Uzelac, G&W Electric Company (20 minutes)
- 4) Challenges and demands in performance of modern insulating materials for power transformers of today and tomorrow, Jelena Lukic, EEINT (15 minutes)
- 5) Exposure of people to electromagnetic fields: legislation, levels and mitigation techniques, Maja Grbic, EEINT (15 minutes).

### Chair

**Maja Grbić**, Electrical Engineering Institute Nikola Tesla

### Speakers

**Aleksandra Lekić**, TU Delft

**Nenad Uzelac**, G&W Electric Company

**Jelena Lukić**, Electrical Engineering Institute Nikola Tesla

**Maja Grbić**, Electrical Engineering Institute Nikola Tesla

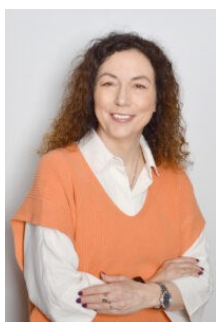


**Aleksandra Lekić** received the B.S., M.S., and Ph.D. degrees in Electrical Engineering from the School of Electrical Engineering, University of Belgrade, Belgrade, Serbia, in 2012, 2013, and 2017, respectively. Between 2012 and 2018 she has been a Teaching Assistant with the School of Electrical Engineering, University of Belgrade, and an Assistant Professor from 2018 to 2019. In 2019 she worked as a Postdoctoral Researcher at the Department of Electrical Engineering ESAT – ELECTA, KU Leuven and in the Institute EnergyVille, Genk, Belgium.



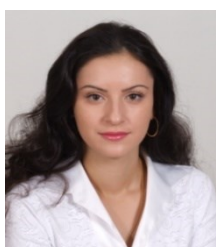
**Nenad Uzelac** EDUCATION: Masters of Science in Product Development Northwestern University, Evanston, Illinois, 2004 Masters of Science in Power Engineering. University of Belgrade (Serbia), 1995 Continuing Education – New Product Development Management, Finite Element Analysis, Switchgear design and testing, Switchgear condition assessment, New Technologies PROFESSIONAL SUMMARY: 20 years of experience in medium voltage switchgear design, testing and production implementation, with focus on reclosers and automation. Actively participates in IEEE and CIGRE working groups and standard

activities. Chair of IEEE Switchgear Technology & Innovation subcommittee. Chair of CIGRE A3 Study committee (Transmission and Distribution equipment). Research interest include electrical and magnetic field analysis, MV switchgear design, development and testing, new product development process optimization, non-intrusive condition assessment and internal fault studies. EMPLOYMENT: G&W Electric Company: 2015 – Present (Global research and standards director) Responsible for global technology development from ideation to proof of concept. G&W Electric Company – 2006 to 2015 (Switchgear R&D Leader) Responsible for new product development in switchgear department – design, testing and production implementation of SF6 and solid dielectric medium voltage switchgear equipment up to 38kV and 25kA. Provide direct supervision and coordination of the activities of R&D team. Conduct research studies on project related activities, like numerical analysis of the pressure rise during the internal faults in SF6 switchgear. Leads feasibility studies for new development switchgear projects. Champion the change of the New Product Development process. G&W Electric Company – 1999 – 2006 – (Project Engineer) Highlights: Part of the design team on 3 phase SF6 medium voltage recloser – responsible for the magnetic actuator and interface electronics design. Project leader in development of 3 phase single/triple solid dielectric medium voltage recloser, responsible for the design and product implementation. Technical lead in development of 8 cycle transfer SF6 switch that utilizes mirror bit communication. Institute “Nikola Tesla”, Serbia – 1995 – 1998 – Research Engineer Participated in development and testing of the analog and digital controllers for power generating plants. Tested and troubleshooted rectifiers and UPSs systems in power utilities.



**Jelena Lukic** was born in Belgrade, Serbia in April 1970. She received her BSc in 1996, the MSc degree in 2004 and PhD degree in 2013. She has been employed in Electrical Engineering institute Nikola Tesla, Belgrade, Serbia from 1996, holding position of head of specialized laboratory for oil and paper insulation testing, accredited according to ISO 17025 from 2004. Her fields of expertise are insulating oil and paper analyses, power transformers condition and risk assessment, know-how in PCB removal, corrosive and aged oils re-refining (holds two registered patents related to transformer oil treatments). She has published more than 80 papers, 9 in peer review papers and 10 papers as invited lecturer at international conferences worldwide. She has been a project leader of more than 20 research projects with the industry in country and abroad, related to insulation systems for

power transformers, including high level of participation in CIGRE and IEC TC 10 WG's. She was convener of CIGRE WG A2.40, IEC TC 10 AhG 40 and is currently convener of CIGRE WG D1.76. Jelena Lukic is delegate of Serbian National Committee in International Electrotechnical Committee Technical Committee 10 (IEC TC 10) – Fluids for Electrotechnical Applications, Serbia NC Representative in CIGRE SC A2-Transformers and IEC TC 10 Liaison Co-officer of CIGRE SC A2.



**Maja Grbić** is a research associate at Electrical Engineering Institute Nikola Tesla, University of Belgrade, Serbia. She received BSc, MSc and PhD degree in electrical engineering in 2010, 2012 and 2021, respectively, from School of Electrical Engineering, University of Belgrade. Since 2010 she has been employed at Electrical Engineering Institute Nikola Tesla, at the Power Facilities Department. Her primary field of interest has been research in the area of electromagnetic fields. She has participated in 14 major projects, 7 times as the head of the project. She has been involved in 46 expert evaluation studies regarding influence of new/reconstructed electromagnetic field sources on the environment, primarily as the head of the study, as well as in 18 studies related to electromagnetic fields and

electromagnetic interference and over 1000 reports primarily referring to electromagnetic field testing. In 2018 she has been appointed head of the Laboratory for electromagnetic field testing, which is accredited in accordance with ISO/IEC 17025 standard. She has published 67 papers at national and international journals and conference proceedings. She was awarded by the Belgrade Chamber of Commerce for the best master's thesis and by the Serbian Chamber of Commerce for the best PhD thesis.

## SS19 | Contemporary and emergent methods for planning and analysis of distribution networks

### Abstract

Widespread electrification will result in distribution networks becoming a crucial bottleneck on the path to a resilient and carbon-neutral power system. This Special Session will explore contemporary and emergent methods that will enable distribution system operators and decision makers to reach net zero goals in a reliable, cost-effective, and timely manner. State-of-the-art planning approaches will be presented from a variety of contexts around the globe. Innovative techniques discussed will span fast-growing fields such as AI-based model-free simulations, multi-vector resilience-oriented planning, and effective integration of low carbon technologies.

### Chair

**Dr. Daniel Donaldson**, University of Birmingham (UK)

### Speakers

**Mathaios Panteli**, University of Cyprus

**Xueqin (Amy) Liu**, Queen's University Belfast

**Matthew Deakin**, Newcastle University

**Dr. Balaji Venkateswaran V**, University of Cyprus

**Dr. Jochen Cremer**, TU Delft

### Short Bio



**Daniel Donaldson** is currently an Assistant Professor in the Department of Electronic, Electrical and Systems Engineering at the University of Birmingham. His main research interests include electricity distribution system planning, forecasting, power system resilience, and climate adaptation of interdependent critical infrastructure. He received a Ph.D. degree from the University of Birmingham, U.K., with a focus on resilience of electric power systems. Previously, he spent seven years working at Southern California Edison (SCE) in a variety of roles across distribution engineering, transmission planning, and demand and DER forecasting and he is a licensed Professional Engineer in the state of California. He is also an IEEE member, Secretary of the IEEE working group on Modern and Future Distribution System Planning, and Industry Liaison for the UK and Ireland IEEE PES Chapter.



**Mathaios Panteli** is currently an Assistant Professor with the Department of Electrical and Computer Engineering, University of Cyprus. His main research interests include techno-economic reliability, resilience and flexibility assessment of future low-carbon energy systems, grid integration of renewable energy sources and integrated modelling and analysis of co-dependent critical infrastructures. Mathaios is an IEEE Senior Member, IET Chartered Engineer (CEng), the Chair of the CIGRE Working Group C4.47 "Power System Resilience" and CIGRE Cyprus National Committee and an active member of multiple IEEE working groups. He is also the recipient of the prestigious 2018 Newton Prize and was selected in the top 12 innovators for 2022 by the Innovation Radar Prize competition of the European Commission.



**Dr Xueqin (Amy) Liu** received the Ph.D. degree in electrical and electronic engineering from Queen's University Belfast (QUB), Belfast, U.K., in 2009, under the joint training with the Institute of Cyber-Systems and Control, Zhejiang University. She continued her academic career in QUB as a research assistant (2009-2011), Lecturer (2013-2019), and Senior Lecturer with the School of Electronics, Electrical Engineering and Computer Science. Her research focuses on addressing emerging challenges around big data applications in the energy domain. She is Co-I leading QUB's research in the €6.7 Million EU SEUPB INTERREG SPIRE2

project, investigating a Storage Platform for the Integration of Renewable Energy on the Island of Ireland. Her QUB SPIRE2 team has developed a diagnostic software for identifying the source of oscillations which has been tested and validated in EirGrid & SONI. Her team won the Best Graduate Student Poster Award at the prestigious 2021 IEEE Power and Energy Society General Meeting.



**Matthew Deakin** is a Royal Academy of Engineering Research Fellow at Newcastle University, UK, and is vice chair of the IEEE Modern and Future Distribution System Planning Working Group. His expertise is in power distribution, smart grids and hybrid ac/dc technologies, and has won more than £1m funding to lead research on these topics. He completed his PhD in Engineering Science in 2020 from the University of Oxford, UK, where he held a Clarendon Scholarship, and received the MEng in Engineering Science in 2015, also from the University of Oxford.



**Balaji Venkateswaran V** holds a Ph.D. in Power Systems from the University of Petroleum and Energy Studies, India, and has over 8 years of research and academic experience in power systems and renewable energy. He is a certified trainer for Engineer & Junior Engineer – Power Distribution and an IEEE Senior Member. Currently, Balaji is a Special Scientist – Research at the Department of Electrical and Computer Engineering, University of Cyprus. He has published research articles in high-impact journals, delivered invited presentations, and worked on several projects funded by various organizations in India, as well as EU-funded research projects. Balaji also developed a software tool on resilient capital investments for smart grids, which was selected among the top 12 innovative solutions in Europe in the 2022 Innovation Radar competition by the European Commission.



**Jochen Cremer** directs the Delft AI Energy Lab as Assistant Professor of Intelligent Electrical Power Grids at the Technical University of Delft. He develops ML-based algorithms for real-time monitoring and control of electrical systems, and examples are state estimation, dynamic security, corrective control, and fast topological reconfigurations. He holds a PhD in Applied Machine Learning to power system security from Imperial College London. He worked at Carnegie Mellon and MIT, RWTH Aachen University, and China and Germany's chemical and energy industry.

## SS20 | Open-source tools for future power systems – ATTEST Project

### Abstract

The decarbonisation of power systems requires the adoption of cleaner and flexible technologies, such as distributed renewable generation, electric vehicles and storage devices. These technologies have unquestionable benefits from an environmental perspective, but will also bring new challenges to the operation and planning of power systems.

This special session will have a series of presentations that will address the foreseen challenges posed by the massive integration of distributed energy sources, ranging from the real-time operation to the long-term planning. Besides the challenges, the presentations will also discuss the potential solutions and showcase a set of open-source tools developed in the ATTEST project, which can be used to overcome the future operation/planning problems.

The ATTEST project, funded by the European Commission, aims at developing and operationalising a modular open-source toolbox comprising a suite of innovative tools to support TSOs/DSOs operating, maintaining and planning the energy systems of 2030 and beyond in an optimised and coordinated manner, considering technical, economic and environmental aspects.

The outputs from the ATTEST project will enable accelerated dissemination, by a wide range of research institutions, within and outside of the project consortium, of the tools that will help TSOs and DSOs to better manage their networks. The demonstration of the results of the project will be valuable for the scientific community and EU energy industry and attest to the relevance of the solutions developed. The ATTEST's ambition is to enable a wide range of users to utilize and test the tools developed in the project, thereby contributing to spread knowledge and experience in the energy systems community in the EU and on a global scale.

- Presentation 1  
Title: Power Network Investment Planning Considering Deep Uncertainty  
Name 1: Eduardo Alejandro Martínez Ceseña
- Presentation 2 (3 speakers)  
Title: ATTEST models and coordination of TSO and DSO flexibility procurement and activation  
Name 1: Tomislav Capuder  
Name 2: Florin Capitanescu  
Name 3: Mohammad Iman Alizadeh
- Presentation 3 (2 speakers)  
Title: Smart environment for asset management in power grids  
Name 1: Gopal Lal Rajora  
Name 2: Miguel Ángel Sanz Bobi
- Presentation 4  
Title: Planning and Operation of TSO-DSO Shared Technologies  
Name: Micael Simões
- Presentation 5  
Title: Real-world implementation of an open-source platform to support DSOs/TSOs activities  
Name: Hrvoje Keko

#### Chair

**Filipe Joel Soares**

#### Speakers

**Eduardo Alejandro Martínez Ceseña**, The University of Manchester  
**Florin Capitanescu**, Luxembourg Institute of Science and Technology (LIST)  
**Mohammad Iman Alizadeh**  
**Gopal Lal Rajora**  
**Miguel Ángel Sanz Bobi**, Comillas Pontifical University  
**Micael Simões**  
**Hrvoje Keko**, Koncar Digital

#### Short Bio



**Filipe J. Soares** has a degree in Physics and a PhD in Sustainable Energy Systems, from Porto University. He is currently a Senior Researcher at INESC TEC and Assistant Professor at the Lusophone University of Porto. He has coordinated and been involved in several projects in the field of power systems for over 14 years, addressing the integration of renewable energies, storage and electric vehicles in power systems, participation of flexible loads and aggregators in electricity markets, energy efficiency, consumer engagement and, more recently, multi-energy systems and green hydrogen production. (<https://orcid.org/0000-0002-0750-5058>)



**Dr. Eduardo Alejandro Martínez Ceseña** ([alex.martinezcesena@manchester.ac.uk](mailto:alex.martinezcesena@manchester.ac.uk)) is a lecturer in Multi-energy Systems in the Department of Electrical and Electronic Engineering at the University of Manchester, UK. He received the BEng degree from the Universidad Autónoma de Baja California (Mexico) in 2004, the MSc degree from Instituto Tecnológico de Morelia (Mexico) in 2008 and the PhD degree from the University of Manchester in 2012, all in electrical engineering. Dr. Martínez Ceseña has co-authored over 50 research papers in peer-reviewed international journals and conferences and a book chapter, and participated in several European and UK research projects including FutureDAMS (GCRF), Smart Street (LCNF), Forward Resilience Measures (NIA), ADDRESS (FP6), DIMMER (FP7) and ATTEST (H2020); specifically, in work streams related to the integration of smart and flexible network solutions, economic and financial assessment, and business models for electricity and multi-energy systems. His research interests include power systems economics, planning and design of generation systems based on renewable energies, distribution network reinforcement planning in the light of demand response, storage and other smart solutions, multi-energy system analysis, optimisation techniques, energy system resilience, and Real Options theory, among others.



**Florin Capitanescu** (Member, IEEE) received the Electrical Power Engineering degree from the Politehnica University of Bucharest, Bucharest, Romania, in 1997, and the Ph.D. degree from the University of Liège, Liège, Belgium, in 2003. Since 2015, he has been a senior researcher with the Luxembourg Institute of Science and Technology, Esch-sur-Alzette, Luxembourg. His main research interests include the application of optimization methods to the operation of transmission and active distribution systems, particularly optimal power flow approaches, power systems security, voltage instability, and smart sustainable buildings.



**Mohammad Iman Alizadeh** received the MS.cin Electrical Power Engineering from Shiraz University of Technology in 2013 and the PhD degree from the Tarbiat Modares University (TMU), Tehran, Iran in 2018. His research skills and interests are in the fields of Demand Response, Demand Side Management, Energy Management Systems, power system flexibility, high non-dispatchable integrated networks, power system economics. Mixed-integer, robust, stochastic optimization techniques in power system operations. He has a vast experience in power system optimization, power system flexibility; Smart Grid, networks with large-scale integration of wind and other non-dispatchable generation resources; and Demand-side Management; Demand Response Programs.



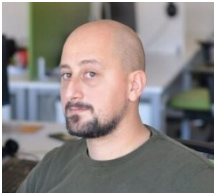
**Gopal Lal Rajora**



**Miguel Ángel Sanz Bobi** is Professor at the Telematics and Computer Science Department and a Researcher at the Institute for Research and Technology (IIT), both within the Engineering School of the Comillas Pontifical University, Madrid (Spain). He divides his time between teaching and research in the Artificial Intelligence field applied to diagnosis and maintenance and asset management of industrial processes. He has been involved in more than 50 industrial projects in the last 30 years concerning the diagnosis in real-time of industrial processes, incipient detection of anomalies based on models, knowledge acquisition and representation, data mining, reliability, predictive maintenance, and prognosis. His research interests include data analysis, the application of artificial intelligence techniques, pattern recognition methods, and technologies supporting the smart industry.



**Micael Simões**



**Hrvoje Keko** is an experienced engineer, researcher and consultant, with most of his career at the meeting point of digital with energy sector. His educational background is from University of Zagreb, Croatia and University of Porto, Portugal. In his career, he held roles in academia, consulting and industry, and currently holds the position of Head of Products and Solutions R&D in KONČAR-DIGITAL, a recently established digital pillar of KONČAR, the largest Croatian electric equipment manufacturing company. His team supports KONČAR's digital product development with a portfolio of research and innovation

projects and has brought up the company's smart grid R&D to the very top of Europe. His talk discusses the challenges of transferring top-notch academic developments into real world usage and the role of semantic data modelling and integration in it.

## SS21 | Young Professionals Panel Session on Future Power System Workforce

### Abstract

The undergoing revolutionary change in power and energy sector has brought new concepts and challenges in operation, planning, and economics of future power and energy systems as we transition to clean, renewable, and low-carbon technologies. The current and upcoming Young Professionals thus need to develop a set of "general" and "technical" skills, relevant to the industry needs, to meet the challenges of emerging power and energy sector. This would also help young engineers increase their chance in securing job positions and keep the job offers rolling in. In this Panel Session, a wide range of skills and knowledge will be discussed, including technical expertise and knowledge (e.g., design/modelling/programming skills) required for most power engineering jobs related to grid connection studies, power system operation, power electronics, system planning, energy sector coupling, electricity markets, utilities, etc. Working in power and energy sector, some jobs may also require dealing with general public, local government, state agencies, and so on. Therefore, a set of general skills may be required, including communication skills, organizational and time-

management skills, and so forth. Furthermore, it is important to discuss how a membership in certain international organizations, such as IEEE and CIGRE, could help the young generation of power and energy engineers with developing the required skills and the essential knowledge. This Panel Session will bring Young Professionals from all around the world together to share insights and their personal experiences to highlight the mentioned skills required for working in the sector, also discussing the challenges they faced when moving from academia to industry. This Panel Session is a unique venue since it is organized by Young Professionals for Young Professionals!

#### Chair

**Dr Mehdi Ghazavi Dozein**, University of Melbourne, Australia

#### Speakers

**Dr Marina Oluić**, Swedish National Grid, Sweden

**Dr Panos Kotsampopoulos**, Senior Research Fellow, National Technical University of Athens, Greece

**Dr Saman Dadjoo Tavakoli**, HVDC Control and Protection Engineer, Siemens Energy, Germany

**Dr Jochen Cremer**, TU Delft, Netherlands

**Dr. Sleiman Mhanna**, The University of Melbourne, Australia

#### Short Bio



**Mehdi Ghazavi Dozein** received M.Sc. degree from University of Tehran and Ph.D. degree from The University of Melbourne. He is currently an Associate Lecturer in Power Systems at The University of Melbourne. His research interests include power system dynamics and stability, and modelling and control of inverter-based technologies.



**Marina Oluić** (Member, IEEE) received the B.Sc. and M.Sc. degrees in electrical engineering from the Faculty of Technical Sciences, University of Novi Sad, Serbia, in 2011 and 2012, respectively, and the joint Ph.D. degree in sustainable energy technologies and strategies from KTH Royal Institute of Technology (Stockholm, Sweden), Comillas Pontifical University (Madrid, Spain) and Delft University of Technology (Delft, The Netherlands), in 2019.

After continuing as a Postdoctoral Researcher at KTH (in the period 2019-2021), Marina joined the R&D Power Technology Section of the Swedish state-owned utility Vattenfall AB where she focused on the offshore power technology while also acting as Vattenfall's R&D representative within Technical Working Group-Electrical (TWG-E) of the Carbon Trust's

Offshore Wind Accelerator (OWA).

As of May 2023, Marina is with the Swedish TSO (Svenska kraftnät) while she additionally serves as an Associate Editor for IEEE Transactions on Power Systems and Power Engineering (PES) Letters and represents Sweden in PES Women in Power (WiP). Her research interests include power system dynamics, stability & control as well as renewable generation & converter-interfaced technologies.



**Panos Kotsampopoulos** received the Diploma in Electrical and Computer engineering and his PhD degree from NTUA in 2010 and 2017, respectively. He also graduated from the School of Education of the National and Kapodistrian University of Athens in 2020. Since 2010, he has been working on research projects at the Smart RUE research group of NTUA, where he is currently a senior researcher. He was a guest researcher at the Austrian Institute of Technology (AIT) in 2012 and 2013. He is chair of the IEEE PES Task Force "Innovative teaching methods for modern power and energy systems" and active member of several IEEE and CIGRE Task Forces and Working Groups. He is a member of the Editorial Board of the IEEE Open Access Journal of Power and Energy and the journal of Energies. He is a chair

of the IEEE Young Professionals Greece and co-founder of the energy community "Collective Energy". He is a Senior Member of IEEE and recipient of the 2020 best paper award of the IEEE Open Access Journal of Power and Energy. His research interests include real-time simulation, control of distributed energy resources, power system dynamics, microgrids, and engineering education.



**Saman Dadjo Tavakoli** received his M.Sc. degree in electrical engineering from Shahid Beheshti University, Tehran, Iran, in 2015. He joined Technical University of Catalonia (UPC), Barcelona, Spain, in 2018 to pursue a Ph.D. degree in electrical engineering. Since 2022, he has been with Siemens Energy as HVDC control and protection expert. His research interests include modern power system dynamics, advanced control system design for power converters, and hydrogen electrolyzers.



**Jochen Cremer** directs the Delft AI Energy Lab as Assistant Professor of Intelligent Electrical Power Grids at the Technical University of Delft. He develops ML-based algorithms for real-time monitoring and control of electrical systems, and examples are state estimation, dynamic security, corrective control, and fast topological reconfigurations. He holds a PhD in Applied Machine Learning to power system security from Imperial College London. He worked at Carnegie Mellon and MIT, RWTH Aachen University, and China and Germany's chemical and energy industry.



**Dr. Sleiman Mhanna** is a Senior Research Fellow at The University of Melbourne working on designing mathematical models and scalable algorithms for the operation and planning of integrated electricity, gas, and hydrogen systems. The studies he has conducted over the past three years, which include electrification of residential heating demand and modelling of hydrogen blending in gas transmission networks, are currently used by Future Fuels Cooperative Research Centre (FF CRC) and its industry partners in their policy initiatives and decarbonisation roadmaps. Dr Sleiman Mhanna received his PhD in electrical engineering from the University of Sydney in 2016 with emphasis on fast distributed methods in power systems and demand response pricing mechanisms. For the subsequent three years he was a research fellow at the same institution working mainly on the award-winning CONSORT project funded by ARENA, where he developed fast distributed optimisation methods and nonlinear pricing structures for load-side distribution network support. He is a senior member at IEEE and an associate editor for IEEE Transactions on Smart Grid and for IEEE Power Engineering Letters

## SS22 | The role of Big data and AI for the secure operation of transmission systems

### Abstract

Energy systems are evolving to low-inertia networks where utilities are now facing more challenges associated to the dramatic increase of inverter-connected devices. Consequently, utilities require higher degree of observability in the network and thus are becoming more dependent of advanced metering infrastructure, monitoring systems and high frequency synchronized wide-area devices in order to improve the decision making and situational awareness of the transmission system. As solution, utilities have adopted methods to handle, process and analyze the information acquired. Since the characteristics of the power systems are considerably different due to the diverse geographical locations, dimension of the systems and nature of the loads, the current handling processes are not necessarily the same nor the most advanced solution. In this context, the IEEE Working Group on Big Data & Analytics for Transmission Systems is working together with transmission system operators and academic partners from different backgrounds to bridge the gap and develop solutions suitable for cope with these emerging issues. The objective of the panel is the discuss the recent advancement on data-driven, and machine learning approaches for different applications in transmission systems and to understand how far these tools are from the reality and to define concrete goals to facilitate utilities to their transition with these advanced tools.

### Chair

**Rafael Segundo**, Zurich University of Applied Sciences, Switzerland, [segu@zhaw.ch](mailto:segu@zhaw.ch)  
**Alfredo Vaccaro**, University of Sannio, Italy, [vaccaro@unisannio.it](mailto:vaccaro@unisannio.it)

### Speakers

**Robert Eriksson**, Svenska kraftnät, Sweden, [robert.eriksson@svk.se](mailto:robert.eriksson@svk.se)  
**Vladimir Terzija**, Newcastle University, UK, [vladimir.terzija@newcastle.ac.uk](mailto:vladimir.terzija@newcastle.ac.uk)  
**Hector Chavez**, University of Santiago de Chile, Chile, [hector.chavez@usach.cl](mailto:hector.chavez@usach.cl)



**Rafael Segundo** received the PhD degree in electrical engineering from Imperial College London in the UK in 2012. He joined the Electric Power System group of KTH, Sweden as postdoctoral researcher in 2013 and since 2014, he is a Research Associate at the Zurich University of Applied Sciences in Switzerland. Dr. Segundo is the founder and chair of the IEEE Working Group on Big Data & Analytics for Transmission Systems and chair of the international workshop DynPOWER since 2017. His research interest includes analysis of power systems dynamics and control, effects of integration of renewable sources in the stability of the system, application of machine learning techniques to improve the situational awareness and the development of indexes to measure the security level of transmission systems.



**Alfredo Vaccaro** received the M.Sc. (Hons.) degree in electronic engineering from the University of Salerno, Salerno, Italy, and the Ph.D. degree in electrical and computer engineering from the University of Waterloo, Waterloo, ON, Canada. Currently, he is a Full Professor of Electric Power Systems at the Department of Engineering of University of Sannio. His research interests include reliable computing-based methods for uncertain power system analysis, and self-organizing architectures for decentralized smart grids computing. Prof. Vaccaro is the Editor in Chief of Smart Grids and Sustainable Energy, Springer Nature, Associate Editor of IEEE trans. on Smart Grids and IEEE trans. on Power Systems, and Vice-Chair of the IEEE PSOPE-Technologies and Innovation Subcommittee.



**Robert Eriksson** received the M.Sc. and Ph.D. degrees in electrical engineering from the KTH Royal Institute of Technology, Stockholm, Sweden, in 2005 and 2011, respectively. From 2013 to 2015, he held a position as an Associate Professor with Center for Electric Power and Energy, Technical University of Denmark – DTU, Kongens Lyngby, Denmark. He is currently a team leader at the Swedish National Grid, Department of Power Systems. Since 2020, he is also an Adjunct Professor at the KTH Royal Institute of Technology. His research interests include power system dynamics and stability, automatic control, HVDC systems/dc grid, and control room applications.



**Vladimir Terzija** received the Dipl.-Ing., M.Sc., and Ph.D. degrees in electrical engineering from the University of Belgrade, Serbia. Since 2023 he is a Professor of Energy Systems & Networks at the Newcastle University, UK. He is also a Distinguished Professor at Shandong University, China, as well as a Guest Professor at the Technical University of Munich, Germany. In the past, he has been with the University of Belgrade (Serbia), ABB (Germany), The University of Manchester (UK) and Skoltech (Russian Federation). His research interests include smart grid applications; WAMPAC; power system protection; transient processes; data analytics and digital signal processing applications in power and energy systems. Prof. Terzija is Editor in Chief of the International Journal of Electrical Power and Energy Systems, Alexander von Humboldt Fellow, Fellow of IEEE and the recipient of the National Friendship Award (China).



**Hector Chavez** received the Bachelor's, Civil Engineer in Electrical and Master's degrees in electrical engineering from the University of Santiago, Santiago, Chile, in 2004, 2006 and 2006, respectively, and the Ph.D. in electrical and computer engineering from the University of Texas at Austin, Austin, TX, USA, in 2013. In 2013, he was a postdoctoral fellow in the Department of Electrical Power Systems, School of Electrical Engineering, KTH Royal Institute of Technology, Stockholm, Sweden. From 2006 to 2009, he was an Instrumentation Engineer at WorleyParsons Minerals and Metals, Santiago. Currently, he is the Director of the Department of Electrical Engineering at the University of Santiago.

## SS23 | International collaborative projects for the energy transition and rural electrification in India

### Abstract

India is undertaking ambitious policies and strategies for the energy transition, while striving to increase electricity access and reliability of supply. To facilitate this transition, international collaborative research projects are currently taking place. The EU-India RE-EMPOWERED project is developing and demonstrating novel tools for microgrids / energy islands, including planning and operation tools, digital platforms, power

electronic converters etc. Similarly, the EU-India SUSTANANCE project develops smart technological concepts to allow higher share of local renewable energy and efficient integrated energy solutions for the electrical, heat, water, waste as well as transportation infrastructure. The USA-India project UI-ASSIST aims to bridge the gap between smart grid, storage, and renewable energy research and facilitate its subsequent adoption by utilities around the world in their distribution system operation and planning. UK-India projects JUICE and SOL-DEV address the integration of renewable generation, energy storage and demand side management focusing mainly on India. Finally, the Norway-India project MULTIGRID focuses on rural mini-grids and develops synchronization strategies for multiple mini-grids.

This session will present these interesting projects, including technical highlights and achievements, in order to foster the exchange of knowledge and best practices

#### Chair

**Dr. Panos Kotsampopoulos**, National Technical University of Athens

**Prof. Nikos Hatzigiorgiou**, National Technical University of Athens

#### Speakers

**Dr. Panos Kotsampopoulos**, National Technical University of Athens

**Dr. Rakesh Sinha**, Aalborg University

**Prof. Miroslav Begovic**, Texas A&M University

**Dr. Thomas Joseph**, Imperial College London

**Dr. Salvatore D'Arco**, SINTEF

#### Short Bio



**Dr. Panos Kotsampopoulos** received the Diploma in Electrical and Computer Engineering and his PhD degree from NTUA in 2010 and 2017 respectively. Since 2010 he has been working on research projects at the Smart RUE research group of NTUA, where he is currently a senior researcher and also adjunct lecturer at NTUA. He was a guest researcher at the Austrian Institute of Technology AIT in 2012 and 2013. He is chair of the IEEE PES Task Force "Innovative teaching methods for modern power and energy systems" and active member of several IEEE Task Forces and Working Groups. He is member of the Editorial Board of the "IEEE Open Access Journal of Power and Energy" and the journal "Energies". He is chair of the IEEE Young Professionals Greece and co-founder of the energy

community "Collective Energy". He is senior member of IEEE and recipient of the 2020 best paper award of the IEEE Open Access Journal of Power and Energy. His research interests include real-time simulation, control of distributed energy resources, power system dynamics, microgrids and engineering education.



**Dr. Rakesh Sinha** received his Bachelor in Engineering in Electrical and Electronics Engineering from Kathmandu University, Nepal (2005). M.Sc. in Energy Engineering, Aalborg University, Denmark (2013). PhD in Flexible Control for Local Heating and Transportation Units in Low Voltage Distribution System (2019) from Department of Energy Technology, Aalborg University, Denmark. Currently he is working as Post-Doc Researcher at Department of Energy, Aalborg University, Denmark. His research focus are in the area of active distribution grids, integrated energy systems and sustainable energy technologies.



**Miroslav M. Begovic** (LFIEEE, CIGRÉ) is former Department Head of Electrical and Computer Engineering, currently the Moore Professor at Texas A&M University. Prior to that, he was Professor and Chair of the Electric Energy Research Group in the School of Electrical and Computer Engineering, and an affiliated faculty member of the Brook Byers Institute for Sustainable Systems and University Center of Excellence in Photovoltaic Research at Georgia Institute of Technology. For the Centennial Olympic Games in 1996 in Atlanta, Drs. Begovic and Rohatgi designed and oversaw construction of a 340 kW PV system on the roof of Aquatic Center at Georgia Tech, the largest roof-mounted PV system in the world at the time. Prof. Begovic has been a member of the IEEE PES Power System Relaying

Committee for two decades and chaired several of its working groups. Dr. Begovic delivered over 110 keynote and invited presentations worldwide. Dr. Begovic served in technical and administrative functions over 35 years of his membership at IEEE, among others as Chair of the IEEE PES Emerging Technologies Coordinating Committee, IEEE PES Treasurer (2010-2011), IEEE PES Distinguished Lecturer from 2011, and served as President-Elect, President and Immediate Past President of the IEEE Power and Energy Society (2012-2018).

He is the recipient of 2019 IEEE PES Meritorious Service Award and 2022 Ramakumar Family Renewable Energy Excellence Award.



**Dr. Thomas Joseph** is currently a Research Associate in the Department of Electrical and Electronic Engineering, Imperial College London and is working on Renewable Energy Empowering European and Indian Communities (RE-EMPOWERED), an EU-India H2020 project. Thomas obtained his PhD degree from the Indian Institute of Technology, Roorkee, India in 2021 and his MTech. degree in electrical engineering (instrumentation and control systems) from the National Institute of Technology, Calicut, India, in 2012. His research interests include optimal control, dynamic state estimation, microcontroller application in power converters, tool development for microgrids and renewable systems etc.



**Dr. Salvatore D'Arco** received the M.Sc. and Ph.D. degrees in electrical engineering from the University of Naples "Federico II," Naples, Italy, in 2002 and 2005, respectively. From 2006 to 2007, he was a postdoctoral researcher at the University of South Carolina, Columbia, SC, USA. In 2008, he joined ASML, Veldhoven, the Netherlands, as a Power Electronics Designer consultant, where he worked until 2010. From 2010 to 2012, he was a postdoctoral researcher in the Department of Electric Power Engineering at the Norwegian University of Science and Technology (NTNU), Trondheim, Norway. In 2012, he joined SINTEF Energy Research where he currently works as a Senior Research Scientist. He is the author of more

than 130 scientific papers and is the holder of one patent. His main research activities are related to control and analysis of power-electronic conversion systems for power system applications, including real-time simulation and rapid prototyping of converter control systems.

## Technical Session Presenters

Authors of accepted papers, or a delegate notified and approved by the conference organizers, are expected to present the paper in person at the conference, in order for their paper to be included in the conference proceedings and uploaded to IEEE Xplore.

Technical Session presentations are scheduled in time slots of 1 hour and 30 minutes, as detailed in the conference programme. Five parallel themed Special Sessions or Technical Sessions will be hosted in each of the time slots, with 6 papers presented in each session.

**Each presenter will have 12 minutes for the presentation followed by 3 minutes for clarifying questions from the audience. Timings will be strictly enforced.**

All presentations are required to use the [PowerTech2023 Paper presentation template](#).

Only Microsoft Power Point (ppt/pptx) or PDF files will be accepted. Mac users should be advised that the display computers will be Windows and are strongly encouraged to check compatibility (including font and slide layout) before presentation.

### Prior the Session

- Presenters are asked to determine their scheduled slot for presentation in the conference programme.
- Presentation must be uploaded to the conference computer during the coffee break/lunch before the start of the scheduled session. In particular:
  - session 09:00–10:30 Presenters must upload the presentation 15 minutes prior to the start of the session
  - session 11:00–12:30 Presenters must upload the presentation during the morning coffee break (10:30 – 11:00)
  - session 12:40–14:10 Presenters must upload the presentation during the morning coffee break (10:30 – 11:00)
  - session 15:30–17:00 Presenters must upload the presentation during lunch break (14:10 – 15:30)
- To ensure the smooth running of sessions with minimal delays, all presentations must be uploaded. It will not be possible to present from your own laptop.
- Presenters are asked to contact their Session Chair before the session if they have any questions. Session chairs will be detailed in the programme once finalized.

### During the Session

- Each accepted paper must be presented in the scheduled session. Absence of the presenter will be taken as NO-SHOW by the Session Chair and the paper manuscript will be excluded from IEEE Xplore upload.
- Please keep strictly to the time limit given (12 minutes per presentation), this will be strictly enforced.

## Poster Session Presenters

The poster sessions form a key part of the conference programme and are scheduled without other presentations in parallel to ensure maximum delegate participation. Small themed Poster Sessions (up to 10 papers) are organized in order to let oral presentations to the Chairs and delegates by the Authors. Poster sessions will be led by dedicated Chairs who will introduce the presenters who have up to 4 minutes to present their work. Timings will be strictly enforced. This will be followed by a brief Q&A.

The allowed format to plot the poster is **A0 portrait: width 84.1 cm x length 118.9 cm (33.1 inch x 46.8 inch)**. The poster boards will not be able to accommodate posters wider than this (so do not bring A0 landscape). Other formats will not be accepted. All poster are required to use the [PowerTech2023 Poster template](#).

**Presenters are required to bring a printed copy of their poster with them to the conference. If you require printing services for your poster, please contact [powertech2023@etf.rs](mailto:powertech2023@etf.rs) no later than 20.06 to request the printing service.**

A full poster is required. Printouts of presentation slides will not be displayed and will not be counted as presented. The corresponding paper manuscript will be excluded from the IEEE Xplore upload.

The absence of a presenter during the scheduled session will be taken as NO-SHOW by the Session Chair and the corresponding paper manuscript will be excluded from the IEEE Xplore upload.

Presenters are asked to contact their Session Chair before the session if they have any questions. Session chairs will be detailed in the programme once finalized.

#### Prior the Session

- Presenters should bring their posters to the registration desk starting from 09:00 until 14:00 on the day of their poster session. Volunteers will display their posters during the lunch break.
- Each poster should be labelled with the number of the corresponding poster session and paper ID. Presenters are asked to look for their number in the conference programme.

#### During the Session

- Presenters must attend their scheduled session 5 minutes prior to the start of the session.
- Presenters are required to be in the session room at their poster location during the entire poster session.
- Poster sessions will be led by dedicated Chairs who will introduce the presenters who have up to 4 minutes to present their work. Timings will be strictly enforced. This will be followed by a brief Q&A.

#### After the Session

- Presenters are required to remove their posters after the session has ended.

## Sunday, June 25

	E1   Baltic	D1   Adriatic	D2   Mediterranean	E1   Aegean	Danube
08:30-10:30	TT01   Utility-Scale Hydrogen Electrolyzers: Fundamentals, Modelling, Grid Support Services, and Operation	TT02   AI-driven Decarbonization for Power Systems	TT08   Modelling, operation, control, and stability analysis of low-inertia power systems	TT05   Innovative Training and Education on Renewable Energy Systems: Towards the Future Resilient, Sustainable and Carbon-Neutral Power Systems	TT06   Grid forming converters connected to the transmission system – Influence of the type of grid forming control on the small signal stability
10:30-10:45	Coffee Break				
10:45-12:45	TT01   Utility-Scale Hydrogen Electrolyzers: Fundamentals, Modelling, Grid Support Services, and Operation	TT02   AI-driven Decarbonization for Power Systems	TT08   Modelling, operation, control, and stability analysis of low-inertia power systems	TT05   Innovative Training and Education on Renewable Energy Systems: Towards the Future Resilient, Sustainable and Carbon-Neutral Power Systems	TT06   Grid forming converters connected to the transmission system – Influence of the type of grid forming control on the small signal stability
12:45-13:30	Lunch				
13:30-15:30	TT04   Stability and harmonic power flow in converter-dominated grids under consideration of converters control nonlinearities	TT07   Integrated electricity-gas-hydrogen systems: an introduction	TT03   Digital energy systems – Technologies, Use cases and Policy Options	TT05   Innovative Training and Education on Renewable Energy Systems: Towards the Future Resilient, Sustainable and Carbon-Neutral Power Systems	TT06   Grid forming converters connected to the transmission system – Influence of the type of grid forming control on the small signal stability
15:30-15:45	Coffee Break				
15:45-17:45	TT04   Stability and harmonic power flow in converter-dominated grids under consideration of converters control nonlinearities	TT07   Integrated electricity-gas-hydrogen systems: an introduction	TT03   Digital energy systems – Technologies, Use cases and Policy Options	TT05   Innovative Training and Education on Renewable Energy Systems: Towards the Future Resilient, Sustainable and Carbon-Neutral Power Systems	TT06   Grid forming converters connected to the transmission system – Influence of the type of grid forming control on the small signal stability
18:00-19:30	WELCOME RECEPTION   Faculty of Electrical Engineering (Technical Faculties Building)				

## Monday, June 26

HALLS COLOR LEGEND:

A   Pacific	B   Atlantic	C   Atlantic	D   Adriatic Mediterranean	E   Aegean Baltic
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	C   Atlantic	D   A. Mediterranean	E   Aegean Baltic	A   Pacific	B   Atlantic
09:00-10:30	---	---	---	OPENING CEREMONY	
10:30-11:00	Coffee Break				
11:00-12:30	---	---	---	PLENARY PANEL	
12:40-14:10	---	---	---	KEYNOTE SPEAKERS	
14:10-15:30	Lunch				
15:30-17:00	S1 - Power Quality	S2 – Energy management in microgrids	S3 - Dynamics of converter-based power systems	SS01 Global Perspectives on Utility of the Future	SS02 A role of flexibility in enabling net-zero energy systems
17:10-18:00	Poster session 1 - Renewable energy	Poster session 2 - Electricity marketTT02	Poster session 3 - Energy storage	Poster session 4 - Stability	Poster session 5 - State estimation
18:00-19:30	COCKTAIL / including Wine Tasting by ABB				

## Tuesday, June 27

	D   A. Mediterranean	E   Aegean Baltic	A   Pacific	B   Atlantic	C   Atlantic
09:00-10:30	S4 - State estimation and parameter identification	S5 - Demand response and load modelling	S6 - Frequency control I	SS03 The Future of Power Flexibility	SS04 Objective-based Machine Learning for Low-carbon Power Systems
10:30-11:00	Coffee Break				
	B   Atlantic	A   Pacific	C   Atlantic	D   A. Mediterranean	E   Aegean Baltic
11:00-12:30	S7 - Voltage stability and control I	S8 - Flexibility in microgrids I	S9 - Reliability, resilience, risk assessment and restoration	SS05 DER operating envelopes and their applications in energy markets and planning	SS06 Transfer of knowledge: Discussing with the Editors in Chief
12:40-14:10	---	KEYNOTE SPEAKERS	---	---	---
14:10-15:30	Lunch				
	C   Atlantic	B   Atlantic	A   Pacific	D   A. Mediterranean	E   Aegean Baltic
15:30-17:00	S10 - Optimal energy scheduling and unit commitment/ Energy management	S11 - Energy storage I	S12 - Power System Planning	SS07 Recent Advances and Trends in Active Distribution Networks	SS08 Grid resilience and Decarbonization of Electric Power System
17:10-18:00	Poster Session 6 - DC power systems	Poster Session 7 - Electrical vehicles	Poster Session 8 - Distribution network operation and palnning	Poster Session 9 - Stability	Poster Session 10 - Protection
18:00-19:30	COCKTAIL / including Rakia Tasting by Saturn Electric				

## Wednesday, June 28

	A   Pacific	B   Atlantic	E   Aegean Baltic	D   A. Mediterranean	C   Atlantic
09:00-10:30	S13 - Power system stability and dynamics	S14 - Converter control	SS09 Modeling, operation and control of multi-energy systems	SS10 What's new in cascading failure analysis?	SS11 Powering Together: Insights into Twinning and Capacity building Projects for Sustainable Power Systems
10:30-11:00	Coffee Break				
	B   Atlantic	A   Pacific	C   Atlantic	E   Aegean Baltic	D   A. Mediterranean
11:00-12:30	S15 - Active distribution networks	S16 - Power System Protection	S17 - AI application in generation and demand forecasting	SS12 Energy Storage Worldwide: Insights and Applications (Session supported by IEEE PES Women in Power)	SS13 Panel on Power Systems in South-East Europe
12:40-14:10	---	KEYNOTE SPEAKERS	---	---	---
14:10-15:30	Lunch				
	A   Pacific	D   A. Mediterranean	C   Atlantic	B   Atlantic	E   Aegean Baltic
15:30-17:00	S18 - Cyber Security	S19 - State Estimation	SS14 UI-ASSIST: International Research Collaboration	SS15 System Integrity Protection Schemes in Modern Power Systems	SS16 Leading innovations and technological solutions for a sustainable future – TRANSIT project
17:10-18:00	Poster Session 11 - AI application	Poster Session 12 - Advance measuring infrastructure	Poster Session 13 - Smart microgrids	Poster Session 14 - Renewable energy	Poster Session 15 - Power quality
19:30-23:30	GALA DINNER/ AZZARO BY JEZERO, ADA CIGANLIJA BB				

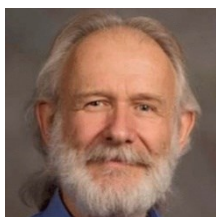
Thursday, June 29

	B   Atlantic	C   Atlantic	A   Pacific	D   A. Mediterranean	E   Aegean Baltic
09:00-10:30	S20 - Voltage stability and control II	S21 - Electrical Vehicles	S22 - Energy Storage II	SS17 Offshore Energy Islands/Hubs	SS18 Challenges and demands of medium voltage technologies for renewable installations and environment impact
10:30-11:00	Coffee Break				
	B   Atlantic	C   Atlantic	E   Aegean Baltic	D   A. Mediterranean	A   Pacific
11:00-12:30	S23 - Optimal power flow	S24 - Energy Market	S25 - AMI and power system monitoring	SS19 Contemporary and emergent methods for planning and analysis of distribution networks	SS20 Open-source tools for future power systems – ATTEST Project
	C   Atlantic	E   Aegean Baltic	B   Atlantic	D   A. Mediterranean	A   Pacific
12:40-14:10	S26 - Frequency Control II	S27 - Flexibility in microgrids II	S28 - High voltage DC networks	S29 - Multi-energy Systems	SS21 Young Professionals Panel Session on Future Power System Workforce
14:10-15:30	Lunch				
	C   Atlantic	B   Atlantic	A   Pacific	D   A. Mediterranean	E   Aegean Baltic
15:30-17:00	S30 - Frequency Control III	S31 - Load flow and power quality	S32 - Modelling and Control	SS23 The role of Big data and AI for the secure operation of transmission systems	SS23 International collaborative projects for the energy transition and rural electrification in India
17:10-18:00	CLOSING CEREMONY				

09:00-10:30 **OPENING CEREMONY**

10:30-11:00 Coffee Break

11:00-12:30

**PLENARY PANEL****Professor Dušan Borojević**

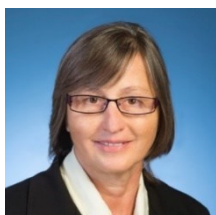
Distinguished Professor at Virginia Tech, US National Academy of Engineering, IEEE Life Fellow

**Professor Mladen Kezunović**

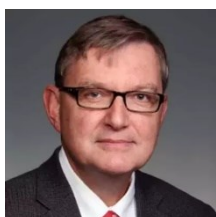
Regents Professor and Eugene E. Webb Endowed Professor at Texas A&M University, US National Academy of Engineering, IEEE Life Fellow

**Professor Slobodan Vukosavić**

Professor at the University of Belgrade, Serbian Academy of Sciences and Arts

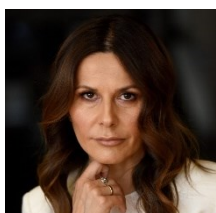
**Professor Marija Ilić**

Senior Research Scientist at LIDS, Adjunct Professor at MIT, Professor Emerita at Carnegie Mellon University, US National Academy of Engineering, Academia Europaea, IEEE Life Fellow

**Dr Damir Novosel**

President and founder of Quanta Technology, US National Academy of Engineering, IEEE Fellow

12:40-14:10

**KEYNOTE SPEAKERS****Jelena Matejic**, General Manager of EMS - Serbian TSO**Dr Vera Silva**, CTO at General Electric Grid Solutions



**Prof. Vijay Vittal**, Regents Professor, Ira A. Fulton Chair Professor, ASU Foundation Professor  
- Arizona State University, U.S. National Academy of Engineering, IEEE Fellow

**14:10-15:30** Lunch

**15:30-17:00** **S1 - Power Quality**

**C | Atlantic**

**3. Simulation and Verification of A 10 Kv Rc Divider Module Composed of Smd Components On Pcb's For Power Quality Measurement**

Saskia Düsdieler; Tobias Kuhnke; Mohammad Razavifar; Frank Jenau, Institute of High Voltage Engineering, TU Dortmund University, Germany

**4. Frequency Analysis of A Novel 10 Kv Rc Voltage Divider Module Composed of Smd-Components On Printed Circuit Boards**

Tobias Kuhnke; Saskia Düsdieler; Mohammad Razavifar; Frank Jenau, Institute of High Voltage Engineering, TU Dortmund University, Germany

**70. Data-Based Harmonic Impact Quantification of Multiple Loads In A Real Medium-Voltage Network**

Lennard Struk; Carl Schweinsberg; Jutta Hanson, Technical University of Darmstadt, Institute of Electrical Power Supply with Integration of Renewable Energy, Germany

**113. Modified Pre-Fluxing Method For Energization of Single-Phase Transformers** Amir Aghazadeh; Kang Li; Sadegh Azizi, University of Leeds, United Kingdom; Vladimir Terzija, Shandong University, China

**181. Evaluation of Harmonic Distortion In Distribution Networks Under Transformer N-1 Security Criterion**

Pablo Rodríguez-Pajarón; Araceli Hernández, Universidad Politécnica de Madrid, Spain; Jovica V. Milanovic, The University of Manchester, United Kingdom

**182. Estimation of Harmonics In Partly Monitored Residential Distribution Networks With Unknown Parameters and Topology**

Pablo Rodríguez-Pajarón; Araceli Hernández, Universidad Politécnica de Madrid, Spain; Jovica V. Milanovic, The University of Manchester, United Kingdom

**15:30-17:00** **S2 - Energy management in microgrids**

**D | Adriatic Mediterranean**

**186. Facility Planning and Operation In Zero Emission Grid With Photovoltaic and Battery Systems**

Sota Miyazaki; Akihisa Kaneko; Yasuhiro Hayashi, Waseda University, Japan; Shunsuke Kawano; Keishi Matsuda; Masayuki Kagita; Nobuhiko Itaya, Mitsubishi Electric Corporation, Japan

**194. Hybrid Local Electricity Market Designs With Distributed and Hierarchical Structures**

Haoyang Zhang; Sen Zhan; Koen Kok; Nikolaos Paterakis, Eindhoven University of Technology, Netherlands

**298. Hierarchical Energy Sharing Management For A Renewable Energy Community With Heterogeneous End-Users**

Jamal Faraji; Zacharie De Grève; François Vallée, University of Mons, Belgium

**337. Scenario Tree Generation Using Data Reconciliation For Aggregators Bidding Strategy**

Mohammad Afkousi-Paqaleh; Alireza Nouri; Andrew Keane, University College Dublin, Ireland

**374. Flexigrid Tools For Real-Life Demonstrations of Local Energy System Concepts At Chalmers Campus Testbed**

Rohini Sharma; Nima Mirzaei Alavijeh; Maryam Mohiti; David Steen; Anh Tuan Le; Per Løveryd, Akademiska Hus, Sweden

**383. Optimal Coordination and Discount Allocation In Residential Renewable Energy Communities With Smart Home Appliances**

Francesco Conte, Campus Bio-Medico University of Rome, Italy; Federico Silvestro; Andrea Vinci, DITEN, University of Genova, Italy; Anna Rita Di Fazio, DIEI, University of Cassino and Southern Lazio, Italy

**15:30-17:00** **S3 - Dynamics of converter-based power systems**

**E | Aegean Baltic**

#### **42. Mode-Shape Deformation of Power System Daes By Time-Domain Integration Methods**

Carlo Tajoli; Georgios Tzounas; Gabriela Hug, ETH Zurich, Switzerland

#### **56. Analytical Discussion On Dynamics of Inverter-Based Resources Under Small-Signal Conditions**

Johanna Vorwerk; Gabriela Hug, ETH Zürich, Switzerland; Mehdi Ghazavi Dozein; Pierluigi Mancarella, The University of Melbourne

#### **131. Ltp Modeling and Analysis of Frequency Coupling In Pll-Synchronized Converters For Harmonic Power Flow Studies**

Federico Cecati; Sante Pugliese, Kiel University, Germany; Johanna Kristin; Maria Becker; Marco Liserre, Kiel University, Germany; Yihui Zuo; Mario Paolone, EPFL, Switzerland

#### **251. Converters Control Roles Selection For Operating Hybrid Ac/dc Grids With Enhanced Small-Signal Stability Performance**

Francesca Rossi; Sergi Costa Dilmé; Josep Arevalo Soler; Oriol Gomis Bellmunt; Eduardo Prieto Araujo, CITCEA UPC, Spain

#### **388. Methodology For Evaluating Equivalent Models For The Dynamic Analysis of Power Systems**

Georgios Barzegkar-Ntovom; Theofilo Papadopoulos, Democritus University of Thrace, Greece; Eleftherios Kontis, Aristotle university of thessaloniki, Greece; Panagiotis Papadopoulos, University of Strathclyde, United Kingdom

#### **409. 100 % Converter-Based Distribution Grids: Determining The Required Grid-Forming Penetration To Ensure Small-Signal Stability**

Jan Kircheis, KU Leuven, Belgium; Johannes Kayser; Steffen Schlegel; Dirk Westermann, TU Ilmenau, Germany

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<b>15:30-17:00</b>	<b>SS01 Global Perspectives on Utility of the Future</b>	<b>A   Pacific</b>
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<b>15:30-17:00</b>	<b>SS02 A role of flexibility in enabling net-zero energy systems</b>	<b>B   Atlantic</b>
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<b>17:10-18:00</b>	<b>Poster session 1 - Renewable energy</b>	<b>C   Atlantic</b>
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#### **22. Identification of Beneficial Expansion Measures**

Raphaël Houben; Albert Moser, IAEW, Germany; Lukas Löhr, RWTH, Germany

#### **24. Transformation of Voltage Control Processes Within The Energy Transition: A German Perspective**

Carsten Thomas Gatermann; Nadja Hiersemann; Dirk Westermann, TU Ilmenau, Germany; Florian SassPhilipp Nickus, 50Hertz Transmission GmbH, Germany

#### **33. Mixed Method For Transmission Loss Allocation**

Metodija Atanasovski; Mitko Kostov; Goran Veljanovski; Blagoja Arapinoski, Faculty of Technical Sciences-Bitola, University St. Kliment Ohridski Bitola, North Macedonia

#### **46. Enhancing Res Grid Connection Via Dynamic Hosting Capacity and Hybridization**

Leslie Herding; Rafael Cossent; Michel Rivier, Institute for Research in Technology, Universidad Pontificia Comillas, Spain

#### **142. Stochastic Dynamic Programming For Energy Management of An Overplanted Offshore Wind Farm With Dynamic Thermal Rating and Storage**

Alexandre Faye-Bedrin, IETR lab, CentraleSupélec, Rennes; SATIE lab, Univ. Rennes, CNRS, ENS Rennes; Anne Blavette, SATIE lab, Univ. Rennes, CNRS, ENS Rennes; Pierre Haessig, IETR lab, CentraleSupélec; Salvy Bourguet, Ildar Daminov, IREENA, Nantes Université, Saint-Nazaire, France

#### **143. Fully Distributed Real-Time Voltage Control In Active Distribution Networks With Large Penetration of Solar Inverters**

Antonin Colot; Thomas Stegen; Bertrand Cornélusse, Université de Liège, Belgium

#### **172. Sizing of Synchronous Condensers To Strengthen A Large-Scale Network Model**

Fernando De Marco; José Gómez; Flavio Fernández, DlgSILENT GmbH, Germany; Patricio Lagos; Eugenio Quintana; Víctor Velar, Coordinador Eléctrico Nacional, Chile

#### **207. Consumer-Centric Home Energy Management System Using Trust Region Policy Optimization-Based Multi-Agent Deep Reinforcement Learning**

Kuthsav Thattai; Jayashri Ravishankar; Chaojie Li, University of New South Wales, Australia

**242. Optimal Resources Planning Algorithm For A Coordinated Multi-Energy System With Industrial Loads**

M. Adnan Shihab; Tom Warendorf; Sergio F. Contreras; Johanna Myrzik, Institute of Automation Technology, University of Bremen, Germany

17:10-18:00 Poster session 2 - Electricity market

D | Adriatic Mediterranean

**39. Strategies Adopted By Wind and Thermal Power Plants In Continuous Trading**

Andrea Alberizzi; Paolo Di Barba, University of Pavia, Italy; Alessandro Zani, R.S.E S.p.a., Italy

**59. Equilibrium Modelling and Analysis In Energy Market With A Novel Procurement Mechanism For Flexible Ramping Products**

Xiang Gao, Shenzhen Polytechnic, China; Ziqing Zhu; Ka Wing Chan; Siqi Bu; Siu Wing Or, The Hong Kong Polytechnic University, Hong Kong; Jiahao Zhang, Hubei University of Technology, China

**76. Linearisation Based Decomposition Method For Circle Approximation In Ac Network Constrained Unit Commitment**

Nuran Cihangir Martin; Bruno Fanzeres, Pontifical Catholic University of Rio de Janeiro, Brazil

**144. Towards A Blockchain-Based Revenue Distribution Mechanism For Electrical Generators**

Bryan Bird; Almero de Villiers; Paul Cuffe, University College Dublin, Ireland

**150. Improved Methodology For Solving Short-Term Inadequacy**

Andrijana Presic; Dusan Presic, SCC Ltd., Serbia; Pablo Bort, ETRA I+D, Spain

**367. Potentials and Barriers of Flexibility Markets For Multi-Energy Systems**

Edoardo Corsetti, RSE, Italy

**377. Predictive Energy Management System For A Pv-Bess System Bidding On Day-Ahead and Intra-Day Electricity Markets**

Andrea Fusco; Domenico Giofrè; Sonia Leva; Giampaolo Manzolini; Emanuele Martelli, Politecnico di Milano, Italy; Luca Moretti, Atlante S.r.l., Italy

**408. Fast Identification of Redundant Constraints In An Electric Network.**

Arnaud Robert; Dirk Van Hertem, KULeuven, Belgium

**417. On The Assessment of The Flexibility Region In Inter-Dso Local Markets**

Ángel Paredes; José A. Aguado, University of Málaga, Spain

17:10-18:00 Poster session 3 - Energy storage

E | Aegean Baltic

**60. High-Stability and High-Precision Power Supply For Superconducting Coils of Sc200 Cyclotron**

Shengmin Pan, Institute of Plasma Physics Chinese Academic of Sciences, China

**65. Optimal Battery Dispatch To Assist A Water Injection System With Offshore Wind Power**

Bruna Cardozo de Lima; Renado Machado Monaro; Maurício Barbosa de Camargo Salles, University of São Paulo, Brazil

**79. An Effective Control Algorithm For Hybrid Superconducting Magnetic/battery Energy Storage Systems Employed In Dc Microgrids**

Pavlos Papageorgiou; Konstantinos Oureilidis; Georgios Christoforidis, University of Western Macedonia, Greece

**101. Underground Gas Storage Linear Modeling: Application To The European Union**

David Pozo; Ricardo Fernández-Blanco; Ricardo Bolado Lavin, European Commission, Joint Research Centre, Directorate C - Energy, Transport and Climate, Energy Security, Distribution and Markets Unit, Netherlands

**153. Optimal Management of Distribution-Connected Assets Operating Under Carbon and Energy Day-Ahead Markets**

Wandry Rodrigues Faria; Benvindo Rodrigues Pereira Júnior, University of São Paulo, Brazil; Gregorio Muñoz-Delgado; Javier Contreras, University of Castilla-La Mancha, Spain

**211. Modelling of A Power Infrastructure Resource Management In A Communication Network**

Gustav Lenart; Furat Shamurad; Lackis Eleftheriadis, Ericsson Research, Sweden

**410. State of Charge Estimation Using A Nonlinear Autoregressive With Exogenous Input Neural Network**

Panagiotis Eleftheriadis; Filippo Lodigiani; Jacopo Bruneri; Emanuele Ogliari; Sonia Leva, Politecnico di Milano, Italy

**457. Smart Transformer-Based Network Reconfiguration For Improved Resilience**

Hrishikesan Vadakkedath Madhavan; Clara Najera-Aleson; Marius Langwasser; Marco Liserre, Kiel University, Germany

**458. A Simulator For Long Term Planning and Real Time Scheduling of Polygenerative Microgrids**

Alice La Fata; Massimo Brignone; Renato Procopio; Stefano Bracco; Federico Delfino, Electrical, Electronics, Telecommunication Engineering and Naval Architecture Department, University of Genoa, Italy; Riccardo Barilli; Martina Ravasi; Fabio Zanellini, Renantis-Falck Renewables S.p.A, Italy; Milutin Petronijevic, Faculty of Electronic Engineering, University of Niš, Serbia

**17:10-18:00 Poster session 4 – Stability**

**A | Pacific**

**15. Fast Frequency Response From Data Centres, Using Machine Learning**

M. Saeed Misaghian; Giovanni Tardioli; Niall Byrne, Integrated Environmental Solutions Ltd (IES Ltd.), Ireland; Ciara O'Dwyer; Damian Flynn, University College Dublin, Ireland

**23. Static Modelling of Loads In Country Level With Big Data In Scandinavia**

Mehdi Javdani; Tarik Abdulahovic; Fredrik Sjögren, Hitachi Energy, Sweden; Johan Setréus, Svenska Kraftnät, Sweden; Mikko Koskinen, Fingrid, Finland; Vegar Storvann, Statnett, Norway

**36. Regularised Learning With Selected Physics For Power System Dynamics**

Haiwei Xie; Jochen Cremer, TU Delft, Netherlands; Federica Bellizio, e Urban Energy Systems Laboratory, Empa, Switzerland; Goran Strbac, Imperial College London, United Kingdom

**49. Real-Time Implementation of Short-Term Voltage Stability Prediction Scheme**

Don Kalana Dulanjith Dharmapala; Athula Dayanath Rajapakse, Univeristy of Manitoba, Canada; Yi Zhang, RTDS Technologies .Inc, Canada

**57. Improving Ann Training With Approximation Techniques For Rocof Trajectory Estimation**

Sangwon Kim, University of Ulsan, South Korea

**72. Measurement-Based Estimation of A Downstream Network**

Panagiotis Mandoulidis; Konstantinos Seklos; Costas Vournas, National Technical University of Athens, Greece

**88. Organization of Virtual Inertia Control of A Wind Power Plant Operating In The Network With A Predominant Content of Renewable Energy Sources**

Andrey Achitaev, Sayano-Shushensky branch of Siberian Federal University, Russia; Konstantin Suslov, National Research University "Moscow Power Engineering Institute", Russia; Pavel Ilyushin, Energy Research Institute of the Russian Academy of Sciences, Russia; Alexander Domyshv, Melentiev Energy Systems Institute, Russia

**126. Impact of Grid-Forming Converter On Electromechanical Oscillations**

Johan Boukhenfouf, Univ. Lille, ULR 2697 - L2EP,F-5900 Lille, France; Xavier Guillaud; Antoine Bruyere, Centrale Lille, F-5900 Lille, France

**127. Multiphysics Analysis of Power Transients Based On Power System and Nuclear Dynamics Softwares Chaining**

Charly Boudot; Jean-Baptiste Droin; Pierre Sciora; Bruno Robisson CEA, France; Yvon Besanger, G2Elab, France

**208. Virtual Power Circle Based Pq Decoupling Technique For A Virtual Synchronous Generator Connected To A Weak Grid**

Daniel Kisinga; Paul Trodden, University of sheffield, United Kingdom

**17:10-18:00 Poster session 5 - State estimation**

**B | Atlantic**

**25. Real-Time Curative Actions For Power Systems Via Online Feedback Optimization**

Lukas Ortmann; Gianni Hotz; Saverio Bolognani; Florian Dörfler, ETH Zurich, Switzerland

**90. A Bi-Level Stochastic Game Model For Pmu Placement In Power Grid With Cybersecurity Risks**

Saptarshi Ghosh; Shehab Ahmed; Charalambos Konstantinou, KAUST; Murali Venkatraman, NEOM

**99. Exploring Operational Flexibility of Active Distribution Networks With Low Observability**

Demetris Chrysostomou; Jose Luis Rueda Torres; Jochen Lorenz Cremer, TU Delft, Netherlands

**106. Solar Radiation Estimation For Photovoltaic Power Generation Using Geostationary and Low-Earth Orbit Satellite Data**

Ryota Tobishima; Shoichi Urano, Meiji University, Japan

**161. Distributed Optimization of Smart Grid Assets For Grid Operation Preserving Power System Operator Sovereignty**

Steffen Meinecke; Martin Braun, University Kassel, Germany; David Sebastian Stock, Fraunhofer Institute for Energy Economics and Energy System, Germany

**231. Misestimation of Impedance Values Within A Distribution Network Optimal Power Flow**

Guénolé Chérot; Roman Le Goff Latimier; Fabien Sanchez; Hamid Ben Ahmed, SATIE, ENS Rennes, CNRS, France

**261. Graph Shortest Path and Dynamic Programming Applied To Sequencing Ord Control Adjustments**

Rafael Martins Barros; Ricardo de Andrade Lira Rabêlo, Universidade Federal do Piauí, Brazil; Guilherme Guimarães Lage, Universidade Federal de São Carlos, Brazil

**301. Data-Based Optimal Estimation of Frequency Bias: The Case of Southwest Power Pool**

Miroslav Kosanic; Marija Ilic, MIT, United States; Daniel Baker; Harvey ScribnerCasey Cathey, SPP, United States

**429. Investigating Systemic Extrapolation of Distribution Grid Investment Costs**

Luis Böttcher; Simon Braun; Marc Trageser; Klemens Schumann; Andreas Ulbig, RWTH Aachen University, Germany

**18:00-19:00**

**COCKATIL**

**09:00-10:30 S4 - State estimation and parameter identification D | Adriatic Mediterranean****119. Enhanced Linear State Estimation For Power Systems Using Purely Scada Measurements**

Amin Nassaj; Amir Abiri Jahromi; Sadegh Azizi, University of Leeds, United Kingdom; Mohammad Rezaei Jegarluei, Arcadis Co, United Kingdom; Vladimir Terzija, Newcastle University, United Kingdom

**249. Experimental Validation of A Unified and Linear State Estimation Method For Hybrid Ac/dc Microgrids.**

Willem Lambrichts; Mario Paolone, EPFL, Switzerland

**260. Attenuated Self-Interference Synchrophasor Estimation: The Sogi Interpolated Dff**

César García Veloso; José María Maza Ortega, Universidad de Sevilla, Spain; Mario Paolone, École Polytechnique Fédérale de Lausanne, Switzerland

**344. Cyber-Physical Power System Testing Platform For Topology Identification In Power Distribution Grids**

Raymundo E. Torres-Olguin; Santiago Sanchez-Acevedo; Olve Mo, SINTEF, Norway; Alejandro Garces-Ruiz, Universidad Tecnica de Pereira, Colombia

**397. Distribution Systems Line Parameter Estimation With Nodal Injection Constraints In Presence of Vehicle-To-Grid**

Carlo Sitzia; Sara Sulis; Paolo Attilio Pegoraro; University of Cagliari, Italy; Daniele Carta; Andrea Benigni, Forschungszentrum Jülich - IEK10, Germany

**463. A Bad Data Resilient Multisensor Fusion Framework For Hybrid State Estimation**

Larah Ascari; Antonio Simões Costa, Federal University of Santa Catarina, Brazil

**09:00-10:30 S5 - Demand response and load modelling E | A. Baltic****83. A Techno-Economic Analysis To Compare Low Voltage Dc With Ac Grids For Led Lighting**

Timon De Wispelaere; Simon Ravyts; Nathan Baeckeland; Michael Kleemann, KU Leuven, Belgium

**195. Parameter Identifiability and Estimation of Thermostatically Controlled Loads**

Ioannis Marios Granitsas; Ian Hiskens; Johanna Mathieu, University of Michigan, United States; Gregory Ledva, Virtual Peaker, United States

**209. Dynamic Grid Tariffs For Electric Vehicle Charging: Results From A Real-World Experiment**

Nico Brinkel, Copernicus Institute of Sustainable Development, Utrecht University, Netherlands; Peter Markotić, ElaadNL, Netherlands; Leon Kuiper; Santor Warmerdam, Stedin Groep, Netherlands; Brecht Baeten, Enervalis, Belgium; Henk Fidler, Stedin Groep, Netherlands; Robin Berg, We Drive Solar, Netherlands; Bart van der Ree, Utrecht Sustainability Institute, Netherlands; Wilfried van Sark, Copernicus Institute of Sustainable Development, Utrecht University, Netherlands; Tarek AlSkaif, Information Technology Group, Wageningen University and Research, Netherlands

**241. Electric Off-Road Mobile Machinery Systems With Portable Energy Supply and Local Energy Generation**

Edvin Wallander; Bobbie Frank; Mats Alaküla; Francisco Márquez-Fernández, Lund University, Sweden

**271. Optimal Energy Rationing For Prepaid Electricity Customers**

Maitreyee Marathe; Line A. Roald, University of Wisconsin-Madison, United States

**333. Recurrent Soft Actor Critic Reinforcement Learning For Demand Response Problems**

Ulrich Ludolfinger; Maren Martens, University of Applied Sciences Landshut, Germany; Daniel Zinsmeister; Vedran Peric; Thomas Hamacher, Technical University of Munich, Germany; Sascha Hauke, University of Applied Sciences Landshut, Germany;

**09:00-10:30 S6 - Frequency control I A | Pacific****58. Virtual Inertia Response and Frequency Control Ancillary Services From Hydrogen Electrolyzers**

Mehdi Ghazavi Dozein; Antonella Maria De Corato; Pierluigi Mancarella, The University of Melbourne, Australia

### **73. Employing Imbalance Forecasts To Proactively Counteract Deterministic Frequency Deviations**

Julie Rousseau; Johanna Vorwerk, Power Systems Laboratory, ETH Zürich, Switzerland; Iason Avramiotis, Swissgrid, Ltd., Switzerland

### **132. Frequency Dynamics of The Northern European Ac/dc Power System: A Look-Ahead Study**

Danilo Obradović, KTH Royal Institute of Technology, Sweden; Matas Dijokas, Technical University of Denmark, Denmark; Georgios Misyris, Technical University of Denmark, Denmark; Tilman Weckesser, Technical University of Denmark, Denmark; Thierry Van Cutsem, Fund for Scientific Research (FNRS), University of Liège, Belgium

### **192. Virtual Synchronous Machine Control For Asynchronous Grid Connections**

Felix Wald; Qiucen Tao; Giovanni De Carne, Karlsruhe Institute of Technology, Germany

### **218. Secondary Frequency Control of Dual-Port Grid Forming Control**

Irina Subotic, ETH Zurich, Switzerland; Dominic Gross, Madison-Wisconsin, United States

### **375. Grid Integration Impacts of Hydrostatic Transmission-Based Wind Turbines**

William Mendieta; Damian Flynn, University College Dublin, Ireland

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<b>09:00-10:30</b>	<b>SS03 The Future of Power Flexibility</b>	<b>B   Atlantic</b>
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<b>09:00-10:30</b>	<b>SS04 Objective-based Machine Learning for Low-carbon Power Systems</b>	<b>C   Atlantic</b>
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<b>10:30-11:00</b>	Coffee Break
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<b>11:00-12:30</b>	<b>S7 - Voltage stability and control I</b>	<b>B   Atlantic</b>
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### **122. Determining A Robust Lower Bound On Voltage Magnitudes To Enhance Voltage Stability**

Katharina Kaiser; Johanna Vorwerk; Gabriela Hug, ETH Zurich, Switzerland; Marc Hohmann; Stavros Karagiannopoulos; Fabian Streiff, Swissgrid AG, Switzerland

### **215. Experimental Validation of Model-Less Robust Voltage Control Using Measurement-Based Estimated Voltage Sensitivity Coefficients**

Rahul Gupta; Mario Paolone, Distributed Electrical Systems Laboratory, EPFL, Switzerland

### **228. Review of Fault Ride Through Support Schemes and A New Strategy For Low-Inertia Power Systems**

Kyriakos Kyriakou; Lenos Hadjidemetriou; Christos Panayiotou, University of Cyprus, Cyprus

### **250. Design of Virtual Impedance Control Loop Using The Complex Frequency Approach**

Dionysios Moutevelis; Javier Roldan Perez; Milan Prodanovic, IMDEA Energy Institute, Spain; Federico Milano, University College Dublin, Ireland

### **283. A Decentralized Transactive-Based Model For Reactive Power Ancillary Service Provision By Local Energy Communities**

Maryam Mohiti; Mohammadreza Mazidi; David Steen, Chalmers university of Technology, Sweden; Tuan Ahn Le, Sweden

### **372. Experimental Validation of A Rule-Based Voltage Regulation Algorithm For Mv Grids**

Manuel Barragan-Villarejo; Francisco de Paula Garcia-Lope; Juan Manuel Mauricio; Jose Maria Maza-Ortega, Universidad de Sevilla, Spain; Georgios Kryonidis; Kyriaki-Nefeli Malamaki; Charis Demoulias, Aristotle University of Thessaloniki, Greece

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<b>11:00-12:30</b>	<b>S8 - Flexibility in microgrids I</b>	<b>A   Pacific</b>
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### **77. Decentralized and Centralized Storage Architectures In Local Energy Markets (lem) and Their Interaction With The Wholesale Market (wsm)**

António Ferreira dos Santos; João Tomé Saraiva, Faculty of Engineering of University of Porto, Portugal

### **189. Using Multivariate Copulas To Capture Forecasting Error and Optimize Flexibility Provision From A Local Energy Community**

Thien-An Nguyen-Huu; Trung Thai Tran; Minh-Quan Tran; Phuong Hong Nguyen; Han Slootweg, Eindhoven University of Technology, Netherlands

**264. Data-Driven Assessment of The der Flexibility Impact On The Lv Grid Management**

Benjamin Fritz; Gil Sampaio; Ricardo Bessa, INESC TEC, Portugal

**304. A Toolbox For Comparing Congestion Management Solutions For Distribution Networks**

Meng Song; Wenche Tobiasson, RISE Research Institutes of Sweden, Sweden; Nima Mirzaei Alavijeh; David Steen; Anh Tuan Le, Chalmers University of Technology, Sweden

**424. Flexibility Service Design For Mitigating Voltage Unbalance In The Distribution Network**

Jiabin Fan; Ivana Kockar, University of Strathclyde, United Kingdom

**441. Marl-Idr: Multi-Agent Reinforcement Learning For Incentive-Based Residential Demand Response**

Jasper van Tilburg; Luciano Cavalcante Siebert; Jochen Cremer, TU Delft, Netherlands

**11:00-12:30 S9 - Reliability, resilience, risk assessment and restoration**

**C | Atlantic**

**6. A Multi-Agent Flisr Model For Smart Grids**

Chaudhry Talha Hassan; Tariq Mahmood Jadoon, Lahore University of Management Sciences, Pakistan

**61. Online Cascading Failure Searching Based On Gradient Boosting Decision Tree**

Tianhao Liu; Yutian Liu, Shandong University, China

**129. Deep Reinforcement Learning Applied To Monte Carlo Power System Reliability Analysis**

Øystein Rognes Solheim; Boye Annfelt Høverstad, NTNU, Statnett SF, Norway; Magnus Korpås, NTNU, Norway

**154. Co-Optimization of Power Line Shutoff and Restoration Under High Wildfire Ignition Risk**

Noah Rhodes; Line Roald, University of Wisconsin-Madison, United States

**252. A Congestion Alleviation Technique Exploiting Structural Insights On The Interaction of Line Loading Limits, Reactance and Line Outage Security Constraints**

Arash Beiranvand, Technological University Dublin, Ireland; Paul Cuffe, University College Dublin, Ireland

**396. Risk Assessment of Power Systems Against Wildfires**

Rosa Serrano; Alessandra Parisio, The University of Manchester, United Kingdom; Mathaios Panteli, University of Cyprus, Cyprus

**11:00-12:30 SS05 DER operating envelopes and their applications in energy markets and planning**

**D | A.Mediterranean**

**11:00-12:30 SS06 Transfer of knowledge: Discussing with the Editors in Chief**

**E | Aegean Baltic**

**12:40-14:10**

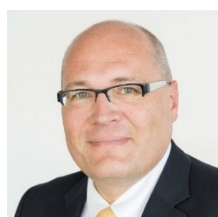
**KEYNOTE SPEAKERS**



**John McDonald**, GE Grid Solutions - Smart Grid Business Development Leader, IEEE PES Past President, U. S. National Academy of Engineering, IEEE Life Fellow, CIGRE Honorary Member



**Prof. Mario Paolone**, Chair of Distributed Electrical Systems laboratory - EPFL, IEEE Fellow, Professor



**Christian Rehtanz**, Head of the Institute of Energy Systems, Energy Efficiency and Energy Economics (ie3) - TU Dortmund University, member of Academy of Science Berlin-Brandenburg, IEEE Fellow

**15:30-17:00 S10 - Optimal energy scheduling and unit commitment / Energy management**

C | Atlantic

**18. Optimal Energy Scheduling of Flexible Industrial Prosumers Via Reinforcement Learning**

Nick van den Bovenkamp; Pedro P Vergara; Peter Palensky, Delft University of Technology, Netherlands; Juan S Giraldo, University of Twente, Netherlands; Edgar Mauricio Salazar Duque, Eindhoven University of Technology, Netherlands; Charalambos Konstantinou, King Abdullah University of Science and Technology, Saudi Arabia

**30. Optimization Model For The Analysis of Multiple Energy Communities In The Same Distribution Network With Different Providers**

Tohid Harighi; Alberto Borghetti; Fabio Napolitano; Fabio Tossani, University of Bologna, Italy

**89. Modeling of Ground Source Heat Pump Systems and Their Operation Under Uncertainties**

Dario Peralta; Claudio Canizares; Kankar Bhattacharya, University of Waterloo, Canada

**138. Analytical Frequency-Constrained Uc For Island Power Systems**

Almudena Rouco; Mohammad Rajabdorri; Enrique Lobato; Lukas Sigrist, Universidad Pontificia Comillas, Spain

**145. Combined Optimal Sizing and Energy Management of A Dc Microgrid Using Milp**

Fadi Agha Kassab; Berk Celik; FABRICE LOCMET; Manuela Sechilariu, Université de Technologie de Compiègne, France; Timothy M. Hansen, South Dakota State University, United States

**311. Optimization of Hybrid Power Plants: When Is A Detailed Electrolyzer Model Necessary?**

Manuel Tobias Baumhof; Enrica Raheli; Andrea Gloppen Johnsen; Jalal Kazempour, Technical University of Denmark, Denmark

**15:30-17:00 S11 - Energy storage I**

B | Atlantic

**21. Comparison of Pumped Hydro Storage Operation Policies For A Brazilian Case Study**

Andressa S. Santos; Carmen L. T. Borges, Federal University of Rio de Janeiro, Brazil

**121. Emergency Battery Energy Storage System Shedding Against Fault-Induced Delayed Voltage Recovery In Power Systems**

Abdul Basit Khan; Yuchen Zhang; Rui Zhang, University of New South Wales, Australia; Zhao Yang Dong, Nanyang Technological University, Singapore

**214. Energy Storage Arbitrage In Day-Ahead Electricity Market Using Deep Reinforcement Learning**

Tim Zonjee, Wageningen University & Research, Netherlands; Shahab Shariat Torbaghan, Wageningen University & Research, Iran

**217. Towards A Blockchain Implementation of A Governance & Revenue Dispersal Mechanism For Investments In Battery Energy Storage Systems**

Bryan Bird; Hanumantha Rao Bokkissam; Paul Cuffe, University College Dublin, Ireland; Iacopo Savelli; Thomas Morstyn, University of Edinburgh, United Kingdom

**353. Cluster-Based Analysis of Feasible Operating Regions For Aggregated Energy Storage Systems**

Florian Klein-Helmkamp; Thomas Offergeld; Andreas Ulbig, RWTH Aachen University, Germany

**355. A Classification of Existing and Emerging Hydrogen Storage Technologies**

Niamh Bosch; Shahab Shariat Torbaghan; Alessio Belmondo Bianchi Di Lavagna, Wageningen University & Research, Netherlands

**15:30-17:00 S12 - Power System Planning**

A | Pacific

**140. Minute Resolution Multi-Area Wind Power Simulation To Estimate Future Reserve Needs**

Henrik Nordström; Lennart Söder, KTH Royal Institute of Technology, Sweden; Robert Eriksson, Svenska kraftnät, Sweden

**152. Priority Chronological Time-Period Clustering For Generation and Transmission Expansion Planning Problems With Long-Term Dynamics**

Álvaro García-Cerezo; Raquel García-Bertrand; Luis Baringo, Universidad de Castilla-La Mancha, Spain

**179. A Methodology For Offshore Transmission System Optimization Considering Spatial Constraints**

Stephen Hardy; Hakan Ergun; Dirk Van Hertem, KU Leuven, Belgium

**305. Substation Topology Planning: Impact On Voltage Stability and Short-Circuit Current**

Daniel Stenzel; Mariano Dominguez Librandi; Rolf Witzmann, Technical University of Munich, Germany; Jörg Michael Schmidt; Vladimir Milic, TenneT TSO GmbH, Germany

**360. Capturing Chronology and Extreme Values of Representative Days For Planning of Transmission Lines and Long-Term Energy Storage Systems**

Mojtaba Moradi-Sepahvand; Simon H. Tindemans, Delft University of Technology, Delft, The Netherlands, Netherlands

**422. Cascade Failures Analyses Improving Resilience On Transmission Expansion Planning**

Luiz Eduardo Oliveira; João Tomé Saraiva, Doctoral Program in Electrical and Computer Engineering, FEUP; INESC TEC, Portugal; Phillipe Vilaça Gomes, Dept. of Comp. Science, Rey Juan Carlos University, Spain; Julio A. D. Massignan, SIEMENS AG, Brazil

**15:30-17:00 SS07 Recent Advances and Trends in Active Distribution Networks**

**D | A. Mediterranean**

**15:30-17:00 SS08 Grid resilience and Decarbonization of Electric Power System**

**E | A. Baltic**

**17:10-18:00 Poster Session 6 - DC power systems**

**C | Atlantic**

**81. Pole-Phase Transformation For Ac/dc Hybrid Power Grids**

Haonan Wang; Boliang Jin; Qihuan Dong; Wujie Chao; Xinzhou Dong, State Key Lab. Of Power System and Generation Equipment, Tsinghua University, China

**280. Power Routing Strategy For An Offshore-Onshore Bipolar Vsc-Hvdc Interconnector**

Jane Marchand; Arcadio Perilla; Midhuna Garapati; Jose Luis Rueda Torres, Delft University of Technology, Netherlands; Francisco Gonzalez-Longatt, University of Exeter, United Kingdom

**286. Flexible Dc-Mmc Interconnecting A Bipole and A Symmetrical Monopole**

Marc Cheah Mañé; Oriol Gomis Bellmunt, CITCEA - UPC, Spain; Juan David Pérez; Daniel Gomez Acero; Florent Morel, SuperGrid Institute, France

**340. Minimum Scr and Impact of Pll Gain On Flat Start Capability On A Point To Point Vsc-Hvdc Interconnection**

Roni Irnawan; Rian Fatah Mochamad; Sarjiya Sarjiya, Universitas Gadjah Mada, Indonesia; Filipe Faria da Silva; Qi Zhang, Aalborg University, Denmark

**361. Guidelines For Emt Transmission Line Models For Time-Domain Protection Algorithms**

Joachim Vermunicht; Willem Leterme; Mudar Abedrabbo; Dirk Van Hertem, KU Leuven/EnergyVille, Belgium

**402. Dc Equivalent of An Ac Circuit Through An Inverter In A Symmetric Monopolar Configuration**

Quentin Delhayé; Marc Bekemans; Emmanuel De Jaeger, UCLouvain, Belgium

**404. Development of Reliable Power Electronic Systems Using Real Time Digital Twin Based Power Hardware-In-The-Loop Testbed**

Aditya Shekhar; Gautam Rituraj; Robin van der Sande; Miad Ahmadi; Vaibhav Nougain; Rohan Deshmukh; Aleksandra Lekic; Peter Palensky; Pavol Bauer, Delft University of Technology, Netherlands

**460. Sizing Methodology For Superconducting Fault Current Limiters In Hvdc Grids**

D. Marene Larruskain; Agurtzane Etxegarai; Aritz Iturregi; Oihane Abarategi; Pablo Eguia, Univ. of Basque Country UPV/EHU, Spain

**464. Detection, Classification and Localization of Faults In LvdC Microgrid Using Ann**

Anu Bhalla; Bhavesh R. Bhalja; Ekta Purwar, Department of Electrical Engineering, Indian Institute of Technology, Roorkee, India; Darko Šošić, University of Belgrade- School of Electrical Engineering, Serbia; Zoran Stojanović, University of Belgrade- School of Electrical Engineering, Serbia

**27. Multistage Stochastic Programming For Vpp Trading In Continuous Intraday Electricity Markets**

Priyanka Shinde; Iasonas Kouveliotis-Lysikatos; Mikael Amelin, KTH Royal institute of Technology, Sweden

**68. Optimizing Charging Time Periods of Electric Vehicles With Reinforcement Learning**

Chris Martin Vertge wall; Tina Möllemann; Philipp Lutat; Andreas Ulbig, RWTH Aachen University, Germany

**176. Vehicle-To-Grid Plug-In Forecast To Aid Aggregator Participation In Ancillary Services Markets**

Jemima Graham; Fei Teng, Imperial College London, United Kingdom; Evelyn Heylen, Centrica Business Solutions, Belgium

**202. Hyperloop Mvdc Electrification System: Modeling, Configuration, and Performance Analysis**

Baoling GUO; Julien Pouget; Samuel Chevailler, HES-SO, Switzerland; Antoine Juge; Giacomo Pareschi, EuroTube Foundation, Switzerland

**235. Impact of Minimum Energy Requirement On Electric Vehicle Charging Costs On Spot Markets**

Raviteja Chemudupaty; Mohammad Ansarin; Ramin Bahmani; Gilbert Fridgen; Hanna Marxen; Ivan Pavić, University of Luxembourg, Luxembourg

**263. Reinforcement Learning Models For Adaptive Low Voltage Power System Operation**

Eleni Stai; Matteo Guscetti; Gabriela Hug ETHZ, Switzerland; Mathias Duckheim, Siemens Technology, Germany

**300. Electric Vehicle Charging With Fractional Renewable Energy Certificates Using Blockchain Technology**

Olayinka Ayo; Nidhal Zribi; Roberto Moreira, EDF Energy UK, United Kingdom; Huajun Zhang; Dominique Bertin, EDF Lab Singapore, Singapore

**328. Analyzing The Medium-Term Impact of The Aggregated Peak Load From Electric Vehicles Using A Clustering-Based Approach**

George Rouwhorst; Sjoerd Doumen; Phuong H. Nguyen, Eindhoven University of Technology, Netherlands; Han Slootweg, Enexis Netbeheer, Netherlands

**13. Dynamic Reconfiguration of Distribution Networks Considering Hosting Capacity: A Risk-Based Approach**

Zeljko Popovic, University of Novi Sad, Faculty of technical Sciences, Serbia; Stanko Knezevic, Schneider Electric, Serbia

**69. Economic Effects of A Nationwide Roll-Out of Energy Sharing In Local Energy Markets**

Klemens Schumann; Nicolas Seubert; Clara Köhnen; Luis Böttcher; Andreas Ulbig, IAEW at RWTH Aachen University, Germany

**86. Methodology For Evaluating Grid Development Strategies Considering Real Options and Risks**

Iver Bakken Sperstad; Rubi Rana; Susanne Sandell, SINTEF Energy Research, Norway

**93. Investment Assessment of Distributed Energy Resources Under Coalitional Energy Management**

Oliver Toftegaard Jensen, Ørsted A/S, Denmark; Liyang Han, Twig Energy ApS, Denmark

**107. Shortest Power Line Route Search By Using Breadth-First Algorithm and Georeferencing**

Vladan Ristic, JSC Elektromreza Srbije, Serbia; Darko Susic, University of Belgrade, School of Electrical Engineering, Serbia; Dragana Ristic, "AL&amp;SA" LLC Pancevo, Serbia

**155. Correction of The Day-Ahead Load Profiles To Improve The Commercial and Industrial Microgrid Efficiency**

Anna Glazunova; Elena Aksaeva, Melentiev Energy Systems Institute SB RAS, Russia

**237. Electricity Market Equilibrium Analysis For Strategic Demand Aggregators: The Value of Demand Flexibility Portfolios' Mix**

Alireza Khaksary; Emmanouel Varvarigos; Prodromos Makris; Konstantinos Steriotis, Institute of Communications and Computer Systems, National Technical University of Athens, Greece, Greece; Georgios Tsaousoglou, Department of Applied Mathematics and Computer Science, Technical University of Denmark, Denmark; Nikolaos Efthymiopoulos, Department of Informatics, School of Sciences, University of Western Macedonia, Greece, Greece;

**254. A Distributed Strategy For Parallel Power System Restoration**

Francesco Lo Iudice; Mario di Bernardo, Univeristà degli Studi di Napoli Federico II, Italy; Ekaterina Dudkina, Emanuele Crisostomi, Università di Pisa, Italy; Marco Coraggio, Scuola Superiore Meridionale, Italy

**265. Active/reactive Power Environmental Redispatch To Mitigate Fossil-Fueled Thermal Power Plant Ghg Emissions In Hybrid Electricity Markets**

Rafael Martins Barros; Ricardo de Andrade Lira Rabêlo, Universidade Federal do Piauí, Brazil; Guilherme Guimarães Lage, Universidade Federal de São Carlos, Brazil

**351. Including Dynamic Security Constraints In Isolated Power Systems Unit Commitment/economic Dispatch: A Machine Learning-Based Approach**

Rui Sousa; Carlos Moreira; Leonel Carvalho; Manuel Matos, INESC TEC - Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciência, Portugal

**17:10-18:00 Poster Session 9 – Stability**

**D | Adriatic Mediterranean**

**29. Assessment of The Network Topological Impact of Line-Switching On Transient Stability**

Jaime Trivino; Juan Morales; Victor Levi, The University of Manchester, United Kingdom

**54. Assessment of Demand Response Impact On The Frequency Stability of Low-Inertia Power Systems**

Rodrigo Afonso, Faculty of Engineering, University of Porto, Portugal; João Abel Peças Lopes, INESC-TEC, Portugal

**78. Data-Driven Control For Power Oscillation Damping: Robustness and Closed-Loop Identification**

Felix Braun, Karlsruhe Institute of Technology (KIT), Germany, Germany; Jan Poland; Mats Larsson, Hitachi Energy Research Baden-Dättwil, Switzerland, Switzerland

**188. Aspects of Grid Code Verification For Small and Medium Size Hydro Power Plants**

Darko Brankovic; Herwig Renner; Robert Schürhuber, Graz University of Technology, Austria

**206. Power System Transient Voltage Stability Region Boundary Approximation and Stability Margin Estimation Based On Residual Neural Network**

Yang Chen; Yonghong Luo; Chao Lu, Tsinghua University, China

**213. Tuning of Cascaded Droop Control Systems For Power Converters Based On The Eigenvalue Analysis**

Aaron Hebing; Xiong Xiao; Anna Pfendler, Technical University of Darmstadt, Germany

**329. Inertia Requirements Assessment For The Italian Transmission Network In The Future Network Scenario**

Andrea Bonfiglio; Matteo Fresia; Manuela Minetti; Renato Procopio; Alessandro Rosini, University of Genoa, Italy; Giuseppe Lisciandrello, Terna S.p.A., Italy; Luca Orrù, Terna S.p.A., Italy

**386. Inertia Estimation of Generation Plants Under Normal Operation In The Cyprus Power System**

Marina Elenkova; Markos Asprou; Lenos Hadjidemetriou; Christos Frangeskou; Christos Panayiotou, KIOS Research and Innovation Center of Excellence, Cyprus; Michalis Michael, Transmission System Operator Cyprus, Cyprus; Andreas Stavrou, Electricity Authority of Cyprus, Cyprus

**436. Investigation of Frequency Domain Analysis Methods For Converter-Driven Stability Evaluation of Converter-Dominated Meshed Systems**

Viswaja Yelliseti; Otmane El Azzati; Albert Moser, RWTH Aachen University, Germany

**440. Effect of Local Power Consumption On Stability of Voltage Source Converters In Weak Grids**

Georgios Tsourakis; Panagiotis Mandoulidis; Michalis Karystianos, IPTO, Greece

**17:10-18:00 Poster Session 10 – Protection**

**E | Aegean Baltic**

**67. Protection, Control and Modeling of Offshore HvdC Grids For Transmission To Onshore**

Riaan Marshall; Jiayang Wu; Zameer Ahmad; Guillermo Mier; Renata Jacyszyn Bachega, DNV, Netherlands

**104. Location Method Based On Fuzzy Entropy For Single Phase To Ground Faults In Non-Effectively Grounded Distribution Network**

Lin Li; Houlei Gao; Zhen Liu; Tong Yuan, School of Electrical Engineering, Shandong University, China

**232. A New Current Differential Protection Criterion For Active Distribution Network**

Yunchi Zhang; Houlei Gao; Tong Yuan, School of Electrical Engineering, Shandong University, China

**273. Fault Line Selection of Three-Core Armored Cables Based On The Analysis of Transient Moduli Considering Conductor Couplings**

Yibo Sheng; Bin Wang; Xinzhou Dong, Tsinghua University, China

**282. Optimal Design and Cascading Failure Evaluation of Remedial Action Schemes**

Aditya Rangarajan; Line Roald, University of Wisconsin-Madison, United States

**293. Modeling of Digital Controllers In Electric Power System Dynamic Simulations**

Gautier Bureau; Marcho Chiaramello; Adrien Guironnet; Patrick Panciatici, Réseau de Transport d'Électricité (RTE), France; Petros Aristidou; Mehran Jafari, Cyprus University of Technology, Cyprus

**321. Modern Electrical Network Restoration Strategy Using Resilience Analysis**

Amr Kassem; Yasser Khalil; Rasha El Azab, Helwan University, Egypt; Mohamed Galeela, Cairo University, Egypt

**385. Optimal and Predictive Under-Frequency Load Shedding Against Critical Islanding Contingencies**

Daniel Baltensperger; Kjetil Uhlen, Norwegian University of Science and Technology (NTNU), Norway

**416. Review and Evaluation of Control-Based Protection Solutions For Converter-Dominated Power Systems**

Shuxiu Cao; Qiteng Hong; Liu Di; Campbell Booth, University of Strathclyde, United Kingdom

**18:00-19:00**

**COCKATIL**

**09:00-10:30 S13 - Power system stability and dynamics****A | Pacific****9. Assigning Shadow Prices To Synthetic Inertia and Frequency Response Reserves From Renewable Energy Sources**

Luis Badesa, Technical University of Madrid (UPM) & Imperial College London, Spain; Carlos Matamala; Yujing Zhou; Goran Strbac, Imperial College London, United Kingdom

**80. Dynamics of Inverter-Based Resources In Weak Distribution Grids**

Bikash Chandra Pal, Imperial College London, United Kingdom; Pierluigi Mancarella; Mehdi Ghazavi Dozein, The University of Melbourne, Australia

**156. Impact of Time Delays On The Performance of A Wide-Area Damping Controller Under Reduced Inertia Scenarios**

Sandro Kellermüller; Miguel Ramirez-Gonzalez; Artjoms Obushevs; Petr Korba, ZHAW, Switzerland

**303. Evaluation of Power System Identification Methods and Their Applicability For Online Pss Tuning**

Diego Cifelli; Catalin Gavriluta; Adolfo Anta, AIT Austrian Institute of Technology GmbH, Austria

**363. Statistical Assessment of The First-Swing Transient Stability of A Single Machine Infinite Bus Network With Renewable Energy Sources Generation**

Juan Dante Morales Alvarado; Jovica Milanovic, The University of Manchester, United Kingdom

**446. Multimode Power Oscillation Damping Controller Synthesis Using Vector Fitting**

Njegos Jankovic; Javier Roldan-Perez; Milan Prodanovic, Electrical Systems Unit, IMDEA Energy Institute, Spain; Salvatore D'Arco; Jon Are Suul, Energy Systems, SINTEF Energy, Norway; Luis Rouco-Rodriguez, Institute for Research in Technology, ICAI, Pontifical Comillas University, Spain

**09:00-10:30 S14 - Converter control****B | Atlantic****34. Power Hardware-In-The-Loop Implementation For Multi-Infeed Grid-Connected Voltage Source Converters**

Luis Orellana; Eduardo Prieto-Araujo; Oriol Gomis-Bellmunt, CITCEA, Universitat Politècnica de Catalunya, Spain; Luis Sainz, Universitat Politècnica de Catalunya, Spain; Tibin Joseph; Carlos E. Ugalde-Loo; Jun Liang, Cardiff University, United Kingdom

**96. Towards A Full Automatized Ultrafast Blackstart Through Inverter-Based Generation**

Josep Aniceto; Julius Bosch, SBB Energie, Switzerland; Adolfo Anta, Austrian Institute of Technology GmbH, Austria

**193. Enhanced Neural Network-Based Polytopic Model For Large-Signal Black-Box Modeling of Power Electronic Converters**

Antonio Giannitrapani; Simone Paoletti, University of Siena, Italy; Bertrand Cornélusse; Antonin Colot, University of Liège, Belgium

**269. Multi-Domain Stability Analysis For The Gfm Placement Problem**

Francisco Fernandes; João Peças Lopes; Carlos Moreira, FEUP, Portugal

**313. Observer-Based Power-Synchronization Control For Grid-Forming Converters**

Tuure Nurminen; Rayane Mourouvin; Marko Hinkkanen, Aalto University, Finland; Jarno Kukkola; Mikko Routimo; Antti Vilhunen, ABB Oy Drives, Finland; Lennart Harnefors, ABB Corporate Research, Sweden

**414. Pv Inverter Fault Classification Using Machine Learning and Clarke Transformation**

Louelson Costa; Ana Silva; Ricardo Bessa, INESC TEC, Portugal; Rui Araújo, INESC TEC and FEUP, Portugal

**09:00-10:30 SS09 Modeling, operation and control of multi-energy systems****E | Aegean Baltic****09:00-10:30 SS10 What's new in cascading failure analysis?****D | A. Mediterranean****09:00-10:30 SS11 Powering Together: Insights into Twinning and Capacity building Projects for Sustainable Power Systems****C | Atlantic**

**225. Uncertainty-Aware Tso-Dso Coordination Methodology For Transmission Voltages Control**

Mohammad Iman Alizadeh; Florin Capitanescu; André Guimaraes Madureira, Luxembourg Institute of Science and Technology, Luxembourg; Muhammad Usman, National Grid ESO, United Kingdom;

**243. Market Order Prequalification For Tso-Dso Coordination**

Ioannis Papayiannis; Markos Asprou; Lenos Hadjidemetriou; Stelios Timotheou, Department of Electrical and Computer Engineering and KIOS Research and Innovation Center of Excellence, Cyprus

**322. Tso-Dso Coordinated Operational Planning In The Presence of Shared Resources**

André Madureira, LIST, Luxembourg; Micael Simões; Filipe Soares, INESC TEC, Portugal; João Peças Lopes, FEUP, Portugal

**327. Assessing Distribution Network Flexibility Via Reliability-Based P-Q Area Segmentation**

Andrey Churkin; Wangwei Kong; Nicolas Jose Melchor Gutierrez; Pierluigi Mancarella; Eduardo Alejandro; Martinez Cesena, The University of Manchester, United Kingdom

**349. Impacts of Distribution Network Reconfiguration On Aggregated der Flexibility**

Andrey Churkin; Miguel Sanchez-Lopez; Eduardo Alejandro Martinez Cesena; Pierluigi Mancarella, The University of Manchester, United Kingdom; Mohammad Iman Alizadeh, Luxembourg Institute of Science and Technology, Luxembourg; Florin Capitanescu, Luxembourg Institute of Science and Technology, Luxembourg;

**394. A Fast Method To Approximate The Flexibility Region of An Active Distribution Network In Pq Space**

Giorgos Priontis; Costas Vournas, NTUA, Greece; Maria Vrakopoulou, The University of Melbourne, Australia

**117. Main Drivers and Regulatory Development Proposals For Relaying Protection Monitoring**

Alexey Nebera; Janez Zakonjssek, IskraTel, d.o.o., Slovenia

**318. Testing Methodology For Performance Evaluation of Distance Protection Relays For Transmission Systems**

Thanakorn Penthong; Mirko Ginocchi; Ferdinanda Ponci; Antonello Monti, RWTH Aachen University, Germany

**335. New Approach In Distribution System Reliability Analysis Considering Protection System Miscoordination**

Miljana Todorović; Jelisaveta Krstivojević, University of Belgrade – School of Electrical Engineering, Serbia

**357. Distributed Protection Coordination Algorithm Applied To Overcurrent-Based Schemes**

Manuel Acevedo; David Romero; Eduardo Mojica; Camilo Cortes, Universidad Nacional de Colombia, Colombia

**369. Impact of Electromagnetic and Optical Cts On Transformer Differential Protection During Transformer Re-Energization**

Ruslan Kanafeev, JSC PROFOTECH, Russia; Nikolay Ivanov; Vladimir Terzija, Skolkovo Institute of Science and Technology, Russia

**425. Exploring Fault Detection Algorithms In Differential Relays For Transmission Line Protection**

Marziyeh Hemmati; Giambattista Grusso, Politecnico di Milano, Italy; Massimo Ambroggi, Thytronic, Italy

**37. Denoising Diffusion Probabilistic Models For Probabilistic Energy Forecasting**

Esteban Hernandez Capel, Liege University, Belgium; Jonathan Dumas, RTE, France

**55. Trade-Off Selection of Data-Driven Methods For Ev Demand Forecasting In A Real Office Environment**

Shicong Zhang; Klaas Thoelen; Thijs Peirelinck; Geert Deconinck, KU Leuven, Belgium

**87. Availability Adversarial Attack and Countermeasures For Deep Learning-Based Load Forecasting**

Wangkun Xu; Fei Teng, Imperial College London, United Kingdom

### 91. Assessing Critical Data Types For Deep Learning-Based Pv Generation Forecasting

Yang Gao; Shengye Qi; Jelena Ponoćko, The University of Manchester, United Kingdom

### 112. Medium-Term Wind Power Forecasting Based On Dynamic Self-Attention Mechanism

Fuhao Chen; Jie Yan; Yongqian Liu; Yamin Yan, North China Electric Power University, China; Lina Bertling Tjernberg, KTH Royal Institute of Technology, Sweden;

### 445. Comparison of Two Modified Deterministic Lstm Models With A Probabilistic Lstm Model For A Day-Ahead Forecasting of Electricity Demands

Shuyang Zhu; Joy Yao; Sasa Djokic, The University of Edinburgh, United Kingdom

**11:00-12:30 SS12 Energy Storage Worldwide: Insights and Applications**  
(Session supported by IEEE PES Women in Power)

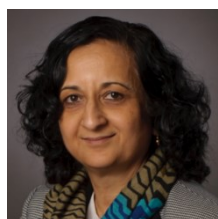
**E | Aegean Baltic**

**11:00-12:30 SS13 Panel on Power Systems in South-East Europe**

**D | A.Mediterranean**

**12:40-14:10**

**KEYNOTE SPEAKERS**



**Prof. Anuradha Annaswamy**, Director of the Active-Adaptive Control Laboratory at MIT, Past President, IEEE CSS, IEEE & IFAC Fellow



**Prof. Pierluigi Mancarella**, Chair Professor of the Electrical Power Systems - University of Melbourne, IEEE Fellow



**Dr Dejan Ostojic**, Past Sector Leader for Energy in the World Bank, an independent member of the Supervisory Board of Ukrenargo.

**14:10-15:30** Lunch

**15:30-17:00 S18 - Cyber Security**

**A | Pacific**

### 11. Experimental Impact Analysis of Cyberattacks In Power Systems Using Digital Real-Time Testbeds

Kalinath Katuri; Thi Nguyen, University of Connecticut, United States; Charalambos Konstantinou; Ioannis Zografopoulos, King Abdullah University of Science and Technology, Saudi Arabia;

### 123. Net-Zero Energy Factories As Active Players In The Decarbonization Process. An Application For Blockchain

Pio Lombardi; Sandeep Yadav Mathepu; Bartłomiej Arendarski; Marc Richter, Fraunhofer Institute for factory operation and automation, Germany; Antonio Pantaleo, Department of agricultural and environmental science. University of Bari Aldo Moro, Italy; Przemyslaw Komarnicki; Hannes Wasser, Magdeburg-Stendal University for Applied sciences, Germany;

### 319. Integration of Remote Attestation Into Iec 61850

Bastian Fraune; Torben Woltjen; Richard Sethmann, Hochschule Bremen, Germany; Björn Siemers, OFFIS e.V.

**330. An Approach To Abstract Multi-Stage Cyberattack Data Generation For MI-Based Ids In Smart Grids**

Ömer Sen; Philipp Malskorn; Simon Glomb; Immanuel Hacker; Andreas Ulbig, IAEW at RWTH Aachen University, Germany; Martin Henze, Security and Privacy in Industrial Cooperation at RWTH Aachen University, Germany

**371. Decentralized Token Exchanges In Blockchain Enabled Interconnected Smart Microgrids**

Disha Lagadamane Dinesha; Balachandra Patil, Indian Institute of Science, India

**471. Mitigating Load-Altering Attacks Against Power Grids Using Cyber-Resilient Economic Dispatch**

Zhongda Chu; Chaudhuri Balarko; Fei Teng, Imperial College London, United Kingdom; Subhash Lakshminarayana, University of Warwick, United Kingdom;

15:30-17:00 **S19 - State Estimation**

**D | Adriatic Mediterranean**

**183. Improvement of System Identification Using N4sid and DbSCAN Clustering For Monitoring of Electromechanical Oscillations**

Maiken Omtveit; Aldrich Zeno; Kjetil Uhlen, Norges Teknisk-Naturvitenskapelige Universitet (NTNU), Norway

**221. Online Inertia Estimation of Power Systems Based On Transient Phasor Data With Weighted Least Squares Method**

Yukai Wang; Akihiko Yokoyama; Jumpei Baba, The University of Tokyo, Japan

**316. Accuracy Analysis of A Dynamic State Estimator With A Hardware In The Loop Approach**

Daniel Baltensperger, Norwegian University of Science and Technology, Norway; Salvatore D'Arco; Santiago Sanchez-Acevedo, SINTEF Energi AS, Norway

**325. Achieving Enhanced Phasor Pod Performance By Introducing A Control-Input Model**

Hallvar Haugdal, SINTEF, Norway; Kjetil Uhlen, Norwegian University of Science and Technology (NTNU), Norway; Hjörtur Jóhannsson, Technical University of Denmark, Denmark

**346. Estimating Unobservable Machines In Multi-Area Power Systems Considering Model Imperfections**

Anton ter Vehn; Lars Nordström, Royal Institute of Technology, Sweden

**384. A Mixed Formulation of Matrix Completion In Low Voltage Distribution Network State Estimation**

Zhe Chen; Charalampos Ziras; Henrik Bindner, Technical University of Denmark, Denmark

15:30-17:00 **SS14 UI-ASSIST: International Research Collaboration**

**C | Atlantic**

15:30-17:00 **SS15 System Integrity Protection Schemes in Modern Power Systems**

**B | Atlantic**

15:30-17:00 **SS16 Leading innovations and technological solutions for a sustainable future – TRANSIT project**

**E | Aegean Baltic**

17:10-18:00 **Poster Session 11 - AI application**

**A | Pacific**

**35. Graph Convolutional Networks For Probabilistic Power System Operational Planning**

Yasmin Bashir Sheikh-Mohamed; Sigurd Hofsmo Jakobsen; Espen Flo Bødal; Fredrik Marinius Haugseth; Signe Riemer-Sørensen; Erlend Sandø Kiel, SINTEF Energy Research, Norway

**52. Towards A Peer-To-Peer Residential Short-Term Load Forecasting With Federated Learning**

Joaquin Delgado Fernandez; Sergio Potenciano Menci; Ivan Pavic, University of Luxembourg, Luxembourg

**163. Bayesian Physics-Informed Neural Networks For Robust System Identification of Power Systems**

Simon Stock; Davood Babazadeh; Christian Becker, Hamburg University of Technology, Germany; Spyros Chatzivasileiadis; Jochen Stiasny, Technical University of Denmark, Denmark;

**198. Explainable Artificial Intelligence For Power System Security Assessment: A Case Study On Short-Term Voltage Stability**

Congbo Bi; Yonghong Luo; Chao Lu, Tsinghua University, China

**230. A Flexible Approach For Selection of The Training Set For Ann-Based Load Forecast Using Autoencoder and Similar Day Method**

Zoran Pajić; Aleksandar Selakov, University of Novi Sad/Faculty of Technical Sciences, Serbia

**277. Autoencoder-Based Fault Diagnosis For Hydropower Plants**

FATEMEH HAJIMOHAMMADALI; Nunzia Fontana; Mauro Tucci; Emanuele Crisostomi, University of Pisa, Italy

**312. Scenario Generation Using Optimized Sampling Strategy For Partially Observable Distribution Grids**

Thijs Becker; Chris Hermans; Koen Vanthournout, Flemish Institute for Technological Research (VITO), Belgium; Geert Deconinck; Muhammad Furqan Azam, KU Leuven, Belgium

**339. Application of Artificial Intelligence To Identify Electric Meter Tariffs**

Aleksandar Đurić; Aleksandar Selakov, Faculty of Technical Sciences, Serbia

**427. Edframe: Open-Source Library For End-To-End Energy Disaggregation In Python**

Iliia Kamyshev; Vladimir Terzija; Elena Gryazina, Skolkovo Institute of Science and Technology, Russia

**450. Machine Learning-Based Short-Term Composite Load Forecasting**

Dzenana Tomasevic; Tatjana Konjic, Faculty of Electrical Engineering, Bosnia and Herzegovina

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**17:10-18:00    Poster Session 12 - Advance measuring infrastructure    D | Adriatic Mediterranean**


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**7. A Framework For Service Restoration of Cyber-Physical Power System**

sChaudhry Talha Hassan; Tariq Mahmood Jadoon, Lahore University of Management Sciences, Pakistan

**43. Securing Smart Grids Locally Using A Power Flow-Based Intrusion Detection System**

Verena Menzel; Nataly Bañol Arias; Johann L. Hurink, University of Twente, Netherlands; Anne Remke, University of Münster, University of Twente, Germany

**118. A System-Based Framework For Optimal Sensor Placement In Smart Grids**

Agrippina Mwangi, Utrecht University, Netherlands; Konrad Sundsgaard, Green Power Denmark, Denmark; Jose Angel Leiva Vilaplana; Guangya Yang, Technical University of Denmark, Denmark; Kaio Vinícius Vilerá, Typhoon HiL, Serbia;

**148. Specifications of A Simulation Framework For Virtualized Intelligent Electronic Devices In Smart Grids Covering Networking and Security Requirements**

Nadine Kabbara, EDF, Utrecht University, France; Agrippina Mwangi; Madeleine Gibescu, Utrecht University, Netherlands; Ali Abedi; Alexandru Stefanov; Peter Palensky, Delft University of Technology, Netherlands

**191. Real-Time Data Extraction, Transformation and Loading Process For Lv Advanced Distribution Management Systems**

Sudeshna Dutta; Adrian Miranda, Plexigrid, Spain; Pablo Arboleya, Universidad de Oviedo, Spain

**279. Cyber-Security Assessment of Power System Digital Components In The Conditions of Hostilities**

Denys Mishchenko; Irina Oleinikova; Dmytro Ivanko, Norwegian University of Science and Technology, Norway

**315. An Analysis of IEC 62351 Implementations For Securing IEC 60870-5-104 Communication**

Ivan Cindrić; Tamara Hadjina, Končar - Digital Ltd., Croatia

**338. Cross Sensor Platform For Transformer Monitoring Applications**

Konrad Diwold, Pro2Future GmbH, Austria; Jakub Waikat; Jakob Gaugl, Siemens Energy Austria GmbH, Austria; Fredi Belavic, Austrian Power Grid AG, Austria; Franz Graf; Ferdinand Fuhrmann, JOANNEUM RESEARCH Forschungsgesellschaft mbH, Austria

**380. Analysis of Risk-Based Diagnostic Scenarios For Overhead Transmission Lines**

Egor Grishin; Elena Gryazina; Dmitriy Titov, SkolTech, Russia

**423. Hybrid Modelling of Interconnected Electric Power and ICT System For Reliability Analysis**

Yushi Chen; Jovica Milanović, The University of Manchester, United Kingdom

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**17:10-18:00    Poster Session 13 - Smart microgrids    C | Atlantic**


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**166. Re-Synchronisation of A Microgrid To The Main Grid Using Multi-Agent Secondary Control**

Andrés Tomás-Martín; Aurelio García-Cerrada; Lukas Sigríst, Comillas Pontifical University, Spain; Sauro Yagüe, Ramón Llull University, Spain; David Rubio Miguel; Fernando-David Martín-Utrilla, i-DE Redes Eléctricas Inteligentes, Spain

**168. Comparison of Grid Forming and Grid Following Control of A Central BES In A Island System Operating In High RES Penetration**

Dimitris Lagos; Nikos Hatziargyriou, National Technical University of Athens, Greece

**171. Efficiency of Post-Processing In Pmu Based State Estimation of Renewable Energy Microgrids**

Amir Abed; Natheer Alwan; Goran Dobric, University of Belgrade, Serbia; Munther H. Abed, University Malaysia Pahang, Malaysia

**270. A Two-Stage Stochastic Model For Coordinated Operation of Natural Gas and Microgrid Networks**

Seyed Farhad Zandrazavi; John Fredy Franco, São Paulo State University, Brazil; Miadreza Shafie-khah, University of Vaasa, Finland; João Soares; Zita Vale, Polytechnic of Porto, Portugal; Alejandra Tabares, Los Andes Uni, Colombia

**275. Evaluation of The Economic, Technical, and Environmental Impacts of Multi-Energy System Frameworks In Distribution Networks**

José Iria, Australian National University, Australia; António Coelho; Filipe Soares, INESC TEC, Portugal; João Peças Lopes, FEUP, Portugal

**288. A Real-Time Phl Implementation of A Novel Nonlinear Distributed Control Strategy For A Multi-Terminal Dc Microgrid**

Ömer Ekin; Veit Hagenmeyer, Karlsruhe Institute of Technology, Germany; Filipe Perez, Paris-Saclay University, France; Gilney Damm, University Gustave Eiffel, France

**348. A Comprehensive Sliding Mode Approach For Photovoltaic-Storage Islanded Microgrids**

Andrea Bonfiglio; Renato Procopio; Alessandro Rosini, University of Genoa, Italy; Antonella Ferrara, University of Pavia, Italy; Gian Paolo Incremona, Politecnico di Milano, Italy

**462. Data Challenges In Asset Management of Power Distribution Systems: Review and Observations**

Wadih Naim; Patrik Hilber; Ebrahim Shayesteh, KTH Royal Institute of Technology, Sweden

**472. Decentralized Goal Function-Based Control of Dgss In Microgrid Applications**

Ivana Isakov; Milan Rapaić; Marko Vekić; Ivan Todorović, University of Novi Sad, Faculty of Technical Sciences, Serbia

**17:10-18:00 Poster Session 14 - Renewable energy**

**B | Atlantic**

**16. Modelling and Characterisation of Flexibility From Distributed Energy Resources**

Shariq Riaz; Pierluigi Mancarella, The University of Melbourne, Australia

**226. Initialization Method For Synchronous and Inverter Based Generation Units In Power Electronic Dominated Networks**

Onur Alican; Carlos Collados Rodriguez; Daniel Westerman Spier; Marc Cheah Mañe; Eduardo Prieto-Araujo; Oriol Gomis-Bellmunt, CITCEA-UPC, Spain

**274. The Illuminator: An Open Source Energy System Integration Development Kit**

Aihui Fu; Saini Raghav; Remko Koornneef, Delft University of Technology, Netherlands

**366. Calculation and Validation of Weather-Informed Renewable Generator Capacities In The Identification of Renewable Resource Droughts**

Jessica Wert; Thomas Chen; Farnaz Safdarian; Thomas Overbye, Texas A&M University, United States; Jonathan Snodgrass, Texas A&M University, United States

**368. The Importance of Technical Distribution Network Limits In Dynamic Operating Envelopes**

Frederik Geth, GridQube, Australia; Tomislav Antić; Tomislav Capuder, University of Zagreb Faculty of Electrical Engineering and Computing, Croatia

**370. Long-Term Unit Commitment With Combined-Cycle Units**

Lysandros Tziiovani; Markos Asprou; Irina Ciornei; Panayiotis Kolios; Lenos Hadjidemetriou; Stelios Timotheou, KIOS Research and Innovation Center of Excellence and Department of Electrical and Computer Engineering, University of Cyprus, Nicosia, Cyprus, Cyprus; Antonis Lazari; Rogiros Tapakis, Transmission System Operator Cyprus, Nicosia, Cyprus, Cyprus;

**400. Bdfg Wind Turbine Partial-Scale Converter: Efficiency, Cost and Volume Comparison of Sic-Based and Igbt-Based Converter Solution**

Jelena Loncarski, University of Bologna, Italy; Hussain A. Hussain, Kuwait University, Kuwait; Taufik Taluo,; Leposava Ristic, University of Belgrade, Serbia

**411. Navigating The Challenges of Converter-Interfaced Generation In Power Systems: A Review of Study Methods and Real-World Applications**

Stepan Vasilev; Ildar Idrisov; Vladimir Terzija, Skolkovo Institute of Science and Technology, Russia; Petr Vasilev, North-Eastern Federal University, Russia

**412. Load-Flow Time-Series Simulation of A Distribution Grid With Pv Modules and Voltage Regulation**

Mu Dong Liu; Keijo Jacobs; Jean Mahseredjian, Polytechnique Montreal, Canada

**17:10-18:00**    **Poster Session 15 - Power quality**

**E | Aegean Baltic**

**14. Assessing The Cnsumers' Share of Harmonic Distortion**

Polina Shcherbakova, Holon Institute of Technology, Israel; Gennady Senderovych, National Technical University Kharkov Polytechnic Institute Kharkiv, Ukraine; Alexander Abramovitz, School of Elec. and Comp. Eng., Ben-Gurion University Beer-Sheva, Israel

**44. Effect of Laying Parameters and Non-Sinusoidal Loading Condition of High-Voltage Underground Cables On Electrical Performance By Finite Element Method**

Yunus Berat Demiroglu; Özcan Kalenderli, Istanbul Technical University, Turkey

**133. Determination of Led Lamp Model Parameters By Using Analytical - Optimization Approach**

Amir Tokić; Meris Redžić; Mensur Kasumović, University of Tuzla, Bosnia and Herzegovina; Viktor Milardić, University of Zagreb, Croatia; Ivan Ramljak, University of Mostar, Bosnia and Herzegovina; Predrag Stefanov, University of Belgrade, Serbia

**137. Use of Smart Pv Inverters For Reactive Power Management In Distribution Grids**

Akhtar Hussain Javed; Phuong H. Nguyen; Johan Morren; J.G. (Han) Slooetweg, Eindhoven University of Technology, Netherlands

**285. Performance Analysis of A 50 Kva Unified Power Quality Conditioner Model For Low Voltage Distribution Network Application**

Joachim Przibylla; Rolf Witzmann; Mateo Lippich Golobart, Technical University of Munich, Germany; Sandor Simon, RWTH Aachen University, Germany; Cornelius Biedermann, TU Brunswick, Germany; Dirk Lehmann, FGH e.V., Germany

**289. The Impact of Large Grid Frequency Deviations On The Performance of Traditional Machine Tools**

Johanna Geis-Schroer; Keanu Seiraffi; Michael Suriyah; Thomas Leibfried, Karlsruhe Institute of Technology (KIT), Germany

**323. Power Definitions For Unbalanced Three-Phase Systems Operating Under Sinusoidal Conditions**

Jovan Mikulović; Tomislav Šekara, University of Belgrade, School of Electrical Engineering, Serbia

**401. Multifrequency Grid-Feeding Inverter Control Considering Various Frequency Component Separation Methods**

András János Horváth; Dávid Raisz; Dániel Divényi, Dept. of Electric Power Engineering, Budapest University of Technology and Economics, Hungary

**447. Estimation of Harmonics In Sparsely Monitored Distribution Networks**

Yuqi Zhao; Jovica Milanovic, the University of Manchester, United Kingdom

**449. Three-Phase Boost Rectifier Control Implemented Using Hardware-In-The-Loop**

Milovan Majstorovic; Bogdan Brkovic; Nikola Vojvodic; Leposava Ristic, University of Belgrade, Serbia; Ana Stankovic, Cleveland State University, United States

**19:30-23:30**

**GALA DINNER**

**09:00-10:30 S20 - Voltage stability and control II****B | Atlantic****41. Review of Recent Developments In Technical Control Approaches For Voltage and Congestion Management In Distribution Networks**

Sen Zhan; Irena Dukovska; Wouter van den Akker; Anne van der Molen; Johan Morren; Nikolaos G. Paterakis; J. G. (Han) Slootweg, Eindhoven University of Technology, Netherlands

**47. Optimization Based Approach To Solve Phase Balancing Problem In Distribution System**

Duhan Cengizer; Berkant Can Erkanat; Oğuzhan Ceylan, Marmara University, Turkey

**53. Voltage Control By Smart Sustainable Buildings: Data-Driven Vs Opf-Based Techniques**

Chunlei Ge; Runze Yu; Geert Deconinck, Department of Electrical Engineering (ESAT), KU Leuven, Leuven, Belgium, Belgium; Iason Avramidis, UK Power Networks Ltd (UKPN), London, United Kingdom, United Kingdom;

**115. Voltage Regulation Strength At Dso/tso Interfaces: Swedish Case Studies**

Stefan Stanković, RISE Research Institutes of Sweden, Sweden; Viktor Weidenmo, Svenska Kraftnät, Sweden

**276. Change of Operating Point In Power System With Voltage Angle-Based Control**

Hassan Alhomsy; Franz Linke; Dirk Westermann, Technische Universität Ilmenau, Germany

**284. Revisiting The French Secondary Voltage Regulation and Assessing Its Dynamic Behavior With Dynawo**

Maxime Monnet, Centrale Supélec, France; Carmen Cardozo; Philippe Juston; Quentin Cossart; Julien Callec, RTE, France

**09:00-10:30 S21 - Electrical Vehicles****C | Atlantic****84. Multi-Armed Bandits Learning For Optimal Decentralized Control of Electric Vehicle Charging**

Raphaël Féraud, Orange Labs, France; Guy Camilleri, Paul Sabatier University Toulouse, France; Hamid Ben Ahmed; Sharyal Zafar; Anne Blavette, École normale supérieure de Rennes (ENS Rennes), France

**124. Techno-Economic Analysis of Smart Ev Charging For Expansion Planning Under Uncertainty**

Spyros Giannelos; Stefan Borozan; Goran Strbac, Imperial College London, United Kingdom; Alexandre Moreira, Lawrence Berkeley National Laboratory, United States

**141. Opportunity of Transport Sustainability For A Small City: Case Study**

Laura Sturaro; Andrea Di Martino; Michela Longo; Valentina Astori; Dario Zaninelli, Politecnico di Milano, Italy; Giacomo Geroli, Arriva Italia, Italy;

**185. Participation of Electric Vehicle Aggregators In Wholesale Electricity Markets: Recent Works and Future Directions**

Saeed Salimi Amiri; Josue Campos do Prado, Washington State University Vancouver, United States; Fazlur Rahman Bin Karim, University of Texas Rio Grande Valley, United States; Pedro Cesar Lopes Gerum, Cleveland State University, United States

**238. Integrating Optimal Ev Charging In The Energy Management of Electric Railway Stations**

Georgia Pierrou; Gabriela Hug, ETH Zurich, Switzerland

**434. Assessment of The Hosting Capacity of A Suburban Area For A Fleet of Electric Vehicles With Uncoordinated and Optimized Charging Strategies**

Alexandra Varets; Elena Gryazina, Skolkovo Institute of Science and Technology, Russia

**09:00-10:30 S22 - Energy Storage II****A | Pacific****28. Can Locational Disparity of Prosumer Energy Optimization Due To Inverter Rules Be Limited?**

Deepjyoti Deka, Los Alamos National Lab, United States; Ana Busic, INRIA and ENS, France; Md Umar Hashmi; Dirk Van Hertem, KU Leuven & EnergyVille, Belgium

**134. Lithium-Ion Battery Management System With Reinforcement Learning For Balancing State of Charge and Cell Temperature**

Katharina Harwardt; Jun-Hyung Jung; Hamzeh Beiranvand; Dirk Nowotka; Marco Liserre, Kiel University, Germany

**391. Evaluation of Ramp-Rate Limitation At Distribution Transformer Level Via Central and Distributed Storage Systems**

Kyriaki-Nefeli D. Malamaki, Independent Power Transmission Operator, Greece; Miloš Cvetković; Aihui Fu, Delft University of Technology, Netherlands; Juan Manuel Mauricio, Universidad de Sevilla, Spain; Charis S. Demoulias, Aristotle University of Thessaloniki ELKE APTh, VAT EL090049627- D' DOI Thessalonikis, Greece

**392. Optimal Storage Allocation For Transmission Network Development Planning: Study Case of Sicily**

Fabio D'Agostino; Bruno Gabriele; Gabriele Mosaico; Matteo Saviozzi; Federico Silvestro, University of Genova, Italy

**407. Critical Assessment of The Explicit Methods For State of Charge Calculation In Vanadium Redox Flow Batteries**

Sergei Parsegov; Mikhail Pugach; Victoria Erofeeva; Federico Ibanez; Vladimir Terzija, Skolkovo Institute of Science and Technology, Russia

**420. Control of Mmc-Based Grid-Forming Statcom With Dc Supercapacitors For Energy Storage**

Eros Avdiq; Jef Beerten, KU Leuven, Belgium

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**09:00-10:30**    **SS17 Offshore Energy Islands/Hubs**    **D | A. Mediterranean**

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**09:00-10:30**    **SS18 Challenges and demands of medium voltage technologies for renewable installations and environment impact**    **E | Aegean Baltic**

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**10:30-11:00**    Coffee Break

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**11:00-12:30**    **S23 - Optimal power flow**    **B | Atlantic**

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**258. Fast Data-Driven Chance Constrained Ac-Opf Using Hybrid Sparse Gaussian Processes**

Mile Mitrovic; Aleksandr Lukashevich; Petr Vorobev; Vladimir Terzija, Skolkovo Institute of Science and Technology, Russia; Yury Maximov; Deepjyoti Dekka, Los Alamos National Laboratory, United States

**259. Affine and Exact Reformulations of Uncertainty Aware Energy and Reserve Dispatch**

Estibalitz Ruiz Irusta, University of Luxembourg, Luxembourg; Adriano Arrigo; Zacharie De Grève, University of Mons, Belgium

**341. A Robust Penalty-Based Approach To Optimal Reactive Power Dispatch With Discrete Controls**

Elnaz Davoodi; Florin Capitanescu, Luxembourg Institute of Science and Technology, Luxembourg

**418. End-To-End Learning With Multiple Modalities For System-Optimised Renewables Nowcasting**

Rushil Vohra; Ali Rajaei; Jochen Cremer, TU Delft, Netherlands

**419. Enriching Neural Network Training Dataset To Improve Worst-Case Performance Guarantee**

sRahul Nellikkath; Spyros Chatzivasileiadis, Technical University of Denmark, Denmark

**448. Mana-Based Load-Flow Solution For Islanded Ac Microgrids**

Nasim Rashidirad; Jean Mahseredjian, Polytechnique Montreal, Canada; Ilhan Kocar; Ulas Karaagac, Hong Kong Polytechnic, Hong Kong

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**11:00-12:30**    **S24 - Energy Market**    **C | Atlantic**

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**201. Locational Market Power of Small Generators In Electricity Markets With Lmp and System Constraints**

Aleksei Seleznev, SKM Market Predictor AS, Norway; Marina Dolmatova, Association NP Market Council, Russia

**219. Development of Coordinated Control of Pv and Distributed Resources: Optimization of Contracted Power, Re Utilization Rate and Economic Efficiency**

Yutaro Ishii; Hideo Ishii; Yaushiro Hayashi; Koroki Dan; Ryunosuke Hayashi; Ayumu Miyasawa, Tokyo Gas Co., Ltd, Japan; Kiyoshi Shima; Ryuichi Tamura, OBAYASHI CORPORATION, Japan

**227. Gpu Optimisation of An Endogenous Peer-To-Peer Market With Product Differentiation**

Beatrice THOMAS; Abdelhafid EL OUARDI; Samir BOUAZIZ, Université Paris-Saclay ENS Paris-Saclay, CNRS, SATIE, France; Roman LE GOFF LATIMIER; Hamid BEN AHMED, UniR SATIE, ENS Rennes, CNRS, France

**229. Day-Ahead Zonal Electricity Price Forecasting Using 1d-Lstm With Neighbouring Zones Data**

Surender Redhu; Bernt A. Bremdal, Smart Innovation Norway AS, Norway

**296. Deep Learning-Based Imbalance Market Price Range Predictions In The Day-Ahead Horizon**

Ayman Esmat, TenneT, Netherlands; Sander Tijm, KNMI, Netherlands; Ibtihal Abdelmottaleb; Madeleine Gibescu, Copernicus Institute of Sustainable Development, Netherlands

**461. Off-Shore Bidding Zones Under Flow-Based Market Coupling**

Kenneth Bruninx, TU Delft, Netherlands; Fernando Dominguez, VITO, Belgium; Michiel Kenis; Erik Delarue, KU Leuven, Belgium

**11:00-12:30**    **S25 - AMI and power system monitoring**

**E | Aegean Baltic**

**75. A Review of Smart Meter Data Analytics For Distribution Network Applications**

Christos Athanasiadis; Theofilos Papadopoulos, Democritus University of Thrace, Greece; Georgios Kryonidis, Aristotle University of Thessaloniki, Greece

**82. Scalability Analysis of A Wireless M-Bus System For Smart Metering and Sensoring**

Néstor Rodríguez-Pérez; Javier Matanza Domingo; Gregorio López López, Institute for Research in Technology, Comillas Pontifical University, Spain; Mitra Hajigholi, Kiona, Sweden

**167. Two-Stage Event-Driven Nilm Utilizing Odd Harmonic Distortion**

Petros G. Papageorgiou; Georgios C. Christoforidis; Aggelos S. Bouhouras, University of Western Macedonia, Greece

**268. Data Rate Prediction For Broadband Powerline Communication Based On Machine Learning**

Philipp Lutat; Anas Laribi; Ömer Sen; Marcel Kurth; Immanuel Hacker; Andreas Ulbig, IAEW at RWTH Aachen University, Germany

**430. Analysis of Smart Meter Data and Impacts On Large-Scale Power Distribution Networks**

Surendra Bajagain; Anamika Dubey, Washington State University, United States

**456. Profitable Sensor Network Design In The Distribution Grid**

Sylvie Koziel; Patrik Hilber, KTH Royal Institute of Technology, Sweden

**11:00-12:30**    **SS19 Contemporary and emergent methods for planning and analysis of distribution networks**

**D | A.Mediterranean**

**11:00-12:30**    **SS20 Open-source tools for future power systems – ATTEST Project**

**A | Pacific**

**12:40-14:10**    **S26 - Frequency Control II**

**C | Atlantic**

**220. System Identification Based Grid Agnostic Adaptive Droop Control Strategy**

Prashant Pant; Thomas Hamacher; Vedran Peric, Technical University of Munich, Germany; Federico Martin Ibanez, Skolkovo Institute Science and Technology, Russia

**244. Nonlinear Stability Assessment of Type-4 Wind Turbines During Unbalanced Grid Faults Based On Reduced-Order Model**

Sujay Ghosh; Mohammad Kazem Bakhshizadeh; Łukasz Kocewiak, Ørsted Wind Power, Denmark; Guangya Yang, Technical University of Denmark, Denmark

**245. Quantitative Effect of The Inertia Emulation Block of Grid-Forming Inverters On Frequency Stability**

Dai Orihara; Hiroshi Kikusato; Hisao Taoka, National Institute of Advanced Industrial Science and Technology, Japan; Akihisa Kaneko; Ryosuke Shikuma; Yasuhiro Hayashi, Waseda University, Japan

**278. Adaptive Day-Ahead and Intra-Day Frequency Restoration Reserves Calculation Methodology For Electricity Balancing Markets**

Yannis Kampouris; Panos Mandoulidis; Giorgos Prionistis, Independent Power Transmission Operator, Greece

**292. Effective Inertia Constant: A Frequency-Strength Indicator For Converter-Dominated Power Grids**

Paul Imgart; Peiyuan Chen, Chalmers University of Technology, Sweden

**307. The Impact of Res Curtailment Strategies For Congestion Avoidance On The Dynamic Frequency Performance of Low-Inertia Systems**

Phivos Therapontos, Electricity Authority of Cyprus, Cyprus; Petros Aristidou, Cyprus University of Technology, Cyprus

**12:40-14:10 S27 - Flexibility in microgrids II**

**E | Aegean Baltic**

**48. Multi-Agent Deep Reinforcement Learning For Coordinated Energy Trading and Flexibility Services Provision In Local Electricity Markets**

Yujian Ye; Yi Tang; Quan Yuan, Southeast University, China; Dimitrios Papadaskalopoulos, University of Patras, Greece; Goran Strbac, Imperial College London, United Kingdom

**97. The Influence of Different Network Tariffs On Distribution Grid Reinforcement Costs**

Ladina Kundert; Anya Heide; Gabriela Hug, ETH Zurich, Switzerland

**165. Grid Reinforcement Costs With Increasing Penetrations of Distributed Energy Resources**

Anya Heide; Ladina Kundert; Gabriela Hug, ETH Zurich, Switzerland; Birgit Schachler, Reiner Lemoine Institute gGmbH, Germany;

**177. Clearing and Pricing For Network-Aware Local Flexibility Markets Using Distributed Optimization**

Saber Talari; Wolfgang Ketter, University of Cologne, Germany; Thorsten Schneiders; Sascha Birk, University of Applied Sciences Cologne, Germany; Daniel Gebbran, Equilibrium Energy, United States

**362. Data-Driven Demand-Side Flexibility Quantification: Prediction and Approximation of Flexibility Envelopes**

Nami Hekmat; Thierry Zufferey; Gabriela Hug, Power Systems Laboratory, ETH Zurich, Switzerland; Philipp Heer; Hanmin Cai, Urban Energy Systems Laboratory, Empa, Switzerland;

**389. Quantification Method For The Potential Downward Flexibility of Full-Electric Heat Pumps During Congestion Events**

Bart van der Holst; Gijs Verhoeven; Phuong Nguyen; Koen Kok, Eindhoven University of Technology, Netherlands; Michel Emde; Jorrit Nutma; Sebastiaan la Fleur, TNO, Netherlands

**12:40-14:10 S28 - High voltage DC networks**

**B | Atlantic**

**26. Virtual Resistance Control For Sequential Green-Start of Offshore Wind Power Plants**

Anubhav Jain, Vestas, Portugal; Jayachandra N. Sakamuri, Hitachi Energy Denmark A/S, Denmark; Nicolaos A. Cutululis; Oscar Saborío-Romano, Technical University of Denmark, Denmark

**103. A Lightning Stroke Identification Method For Hvdc Transmission Line Protection**

Zhen Liu; Houlei Gao; Lin Li; Fang Peng, School of Electrical engineering, Shandong University, China

**164. Single-Ended Dc Fault Location Method For Mmc-Based Hvdc Power System Using Adaptive Multi-Step Levenberg-Marquardt Algorithm**

Le Liu; Fan Xie; Marjan Popov; Aleksandra Lekic, IEPG, Faculty of EEMCS, Delft University of Technology, Netherlands; Zhiguo Hao, School of Electrical Engineering, Xi'an Jiaotong University, China;

**266. Impact of Structural Design of Dc Distribution Grids On Reliability of Supply**

Julian Saat; Ruben Fürs; Sebastian Stein; Andreas Ulbig, RWTH Aachen University, Germany; Maxim Müllender, RWTH Aachen University, Belgium

**320. Control of Mmc-Based Isolated Dc/dc Converter For Hvdc Tapping**

Qi Zhang; Filipe Faria da Silva, AAU Energy, Aalborg University, Denmark; Roni Irnawan; Rian Fatah Mochamad, Department of Ele. and Inf. Engineering, Gadjah Mada University, Indonesia

**444. Experimental and Analytical Evaluation of Equipment Sensitivity To Dc Voltage Ripple and Ac Voltage Sags**

Joy Yao; Shuyang Zhu; Paul Judge; Sasa Djokic, The University of Edinburgh, United Kingdom

**12:40-14:10 S29 - Multi-energy Systems**

**D | Adriatic Mediterranean**

**130. Coupled Multi-Energy Grid Planning - Paving The Way From Isolated To Integrated Planning**

Merlin Engel, Innovation Management, Stromnetz Hamburg GmbH, Germany; Jonathan Vieth; Arne Speerforck, Institute of Engineering Thermodynamics, Hamburg University of Technology, Germany; Johannes Heise; Christian Becker; Marwan Mostafa; Davood Babazadeh, Institute of Electric Power and Energy Technology, Hamburg University of Technology, Germany

### **239. Modeling of Multi-Energy Systems As Multilayer Networks**

Carmela Bernardo, Linköping University, Sweden; José Luis Domínguez-García; Antonio Pepiciello, Catalonia Institute for Energy Research, Spain

### **240. Modeling and Sizing of A Hydrogen Bus Refueling Infrastructure -- A Case Study For Reunion Island**

Agnès François; Robin Roche, FEMTO-ST Institute, FCLAB, Univ. Bourgogne Franche-Comté, UTBM, CNRS, France; Dominique Grondin; Michel Benne, ENERGY-lab, Université de La Réunion, France

### **345. Sizing of An Integrated Power Supply System With An Electrolyzer and A Hydrogen-Fueled Gas Turbine**

Fatimatou Wade; Robin Roche; Damien Paire, Femto-ST Institute, FCLAB, Univ. Bourgogne Franche-Comté, UTBM, CNRS, France; Alexandre Chailan, GE Gas Power, 20 Avenue du Maréchal Juin, BP 379, France; Vincent Bertrand, CRESE EA3190, Université de Franche-Comté, France

### **393. Integration of Hydrogen In Sequential Monte Carlo Power Systems Adequacy Assessment**

François Vallée, UMONS, Belgium; Aurélia Hernandez; Emmanuel De Jaeger, UCLouvain, Belgium

### **405. Techno-Economic Analysis of Low-Temperature Electrolysis' Waste-Heat Utilization**

Thomas Swarts; Johan Morren; Wouter van den Akker; Han Slootweg, Eindhoven University of Technology, Netherlands; Arjan van Voorden, Stedin, Netherlands

## **12:40-14:10 SS21 Young Professionals Panel Session on Future Power System Workforce**

**A | Pacific**

## **15:30-17:00 S30 - Frequency Control III**

**C | Atlantic**

### **8. A Stability Analysis of Hybrid Control System Based On Microgrid Considering Asymmetric Synthetic Inertia With Time Delay**

Jingting Qi; Takao Tsuji, Yokohama National University, Japan; Yosuke Nakanish, Waseda University, Japan; Yoshinobu Ueda, Meidensha Corporation, Japan

### **10. A Non-Intrusive Approach For Enhancing Power-System Frequency Stability**

Tadej Skrjanc; Rafael Mihalic; Urban Rudez, University of Ljubljana, Faculty of Electrical Engineering, Slovenia

### **20. Design and Comparison of Ufls Schemes of Isolated Power Systems Based On Frequency Stability Margin**

Mónica Vadillo; Lukas Sigrist, Universidad Pontificia Comillas, Spain; Urban Rudez, Univerza v Ljubljani, Slovenia

### **94. Non-Linear, Bivariate Stochastic Modelling of Power-Grid Frequency Applied To Islands**

Leonardo Rydin Gorjão, Faculty of Science and Technology, Norwegian University of Life Sciences, Norway; G. Cigdem Yalcin, Department of Physics, Istanbul University, Turkey; Oliver Kamps, Center for Nonlinear Sciences (CeNoS), University of Münster, Germany; Veit Hagenmeyer; Ulrich Oberhofer; Benjamin Schäfer, Institute for Automation and Applied Informatics, Karlsruhe Institute of Technology, Germany

### **382. Identification of Important Locational, Physical and Economic Dimensions In Power System Transient Stability Margin Estimation**

Robert Hamilton; Panagiotis Papadopoulos; Waqqas Bukhsh; Keith Bell, University of Strathclyde, United Kingdom

### **426. Distributed Frequency Control and Congestion Management With Coupling Inter-Area Constraints**

Oleg O. Khamisov; Vladimir Terzija, Skolkovo Institute of Science and Technology, Russia

## **15:30-17:00 S31 - Load flow and power quality**

**B | Atlantic**

### **92. Overview of Data-Driven Power Flow Linearization**

Mengshuo Jia; Gabriela Hug, ETH Zurich, Switzerland

### **135. Solving Ac Power Flow With Graph Neural Networks Under Realistic Constraints**

Luis Böttcher; Hinrikus Wolf; Bastian Jung; Philipp Lutat; Marc Trageser; Andreas Ulbig; Martin Grohe, RWTH Aachen University, Germany; Oliver Pohl, Schleswig Holstein Netz AG, Germany; Xiaohu Tao, E.ON SE, Germany

### **146. Harmonic Power-Flow Study of Hybrid Ac/dc Grids With Converter-Interfaced Distributed Energy Resources**

Johanna Kristin Maria Becker; Yihui Zuo; Mario Paolone, EPFL, Switzerland; Andreas Martin Kettner, PSI Neplan AG, Switzerland

**378. Power Flow Algorithm Using A Second Order Differentiation Approach**

FRANCISCO ECHAVARREN; LUIS ROUCO; ÁLVARO BENÍTEZ; LUKAS SIGRIST, Universidad Pontificia Comillas. Escuela Técnica Superior de Ingeniería ICAI. Instituto de Investigación Tecnológica., Spain

**413. An Optimal Scheduling Tool For The Realization of On-Shore Power Supply At Seaports With Limited Power Supply From The Distribution Grid**

George Konstantinidis; Alexandros Paspatis; Emmanuel Karapidakis, Hellenic Mediterranean University, Greece

**433. Proportional Multiresonant Controller With Automatic Gains Adjustment For Grid-Connected Inverters**

Ilya Veretennikov; Yaroslav Vlasov; Federico Ibanez; Vladimir Terzija, Skolkovo Institute of Science and Technology (Skoltech), Russia; Ahmad Ali Nazeri, University of Kassel, Germany

15:30-17:00 **S32 - Modelling and Control**

**A | Pacific**

**74. A Multi-Objective Home Energy Management System Based On Non-Intrusive Load Monitoring and Heat Pump Control**

Christos Athanasiadis; Theofilos Papadopoulos, Democritus University of Thrace, Greece; Georgios Kryonidis, Aristotle University of Thessaloniki, Greece

**149. Pseudo-Worst-Case Forecast With Neural Networks In Low Voltage Grids**

Razieh Balouchi; Ulf Häger, Technical University Dortmund, Germany; Wolfram Wellßow, University of Kaiserslautern, Germany

**173. Data Driven System Identification For Solid Oxide Fuel Cell Systems**

Florian Strobel; Davood Babazadeh; Christian Becker, Institute of Electrical Power and Energy Technology, Hamburg University of Technology, Germany

**247. Methods Comparison For Load Sensitivity Identification**

Maeva Courcelle; Qiucen Tao; Johanna Geis-Schroer; Thomas Leibfried; Giovanni De Carne, Karlsruhe Institute of Technology, Germany; Sergio Bruno, Politecnico di Baro, Italy

**272. Ap-Gnn: Unsupervised Adaptive Distribution Grid-Level Representation Learning**

Yuzhou Chen, Temple University, United States; Miguel Heleno; Alexandre Moreira, Lawrence Berkeley National Laboratory, United States; Yulia R. Gel, University of Texas at Dallas, United States

**358. M-Class Pmu For General Purpose Embedded Controllers In Ni Veristand Environment**

Anurag Mohapatra; Steffen Büttner; thomas hamacher; vedran peric, Technical University of Munich, Germany

15:30-17:00 **SS22 The role of Big data and AI for the secure operation of transmission systems**

**D | Adriatic Mediterranean**

15:30-17:00 **SS23 International collaborative projects for the energy transition and rural electrification in India**

**E | Aegean Baltic**

17:10-18:00

**CLOSING CEREMONY**



