

25
godina
years



13. SAVETOVANJE O ELEKTRODISTRIBUTIVNIM MREŽAMA
sa regionalnim učešćem

13th CONFERENCE ON ELECTRICITY DISTRIBUTION IN SERBIA
with regional participation

IZVEŠTAJ REPORT



12-16/09/2022, Kopaonik, Serbia





Organizator: Nacionalni komiteti CIREL Srbije u saradnji sa nacionalnim komitetom CIREL Crne Gore i drugim, kao i sa kompanijama i stručnjacima iz zemlje i regiona.

Nacionalni komitet CIREL Srbije je profesionalna i stručna organizacija, posvećena razmeni znanja i iskustva u oblasti distribucije električne energije. Okuplja istaknute stručnjake iz elektroprivrednih organizacija, elektrotehničkih fakulteta i instituta, projektnih, izvođačkih i proizvodnih organizacija sa teritorije Srbije i regiona.

www.ciredserbia.org.rs

Organized by: CIREL Liaison Committee of Serbia in cooperation with CIREL Montenegro and others, as well as with companies and experts from the country and the region.

CIREL Liaison Committee of Serbia is the professional and expert organization; dedicated to the exchange of knowledge and expertise in the technical field of electricity distribution. It gathers professionals and experts from power distribution companies, electrical engineering faculties, institutes and others from Serbia and the region.

www.ciredserbia.org.rs



Podrška: CIREL (Congrès International des Réseaux Electriques de Distribution) - Međunarodna konferencija za elektrodistribuciju, vodeći forum za susrete međunarodne elektrodistributivne zajednice.

Svrha CIREL-a je da radi na povećanju poslovne sposobnosti, veština i znanja onih koji učestvuju u aktivnostima CIREL-a. CIREL svake druge godine organizuje savetovanje i izložbu gde su postavljena najnovija dostignuća i najbolje prakse u tehnologiji i upravljanju tehničkom stranom elektrodistribucije. Između savetovanja CIREL organizuje posebne radne grupe na aktuelne teme koje su od ključnog značaja za elektrodistributivnu zajednicu.

www.cired.net

Supported by: CIREL (Congrès International des Réseaux Electriques de Distribution) - International Conference on Electricity Distribution, the leading forum for international electricity distribution community meets.

CIREL works for the purposes of increasing the business relevant competencies, skills and knowledge of those participating in CIREL's activities. CIREL offers a biennial conference and exhibition where developments and best practices in technology and management of the technical side of electricity distribution are presented. Between conferences CIREL may organize specific Working Groups on current subjects of key interest to the electricity distribution community.

www.cired.net

Ciljevi savetovanja

Zemlje regiona se nalaze na sličnom tehničkom nivou razvoja i prakse distribucije električne energije i sa sličnim problemima u eksploataciji i upravljanju distributivnim mrežama. Zemlje regiona se nalaze na različitim stepenima procesa restrukturiranja, deregulacije i privatizacije elektroprivrede, ali pred istim ili sličnim izazovima otvaranja tržišta električne energije. Savetovanje treba da obezbedi razmenu znanja i iskustva o zajedničkim problemima razvoja tehnologije, reorganizacije i modernizacije distribucije električne energije u regionu.

Conference objectives

Countries in the region are at the similar technical level and practice in electricity distribution with similar problems in operation and management of distribution networks. They are at different levels of restructuring, deregulation and privatization process of electric power industries but face the same or similar challenges in opening of electricity markets. The Conference aims to enable regional exchange of experience and practice in operation, management, organization, and modernization of electricity distribution.

ORGANIZACIONI ODBOR / ORGANIZING COMMITTEE

Zoran Simendić, predsednik CIREC Srbije / *Chairman of CIREC LC of Serbia*
Goran Radovanović, Elektrodistribucija Srbije d.o.o. Beograd / *Electric Power Distribution, Belgrade*
Dragoslav Jovanović, član CIREC Srbije / *Member of CIREC LC of Serbia*
Slobodan Kujović, član CIREC Srbije / *Member of CIREC LC of Serbia*
Saša Stefanović, Elektrodistribucija Srbije d.o.o. Beograd / *Electric Power Distribution, Belgrade*
Marija Erdeljan, Tehnički sekretar CIREC Srbije / *Technical Secretary of CIREC LC of Serbia*

PROGRAMSKI ODBOR / PROGRAM COMMITTEE

dr Vladimir ŠILJKUT, JP Elektroprivreda Srbije / *PE Electric Power Industry of Serbia*
Prof. dr Vladimir KATIĆ, Fakultet tehničkih nauka, Novi Sad / *Faculty of Technical Sciences, NS*
mr Dušan VUKOTIĆ, Elektrodistribucija Srbije d.o.o. Beograd / *Power Distribution of Serbia Belgrade*
dr Željko POPOVIĆ, Fakultet tehničkih nauka, Novi Sad / *Faculty of Technical Sciences, Novi Sad*
dr Aleksandar JANJIĆ, Elektronski fakultet, Niš / *Electronic Faculty, Nis*
dr Nenad KATIĆ, Fakultet tehničkih nauka, Novi Sad / *Faculty of Technical Sciences, Novi Sad*

UVODNA REČ / INTRODUCTORY WORD

XIII SAVETOVANJE O ELEKTRODISTRIBUTIVNIM MREŽAMA SRBIJE sa regionalnim učešćem koje se organizuje pod pokroviteljstvom CIREC - Međunarodne konferencije za elektrodistribuciju, a od strane Nacionalnog komiteta CIREC održano je na Kopaoniku, u Hotelu Grand, od 12. do 16. septembra 2022. godine.

Kao i prethodnih godina, Savetovanje je i ove godine imalo kako naučno-stručnog tako i komercijalnog sadržaja. Od 102 prijavljena rada prihvaćeno je 87 radova, dok je prateća izložba okupila 60 kompanija.

Prema izvedenim podacima na skupu je prisustvovalo 675 registrovanih učesnika, kako autora referata i predstavnika firmi koje su učestvovala u komercijalnoj izložbi, tako i onih zainteresovanih za izlaganja autora ili posetu izložbi.



Sastanak izvršnog odbora CIREC SRBIJA održan je u okviru Savetovanja, 15. septembra.

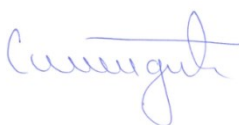
XIII CONFERENCE ON ELECTRICITY DISTRIBUTION IN SERBIA with regional participation, supported by CIREC, the International Conference on Electricity Distribution and organized by CIREC Liaison Committee of Serbia was held in Grand Hotel, Kopaonik, September 12-16, 2022.

As in previous years, the Conference consisted of both scientific and commercial content. From 102 submitted papers 87 have been accepted. The exhibition gathered 60 companies.



According to collected data the Conference was attended by 675 registered participants, including paper authors, representatives of the exhibiting companies, and participants showing interest in both papers and the exhibition.

The meeting of the Executive Committee of CIREC SERBIA was held during the Conference, September 15.



Predsednik Nacionalnog komiteta CIREC Srbije

President of the CIREC Liaison Committee of Serbia

DR ZORAN SIMENDIĆ

SVEČANO OTVARANJE / OPENING CEREMONY

XIII savetovanje o elektrodistributivnim mrežama Srbije sa regionalnim učešćem otvoreno je na svečanoj ceremoniji u Hotelu Grand 12. septembra 2022. godine u 18:00 časova. Ceremoniji otvaranja prisustvovalo je preko 350 ljudi.



Darko KARAPANDŽIĆ, Elektroprivreda Srbije d.o.o. Beograd, zvanično je otvorio XIII Savetovanje.

Predsednik Nacionalnog komiteta CIREC Srbija, dr **Zoran SIMENDIĆ**, održao je kratak uvodni govor kojim je poželio dobrodošlicu svim učesnicima i sponzorima.

Skup su pozdravili i:



Jovica VLATKOVIĆ, vršitelj dužnosti izvršnog direktora za razvoj i investicije Mješovitog Holdinga Elektroprivrede Republike Srpske

Rajko RADOŠEVIĆ, predsednik Odbora Crnogorskog elektrodistributivnog sistema

Nebojša PETROVIĆ, savetnik generalnog direktora za tehnička pitanja Akcionarskog društva Elektromreža Srbije i predsednik CIGRE Srbija

The XIII Conference on Electricity Distribution of Serbia with regional participation was opened at the official ceremony in the Hotel Grand on September 12, 2022, at 18h. More than 350 participants were present.

Darko KARAPANDŽIĆ, Power Distribution of Serbia, Belgrade, has officially opened the XIII Conference.

President of CIREC Liaison committee of Serbia, **Zoran SIMENDIĆ, PhD** gave a short introductory speech welcoming all the participants and sponsors.

The introductory words were also given by:

Jovica VLATKOVIĆ, acting executive director of MH Elektroprivreda Republike Srpske



Rajko RADOŠEVIĆ, president of the Board of power distribution systems of Montenegro



Nebojša PETROVIĆ, representative of AD Elektromreža Srbije and president of CIGRE Serbia

Prema tradiciji na Svečanom otvaranju dodeljene su ovim povodom po prvi put statue, umesto plaketa, za doprinos Savetovanju pokroviteljima i sponzorima.



Za doprinos razvoju CIREDBelgium Savetovanja u Srbiji:
Prof. dr Jovica MILANOVIĆ, Univerzitet u Mančesteru

Generalni pokrovitelj Savetovanja:
Darko KARAPANŽIĆ, za Elektrodistribuciju Srbije

Pokrovitelj savetovanja:
Jovica VLATKOVIĆ, MH Elektroprivreda Republike Srpske

Generalni sponzor Savetovanja:
Vladimir POPOVIĆ, Energize, Beograd

Zlatni sponzori Savetovanja:
Aleksandar ĆOSIĆ, ABB, Beograd
Uroš IVANOVIĆ, COMEL
Zoran KUKOBAT, ELNOS Grupa
Mihailo DIVAC, GE Grid Solutions
Franci ČUČNIK, Iskraemeco, Slovenija
Igor VUJIČIĆ, Meter&Control
Nevena ĐUKIĆ, MT-Komex
Ksenija KARIĆ, Schneider Electric
Medeja LONČAR, Siemens



Veliki sponzori Savetovanja:
Jasmina POPOVIĆ, DNP-Inženjering
Bratislav CVETKOVIĆ, Energotehnika Južna Bačka
Predrag NOVAKOVIĆ, MARTI Komerc
Aleksandar BOGAVAC, Minel TRAFO
Goran ŠVENDA, Schneider Electric HUB Novi Sad
Zoran RABRENOVIĆ, Weidmüller
Marija PAUNOVIĆ, SNE Energy
Jadranka ŠUPICA, SOMBORELEKTRO
Nikola POPOVIĆ, SRC Soft i Infoprojekt

Zahvalnost je iskazana i Hotelu Grand, kao izvrsnom domaćinu i tim povodom uručena je statua **g. Radošu ĐORĐEVIĆU**, direktoru hotela.

Following the tradition of the CIREDBelgium conference, statues, instead of acknowledgements, were handed for contribution to the Conference to endorserers and sponsors.

For contribution to CIREDBelgium Conferences in Serbia:
Prof. Jovica MILANOVIĆ, PhD, University of Manchester

General Endorser of the Conference:
Darko KARAPANŽIĆ, for Powerdistribution company of Serbia

Endorser of the Conference:
Jovica VLATKOVIĆ, Elektroprivreda Republike Srpske

General sponsor:
Vladimir POPOVIĆ, Energize, Belgrade

Golden Sponsors:
Aleksandar ĆOSIĆ, ABB, Belgrade
Uroš IVANOVIĆ, COMEL
Zoran KUKOBAT, ELNOS Group
Mihailo DIVAC, GE Grid Solutions
Franci ČUČNIK, Iskraemeco, Slovenia
Igor VUJIČIĆ, Meter&Control
Nevena ĐUKIĆ, MT-Komex
Ksenija KARIĆ, Schneider Electric
Medeja LONČAR, Siemens



Great Sponsors:
Jasmina POPOVIĆ, DNP-Inženjering
Bratislav CVETKOVIĆ, Energotehnika Južna Bačka
Predrag NOVAKOVIĆ, MARTI Komerc
Aleksandar BOGAVAC, Minel TRAFO
Goran ŠVENDA, Schneider Electric HUB Novi Sad
Zoran RABRENOVIĆ, WEIDMUEILER
Marija PAUNOVIĆ, SNE Energy
Jadranka ŠUPICA, SOMBORELEKTRO
Nikola POPOVIĆ, SRC Soft - Infoprojekt

The statue was also given to **Mr. Radoš ĐORĐEVIĆ**, director of Grand Hotel, as gratitude for excellent hospitality and service.

UVODNA PREDAVANJA / INTRODUCTORY LECTURES



IZAZOVI PRELASKA NA DISTRIBUTIVNE MREŽE SA NEUTRALNOM EMISIJOM GASOVA STAKLENE BAŠTE I PREUZIMANJA ULOGA OPERATORA DISTRIBUTIVNOG SISTEMA

CHALLENGES OF TRANSITION TO NET-ZERO DISTRIBUTION NETWORKS AND DISTRIBUTION SYSTEM OPERATION

Prof. Jovica V. MILANOVIĆ, Dipl.Ing., MSc, PhD, DSc, FIET, FIEEE, The University of Manchester

Jovica V. Milanović je stekao zvanje dipl. inženjera i M.Sc na Univerzitetu u Beogradu, Jugoslavija, zvanje doktora nauka na Univerzitetu u Njukasl u Australiji, i D.Sc. diplomu pri Univerzitetu u Mančesteru u Velikoj Britaniji. Pre nego što se pridružio Univerzitetu u Mančesteru, u Velikoj Britaniji, 1998. radio je sa "Energoprojektom" inženjering i konsalting Co. i Univerzitetom u Beogradu u Jugoslaviji, i Univerzitetima Njukasl i Tasmanija u Australiji.

Trenutno je profesor elektrotehnike i zamenik načelnika Katode za elektrotehniku i elektronsko inženjerstvo univerziteta u Mančesteru, u Velikoj Britaniji i gostujući profesor na Univerzitetu u Novom Sadu i Univerzitetu u Beogradu, u Srbiji. Bio je predsednik 5 međunarodnih konferencija, urednik ili član uredničkih/tehničkih odbora 70+ međunarodnih časopisa i konferencija, procenitelj istraživačkog projekta ili član panela za brojne savete za finansiranje međunarodnih vladinih istraživanja, član 9 (konsolidatora 3) prošlih ili sadašnjih IEEE/CIGRE/CIREG RG i konsultant ili član savetodavnih odbora za nekoliko međunarodnih kompanija. Profesor Milanović je učestvovao ili vodio brojne istraživačke projekte ukupne vrednosti veće od 80 miliona funti, objavio oko 600 istraživačkih radova i izveštaja, održao oko 30 uvodnih govora na međunarodnim konferencijama i predstavio oko 150 kurseva/tutorijala i predavanja industriji i akademskom auditorijumu širom sveta.

Profesor Milanović je ovlašćeni inženjer u Velikoj Britaniji, inostrani član Akademije inženjerskih nauka Srbije, saradnik IEEE, istaknuti predavač IEEE PES-a, član Odbora za tehničku podršku IEEE PES industrije, član IEEE PES-a za dugoročno planiranje, član IEEE Odbora počasnih članova i glavni i odgovorni urednik IEEE transakcija u oblasti elektroenergetskog sistema. Bio je šest godina član Upravnog odbora IEEE PES-a kao regionalni predstavnik za Evropu, Bliski istok i Afriku, član i potpredsednik Komisije za procenu IEEE PES počasnih članova i član i predsednik IEEE Komisije Herman Halperin za dodelu nagrada u oblasti prenosa i distribucije.

Jovica V. Milanović received Dipl.Ing. and M.Sc. degrees from the University of Belgrade, Yugoslavia, Ph.D. degree from the University of Newcastle, Australia, and D.Sc. degree from The University of Manchester, UK. Prior to joining The University of Manchester, UK, in 1998, he worked with "Energoproject", Engineering and Consulting Co. and the University of Belgrade in Yugoslavia, and the Universities of Newcastle and Tasmania in Australia.

Currently, he is a Professor of Electrical Power Engineering and Deputy Head of Department of Electrical and Electronic Engineering at The University of Manchester, UK, and Visiting Professor at the University of Novi Sad and the University of Belgrade, Serbia. He was chairman of 5 international conferences, editor or member of editorial/technical boards of 70+ international journals and conferences, research project assessor or panel member for numerous international government research funding councils, member of 9 (convenor of 3) past or current IEEE/CIGRE/CIREG WG and consultant or member of advisory boards for several international companies. Professor Milanovic participated in or lead numerous research projects with total value of more than £80 million, published about 600 research papers and reports, gave about 30 key-note speeches at international conferences and presented about 150 courses/tutorials and lectures to industry and academia around the world.

Professor Milanovic is a Chartered Engineer in the UK, Foreign member of the Serbian Academy of Engineering Sciences, Fellow of the IET, Fellow of the IEEE, Distinguished IEEE PES Lecturer, member of the IEEE PES Industry Technical Support Leadership Committee, member of the IEEE PES Long Range Planning Committee, member of IEEE Fellows Committee and Editor-in-Chief of IEEE Transactions on Power Systems. He was a member of the IEEE PES Governing Board as Regional Representative for Europe, Middle East and Africa for six years, member and vice-chair of IEEE PES Fellows Evaluation Committee and member and Chair of the IEEE Herman Halperin Transmission and Distribution Award Committee.



SMANJENJE GUBITAKA U DISTRIBUTIVNOJ MREŽI U OKVIRU PRELASKA NA ODRŽIV AKTIVAN SISTEM

REDUCING LOSSES IN DISTRIBUTION NETWORKS DUE TO ACTIVE SYSTEM TRANSITION

Prof. dr Vladica MIJAILOVIĆ, dipl. inž. El, FTN Čačak

Vladica Mijailović je rođen u Kraljevu 1966. godine. Diplomirao je na Energetskom odseku Elektrotehničkog fakulteta u Beogradu 1991. godine, na temu kompenzacije reaktivne energije u distributivnim mrežama. Magistarski rad i doktorsku disertaciju je odbranio na istom fakultetu 1995. i 1999. godine, respektivno. I magistarski rad i doktorska disertacija su iz oblasti pouzdanosti distributivnih sistema.

Na Fakultetu tehničkih nauka u Čačku je zaposlen od 1991. godine. Prošao je sva saradnička i nastavnička zvanja. U novembru 2009. izabran je za redovnog profesora za užu naučnu oblast Elektroenergetika. Realizuje nastavu iz predmeta Razvodna postrojenja, Distribuirani izvori energije, Automatizacija i pouzdanost distributivnih sistema i Pouzdanost visokonaponskih postrojenja. Sva njegova dosadašnja istraživanja su vezana za oblast distribucije električne energije.

Vladica Mijailovic was born in Kraljevo in 1966. He graduated from the Energy Department of the Faculty of Electrical Engineering in Belgrade in 1991, on the topic of compensating for reactive energy in distribution networks. He received his master's and doctoral degree at the same faculty in 1995 and 1999, respectively. His master's work and doctoral dissertation are both in the field of reliability of distribution systems.

He has been employed at the Faculty of Technical Sciences in Čačak since 1991. He has been through all the collaborative and teacher titles. In November 2009, he was elected full professor for the narrower scientific field of Electroenergetics. He realizes classes from the subject of Distribution switchgear, Distributed Energy Sources, Automation and Reliability of Distribution Systems and Reliability of High Voltage Plants. All his research so far is related to the area of electricity distribution.



ANALITIKA VELIKIH PODATAKA ZA PREDVIĐANJE, UPRAVLJANJE I UBLAŽAVANJE PREKIDA

BIG DATA ANALYTICS FOR PREDICTING, MANAGING AND MITIGATING OUTAGES

Prof. Mladen KEZUNOVIĆ, Dipl.Ing., MSc, PhD, Texas A&M University

Mladen Kezunović je već 35 godina zaposlen na Univerzitetu Teksas A&M, sedištu koledža, TX, SAD, gde ima zvanje profesora (Regents Professor, Eugene E. Webb Professor) i direktora konzorcijuma Elektrotehničkog istraživačkog centra (Site Director of "Power Engineering Research Center"). On je već 30 godina i direktor XpertPower™ i Saradnika, konsultantske firme specijalizovane za modeliranje elektroenergetskog sistema i analitiku podataka. Njegova ekspertiza obuhvata oblast relejne zaštite, modeliranja kvarova, analize automatizovanog poremećaja elektroenergetskog sistema, računarske inteligencije, analize podataka i pametnih mreža. Autor/koautor je preko 600 radova, prezentiranih na preko 120 seminara, predavanja na poziv, i kratkim kursovima, i bio je konsultant za preko 50 kompanija širom sveta. Dr Kezunović je doživotni član IEEE i CIGRE, počasni i uvaženi član. On je registrovani profesionalni inženjer u Teksasu. Član je Američke nacionalne akademije za inženjerstvo.

Mladen Kezunovic has been with Texas A&M University, College Station, TX, USA, for 35 years, where he holds titles of Regents Professor, Eugene E. Webb Professor, and Site Director of "Power Engineering Research Center" consortium. He is also the Principal of XpertPower™ Associates, a consulting firm specializing in power system modeling and data analytics for the last 30 years. His expertise is in protective relaying, fault modeling, automated power system disturbance analysis, computational intelligence, data analytics, and smart grids. He has authored/co-authored over 600 papers, given over 120 seminars, invited lectures, and short courses, and consulted for over 50 companies worldwide. Dr. Kezunovic is an IEEE Life Fellow, and a CIGRE Fellow, Honorary and Distinguished Member. He is a Registered Professional Engineer in Texas. He is a member of the US National Academy of Engineering.

ZAKLJUČCI STRUČNIH KOMISIJA / EXPERT COMMITTEES CONSLUSIONS

STK 1 – KOMPONENTE MREŽA

Predsednik komisije: dr Vladimir ŠILJKUT
JP Elektroprivreda Srbije

Za XIII Savetovanje o elektrodistributivnim mrežama u organizaciji CIRE-SRBIJA, Stručna komisija 1 "KOMPONENTE MREŽA" prihvatila je ukupno 20 radova.

Za prvu preferencijalnu temu prihvaćeno je osam radova. Druga preferencijalna tema je razmatrana u tri rada. Bilo je pet radova koji se odnose na treću preferencijalnu temu. Za četvrtu preferencijalnu temu prihvaćeno je tri rada i jedna informacija, dok za petu nije bilo prijavljenih radova.



Nakon izlaganja radova doneti su sledeći zaključci:

1. Zaključci u vezi s održavanjem vodova, postrojenja i njihovih elemenata:
 - 1.1 Izbaciti iz upotrebe i tehničkih specifikacija za javne nabavke potporne izolatore tipa D (Ps), sa konusnom navojnom čaurom i bez nje, i zameniti ih potpornim izolatorima tipa R.
 - 1.2 Proizvođači štapnih i potpornih izolatora za nadzemne vodove treba da ispoštuju sve smernice tehničkih specifikacija IEC/TS 60815.
 - 1.3 Proizvođači mernih transformatora treba da razmotre unapređenja konstrukcija ovih uređaja kako bi se u praksi olakšala primena ultrazvučne metode ispitivanja parcijalnih pražnjenja, a kod inverznih strujnih transformatora, naponskih transformatora sa otvorenim magnetnim jezgrom i kombinovanih transformatora uzorkovanjem utvrdili potrebni nivoi pojačanja osetljivosti.
2. Zaključci u vezi sa projektovanjem, planiranjem radova, izgradnjom i modernizacijom vodova i postrojenja:
 - 2.1 Pri projektovanju novih i rekonstrukciji postojećih nadzemnih vodova, predviđati i u praksi sprovesti sve mere koje propisuje odgovarajuća evropska direktiva, tehnička regulativa i stručna literatura, kada je reč o zaštiti ptica od elektrokcije.
 - 2.2 Prilikom planiranja radova na elektrodistributivnim nadzemnim vodovima trasiranim paralelno sa prenosnim vodovima potrebno je analizirati uticaj indukovane elektromotorne sile, da bi se sagledali i procenili bezbednosni rizici koji zahtevaju primenu mera zaštite i ciljane obuke za bezbedan rad izvođača radova.
 - 2.3 Prilikom projektovanja novih stambenih i poslovnih objekata predvideti postavljanje kablovskih priključnih kutija tako da se povišene vrednosti magnetnog polja ne javljaju u stambenim i poslovnim prostorijama.

EC 1 – NETWORK COMPONENTS

Chairman: Vladimir ŠILJKUT, PhD
Electric Power Industry of Serbia

For the 13th Conference on Electricity Distribution organized by CIRE-SERBIA, the Expert Committee 1 "NETWORK COMPONENTS" has accepted a total of 20 papers.

Eight papers were accepted for the first preferential topic, The second preferential topic was discussed in three papers. Five papers were presented within subject three, while four within the fourth referential subject and no papers were submitted for the fifth preferential topic.



After presentations, following conclusions were made:

1. Conclusions regarding the maintenance of lines, plants and their elements:
 - 1.1 Remove from use and technical specifications for public procurement post insulators type D (Ps), with and without a conical screw sleeve, and replace them with post insulators type R.
 - 1.2 Manufacturers of long rod and post insulators for overhead lines should comply with all guidelines of the technical specification IEC/TS 60815.
 - 1.3 Manufacturers of metering transformers should consider improvements in the construction of these devices in order to facilitate the application of the ultrasonic partial discharge testing method in practice, and in the case of inverse current transformers, voltage transformers with an open magnetic core and combined transformers, the required sensitivity amplification levels can be determined by sampling.
2. Conclusions regarding the design, planning of works, construction and modernization of lines and facilities:
 - 2.1 When designing new and reconstructing existing overhead lines, anticipate and implement in practice all measures prescribed by the corresponding European directive, technical regulations and professional literature, when it comes to protecting birds against electrocution.
 - 2.2 When planning works on distribution overhead powerlines routed in parallel to transmission lines, it is necessary to analyze the influence of induced electromotive force, in order to recognise and assess the safety risks that require the application of protection measures and targeted training for safe work of contractors.
 - 2.3 When designing new residential and commercial buildings, foresee the placement of cable terminal boxes so that elevated values of the magnetic field do not occur in residential and commercial premises.

- 2.4 Prilikom ocene izloženosti ljudi magnetnom polju u blizini transformatorskih stanica 10(20)/0,4 kV primenjivati metodologiju zasnovanu na merenju i proračunu magnetne indukcije. Prilikom projektovanja i izgradnje novih transformatorskih stanica u zgradama, šinske ili kablovske veze energetskog transformatora SN/NN i NN table potrebno je postaviti na što većem rastojanju od zona povećane osetljivosti.
- 2.5 Preorijentisati se na mašinsko polaganje kablova uz primenu mera za smanjenje vučne sile na deonici trase kablova i smanjenje sile pritiska između koturača i kablova u krivinama trase.
- 2.6 U transformatorskim stanicama i razvodnim postrojenjima koja napajaju važnije potrošače, treba koristiti savremene sisteme za automatsko prebacivanje napajanja, poput sistema ATS (*Automatic Transfer Switch*), uz neophodne promene u postojećim podešenjima podnaponske zaštite.
3. Zaključci u vezi sa monitoringom, ispitivanjima, dijagnostikom i strategijom održavanja komponenti:
 - 3.1 Pri određivanju strujne opterećenosti voditi računa i o procesu starenja izolacije.
 - 3.2 Pri ispitivanju strujnih transformatora u pogonu, treba ubuduće primenjivati merne sisteme koji omogućavaju proveru njihove tačnosti pod naponom.
 - 3.3 Potrebno je sprovesti prva ispitivanja elektromagnetnog zračenja u zonama povećane osetljivosti:
 - (a) koje se nalaze neposredno pored ili iznad transformatorskih stanica u zgradama,
 - (b) kod kojih na spoljašnjoj strani zidova postoje kablovske priključne kutije.
4. Zaključci u vezi sa modelovanjem i primenom softverskih alata:
 - 4.1 Podsticati izradu, verifikaciju i korišćenje korisničkih programa za inženjerske proračune i projektovanje.
 - 4.2 Pri modelovanju i određivanju pozicije UHF davača za merenje parcijalnih pražnjenja, potrebno je sagledati uticaj stvarne konstrukcije energetskog transformatora na prostiranje elektromagnetnih UHF talasa iz izvora parcijalnih pražnjenja u električnoj izolaciji u sudu energetskog transformatora, od mesta njihovog nastajanja do prijemnih UHF antena.
 - 4.3 U cilju provere mehaničke i termičke izdržljivosti transformatora pri kratkom spoju, preporučuje se korišćenje programa za određivanje maksimalnih struja kratkog spoja koje se mogu javiti kroz namotaje transformatora, koji omogućava da se dobiju vrednosti struja kroz svaki od namotaja transformatora pri različitim tipovima kvara.
 - 4.4 Kao alternativu korišćenju komercijalnih, profesionalnih softvera za proračun uzemljivačkih sistema, preporučuje se upotreba softvera na bazi programske platforme zasnovane na tabelarnom pristupu.
- 2.4 When assessing the exposure of people to the magnetic field in the vicinity of 10(20)/0.4 kV transformer stations, apply a methodology based on measurement and calculation of magnetic induction. During the design and construction of new transformer stations in buildings, rail or cable connections of MV/LV power transformers and LV switchboards should be placed as far as possible from zones of increased sensitivity.
- 2.5 Switch to mechanical laying of cables with the application of measures to reduce the traction force on the section of the cable route and reduce the pressure force between the rollers and the cable in the bends of the route.
- 2.6 In transformer stations and switchgears that supply privileged consumers, state of the art systems for automatic power switching, such as the ATS (*Automatic Transfer Switch*) system, should be used, with necessary changes in the existing undervoltage protection settings.
3. Conclusions regarding monitoring, tests, diagnostics and component maintenance strategy:
 - 3.1 1 When determining the current carrying capacity, take into account the aging process of the insulation.
 - 3.2 When testing current transformers in operation, metering systems that allow checking their on-load accuracy should be applied in the future.
 - 3.3 It is necessary to conduct the first tests of electromagnetic radiation in zones of increased sensitivity:
 - (a) located immediately next to or above transformer stations in buildings,
 - (b) where there are cable terminal boxes on the outside of the walls.
4. Conclusions regarding modeling and application of software tools:
 - 4.1 Encourage the creation, verification and use of user programmes for engineering calculations and design.
 - 4.2 When modeling and determining the position of the UHF transmitter for measuring partial discharges, it is necessary to look into the influence of the actual construction of the power transformer on the propagation of electromagnetic UHF waves from the source of partial discharges in the electrical insulation in the power transformer vessel, from the place of their origin to the UHF-receive antennas.
 - 4.3 In order to check the mechanical and thermal durability of the transformer in the event of a short circuit, it is recommended to use a programme for determining the maximum short circuit currents that can occur through the windings of the transformer, which allows obtaining the values of the currents through each of the windings of the transformer for different types of failure.
 - 4.4 As an alternative to using commercial, professional software for the calculation of earthing systems, it is recommended to use a platform based tabular approach for embedded systems software development.

5. Zaključci u vezi s izradom i ažuriranjem tehničke regulative:

- 5.1 Inicirati formiranje radne grupe CIREĐ Srbije za tipizaciju postupka i standardizaciju opreme za uzorkovanje ulja iz energetske i merne transformatora.
- 5.2 Potrebno je inicirati rad na izradi standarda za generatore, energetske transformatore i prateće sklopove energetske elektronike, koji su sastavni elementi vetroelektrana.
- 5.3 Neophodno je započeti rad na ažuriranju Tehničkih preporuka Elektro distribucije Srbije.

5. Conclusions regarding the development and updating of technical regulations:

- 5.1 Initiate setting up the CIREĐ Serbia working group for procedure typification and standardization of equipment for oil sampling from power and metering transformers.
- 5.2 It is necessary to initiate work on the development of standards for generators, power transformers and supporting power electronics assemblies, which are integral elements of wind power plants.
- 5.3 It is necessary to start work on updating the Technical Recommendations of the Electricity Distribution of Serbia.

Najzapaženiji rad / The most prominent paper:



R-1.13

**ANALIZA NIVOA MAGNETSKE INDUKCIJE U STANU USLED UTICAJA NISKONAPONSKIH KABLOVSKIH PRIKLJUČNIH KUTIJA
ANALYSIS OF MAGNETIC FLUX DENSITY LEVELS IN THE APARTMENT DUE TO THE INFLUENCE OF LOW VOLTAGE CABLE TERMINAL BOXES**

Maja Grbić, Dejan Hrvić, Aleksandar Pavlović

Nagrada za tehničku inovaciju / Technical innovation award:



R-1.03

**VALIDACIJA MERENJA AMPLITUDNE I FAZNE GREŠKE VISOKONAPONSKIH STRUJNIH TRANSFORMATORA U POGONU BEZ PREKIDA ISPORUKE ELEKTRIČNE ENERGIJE
VALIDATION OF LIVE LINE MEASUREMENT OF AMPLITUDE AND PHASE DISPLACEMENT ERRORS OF HIGH-VOLTAGE CURRENT TRANSFORMERS WITHOUT INTERRUPTION OF ELECTRICITY SUPPLY**

Uroš Kovačević, Vladeta Milenković, Dragana Naumović-Vuković, Nenad Kartalović, Nenad Stojanović, Miodrag Stojanović

STK 2 - KVALITET ELEKTRIČNE ENERGIJE U ELEKTRODISTRIBUTIVNIM SISTEMIMA

Predsednik: Prof. dr Vladimir KATIĆ
Fakultet tehničkih nauka Univerziteta u Novom Sadu

Svi prijavljeni i dostavljeni radovi za STK 2 su recenzirani od strane kompetentnih recenzenata, a nakon recenzije, urađenih ispravki od strane autora i diskusije na Stručnoj komisiji, za izlaganje prihvaćeno je 8 radova kao referati. Stručna komisija referate je svrstala po preferencijalnim temama i to 7 radova u prvu, 1 rad u šestu preferencijalnu temu.



Nakon sesije, održan je sastanak STK 2 i doneti su sledeći zaključci:

1. Primeri dobre prakse vezane za slučajeve primedbi potrošača na nedovoljan kvalitet električne energije su od velikog značaja za sve inženjere u elektrodistribuciji. Ohrabriti inženjere da svaki ovaj slučaj opišu i prezentuju na stručnim konferencijama (CIREd i sl.), a poželjno je i formirati bazu podataka o ovim slučajevima. Na taj način bi se pomoglo da se budući slučajevi brže i lakše dijagnostikuju i poremećaji otklone.
2. Pojava flikera u mreži vezana je za rad velikih livnica i sličnih potrošača sa intermitentnim radom. Inicirati izradu studije za istraživanje uticaja ovih postrojenja na nivo flikera u mreži EPS-a i utvrditi zone sa mogućim negativnim uticajima.
3. Inicirati izradu studije istraživanja uticaja napajanih stanica za punjenje električnih vozila na kvalitet električne energije, posebno u domenu stabilnosti napona i generisanja viših harmonika (u opsezima od 150 Hz do 150 kHz).
4. Potrebno je dalje pratiti istraživanja uticaja prozumeri sa krovnim fotonaponskim elektranama male snage na rad lokalne distributivne mreže sa aspekta kvaliteta električne energije.
5. Predložiti Izvršnom odboru CIREd-a da kod odgovarajućih institucija inicira izradu studije koja bi sadržala i sveobuhvatna merenja parametara kvaliteta električne energije, posebno viših harmonika, u cilju sagledavanja novog stanja u distributivnoj mreži s obzirom na povećano prisustvo raznih vrsta nelinearnih potrošača, intenzivno priključivanje distribuiranih izvora, punionica električnih automobila i autobusa, te moguće pojave skladišta električne energije.

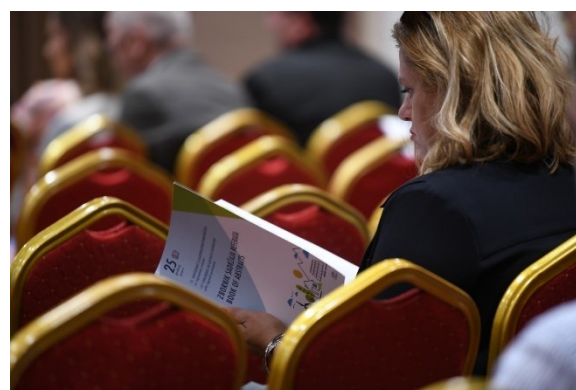
EC 2 - POWER QUALITY IN POWER DISTRIBUTION SYSTEMS

Chairman: Prof. Vladimir KATIĆ, PhD
Faculty of Technical Sciences, University of Novi Sad

All reported and submitted papers for EC 2 were reviewed by competent reviewers, and after review, corrections made by the author, and discussion at the Session, 8 papers were accepted as references. The Expert Commission classified the papers by preferential subjects, out of which 7 into preferential subject 1, and 1 paper into preferential subject 6.

After the session, a meeting was held, with following conclusions made:

1. Examples of good practice related to cases of consumer objections to insufficient quality of electrical energy are of great importance for all engineers in the field of electricity distribution. Encourage engineers to describe and present each of these cases at professional conferences (CIREd, etc.), as it is desirable to create a database of these cases. This would facilitate quicker diagnosis of future cases and elimination of disorders.
2. The flicker phenomenon in the network is related to the operation of large foundries and similar consumers with intermittent operation. Initiate the development of a study to investigate the impact of these plants on the flicker level in the EPS network and determine the zones of possible negative impacts.
3. Initiate the development of a research study on the impact of electric vehicle charging stations on the quality of electrical energy, especially in the domain of voltage stability and generation of higher harmonics (in the range from 150 Hz to 150 kHz).
4. It is necessary to further monitor the research of the impact of prosumers with low-power rooftop photovoltaic power plants on the operation of the local distribution network from the aspect of electrical energy quality.
5. Suggest to the Executive Board of CIREd that the appropriate institutions should initiate the development of a study that would include comprehensive measurement of electricity quality parameters, especially in terms of higher harmonics, in order to assess the new situation in the distribution network in view of the increased presence of various types of non-linear consumers, intensive connection of distributed sources, charging stations for electric cars and buses, and the possible phenomenon of electrical energy storage.



6. Pratiti iskustva i stručna rešenja vezano za zaštitu objekata i lica od atmosferskih prenapona, različitih načina uzemljenja i uzemljenih mreža, te uticaja parametara kvaliteta na održavanje i životni vek opreme u distributivnim mrežama.

6. Monitor experiences and professional solutions related to the protection of buildings and persons from atmospheric overvoltages, different methods of grounding and grounded networks, and the impact of quality parameters on the maintenance and lifetime of equipment in distribution networks.

Najzapaženiji rad / the most prominent paper:



R-2.01

ANALIZA ISPORUČENE ELEKTRIČNE ENERGIJE KDS "BARRY-CALLEBAUT - CHOCOLATE FACTORY NOVI SAD"
ANALYSIS OF DELIVERED POWER TO CUSTOMER "BARRY-CALLEBAUT - CHOCOLATE FACTORY NOVI SAD"

Milica Porobić, Dragan Cvetinov, Radislav Milankov, Ratko Rogan



STK 3 - ZAŠTITA I UPRAVLJANJE ELEKTRODISTRIBUTIVNIM MREŽAMA

Predsednik komisije: mr Dušan Vukotić
Elektrodistribucija Srbije d.o.o. Beograd

U okviru stručne komisije STK-3 prezentovano je ukupno 15 radova i informacija, od ukupno 16 referata i informacija, koji su uvršćeni u program ovogodišnjeg Savetovanja.



Nakon prezentacije radova doneseni su sledeći zaključci prema prezentovanim temama iz oblasti zaštite i upravljanja u elektrodistributivnim mrežama:

1. Prezentovano je jedno od najsavremenijih rešenja iz oblasti automatizacije SN elektrodistributivne mreže, gde se nivo automatizacije podiže na viši nivo, odnosno na nivo napredne automatizacije SN elektrodistributivne mreže. Očekivanja od primene napredne automatizacije SN elektrodistributivne mreže su izuzetno velika, jer donosi rešenja u praksi koja eliminišu i na efikasan način rešava dosadašnje probleme koji su bili prisutni prilikom automatizacije u SN elektrodistributivnoj mreži, pre svega u slučajevima kada je potrebno brzo odrediti delove mreže koji su pogođeni kvarom. Napredna automatizacija SN elektrodistributivne mreže obezbeđuje horizontalnu komunikaciju između distributivnih transformatorskih stanica SN/NN, ali i između povezanih susednih napojnih transformatorskih stanica u kojima su instalirani mrežni kontroleri. Prezentovani koncept napredne automatizacije SN mreže će u daljoj budućnosti biti dominantan koncept automatizacije pre svega u gusto naseljenim urbanim delovima kojima upravlja Operator distributivnog sistema (ODS).
2. Nakon intenzivne unifikacije centra upravljanja Operatora distributivnog sistema (ODS) koja je praktično završena, obezbeđeni su svi preduslovi da se delimično okonča prva faza optimizacije operativnog upravljanja kod ODS, ali i da se uvede centralizovano vođenje dispečerskih događaja kroz uvođenje aplikacije elektronskog dispečerskog dnevnika. Kroz radove je prezentovano rešenje promene organizacije operativnog upravljanja elektrodistributivne mreže kroz uvođenje centara upravljanja višeg nivoa, ali i paralelno uvođenje aplikacije elektronskog dnevnika, gde se nedvosmisleno može utvrditi na koji način je postignuta daleko veća efikasnost rada dispečerskih centara, ali i samog operativnog upravljanja SN elektrodistributivnom mrežom.

EC 3 – PROTECTION AND CONTROL IN DISTRIBUTION NETWORKS

Chairman: Dušan Vukotić, M.Sc.
Electric Power Distribution of Serbia, Belgrade

In EC 3, 15 papers and information were presented out of a total of 16 accepted for this year's Conference programme.

After presenting the papers, the following conclusions were drawn concerning several subjects from the field of protection and control in electricity distribution:

1. *One of the state of the art solutions in the field of automation of the MV electrical distribution network was presented, where the level of automation is raised to a higher level, i.e. to the level of advanced automation of the MV electrical distribution network. Expectations from the application of advanced automation of the MV electrical distribution network are extremely high, because it brings solutions in practice that eliminate and effectively solve the previous problems that were present during automation in the MV electrical distribution network, above all in cases where it is necessary to quickly establish the parts of the network that are affected by the failure. Advanced automation of the MV electrical distribution network ensures horizontal communication between MV/LV distribution transformer stations, but also between connected adjacent supply transformer stations where network controllers are installed. The presented concept of advanced automation of the MV network will be the dominant automation concept in the future, primarily in densely populated urban areas managed by the Distribution System Operator (DSO).*
2. *After the intensive unification of the control centre of the Distribution System Operator (DSO), which has practically been completed, all prerequisites are provided to partially complete the first phase of operational management optimization at the DSO, but also to introduce centralized management of dispatching events through the introduction of an electronic dispatch log application. The papers presented a solution to changing the organization of the operational management of the electrical distribution network through the introduction of higher-level control centres, but also the parallel introduction of the electronic log application, where it can be unambiguously determined in what way much greater efficiency was achieved in the operation of the dispatch centres, as well as the operational management of the MV electrical distribution network itself.*



3. Praktično u poslednjoj deceniji je došlo do značajnih promena u pogledu karakteristika SNDM mreže, budući da su one praktično postale aktivne mreže, pre svega zbog veće prisutnosti distribuirane proizvodnje, ali i promene karaktera krajnjih kupaca koji sve više postaju „kupci-proizvođači“ koji ugrađuju proizvodne kapacitete. Iz tog razloga potpuno je promenjen koncept zaštite elektrodistributivne mreže, gde sve više postoji potreba da se koordinira realizovana zaštita između komponenti elektrodistributivne mreže. Promena tokova energije u SNDM mreži prouzrokovala je potrebu za primenom zaštitnih uređaja po dubini SNDM na mestima priključenja distribuirane proizvodnje, ali i po dubini mreže krajnjih korisnika iza mesta priključenja na elektrodistributivnu mrežu, pa samim tim evidentno postoji sve veća potreba za koordinacijom delovanja zaštitnih uređaja u cilju postizanja željenog nivoa selektivnosti nakon pojave neplaniranih ispada u elektrodistributivnoj mreži.
4. Pojednim radovima u okviru koji je obrađena zaštita elektrodistributivnih mreža sve više su prisutna rešenja digitalizacije elektroenergetskih postrojenja u najširem značaju te reči. Prezentovana rešenja digitalizacije se pre svega odnose na primenu savremenih rešenja koja u značajnoj meri redukuju potrebu za dugačkim sekundarnim vezama kojima su izvršena ožičenja primarnih elemenata postrojenja, što u velikoj meri smanjuje troškove utroška materijala, ali i povećava pouzdanost primenjenih upravljačkih šema. U tehničkom smislu svi izazovi koji se nalaze pred digitalizacijom su u praktičnom smislu relativno lako rešiva, osim što i dalje postoji potreba da se unapređuju stručna saznanja koja su neophodna da se poseduju prilikom implementacije i eksploatacije ovako složenih sistema zaštite.
5. Pred održavanjem elektroenergetske mreže su veliki izazovi, budući da su sve veći zahtevi da ono bude što efikasnije. U tom smislu uvode se najsavremenija tehnička rešenja koja omogućavaju nadzor rada primarne i sekundarne opreme u elektroenergetskim postrojenjima, a koja su i prezentovana u nekoliko radova. Sa druge strane, složenost problema održavanja elektroenergetske mreže sigurno zahteva veću pažnju stručne javnosti, ali nažalost relativno mali broj radova je obradio ovu oblast. Imajući u vidu gore navedene razloge sigurno će na sledećem Savetovanju biti daleko veći broj radova koji će obrađivati ovu oblast.
6. Prezentovani referati iz oblasti primene informaciono-telekomunikacionih sistema u elektrodistributivnim mrežama nedvosmisleno ukazuje da telekomunikacije u elektrodistributivnim sistemima sve više zauzimaju centralno mesto i da predstavlja kohezivni faktor u realizaciji sve prisutnijih rešenja inteligentnih elektrodistributivnih mreža svih naponskih nivoa („Smart Grids“). Imajući u vidu potrebu da se razmenjuju velike količine informacija između centara upravljanja i ugrađene opreme po dubini elektrodistributivne mreže svih naponskih nivoa, bilo da se ta komunikacija vrši vertikalno između nivoa opreme i sistema ili horizontalno između ugrađene opreme po dubini mreže, neophodnost primene efikasnih IKT sistema sve više postaje imperativ. Najnovija rešenja iz oblasti
3. Practically in the last decade, there have been significant changes regarding the characteristics of the MVDN, since they have practically become active networks, primarily due to the greater presence of distributed production, but also the change in the character of end customers who are increasingly becoming "prosumers" installing production capacities. For this reason, the concept of electrical distribution protection has been completely changed, where there is an increasing need to coordinate the realized protection between the components of the electrical distribution network. The change in energy flows in the MVDN caused the need for the in-depth application of protective devices of the SNDM at the points of connection of distributed production, but also in-depth application of the network of end users behind the point of connection to the electrical distribution network, and therefore there is evidently an increasing need for the coordination of the action of protective devices in order to achieve the desired level of selectivity after occurrence of unplanned outages in the electrical distribution network.
4. Some papers that deal with the protection of electrical distribution network reflect a greater tendency for solutions based on digitization of power plants in the broadest sense of the word. The presented digitization solutions primarily relate to the application of modern solutions that significantly reduce the need for long-term secondary connections used for wiring the primary elements of the plant, which greatly reduces the cost of material consumption, but also increases the reliability of the applied control schemes. In technical terms, all the challenges facing digitization are relatively easy to solve practically, except that there is still a need for continual improvement of professional knowledge that is required during the implementation and exploitation of such complex protection systems.
5. Maintenance of the electrical network is facing great challenges, since there are growing requirements in terms of efficiency. In this sense, the state of the art technical solutions are being introduced, which enables the monitoring of the operation of primary and secondary equipment in power plants, as presented in several papers. On the other hand, the complexity of the problem of maintaining the electrical network certainly requires greater attention from the professional public, but unfortunately, relatively few papers have addressed this area. Bearing in mind the above-mentioned reasons, there will certainly be a much larger number of papers dealing with this area at the next Conference.
6. The presented reports from the field of application of information and telecommunication systems in electrical distribution networks unequivocally indicate that telecommunications in electrical distribution systems are increasingly taking a central place, and that they are a cohesive factor in the realization of increasingly present solutions of intelligent electrical distribution networks of all voltage levels ("Smart Grids"). Bearing in mind the need to exchange large amounts of information between control centres and embedded equipment in the depth of the electrical distribution network of all voltage levels, regardless of whether that communication is carried out vertically between the level of equipment and the system or horizontally between embedded equipment in the depth of

bezbednosti i zaštite takvih sistema od strane spoljnih napada i narušavanja integriteta takvih sistema, svakako preuzimaju primat u razmatranju IKT sistema. Prepoznat je značaj daljeg razvoja telekomunikacionih sistema, pre svega kao okosnice daljeg razvoja elektrodistributivnog sistema u celini, jer energetski i telekomunikacioni resursi u jednom elektrodistributivnom preduzeću predstavljaju nedvosmisleno jedan integrisan sistem.

7. Iako su to bili zaključci sa prethodnih Savetovanja, ponovo je napomenuto da treba intenzivirati proces u cilju izrade novih tehničkih preporuka i internih standarda, koje treba ekskluzivno da sprovede Operator distributivnog sistema, ali i u saradnji koju treba pokrenuti sa sve prisutnijim Operatorima zatvorenih distributivnih sistema. Međusobnu saradnju između operatera treba usmeriti na izradu i donešenje zajedničkih granskih standarda, kojima bi se uredili tehnički aspekti međusobnih odnosa između operatera koji upravljaju elektrodistributivnim sistemom na distributivnom nivou.

the network, the necessity of applying efficient ICT systems becomes more and more imperative. The latest solutions in the field of security and protection of such systems from external attacks and damage to the integrity of such systems are certainly taking the lead in the consideration of ICT systems. The importance of further development of telecommunication systems has been recognized, primarily as the backbone of further development of the electrical distribution system as a whole, because energy and telecommunication resources in an electrical distribution company unequivocally represent a single integrated system.

7. And although these were the conclusions from the previous Conferences, it was again noted that the process should be intensified in order to develop new technical recommendations and internal standards, which should be exclusively implemented by the Distribution System Operator, but also in cooperation that should be initiated with the increasingly present Operators of closed distribution systems. Mutual cooperation between the operators should be focused on the development and adoption of joint branch standards, which would regulate the technical aspects of mutual relations between operators managing the electrical distribution system at the distribution level.



Najzapaženiji rad / the most prominent paper:

R-3.06

STACIONARNA DODATNA STRUJA CIRKULACIJE U SN MREŽI USLED POPREČNE KOMPONENTE PADA NAPONA ADDITIONAL NON-TRANSIENT CIRCULATION CURRENT IN MV NETWORKS DUE TO TRANSVERSAL VOLTAGE DROP COMPONENT

Dragan Cvetinov, Gordana Jovanović

Obrazloženje:

Predloženi referat je izabran većinom glasova kao najzapaženiji referat iz razloga što je obradio jedan problem koji je vrlo prisutan prilikom svakodnevnog upravljanja SN elektrodistributivnom mrežom. Do sada uočeni efekti povećanja struja opterećenja SN izvoda prilikom stavljanja u paralelan rad SN izvoda, koji se napajaju iz jedne ili najčešće iz više napojnih transformatorskih stanica, su tumačeni na osnovu različitih pristupa. Pojava velikih struja opterećenja koji se javljaju prilikom stavljanja u paralelni rad SN izvoda često je u operativnom upravljanju rešavano heurističkim pristupom od strane operatera u centrima upravljanja, dok je rad pokušao da putem adekvatnih proračuna u slučaju realnih situacija u SN mreži da ocenu nivoa opterećenja koje se pojavljuje u ovim situacijama u cilju da eventualno spreči pojavu preopterećenja izvoda koje bi dovelo do neplaniranog ispada. U radu je obrađen relativno mali skup realnih situacija, ali imajući u vidu da korišćeni pristup može da se primeni i na veliki broj sličnih situacija u SN elektrodistributivnoj mreži, što svakako omogućava dalja istraživanja i proširivanje date metodologije u budućnosti u cilju rešavanja ovih slučajeva koji su vrlo prisutni u operativnom upravljanju. Predloženo rešenje je trasiralo put ka sagledavanju i drugih rešenja, a pre svega u cilju efikasnijeg operativnog upravljanja SN elektrodistributivnom mrežom od strane nadređenog centra upravljanja.

The proposed report was selected by the majority of votes as the most notable report for the reason that it addressed a problem that is certainly present in the daily management of the MV electrical distribution network. So far, the observed effects of increasing the load currents of the MV feeders when putting the MV feeders into parallel operation, which are supplied from one or usually from several power supply transformer stations, have been interpreted based on different approaches. The occurrence of large load currents that occur when the MV feeders are put into parallel operation was often solved in operational management with a heuristic approach by operators in the control centres, while the paper tried to assess the level of load that appears in these situations through adequate calculations in the case of real situations in the MV network in order to possibly prevent the occurrence of overloading of feeders that would lead to an unplanned outage. The paper deals with a relatively small set of real situations, but bearing in mind that the approach used can be applied to a large number of similar situations in the MV electrical distribution network, which certainly enables further research and expansion of the given methodology in the future in order to solve these cases that are very present in operational management. The proposed solution has paved the way to considering other solutions, primarily with the aim of more efficient operational management of the MV electrical distribution network by the superior control centre.

STK 4 - DISTIBUIRANA PROIZVODNJA I EFIKASNO KORIŠĆENJE ELEKTRIČNE ENERGIJE

Predsednik komisije: dr Željko POPOVIĆ
Fakultet tehničkih nauka, Novi Sad



Nakon prezentacije radova na Savetovanju doneti su sledeći zaključci:

1. Intenzivirati istraživanja kratkoročnih i dugoročnih uticaja obnovljivih izvora (generatora, skladišta, upravljanja potrošnjom, i sl.), na sve poslovne procese u distributivnom sistemu Srbije uz uvažavanje neizvesnosti i varijabilnosti u proizvodnji i potrošnji električne energije. U tom cilju angažovati na organizovan i sistemski način sve resurse u Srbiji – fakultete i institute, predstavnike regulatornih i zakonodavnih tela, agregatore, kao i ostale zainteresovane strane radi dobijanja jasnog plana (ili skupa planova) kojima se definišu potrebne promene kako u poslovnim procesima ODS-a tako i u ostalim oblastima u cilju minimizacije rizika od mogućih negativnih efekata/posledica.
2. Intenzivirati proučavanje mogućih uticaja različitih nivoa penetracije fotonaponskih generatora i električnih vozila (punionica) u reprezentivnim niskonaponskim mrežama u Srbiji. Na osnovu toga sagledati (preporučiti) mere, sa stanovišta tehničkih rešenja kao i sa stanovišta legislative, koje se trebaju preduzeti da bi se smanjili rizici od potencijalnih negativnih/neželjenih efekata.
3. Unaprediti istraživanja iz oblasti upravljanja opterećenjem kao resursa kojim se mogu značajno smanjiti negativni uticaji vezani za visok stepen neizvesnosti i varijabilnosti u proizvodnji obnovljivih izvora i time povećati nivo penetracije ovakvih izvora.
4. Obezbediti da svi podaci o distributivnom sistemu koji predstavljaju bazu za primenu koncepta pametnih mreža (npr. podaci o elementima sistema na svim naponskim nivoima, podaci o broju, vrsti i trajanju prekida i poravki i sl.) budu na sistemski i sistematski način prikupljeni i obrađivani (npr. korišćenjem sistema za upravljanje prekidima (Outage Management System)).

EC 4 - DISTRIBUTED PRODUCTION AND EFFICIENT USE OF ELECTRICITY

Chairman: Željko POPOVIĆ, PhD
Faculty of Technical Sciences, Novi Sad



After presenting the papers, the following conclusions were drawn:

1. Intensify research into the short-term and long-term impacts of renewable sources (generators, storage, consumption management, etc.) on all business processes in the distribution system of Serbia, while respecting the uncertainty and variability in the production and consumption of electrical energy. To this end, engage in an organized and systematic manner all resources in Serbia - faculties and institutes, representatives of regulatory and legislative bodies, aggregators, as well as other stakeholders in order to obtain a clear plan (or set of plans) that define necessary changes in the business processes of DSOs - as well as in other areas in order to minimize the risk of possible negative effects/consequences.
2. Intensify the study of possible impacts of different levels of penetration of photovoltaic generators and electric vehicles (charging stations) in representative low-voltage networks in Serbia. Based on that, review (recommend) measures, from the aspect of technical solutions as well as from the aspect of legislation, which should be undertaken in order to reduce the risks of potential negative/side effects.
3. Improve research in the field of load management as a resource which can significantly reduce the negative impacts related to the high degree of uncertainty and variability in the production of renewable sources and thereby increase the penetration level of such sources.
4. Ensure that all data on the distribution system that represent the basis for the application of the smart grid concept (e.g., data on system elements at all voltage levels, data on the number and type and duration of outages and repairs, etc.) are systemically and systematically collected and processed (e.g. using the Outage Management System).

Najzapaženiji rad / the most prominent paper is:

R-4.02

OPTIMALNA LOKACIJA I KONFIGURACIJA SISTEMA SAČINJENOG OD FOTONAPONSKOG I SISTEMA ZA SKLADIŠTENJE ENERGIJE UZIMAJUĆI U OBZIR SMANJENJE GUBITAKA U DISTRIBUTIVNOJ MREŽI
OPTIMAL LOCATION AND CONFIGURATION OF THE SYSTEM CONSISTING OF PHOTOVOLTAIC AND ENERGY STORAGE SYSTEM CONSIDERING THE REDUCTION OF LOSSES IN DISTRIBUTION NETWORK

Nikola Krstić, Dragan Tasić

STK 5 - PLANIRANJE DISTRIBUTIVNIH SISTEMA

Predsednik: Prof. dr Aleksandar Janjić
Elektronski fakultet Niš

U okviru STK5, u sklopu 5 preferencijalnih tema, prispelo je 14 stručnih radova koji odgovaraju karakteru skupa i preferencijalnim temama, od kojih je nakon izvršene stručne recenzije i klasifikacije 11 svrstano u referate, a 3 rada svrstano u informacije. U prispelim radovima tretirano je svih pet preferencijalnih tema u okviru kojih su razmatrane aktuelne problematike, a na koje se odgovaralo savremenim inženjerskim pristupom. Kontinuitet aktuelnosti obrađenih tema i ove godine, kao i prethodnih godina, potvrdile su značaj nacionalnog komiteta CIRE-a za planiranje distributivnih mreža.



Zaključci rada Stručne komisije 5 su sledeći:

1. Planiranje distributivnih sistema značajno se usložnjava u uslovima rada sa velikim brojem distributivnih generatora disperzivno priključenih na ED mrežu. Potrebno je beskompromisno insistirati na prikupljanju i obradi podataka i studioznom pristupu provere funkcionisanja elektrodistributivnog sistema sa postojećim i planiranim distributivnim generatorima, kako se perspektivno stanje funkcionalnosti mreže i sam rad distributivnih elektrana, ne bi ugrozilo.
2. Povećanjem broja priključenih distributivnih generatora na ED mrežu raste potreba za upravljanjem potrošnjom i proizvodnjom kod krajnjih korisnika. Primena sistema kompozitne virtualne elektrane i agregacije pomoću iste, može predstavljati značajan alat za upravljanje proizvodnjom, potrošnjom i integracijom OIE u EES.
3. Predstavljani radovi su potvrdili da je neophodno nastaviti sa sistematičnim pristupom prikupljanja i obrade podataka i integracijom u kompleksne sisteme za upravljanje podacima. Prognoza potrošnje, širenja konzuma, distributivne proizvodnje, ali i gubitaka električne energije ključni su za uspešno planiranje tržišnih aktivnosti. Potrebno je usavršiti ponuđene modele uz primenu dostupnih specijalizovanih softverskih paketa koje posjeduje ODS, uvažavanjem svih uticajnih faktora.

EC 5 - DISTRIBUTION SYSTEM PLANNING

Chairman: Aleksandar Janjić, PhD
Faculty of Electronics, Niš

Within EC5, in 5 preferential topics, 14 papers were submitted that correspond to the character of the group and topics and, after expert review and classification, 11 of them were classified as reports and 3 papers were classified as information. In the submitted works, all five topics were taken into account, where current problems were discussed and looked into from the state-of-the-art engineering standpoint. The continuity of topicality of the topics discussed this year, just as as in the previous years, has confirmed the importance of the CIRE Liason Committee of Serbia for distribution network planning.

Conclusions for EC 5 are the following:

1. The planning of distribution systems becomes significantly more complex in working conditions with a large number of dispersed generators connected to the ED network. It is necessary to insist uncompromisingly on the collection and processing of data and on a studious approach to checking the functioning of the electrical distribution system with existing and planned distribution generators, so that the prospective state of network functionality and the operation of distribution power plants would not be jeopardized.
2. With the increased number of distribution generators connected to the ED network, there is a growing need for managing the consumption and production of the end users. The application of the composite virtual power plant system and the aggregation thereof, can be a significant tool for managing the production, consumption, and integration of RES in the EES.
3. The presented papers have confirmed that it is necessary to continue with a systematic approach to data acquisition and processing and the integration thereof into the complex data management systems. The forecast of demand, growth of demand, distribution production, but also electrical energy losses are crucial for successful planning of market activities. It is necessary to upgrade the offered models with the application of the available specialized software packages owned by the DSO, taking into account all the impact factors.



Najzapaženiji rad / the most prominent paper:



R-5.9

AGREGACIJA KOMPOZITNE VIRTUELNE ELEKTRANE – JEDAN OD MOGUĆIH ODGOVORA NA IZAZOVE ZA ELEKTROENERGETSKI SISTEM SRBIJE U PROCESU DEKARBONIZACIJE

AGGREGATION OF COMPOSITE VIRTUAL POWER PLANT - A POSSIBLE ANSWER TO THE CHALLENGES FOR THE SERBIAN POWER SYSTEM IN THE DECARBONIZATION PROCESS

Vladimir Šiljkut, Nikola Georgijević, Saša Milić, Aleksandar Latinović, Dušan Vlaisavljević, Radoš Čabarkapa



STK 6 – TRŽIŠTE ELEKTRIČNE ENERGIJE I DEREGULACIJA

Predsednik komisije: Dr Nenad Katić
Fakultet tehničkih nauka, Novi Sad, Srbija



Tokom zasedanja komisije uživo je prezentovano 9 od 12 objavljenih radova u okviru preferencijalnih tema. Na osnovu diskusije tokom zasedanja komisija je donela sledeće zaključke:

1. Regulacija elektroprivrede i tržišta električne energije je unapređena izmenama i dopunama Zakona o energetici, kao i donošenjem novog Zakona o obnovljivim izvorima 2021. godine, a posebno uvođenjem novih delatnosti agregatora i kategorije kupac-proizvođač. Potrebno je nastaviti rad na unapređenju regulative vezano za delatnosti agregatora i kategorije kupac-proizvođač na osnovu prvih iskustava iz prakse, a koja pokazuju da postojeća regulativa ne pruža potpuno jasno okruženje za efikasnu primenu u praksi.
2. Nedavna eskalacija cena električne energije na veleprodajnim tržištima širom Evrope usled globalnih ekonomskih poremećaja, istakla je potrebu razvoja dodatne regulacije zaštite tržišta u poremećenim uslovima. Posledice ovih poremećaja su posebno vidljive na maloprodajnoj strani, gde je praktično došlo do suspenzije maloprodajnog tržišta povlačenjem manjih konkurentnih snabdevača u nemogućnosti takmičenja sa velikim garantovanim snabdevačem.
3. Zapažena je izuzetna kompleksnost postupaka koje sprovodi ODS na maloprodajnom tržištu i prikazani su alati za analize i praćenje ovih postupaka. Potrebno je nastaviti dalje unapređenje ovih alata sa ujednačavanjem na nivou ODS-a i daljim razvojem u pravcu kompletne digitalizacije postupaka.
4. Predstavljena je regulativa vezana za Direktnu dalekovodu, koja u potpunosti ne obezbeđuje efikasnu primenu u praksi, a naročito u nedostatku referentnih primera. Neophodno je dalje unaprediti ovu regulativu u cilju realne primene u praksi i doprinosa povećanju efikasnosti korišćenja električne energije.

EC 6 – ELECTRICITY MARKET AND DEREGULATION

Chairman: Nenad Katić, PhD
Faculty of Technical Sciences, Novi Sad, Serbia



During the commission session, 9 out of 12 published papers were presented live in the framework of preferential topics. Based on the discussion during the session, the commission reached the following conclusions:

1. The regulation of the electricity industry and the electricity market has been improved by amendments to the Energy Law, as well as by adoption of the new Law on Renewable Energy Sources in 2021, and in particular by the introduction of new activities of the aggregators and the Prosumer category. It is necessary to continue work on the improvement of regulations related to the activities of aggregators and the Prosumer category based on the first experiences from practice, which show that the existing regulation do not provide a completely transparent environment for effective application in practice.
2. The recent escalation of electricity prices on wholesale markets across Europe due to global economic disruptions has highlighted the need to develop additional market protection regulation in disrupted conditions. The consequences of these disruptions are particularly visible on the retail side, where the retail market was practically suspended by the withdrawal of smaller competitive suppliers unable to compete with the large guaranteed supplier.
3. The extraordinary complexity of the procedures carried out by the DSO in the retail market was noted and the tools for analysis and monitoring of these procedures were presented. It is necessary to continue further improvement of these tools with standardization at the level of DSOs and further development in the direction of complete digitization of procedures.
4. The regulation related to Direct Distribution Powerlines was presented, which does not fully ensure effective application in practice, especially in the absence of reference examples. It is necessary to further improve this regulation in order to implement it in practice and contribute to increasing electrical energy efficiency.

Najzapaženiji rad / the most prominent paper:



R-6.09

MODELI FUNKCIONISANJA AGREGATORA NA TRŽIŠTU ELEKTRIČNE ENERGIJE
MODELS OF THE FUNCTIONING OF AGGREGATORS IN THE ELECTRICITY MARKET

Dunja Grujić, Miloš Kuzman

Autorima najzapaženijih radova dodeljene su nagrade i CIREC statua u okviru zasebnog koktela održanog tim povodom u četvrtak, 15. septembra. Nagrade prisutnim autorima dodelio je predsednik Nacionalnog komiteta CIREC Srbija, dr Zoran Simendić, uz predsednika svake od šest stručnih komisija.

The authors of the most notable papers were awarded a certificate and a CIREC statue within a separate cocktail held for that occasion on Thursday, September 15. The awards to the authors that were present at the moment were handed by the President of the CIREC Liaison Committee of Serbia, Dr. Zoran Simendić, along with a chairman of each of the 6 expert committees.



OKRUGLI STOLOVI – PANELI / ROUND TABLES – PANELS

OKRUGLI STO 1: Agregator kao novi učesnik na tržištu – operator virtualne elektrane nastale agregacijom upravljive potrošnje i distribuirane proizvodnje

MODERATOR:

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KRATAK SADRŽAJ OKRUGLOG STOLA

Izmenama i dopunama *Zakona o energetici* (ZoE) iz 2021. uvedeni su pojmovi agregiranja i agregatora kao novog učesnika na tržištu, a generalno su definisane i njegove dužnosti. *Zakonom o korišćenju obnovljivih izvora energije* (ZOIE), takođe iz 2021, utvrđeno je da kupac-proizvođač ima pravo da samostalno ili posredstvom agregatora proizvodi električnu energiju za sopstvenu potrošnju, skladišti električnu energiju za sopstvene potrebe, a višak proizvedene električne energije isporuči u prenosni, distributivni, odnosno zatvoreni distributivni sistem.

I pored ovih, načelnih, rešenja u navedenim zakonima kojima se uređuje oblast energetike u Republici Srbiji, pravna regulativa u delu agregacije nije u potpunosti uređena. Posebno se treba imati u vidu činjenica da agregiranje nije predviđeno kao energetska delatnost, odnosno agregator (prema ZoE – fizičko ili pravno lice koje pruža uslugu objedinjavanja potrošnje i/ili proizvodnje električne energije u cilju dalje prodaje, kupovine ili aukcija na tržištima električne energije), ne može da obezbedi licencu ili drugu saglasnost za pružanje ove usluge.

Sa druge strane, *Direktiva EU 2019/944* jasno predviđa da je svaki učesnik na tržištu električne energije dužan da ugovorom uredi svoju balansnu odgovornost, da je prenese na drugog učesnika na tržištu električne energije, da potpiše ugovor o potpunom snabdevanju ili da se registruje kao balansno odgovorna strana. U skladu sa članom 17(3.d) ove Direktive, ta obaveza nije zaobišla ni novog učesnika na tržištu – Agregatora. U tom smislu, nema suštinske razlike između Snabdevača i Agregatora. Ipak, jedna od osnovnih razlika između ova dva učesnika na tržištu je što Snabdevač upravlja potrošnjom implicitno (kupac reaguje na cenovne signale Snabdevača iz računa, a težnja je da se ide, sa uvođenjem „pametnih“ brojlara, ka dinamičkom tarifiranju), dok Agregator ima mogućnost da upravlja potrošnjom i eksplicitno (direktno, aktivno). To bi trebalo da podrazumeva definisanje/ugovaranje uslova pod kojima Agregator

ROUND TABLE 1: Aggregator as a New Market Participant – Operator of a Virtual Power Plant Created by Aggregation of Managed Load and Distributed Generation

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SHORT DESCRIPTION OF THE ROUND TABLE

Amendments to the Energy Law (EL) from 2021 introduced the concepts of aggregation and Aggregator as a new market participant, and generally defined its duties. The Law on the Use of Renewable Energy Sources (LURES), also from 2021, stipulates that the prosumer has the right to independently or through an Aggregator produce electricity for its own consumption, electricity storage for its own needs, and deliver surpluses of electricity to transmission-, distribution-, or closed distribution system.

Despite these, principal solutions in the mentioned laws, which regulate the field of energy in the Republic of Serbia, the legislative related to the aggregation is not completely regulated. Special attention should be paid to the fact that aggregation is not envisaged as an energy activity, i.e., Aggregator (according to EL - a physical or legal person that provides aggregation of consumption and / or production of electricity for resale, purchase or auction on electricity markets), cannot obtain a license or other consent to provide this service.

On the other hand, EU Directive 2019/944 clearly stipulates that each participant in the electricity market is obliged to regulate its balancing responsibility by contract, to transfer it to another participant in the electricity market, to sign a full supply contract or to register as balancing responsible party. In accordance with Article 17(3.d) of this Directive, this obligation has not bypassed a new market participant - the Aggregator. In that sense, there is no essential difference between the Supplier and the Aggregator. However, one of the main differences between these two market participants is that the Supplier manages consumption implicitly (the customers respond to the Supplier's price signals from the account, and the aim is to go, with the introduction of "smart" meters, towards dynamic pricing), while the Aggregator has ability to manage consumption explicitly (directly, actively). This should include defining / contracting the conditions under which the Aggregator manages the customers' the

upravlja potrošnjom kupca (i potrošnjom i proizvodnjom kupca-proizvođača) i po kojoj ceni, u okviru posebnog ugovora ili u okviru Ugovora o snabdevanju. Stoga je za dalje definisanje uloge agregatora u Srbiji potrebno izmeniti nacionalnu sekundarnu legislativu u skladu sa odredbama navedene Direktive EU, a cilj ovog okruglog stola je da se stručnoj javnosti izlože, na uvid i mišljenje, mogući modaliteti i varijante.

Eksplisitno upravljanje potrošnjom bi, inače, omogućilo Agregatoru da ostvaruje profit i na tržištima sistemskih usluga i balansne energije, ali je za to, pored trenutno nedostajuće regulative, neophodna i adekvatna infrastruktura koja podrazumeva masovnu upotrebu odgovarajućih „pametnih“ brojlara, što je još jedna od prepreka koju je potrebno otkloniti u cilju pune primene koncepta Agregatora na tržištu Republike Srbije.

role of the Aggregator in Serbia, it is necessary to this change the national secondary legislation in accordance. consumption (and the consumption and generation of the prosumers) and at what price, under a separate contract or under a supply contract. Therefore, in order to further define with the provisions of the said EU Directive, and the aim of round table is to present possible modalities and variants to the professional public.

Explicit consumption management would otherwise enable the Aggregator to make a profit in the markets of system services and balancing energy, but for that, in addition to the currently missing regulations, adequate infrastructure is necessary, which means mass use of appropriate “smart” meters, which represents another obstacle that needs to be removed in order to fully implement the concept of Aggregators on the electricity market in the Republic of Serbia.



OKRUGLI STO 2: Obnovljivi izvori u niskonaponskoj mreži: regulativa i izazovi

MODERATOR:

dr Željko POPOVIĆ, Fakultet tehničkih nauka, Novi Sad

UČESNICI:

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dr Vladimir KATIĆ, Fakultet tehničkih nauka, Novi Sad
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Vladimir POPOVIĆ, Energize d.o.o. Beograd
dr Goran KOVAČEVIĆ, CIRED Crna Gora
Miloš KOSTIĆ, MT-Komex, Beograd

KRATAK SADRŽAJ OKRUGLOG STOLA

U okviru okrugla stola će se razmatrati uticaj obnovljivih izvora električne energije, a pre svega fotonaponskih solarnih panela (PV), na poslovne procese u niskonaponskoj mreži. Razmatraće se svi aspekti priključenja PV u niskonaponskoj mreži u Srbiji. Takođe, razmatraće se i uticaj PV na ostale poslovne procese, pre svega na operativno i dugoročno planiranje u niskonaponskoj mreži, na upravljanje niskonaponskom mrežom kao i na kvalitet električne energije. Biće prikazana domaća i strana iskustva i regulativa kao i međunarodni standardi koji se primenjuju u ovoj oblasti. Pored toga, biće prikazane i moguće koristi/troškovi koje PV u niskonaponskoj mreži donose operatoru sistema, korisnicima sistema kao i društvu kao celini.



ROUND TABLE 2: Renewables in Low Voltage Network: Regulation and Challenges

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Obrenko ČOLIĆ, Elektrodistribucija Srbije d.o.o. Beograd
dr Vladimir KATIĆ, Fakultet tehničkih nauka, Novi Sad
dr Željko POPOVIĆ, Fakultet tehničkih nauka, Novi Sad
Vladimir POPOVIĆ, Energize d.o.o. Beograd
dr Goran KOVAČEVIĆ, CIRED Crna Gora
Miloš KOSTIĆ, MT-Komex, Beograd

SHORT DESCRIPTION OF THE ROUND TABLE

The round table will discuss the impact of renewable energy sources, especially photovoltaic solar panels (PV), on business processes in the low voltage network. All aspects of connecting PV in the low voltage network in Serbia will be considered. Also, the impact of PV on other business processes will be considered, primarily on operational and long-term planning in the low voltage network, on the control of the low voltage network as well as on the quality of electricity. Domestic and foreign experiences and regulations as well as international standards applied in this field will be presented. In addition, the possible benefits/costs that PV in the low voltage network brings to the system operator, system users and society as a whole will be presented.



OKRUGLI STO 3: Digitalizacija elektroenergetskih objekata

MODERATORI:

Dušan VUKOTIĆ, Elektrodistribucija Srbije d.o.o. Beograd
Branko ĐORĐEVIĆ, Elektromreža Srbije AD, Beograd

UČESNICI:

Vladimir STOJČIĆ, Elektrodistribucija Srbije d.o.o. Beograd
Zoran M. STOJANOVIĆ, Elektrodistribucija Srbije d.o.o. Beograd
Vladimir ILIĆ, Elektromreža Srbije AD, Beograd

KRATAK SADRŽAJ OKRUGLOG STOLA

Digitalizovana elektroenergetska mreža sa svojim tehničkim atributima, digitalizovanim sekvencama i slikama, kao i ostalim podacima, predstavlja temelj upravljanja, održavanja i planiranja mreže, kao i izvršavanje mrežnih proračuna, a pre svega u cilju smanjenja tehničkih i netehničkih (komercijalnih) gubitaka. Iz tog razloga od ključnog značaja je proces digitalizacije elektroenergetske mreže (objekata i vodova) svih naponskih nivoa u cilju prikupljanja pre svega tehničkih i topoloških atributa, kao i određivanje tačnog napajanja krajnjih kupaca. Nedostatak podataka o elektroenergetskoj mreži (objektima i vodovima), kao i ostalim infrastrukturnim objektima operatora prenosnom i distributivnog sistema, direktna je posledica višedecenijskog nepoštovanja procedura unosa tehničkih podataka, njihovog neadekvatnog ažuriranja, ali i nepotpuno sagledanih procesa koji nisu bili predviđeni odgovarajućim sistematizacijama radnih mesta i poslova. Iz tog razloga neophodno je posao digitalizacije zaokružiti na celokupnoj elektroenergetskoj mreži u Srbiji, bilo da se radi o mreži u nadležnosti operatora prenosnog ili distributivnog sistema. Neophodno je dati prioritet ovim procesima tamo gde su započeti, ali i proširiti te procese na konzumna područja koja nisu kompletna. Glavni cilj koji je potrebno postići u budućnosti je potpuno digitalizovana 2D i 3D elektroenergetska mreža sa svim transformatorskim stanicama i vodovima, ali i drugim infrastrukturnim objektima operatora sistema. Kao masovna sredstva realizacije poslova digitalizacije na terenu koriste se najsavremenija oprema, kao što su: GNSS uređaji, bespilotne letelice, LIDAR-i i 3D skeneri. Kao prateća neophodna softverska rešenja primenjuju se softveri za post-procesiranje i konverziju podataka, a kao ključna okruženja ističu se BIM i GIS softverska rešenja.

Informaciono modeliranje zgrada (skraćeno BIM), definisano je kao proces i opšti termin projektovanja, izgradnje i rada, na osnovu fizičkih i funkcionalnih karakteristika digitalnog izraza građevinskih projekata i objekata tokom celog njihovog životnog ciklusa.

BIM podaci obuhvataju ne samo uobičajene zgrade, već i strukture kao što su: elektrane, transformatorske stanice, priključno razvodna postrojenja, itd., ali i infrastrukturu linearnog oblika kao što su: putevi, železničke pruge, tuneli, koridori, podzemni i nadzemni vodovi svih naponskih nivoa,

ROUND TABLE 3: The Digitalization of Electric Power Facility

MODERATORI:

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Branko ĐORĐEVIĆ, Elektromreža Srbije AD, Beograd

PARTICIPANTS:

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Zoran M. STOJANOVIĆ, Elektrodistribucija Srbije d.o.o. Beograd
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SHORT DESCRIPTION OF THE ROUND TABLE

Digitized electric power network with its technical attributes, digitized sequences and images, as well as other data, is the basis of system operating, maintenance and planning of the electric power network, as well as performing network calculations, primarily to reduce technical and non-technical (commercial) losses. For that reason, the process of digitalization of the electric power network (facilities and lines) of all voltage levels is of key importance in order to collect primarily technical and topological attributes, as well as to determine the exact power supply of end users. The lack of data on the electric power network (facilities and lines), as well as other infrastructure facilities of transmission and distribution system operators, is a direct consequence of decades of non-compliance with technical data entry procedures, their inadequate updating, but also incompletely reviewed processes and the non-existence of this type of work. For that reason, it is necessary to complete the work of digitalization on the entire electric power network in Serbia, whether it is a network under the jurisdiction of the transmission or distribution system operator. It is necessary to give priority to these processes where they started, but also to expand these processes to consumption areas that are not complete. The main goal that needs to be achieved in the future is a fully digitalized 2D and 3D power grid with all transformer stations and lines, but also other infrastructure facilities of the system operator. The most modern equipment, such as: GNSS devices, unmanned aerial vehicles, LIDARs and 3D scanners, are used as mass means of realization of digitalization works in the field. Post-processing and data conversion software are used as accompanying necessary software solutions, and BIM and GIS software solutions stand out as key environments.

Information modeling of buildings (abbreviated BIM) is defined as the process and general term of design, construction and operation, based on the physical and functional characteristics of the digital expression of construction projects and facilities throughout their life cycle.

BIM data include not only common buildings, but also structures such as: power plants, transformer stations, switchyards, etc., but also linear infrastructure such as: roads, railways, tunnels, corridors, underground and overhead lines of all voltage levels, pipelines (water, gas, oil), etc. With the intensive popularization of BIM technology applications, where the integrated environment of BIM and

cevovodi (voda, gas, nafta), itd. Uz intenzivnu popularizaciju BIM tehnoloških aplikacija, gde je posebno interesantan pristup integrisanog okruženja BIM i GIS aplikacija, pojavili su se veći zahtevi za performansama pregledanja BIM podataka u 3D scenama, a naročito u realnom vremenu. S toga je potreba za simplifikacijom i uopštavanjem BIM podataka sve veća.

GIS rešenje u 3D tehnologiji nam omogućava sistematsku i jednostavniju vizualizaciju BIM modela i u njemu je omogućen celokupan prikaz digitalizovane 2D i 3D mreže, kao i objekata od značaja kojima možemo pristupiti, upravljati njima, ali i dalje obrađivati i uređivati, planirati, projektovati, vršiti razne proračune nad njima i pristupiti direktno podacima i dokumentaciji koji se odnose na ciljne elektroenergetske objekte.

Predmet sagledavanja ovog okruglog stola biće dosadašnji rezultati 2D i 3D digitalizacije elektroenergetskih objekata svih naponskih nivoa, načini prikupljanja terenskih podataka, korišćeni softveri za post-procesiranje i konverziju podataka i rešenjima za kreiranje 3D modela (BIM), kao i vizualizaciju u 2D i 3D prikaze koji se prikazuju u okviru formiranog „Digital Twin“. GIS rešenja u 3D tehnologiji su zasnovana na 2D/3D integrisanoj GIS tehnologiji, koja intenzivno napreduje u pogledu razvoja računarske i analitičke mogućnosti modela geo-prostornih podataka, pri čemu pre svega kombinuje kosu fotogrametriju, BIM podatke, snimljeni „oblak“ tačaka, 3D polje i druge heterogene podatke sa više izvora, a koji postavljaju već standard za podršku GIS sistemima. Na osnovu distribuiranih alata za automatizaciju obrade, može se postići efikasno upravljanje kompletnim procesom formiranja 3D podataka u realnom vremenu, gde se pre svega misli na dobijanje kosog modela fotogrametrije i „oblaka“ tačaka. Ciljno GIS rešenje treba da integriše standardne IT tehnologije, kao što su WebGL, napredne tehnologije: VR, AR, AI, itd., u pripremu podataka i za 3D štampanje elementa energetskog sistema. Sagledane tehnologije treba da omoguće sticanje praktičnijih 3D iskustava iz prakse, u cilju daljeg promovisanja GIS u 3D tehnologiji, pre svega postizanja visokog stepena (interne i spoljne) integracije kod raznih subjekata, ali i integracije u troslojnoj arhitekturi „vazduh/zemlja/podzemlje“, čime bi se još više učvrstila primena novog GIS u 3D tehnologiji u kompletnom prostoru.



GIS applications is particularly interesting, there are higher requirements for the performance of viewing BIM data in 3D scenes, especially in real time. Therefore, the need for simplification and generalization of BIM data is growing.

GIS solution in 3D technology allows us a systematic and simpler visualization of BIM models and it provides a complete view of the digitized 2D and 3D network, as well as important objects that we can access, manage, but still process and edit, plan, design, perform various calculations on them and access directly the data and documentation related to the target power facilities.

The subject of this Round table will be the results of 2D and 3D digitization of power facilities of all voltage levels, methods of field data collection, software used for post-processing and data conversion and solutions for creating 3D models (BIM), as well as visualization in 2D and 3D views which are displayed within the formed "Digital Twin". GIS solutions in 3D technology are based on 2D/3D integrated GIS technology, which is intensively advancing in terms of developing computing and analytical capabilities of geospatial data models, combining oblique photogrammetry, BIM data, surveyed "cloud" points, 3D field and other heterogeneous data from multiple sources, which already set the standard for supporting GIS systems. Based on the distributed tools for processing automation, it is possible to achieve efficient management of the complete process of forming 3D data in real time, where it primarily means obtaining an oblique model of photogrammetry and "cloud" points. The target GIS solution should integrate standard IT technologies, such as WebGL, advanced technologies: VR, AR, AI, etc., in data preparation and for 3D printing of energy system elements. The considered technologies should enable the acquisition of more practical 3D experiences from practice, in order to further promote GIS in 3D technology, primarily achieving a high degree of (internal and external) integration with various entities, but also integration in three-layer architecture "air / ground / underground", which would further strengthen the application of the new GIS in 3D technology in the entire space.



POSLOVNE PREZENTACIJE / BUSINESS PRESENTATIONS

Utorak / Tuesday, 13.09.2022.

Josif Pančić B	15:00-15:50	Schneider Electric Srbija: Održiva rešenja za distributivne trafostanice / <i>Substations with AIR technology</i>
Josif Pančić A	15:30-15:50	MT-Komex: Investiciono ulaganje i isplativost solarnih elektrana u Srbiji <i>Investment and cost-effectiveness of solar power plants in Serbia</i>
Josif Pančić B	16:00-16:50	Energize: Presentacija generalnog sponzora / <i>General sponsor presentation</i>
Kopaonik	17:00-17:50	ABB
Josif Pančić A	17:30-17:50	DNP-Inženjering
Josif Pančić A	18:00-18:50	Elnos Group
Kopaonik	18:00-18:50	GE Grid Solution
Josif Pančić B	18:30-18:50	Južna Bačka / Elektromontaža
Josif Pančić B	19:00-19:50	Siemens Srbija

Sreda / Wednesday, 14.09.2022.

Josif Pančić A	15:00-15:50	Saturn Electric
Josif Pančić B	15:00-15:20	Schneider Electric HUB NS: Budućnost analitike u niskonaponskoj mreži <i>Future of Low Voltage network analytics</i>
Kopaonik	15:00-15:50	Meter&Control
Josif Pančić B	15:30-16:20	AVEVA: <i>Shaping a Digital Future in Utilities</i>
Josif Pančić A	16:00-16:50	Comel
Kopaonik	16:00-16:50	Iskraemeco: First half: Višenamenska softverska platforma za upravljanje mernim podacima u realnom vremenu / <i>Multi-utility software Suite for near-real time data management</i> Second half: Obezbeđivanje interoperabilnosti u pametnom merenju poštujući DLMS i IDIS standard / <i>Assuring interoperability in smart metering respecting DLMS and IDIS standards</i>
Josif Pančić B	16:30-16:50	Weidmuller
Josif Pančić A	17:00-17:20	Infoprojekt / SRC Soft: Vakuumske rastavne sklopke, lokatori kvara na SN mreži, iskustva sa integracijom u SDU putem GPRS i povezivanje sa View4 SCADA / <i>Load break switches, fault current indicators on MV network, experiences with integration into SDU via GPRS and connecting to View4 SCADA</i>
Kopaonik	17:00-17:20	Marti Komerc / Nexans
Kopaonik	17:30-17:50	Siemens Energy
Kopaonik	18:00-18:50	Iritel: Postupci za povećanje pouzdanosti rada pomoćnih napajanja i povećanje efikasnosti rada službi održavanja u Elektroprivredi Srbije / <i>Procedures for increasing the reliability of auxiliary power supplies and increasing the efficiency of the maintenance services of the electricity industry of Serbia</i>
Josif Pančić A,	18:30-18:50	Solar Land: Investiciono ulaganje u BIO Solar / <i>The Solar Land - investment in BIO Solar</i>
Josif Pančić B	18:30-18:50	MT-Komex: Razvoj infrastrukture i elektromobilnosti u Srbiji <i>Development of infrastructure and electromobility in Serbia</i>
Hotel Viceroy	19:00-19:50	Global Substation Solutions: Sve je lakše uz pivo - Osvrti i težnje Global Substation Solutions-a <i>Everything is easier with beer - Global Substation Solutions reviews and aspirations</i>

Sve planirane prezentacije su održane i bile su dosta dobro posećene. Učesnici konferencije imali su prilike da čuju o poslovnim aktivnostima kompanija u prethodnom periodu i proizvodima i uslugama koje nude.

All business presentations were held and well attended. Participants had the opportunity to get information regarding new business solutions of the companies presenting.



IZLOŽBA OPREME I USLUGA / EXHIBITION OF EQUIPMENT AND SERVICES

Tokom Savetovanja, organizovana je i izložba opreme, usluga i novih tehnologija iz oblasti elektrodistribucije na kojoj su učestvovalе mnoge strane i domaće kompanije.

During the Conference, an exhibition of equipment, services, and new technologies from the field of electricity distribution was organized, in which many foreign and local company took part.

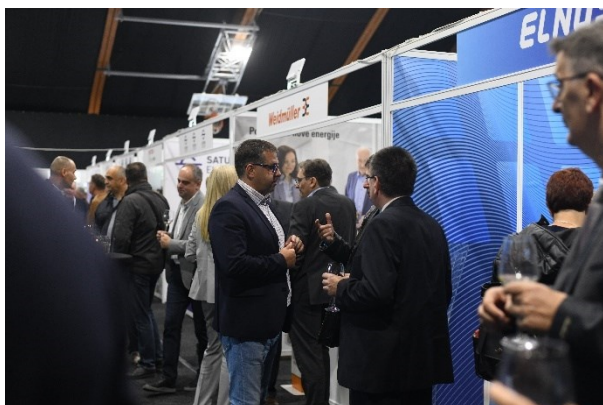
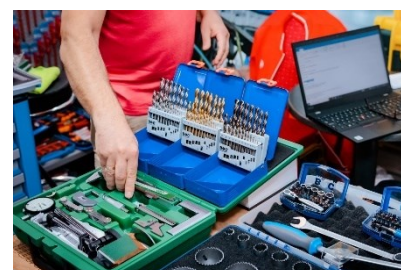
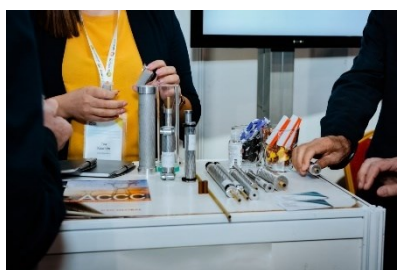


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DEC

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ELTEC Export-Import
Enel PS / Enel tre solare
Energize
EPLAN / RITTAL
ETI B
Feman
FMT - Fabrika mernih
transformatora
GE Grid Solutions
GPS INSULATORS
Green Plus
I E D d.o.o. Beograd
Infoprojekt/ SRC Soft

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VESIMPEX
WEIDMULLER



SVEČANO OTVARANJE / OPENING CEREMONY

U umetničkom delu programa Svečanog otvaranja savetovanja nastupila je Jadranka Jovanović, srpska operska primadona, mecosopran, prvakinja Opere Narodnog pozorišta u Beogradu, jedna od najpopularnijih umetnica u klasičnoj muzici u Srbiji sa velikim međunarodnim ugledom i karijerom.

Koktel dobrodošlice standardno je održan nakon ceremonije otvaranja i kao i do sada bio je prilika za susrete starih prijatelja i kolega i prilika za nove učesnike savetovanja CIREC Srbije da se predstave i upoznaju.

The artistic program of the Opening Ceremony was performed by Jadranka Jovanovic, a primadonna of Opera in the National Theatre in Belgrade, Serbia. She was born in Belgrade, and she is one of the most popular artists in the classic music in her country with a respected international career.

A welcome cocktail standardly followed the opening ceremony and as always represented the opportunity for encounters of old colleagues and an opportunity for new participants of CIREC Serbia meeting and exhibition to present them selves.



SASTANAK IZVRŠNOG ODBORA / EXECUTIVE COMMITTEE MEETING

Sastanak izvršnog odbora Nacionalnog komiteta CIREC Srbija održan je u okviru Savetovanja, 15. septembra 2022. godine. Nakon sastanka definisane su preferencijalne teme za buduće Savetovanje 2024.

The meeting of the Executive Committee of the CIREC Liaison Committee of Serbia was held within the Conference, on September 15, 2022. After the meeting, preferential topics for the 2024 Conference were defined.



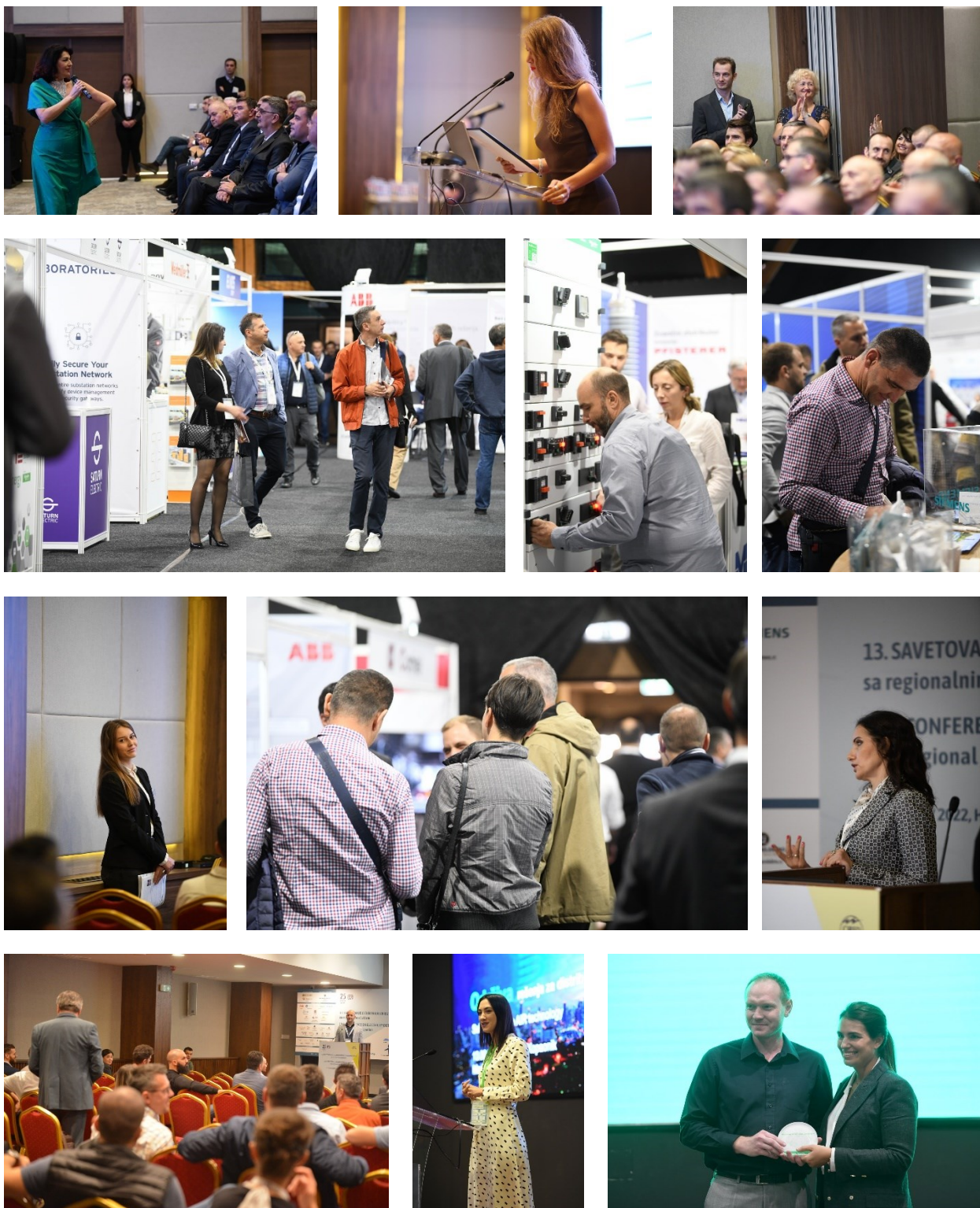
SKUPŠTINA CIREC SRBIJA / CIREC SERBIA ASSEMBLY

XV redovne sednice Skupštine CIREC SRBIJA se održala u četvrtak 15. septembra 2022. na Kopaoniku. Prisutno je bilo 25 članova od ukupno 77 članova skupštine. Donete su sledeće odluke:

1. usvaja se Izveštaj o radu predsednika Skupštine i Izvršnog odbora između dve redovne sednice Skupštine.
2. da se izbori za predsednika, članove Izvršnog i Nadzornog odbora održe tokom 2023. godine vansednično (pismenim obaveštavanjem i izjašnjavanjem). Radna grupa koja će pripremiti, primati glasačke listiće, prebrojati glasove i napraviti izveštaj o glasanju: Marija Erdeljan, Ratko Rogan, Zoran Simendić
3. da prof. dr Mladen Kezunović i prof. dr Jovica Milanović budu počasni članovi CIREC Srbije.

At the XV regular session of the Assembly of CIREC Serbia held on September 15, 2022 at Kopaonik, 25 out of a total of 77 members were in attendance. The following decisions were taken during the meeting:

1. *Work report on the President of the Assembly and the Executive Board between two regular sessions of the Assembly was adopted.*
2. *It was decided to hold elections for the president, members of the Executive, and Supervisory Boards in 2023 through written notification and declaration, without meeting. A working group appointed to prepare, receive ballots, count votes, and create a report on the voting: Maria Erdeljan, Ratko Rogan, Zoran Simendić*
3. *To designate Prof. Dr. Mladen Kezunović and Prof. Dr. Jovica Milanović as honorary members of CIREC Serbia*



KONTAKT PODACI / CONTACT DETAILS

Za sva pitanja u vezi sa Savetovanjima CIRED Srbija možete kontaktirati tehnički sekretarijat.

For all questions regarding CIRED Liaison Committee Conferences you may contact the technical secretariat.



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