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ABSTRACT BOOK

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CONFERENCE PARTNERS:

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SESSION 1 – NETWORK COMPONENTS

Guarantee: Karel Kohout, ČEZ Distribuční služby, s.r.o.

UTILIZATION OF ROBOTICS FOR DIAGNOSTICS AND MONITORING PURPOSES DURING WORKS ON ENERGIZED DISTRIBUTION NETWORK

Vladimír Vajnar, Václav Mužík, Pavla Hejtmánková, Jana Jiřičková, ZČU v Plzni
Jan Kacíř, Energon Dobříš s.r.o.

Distribution system operators (both individuals and legal entities) are responsible for safe and reliable DS operation and development. DS monitoring and diagnostics is carefully performed in compliance with regulations for preventive maintenance focusing on optimization both, periodical maintenance and maintenance based on equipment status. Regarding the new technologies development, robotics can be utilized for monitoring and diagnostics during work on energized DS. Service robotics provides new features for DS modernization, reliability and safe operation as well as procedures for diagnostics of DS equipment. This paper deals with diagnostics and monitoring of DS, summarizes preventive maintenance regulations. Additionally, it deals with procedures utilize during inspection and maintenance aiming for reliability and safety of DS operation regarding the implementation of service robotics into DS and show its advantages and practice usage.

COMPARISON OF ONLINE MONITORING AND OFFLINE DIAGNOSTICS OF POWER BREAKERS

Václav Straka, "TMV SS" spol. s r.o.

Power breaker is integral part of distribution networks and to ensure safe and reliable operation, it has to be tested under terms and conditions specified by manufacturer or preventive maintenance. Usually, the tests are performed offline requiring the breaker to be disconnected from the network temporarily. The offline tests scope is relatively known including its benefits regarding diagnostics. These regular tests can be supplemented by online monitoring of critical power breakers. This paper deals with function description, differences between online and offline tests. Additionally, it assess whether this approach is suitable for HV breakers.

LOWERING THE ELECTRIC ARC INJURY RISK AT THE MV AND HV POWER EQUIPMENT

Pavel Novák, Miroslav Prokeš – EL-INSTA ENERGO s.r.o.

Once the electric arc appears, the serious damage it causes on equipment can be mitigated as well as nearby staff can be protected. Both passive and active elements can be utilized. Arc guards and arc limiters are used as active protection of equipment and personal. This paper deals with such active protective elements.

HV CABLES

Petr Beneš, Martin Geldoň, Com – Pakt energy, a.s.

HV cables are more often utilized as the only solution for interconnection of urban areas and for power output from substations and power stations. This paper deals with pros and cons of HV cables in comparison with overhead line. Paper also presents experience and recommendations related to the design, construction and operation of these cables.

METHODS OF HV CABLE TEMPERATURE MONITORING THROUGH OPTICAL FIBER

Milan Singer, konzultant; Jan Vočko, PREdistribuce a.s.

Measuring of cables temperature through optical fiber while monitoring their load can be utilized to sustain reliability and quality of high power transmission using HV cables. This paper shows that monitoring of cable temperature and load (given that cable parameters are known) can provide not only measures for cable allowed heat checks (for purpose of managing the cable operation) but relevant local parameters as well. This paper listed calculation formulas, their application for cables in operation and provides the model simulations.

FACTORS AFFECTING AMPACITY OF CABLES

Jan Vočko, PREdistribuce, a.s.

The ampacity is affected by various factors which can decrease transmission capacity of cable, power quality and jeopardize safety of whole cable. This paper classifies these effects, cause of their appearance and procedures of how to mitigate their impact. The paper illustrates the calculations performed in compliance with existing standards and simulations supplemented by IR-camera measurements

BIRDS PROTECTION AND ASSOCIATED MV ELEMENTS – IMPACT EVALUATION

Kamil Čihák, ČEZ Distribuce, a. s.

This paper deals with environmental, mechanical and electrical impacts on plastic cover type (OKI, UNI, BCIC) which are mounted on supporting insulators of MV lines and their impact on line elements such as insulators, conductors etc.

OPTICAL FIBER INSTALLATIONS ON MV OVERHEAD LINES

Roman Kloubec, AZ Elektrostav, a.s.; Petr Lehký EGÚ Brno, a.s.

This paper focuses on installation of optical fibers on supporting points of MV overhead lines. First part deals with emplacement options for existing supporting points and optical fibers behavior related to commonly used conductors. The second part presents experience gained during first project implementations.

SESSION 2 – POWER QUALITY AND EMC

Guarantee: Pavel Santarius, VŠB-TU Ostrava

DS POWER QUALITY PER VOLTAGE LEVEL FOR ALL DSO

Jan Petrásek, František Kysnar, EGC - EnerGoConsult ČB s.r.o.

This paper deals with evaluation of power quality parameters at transfer points between TS and DS, 110 kV consumptions, 110 kV/MV supply stations and characteristic LV networks. The evaluation deals with both continuous phenomena and voltage events. Due to the long-term monitoring, this paper presents developments of each parameter – voltage, Plt, Pst, uu and THDu. The longest monitoring period is provided for LV networks (2004) and TS/DS supply points (2006). This paper highlights troubled parameters at points where required limits (according to the CSN EN 50160) are not achieved.

ASSESSMENT OF COMMON APPLIANCES OPERATION WITHIN ISLANDED MICROGRID

Martin Kašpírek, Jan Jiřička, E.ON Distribuce, a.s.

This paper deals with assessment of common appliances operation within island mode of home-microgrid regarding the compliance of power quality specified by CSN EN 50156. Specific appliances operation is assessed concerning the voltage changes, power quality and reactive power consumption/supply first during connection to public distribution network. Then they are compared to the parameters gained during the island operations when the microgrid was supplied by battery with inverter in one case and by petrol invertor generator.

FULL SCALE MONITORING OF ALL VOLTAGE LEVELS POWER QUALITY WITHIN STREDOSLOVENSKA DISTRIBUCNA A.S.

Miroslav Dubovský, Stredoslovenská distribučná, a.s.

This paper deals with full scale monitoring af all voltage levels power quality within Stredosloveska distribucna a.s. area. For TS/DS supply points (400 kV/110 kV and 220 kV/110 kV), the power quality monitoring is assessed at 110 kV side. For distribution nodes (110 kV/22 kV), the power quality monitoring is assessed at 22 kV level or in case of newly constructed/refitted networks at both 110 kV and 22 kV voltage levels. The paper presents description of power quality analyzers use for monitoring as well as application software that was utilized for parametrization and evaluation of data. The paper summarizes the options of utilization of monitoring system for consumer requests related to quality of electricity distribution and for solving the DS needs.

ASSESSMENT OF VOLTAGE DIPS IN DISTRIBUTION SYSTEM WITH REGARDS TO DEFINITION OF DIRECTIVE VALUES

Miloslava Tesařová, ZČU v Plzni, Martin Kašpírek, E.ON Distribuce, a.s.

This paper deals with assessment of voltage dips in context of possible introduction of standard that focusing on their appearance frequency within DS. The paper discusses the many issues of standardized values. This paper utilizes data of long-term monitoring of short-time voltage dips on each voltage level within the E.ON supply area in the Czech Republic. The development of events appearance during given period and other relevant standpoints affecting voltage dips frequency and

appearance (such as supply area characteristics, geographical and climate conditions, time aggregation of entries) are analyzed.

ASSESSMENT OF VOLTAGE EVENTS WITHIN AREA SUPPLIED BY CEZ DISTRIBUCE A.S.

František Kysnar, Jan Petrásek, EGC-EnerGoConsult ČB s.r.o.,
Jiří Vániš, Josef Barochovský, ČEZ Distribuce, a.s.

This paper deals with assessment of voltage events experienced on each voltage level within area of CEZ Distribuce a.s. Voltage events are threated in details for MV and LV focusing on assessment of their impacts on customers, measures for decreasing their frequency and other aspects associated with voltage event issues.

LV DISTRIBUTION NETWORK VOLTAGE STABILIZATION OPTIONS USING LINE CONDITIONER

Zdeněk Matoušek, Ladislav Kašpárek, ELCOM, a.s.
Jan Jiřička, Petr Honsa E.ON Distribuce, a.s.

This paper introduces the options of voltage stabilization and power quality improvements within specifically configurable LV distribution networks (remote radial networks). It deals particularly with the distribution networks states affected by reverse power flow of RES (PV, small hydro) that can deteriorate power quality.

PILOT PROJECT EVALUATION OF LV NETWORK VOLTAGE STABILIZATION USING LINE CONDITIONER

Jan Jiřička, Petr Honsa, Martin Kurfiřt E.ON Distribuce, a.s.
Zdeněk Matoušek, Ladislav Kašpárek, ELCOM, a.s.

This paper evaluates operational experience with state-of-the-art version of line conditioner EAFS 050-S produced by ELCOM a. s. and which is utilized to improving the power quality parameters within problematic LV distribution networks. Updated version allows for reliable operation of equipment during bi-directional power flow, solving the issues of RES integration into LV networks. The evaluation is focusing mainly on dynamics stabilization options of line conditioner in terms of their impact on voltage rms value, flicker, voltage unbalance, range limitation and automatic bypassing during irregular operational state of equipment.

E-MOBILITY AND POWER QUALITY FROM CEZ DISTRIBUCE POINT OF VIEW

František Rajský, Stanislav Hes, ČEZ Distribuce a.s.

Power quality is important for reliable and safety operation of DS. There are many factors affecting the power quality in modern era. The recharge station with improper regulation or placed at unsuitable location can be the most affecting factor. Chapter “Measuring electrical recharging station” deals with placing issue based on measurements provided by CEZ Distribuce, a.s. To get a whole picture, it needs to be noted to the variety of recharge station consumption in regard e-vehicles equipment (single-, two- and three-phase).

E-vehicle recharging is important for expansion of this specific part of transportation however is shall not deteriorate power quality within distribution area of CEZ Distribuce, a.s. Thus the final part of this paper deals with possible conditions of recharge station integration into area of CEZ Distribuce, a. s. as well as with regulation of recharge station through e.g. Ripple Control.

IMPACT OF E-VEHICLES RECHARGING ON DISTRIBUTION SYSTEM

Martin Kurfiřt, Jan Hlavnička, Jan Teplý, E.ON Distribuce, a.s.

This paper deals with assessment of recharger impacts on distribution system measured at the cable POC. E-vehicle recharging characteristics are described for both cases, when the battery is recharging through E-vehicle integral inverter and when the inverter is incorporated in the recharging stand. The impact assessment is focusing on reactive and active power flow, ratio of high harmonics within consumed current and voltage unbalance impacts on distribution network.

OPERATIONAL EXPERIENCE WITH E-VEHICLE RECHARGING STATIONS

Zdeněk Hejpetr, PREdistribuce, a.s.

This paper deals with impacts of recharging stations connected to the distribution network. It details and analyzes the characteristics of recharging station consumption on several cases.

VERIFICATION OF HOT-FORMING HYDRAULIC PRESS REAL INPUT POWER AND IMPACTS FOR IMPORTANT CUSTOMER WITHIN THE E.ON DISTRIBUCE SUPPLY AREA

Karel Procházka, David Jakeš, Josef Hrouda, EGC - EnerGoConsult ČB s.r.o.

This paper shows the results of measurement (voltage changes, current profile, active and reactive power impulses and flicker) that was performed in Heiligenstadt in Germany during ATH hot-forming press (sheet power of 780 kVA) operation under conditions that are corresponding to those to be experienced by customer in the Czech Republic. Additionally, the paper presents the determination of network short circuit power that is needed for recalculation of flicker at the customer POC.

ISSUES OF OPERATIONAL IMBALANCE WITHIN LV NETWORKS, IT IMPACTS AND SOLUTION OPTIONS

Jan Jiřička, E.ON Distribuce, a.s.

This paper deals with origin of imbalance within LV networks. Further, it specifies adverse effects of such imbalance on symmetrical and asymmetrical appliances as well as operational safety of appliances in form of allowed touch voltage. The real options for solving the imbalance issues are shown, including comparison of situation before and after the corrective measures are taken.

ROCOF AND TRACEPQM PROJECTS – CALCULATION OF UNCERTAINTY FOR POWER QUALITY MEASUREMENT

Stanislav Mašláň, Věra Nováková Zachovalová, Martin Šíra, Český metrologický institut

This paper describes the purpose and status of European projects of EMPIR ROCOF and TracePQM. Calculating algorithms for power quality parameters (such as ROCOF – Rate of Change of Frequency, phasor, flicker, THD power etc.) are determined within these projects. CMI deals mainly with determination of algorithms and calculation of spreading the uncertainty throughout whole measuring chain and algorithm. The general sample measuring system for metrology application will be introduced; its potential utilization will be presented as well as examples of already implemented algorithms.

SESSION 3: OPERATION, CONTROL AND PROTECTION

Guarantee: Petr Toman, VUT Brno

ZAŘÍZENÍ PRO MONITOROVÁNÍ VN ROZVODEN (SMD)
RADOMÍR DOLEŽAL, SCHNEIDER ELECTRIC CZ

TRANSFORMER STATION MONITORING THROUGH BPL COMMUNICATION USING MV LINE

Petr Mlýnek, Radek Fujdiak, Pavel Šilhavý, Petr Blažek, VUT v Brně
Jan Hlavnička, E.ON Distribuce, a.s.

Existing GPRS/LTE communications cannot be utilized in locations with no signal (cellars, etc.) or where this type of communication is unsuitable due to the third party (cell-phone operator) cyber security. Therefore utilization of existing MV/LV lines for BPL/PLC is ideal solution to creating of independent communication trace. This paper focuses on BPL technology used for 22 kV lines and its characteristics. Additionally the paper deals with performance measurements of BPL modems that are used to communication through MV cables and overhead lines.

PREDICTION OF CONSUMER BEHAVIOR WITHIN LV DISTRIBUTION SYSTEM

Petr Mlýnek, Václav Uher, Petr Toman, VUT v Brně
Juan Zamphiropolos, E.ON Distribuce, a.s.

This paper focuses on utilization of measurements acquired from points of connection/consumptions to predicting the consumer behavior within the LV distribution system. Based on the meters data gained during the pilot project, various methods of prediction were verified; additionally, necessary input conditions were determined for credible prediction.

REACTIVE POWER FLOWS WITHIN LV NETWORKS AND THEIR IMPACTS ON HIGHER VOLTAGE LEVELS

Zbyněk Brettschneider, PREdistribuce, a.s.; Boris Vodvárka, ČEZ Distribuce, a.s.;
Vojtěch Novák, E.ON Distribuce, a.s; Pavel Bürger, EGC-EnerGoConsult ČB s.r.o.

Regarding the distribution system the LV network serves as the POC for most of small-scale consumers. Reactive power flow is directly associated with reactive power consumption. LV network impacts were not analyzed in details so far. This paper deals with impacts of consumption points on the reactive power flow from various aspects; it differentiates between impacts of inhabitant small-scale consumption, enterprise small-scale consumption, size of consumption on main breaker dimension basis etc. The analyzation is based on data from each distribution utility database, power analyzers, etc. Analyzation results were then utilized as input data for LV network model verifying the impacts of variable load on reactive power flow at MV/LV transformer nodes.

EXPERIENCE WITH PILOT PROJECT OF SMART DISTRIBUTION

STATIONS WITHIN PREDI

Jiří Kodad, Pavel Glac, Michal Šolle, Jakub Martínek, PREdistribuce, a.s.

Smart distribution station project was started by PREdistribuce last year following the agreed strategy. Now, all 18 stations are installed. Some have been operating for almost one year other for short period of time. All stations are connected to the SCADA system and supervision station allowing the remote control. Due to the wide deployment of smart station which should start in 2019 the engineering solution was optimized. The optimization focuses on simplification of technological entities delivery, procedures, enrollment and the life-cycle maintenance. In addition to experience with implementation, operation and remote control, there is a lot of operational and diagnostics data available. This paper presents some experience related to pilot project and their utilization for optimization of smart station solutions.

TESTING OF PROCEDURES TO GROUND FAULTS TESTING AND DETECTION WITHIN MV DISTRIBUTION NETWORK

Michal Juřík, Jan Jiřička, E.ON Distribuce a.s.; David Topolánek, Petr Toman, VUT v Brně

The advance in the instrument and communication technologies extends the areas of distribution system monitoring and management. Reliable detection and localization of ground faults within isolated network is one such area where numerous manufacturers offer products with required functionalities. Three such products were evaluated by E.ON and BUT under operational test conditions on MV overhead line at various resistance values at the point of fault.

FAULT DETECTION ON SINGLE INSULATED CONDUCTORS

Jan Vaculík, E.ON Distribuce a.s.; Stanislav Mišák, Jan Fulneček, VŠB – TU Ostrava
Jan Grossmann, Elvac, a.s.; Vladimír Najman, ČEZ Distribuce a.s.

Distribution utilities use the so called simple insulated conductors at the MV level, which are installed in heavy terrain and forest paths where the branches falling on line represent high risk. Main advantage of such line is that it can conduct electric power even if there are multiple contact points of line with branches. On the other hand, the localization of ruptured line which then falls to ground is complicated since there is no ground fault (due to the insulation) that could be detected by protections. Possible solution presents the usage of the insulated conductor fault detectors which can detect the fault on the base of discharge analyzation activity. Such activity implicates the line insulation degradation which can be detected even before the fatal failure occurs. Three insulated line fault detectors are currently tested by E.ON Distribuce, a. s. in close cooperation with VSB-TOU and ELVAC, a. s. within the pilot project in the Otrokovice area.

MV DIAGNOSTICS USING PLC MODEM

Ladislav Šťastný, Bedřich Beneš, ModemTec; Ondřej Baštán, VUT v Brně

Regarding the faults occurrence during the operational period, the power systems are very the same as any other large systems. Statistics of faults and cost associated with faults is divided into three periods, so called “bathtub curve”. Implementation of diagnostics (preferably using monitoring) is one possible method of increasing system service life. In case of MV system the monitoring is dealing with partial discharges, which are both indicators and sources of insulation degradation. Coupling device of PLC modem allows for evaluation of such partial discharges. Integration of several functions into one element (particularly on the MV level) offers technical and economic benefits – allows for communication and insulation status monitoring at the same time. MV machine and line faults can be forecast using diagnostics even before the fault occurs.

PROTECTING OF SYNCHRONOUS AND ASYNCHRONOUS MOTORS, THERMAL SENSOR SYNERGY

Jaroslav Pospíšil, Tomáš Effenberger Protection & Consulting, s.r.o.

This paper presents evaluation of protecting the AC motors as defined in CSN 33 3051 and describes new approaches to protection that are based on possible faults, such as phase and ground faults, faults resulting from temperature, overloading etc. Characteristic protection schemes are recommended for motors with and without stator winding node extraction and with or without RTD sensors. The paper includes brief description of motor diagnostics that utilizes e.g. measurement of electric parameters as well implemented GE protection.

INRUSH CURRENT OF TRANSFORMER – HARMONICS IN CURRENT AND DIFFERENTIAL PROTECTION BLOCKING

Jiří Bermann, ABB s.r.o.

Inrush current of transformers affected the service life of power equipment in power industry and decrease the accuracy and selectivity of protections. Magnetic plate development leads to increase of the inrush currents as well as their time constant. These inrush currents need to be taken into account in protection settings. This concerns particularly differential protection because it considers the inrush current as internal short-current of equipment. One option is blocking the differential member of protection by second current harmonic of inrush current. This paper illustrates determination process of volume of harmonics in inrush current using the substitution of magnetic characteristic by simple mathematic formula.

REVISION OF CSN 33 3051 STANDARD – PART: SPINNING MACHINES

Jaroslav Pospíšil, Protection & Consulting, s.r.o.

The paper provides new sources for revision of existing standard (CSN 33 3051). Protection of 1 GW generator (including requirements for protection of auxiliary system equipment and backup system) for nuclear power plant is shown.

SESSION 4 – DISTRIBUTED ENERGY RESOURCES AND ELECTRICITY USAGE

Guarantee: František Kysnar, EGC ČB s.r.o.

TSO-DSO COOPERATION WITHIN THE EUROPE

Martin Pistora, Petra Kopýtková – ČEPS, a.s.

This paper deals with cooperation between TSO and DSO within the Europe. It describes both the existing situation of informal cooperation under the European Commission and the future as it is proposed by so called “winter legislative package” (or “Clean Energy for All European”). This supposes creation of central organization for distribution system operators (EU DSO Entity) instead of existing voluntary associations such as EDSO, EURELECTRIC or CEDE. Additionally it presents the ENTSO-

E‘s proposal regarding the future forms of cooperation with EU DSO Entity as well as key topics this cooperation should aim for.

IMPLEMENTATION OF EUROPEAN NETWORK CODES INTO NATIONAL NETWORK CODES

Oldřich Rychlý, ČEPS, a.s.

Implementation of network connectivity code (NC RfG, NC DCC and NC HVDC) will come to the end this year. New requirements will be processed into the distribution system code and transmission system code by DSOs. These new connectivity requirements will apply after three years since this directive become applicable. Since these codes are not applicable to the same date new ones will be activated between April and September of 2019. This paper summarizes newly approved requirements regarding the network connectivity (according the NC RfG and NC DCC). Additionally, the paper deals with implementation of operational codes and SOGL and NCER general directions and introduces their main requirements.

IMPLEMENTATION OF EU DIRECTIVE # 2016/631 (RFG), #2016/1388 (DCC), #2017/1486 (SOGL) AND PREPARATION OF NETOWRK CODE CHANGES

Karel Procházka, EGC-EnerGoConsult ČB s.r.o.

This paper presents details of implementation in progress of EU directive and informs about needed and prepared changes of distribution code, including its appendixes. Particularly it deals with Main body of distribution code, Appendix 4, Appendix 6 and Appendix 7.

NON-FREQUENCY AUXILIARY SERVICES WITHIN DS – UPDATED APPENDIX 7 OF DISTRIBUTION CODE

František Kysnar EGC-EnerGoConsult ČB s.r.o.; Zdeněk Pavlovič, Vlado Kubic, Jan Šeda, ČEZ Distribuce, a.s.; Petr Vaculík, Miroslav Kozák E.ON Distribuce, a.s.; Aleš Krula, Zdeněk Hejpetr, PREdistribuce, a.s.

This paper deals with updated Appendix 7 of Distribution Code regarding the non-frequency auxiliary services. This paper describes such services, process of their certification and evaluation. Expected evaluation of such services is illustrated on various examples.

INTERFLEX – PRESENT DAY RESULTS OF PROJECT

Stanislav Hes, Pavel Derner, Jan Kůla, Jan Švec, ČEZ Distribuce, a.s.

This paper contains the information of present day results of European project Interflex in which the CEZ Distribuce is working as leading entity of task package Demo2. Interflex is focusing on increasing the flexibility within European distribution system operators and is partially funded by European Commission within the Horizon 2020 program. Demo2 part is aiming for testing of features, which are not standardized for distribution networks yet. Main goal is to increase the potential of connection RES as well as efficiency of E-vehicles recharging stations integration to be connected to the DS. Particularly it aims at integration of PV (with Q(U) and P(U) functions), U/Q regulation of generation connected to the MV (PV, WT, BGS), development and deployment of smart recharging stations for E-vehicles and integration of PV with energy storage on demand side.

MEANS FOR INCREASING THE CONNECTIVITY OF GENERATION WITH AUTONOMOUS REGULATIONCHARACTERISTICS AT THE LV LEVEL

Pavel Derner, Stanislav Hes, Jan Kůla, Jan Švec, ČEZ Distribuce, a.s.

This paper show the analysis of increasing LV networks connectivity of generation equipped with active autonomous regulation of Q(U)/P(Q). This paper compares the real regulation characteristics with simplified calculation results. Possible increase of connectable power is evaluated theoretically for given distribution networks from InterFlex project and LV terminal types (according to the NAP SG). Terminal power parameter impacts on increased connectivity are analyzed and real reactive power overflow to MV level is compared to the one calculated through simplified formula.

Q(U) AND P(U) CHARACTERISTIC IMPACT ON INCREASING GENERATION CONNECTIVITY TO DS

Josef Hrouda, Jan Petrásek, Karel Procházka, EGC-EnerGoConsult ČB s.r.o.

This paper deals with P(U) and Q(U) regulation impacts on volume of connectible power. It analyzes the benefits of such regulation on conductor R/X ratio. Regulation voltage sensitivities (expressed by V/kVAr ratio) are calculated for various conductors used in practice at LV and MV level. Additionally, this paper provides the analysis of LV network parameters with respect to required “fit and inform” of sources up to 50 kW.

INTEGRATION OF GENERATION WITH U/Q REGULATION INTO MV DISTRIBUTION NETOWRKS

Pavel Derner, Stanislav Hes, Jan Kůla, Jan Švec, ČEZ Distribuce, a.s.

This paper deals with MV generation regulation impacts on voltage setpoint value and the integration of such generation into distribution networks. The benefits of such regulation for voltage stabilization are emphasized. Model connectivity calculation is made over the selected distribution networks incorporated regulated generation from the InterFlex project, illustrating some aspects and possible limitations relating to the generation connectivity. The impact of power parameters of MV networks on U/Q regulation is shown. Several measurements of U/Q regulation implementation are presented as well.

EXPERIENCE WITH POWER STORAGE LOCATED AT THE RECHARGING STATION POINT OF CONNECTION TO THE DS

Lukáš Křivanec, PREdistribuce, a.s.

RES and e-vehicles are on the rise since the European Union is forcing their usage particularly in order to improve the urban environment. Because of this, we expect the increase of numbers of e-vehicles as well as DER. Hence to be ready for these new challenges, PRE decided to implement pilot project which combines fast recharging station for e-vehicles, PV and power storage (using the battery). This project is verifying the impacts of such equipment on local power parameters and gaining experience with operation in various modes.

IMPACTS OF E-VEHICLES RECHARGING ON DISTRIBUTION

SYSTEM CONDITION

Pavel Derner, Stanislav Hes, Jan Kůla, Jan Švec, ČEZ Distribuce, a.s.

This paper deals with recharging of e-vehicles from distribution system, its impact on power quality and forecasting new trends and technologies related to the e-mobility development. Within the InterFlex project, CEZ Distribuce is testing the measures to limiting recharging power on dispatcher request basis (during emergency situations) and during under-voltage/under-frequency at POC. Additionally, this paper analyzes engineering and financial impacts of e-mobility scenarios on LV/MV networks to the 2040. Eventually, activities and recommendations for e-mobility integration into DS will be presented based on the European association cooperation.

ASSESSMENT OF FIELD TESTS OF BATTERY POWER STORAGE IN MYDLOVARY

Martin Kurfiřt, Michal Juřík, E.ON Distribuce, a.s.; Petr Hloucha, Siemens s.r.o.

This paper describes each operational parameter of battery power storage (SIESTORAGE); analyzes charging/recharging cycle; focuses on regulation features using reactive and active power, dynamics and overall efficiency. Parameters were measured at both LV level (between inverters and transformer) and MV level (22 kV bay in substation) and compared subsequently. All operational modes were verified through measurement during field tests of battery, which can be utilized to balancing the power of energy trader.

IMPACT OF UNDERGROUND WATER LEVEL ON THE CONDUCTANCE CHANGE OF UPPER GROUND LAYERS IN LATEST PERIOD

Jan Šeda, ČEZ Distribuce, a.s.

The impact of mankind on climate is widely discussed for long time. Gradual lowering of underground water level is experienced in hydrogeology. This can affect among others the conductance of upper ground layers. This paper makes notice of this phenomenon and utilizes information from different branch.

JOINT ENERGY MANAGEMENT WITHIN APARTMENT HOUSE

Petr Wolf, Tomáš Vácha, Sofiane Kichou, Nikolaos Skandalos, UCEEB ČVUT v Praze

This paper deals with utilization of PV as local power source for apartment building that use shared network within so called direct line. The case study shows the engineering solution of house energy based on real measurements. Several configurations are discussed, considering the PV output power, possible battery energy storage and/or utilization of electricity surplus for heating/hot water heating.

SESSION 5: DISTRIBUTION SYSTEM DEVELOPMENT

Guarantee: Jaroslav Šabata, EGÚ Brno, a.s.

DEVELOPMENT OF FIBRE-OPTIC INFRASTRUCTURE

Pavel Seidl, ČEZ Distribuce a.s.

This project aims at implementation of fibre-optic infrastructure in CEZ Distribuce a. s. with respect to management system requirements and smart grids future needs. It is based on draft of fibre-optic infrastructure development of CEZ Distribuce a. s. and provides the construction of fibre-optic network till 2040. New fibre-optic network supports technology changes related to the rise of DER, development of e-mobility, improvements of DS reliability and expected increase of data communication associated with smart measuring systems (AMM). Project includes engineering solutions and specifications used for supplies selection procedures.

SIMULATION OF ASSET RENEWAL IN CEZ DISTRIBUCE, A.S.

Adam Teringl, Daniel Kašpar, ČEZ Distribuce, a.s.

This paper presents the process of prospect making regarding the HV/MV/LV distribution system resources renewal. Asset Management includes activities, which are implementing asset manager rights, to achieving company's strategic goals and politics. Asset management is performed effectively and sustainably. Medium- and log-term asset management plans incorporate the simulation of asset operation and maintenance and determine specific development projects. Renewal process is determined by age, usage, technical state and evaluated engineering risks. all these information are used for specification of reconstruction priority.

ANALYSIS OF MUNICIPAL LATTICE DISTRIBUTION NETWORK

Michal Ptáček, Lucie Frechová, VUT v Brně;
Jan Vaculík, E.ON Distribuce a.s.; Radek Hochmann, E.ON Česká republika s.r.o.

This paper presents the operation analyzation of municipal distribution network with dense lattice topology. Due to technical economic aspects, large municipal lattice networks are usually operated as radial networks since the lattice topology allows for various radial connections. Though the analyzation of lattice network operation is still reasonable particularly their safety and stability. The paper presents the power flow calculation as well as assessment of specific operational parameters acquired from long-term measurements. Analyzation deals with both the normal operation of lattice network and assessment of operation during switching the former network topology caused by required operational action.

IMPACT OF RAILWAY SUPPLY TRANSITION TO 25 KV AC SYSTEM ON DISTRIBUTION SYSTEM

Milan Krátký, Petr Modlitba, EGÚ Brno, a. s.

Future development of railways and its increased usage leads to need for expanding of electrified lines, modernization of supply and transition of existing lines supplied by DC 3 kV system to unified AC 25 kV system in the Czech Republic. Unification of supply system was agreed by Central commission of Ministry of Transport in December 2016. Projects for reconstruction, expanding and transition to unified AC 25 kV system are prepared nowadays. This results in increase demands of railways on

distribution systems, which shall not affect the power quality. Two different methods using semiconductor technologies are compared. This paper evaluates both these technologies and proposes the suitable solution in context of 110 kV distribution system impact.

OVERFLOW OF REACTIVE POWER WITHIN DS

František Žák, Unicapital Distribuce

The reactive power issues changed from high consumption to high injection during the time. This is mostly caused by higher ratio of cables as well as different reactive power characteristic of appliances. Overflow of reactive power associates with loss increase, fine issued for power factor violation, fine for reactive power injection and voltage balance in network. Reactive power overflow fine is the most transparent. Reactive power fine can significant as well but it can be effectively eliminated. The change from inductance to capacitance reactive power can caused distinctive voltage changes. Hence this paper deals with such reactive power overflow.

IMPLEMENTING STATISTICS INTO PREDI DISTRIBUTION NETWORK MANAGEMENT AND RENEWAL

Zbyněk Brettschneider, Martin Hejhal, Petr Lžičař, Radek Hanuš, PREdistribuce, a.s.

PREdistribuce developed the software that provides statistical features for optimization of distribution network management and renewal. Current version is focused on MV cable network determining failure rate and restoring indexes. MV network faults are located base on these indexes. Index of restoring is used to determine each MV resources restoring priority.

POWER QUALITY EVALUATION FOR 2017

Jan Šefránek, Energetický regulační úřad

This paper presents evaluation of power quality and services associated with power supply in the Czech Republic power industry in 2017. The evaluation of supply continuity is aimed for, including quality regulation motivation. The paper contains up-to-date information related to power quality regulation and revision of regulation no. 540/2005 series.

FAULT LOCALIZATION WITHIN MV USING FAULT LOCATER REACTANCE

Branislav Anderko, Slavomír Veseleňák, Východoslovenská distribučná, a.s.

This paper deals with function which can determine the probable fault location within the MV distribution system. State-to-the-art protection includes fault locator (FLOC) that calculates the reactance between fault and protection (so called fault loop reactance) through measurement electric variables during the MV line fault. This calculation provides reliable results in case of phase-to-phase faults. When the fault loop reactance is known the fault can be localized using other parameters, thus helping the dispatcher identified the fault. To perform the calculation, reactance of each distribution system line element reactance needs to be known.

INSTALATION OF AUTOMATED REMOTE ELEMENTS INTO DISTRIBUTION SYSTEMS

Pavel Seidl, ČEZ Distribuce a.s.

Project objective is installation of remote controlled DS switches with advanced functionalities and with partial automation, which improves supply continuity indicators (SAIFI, SAIDI). Remote controlled elements (RCE) allow faster and more effective manipulations and automated actions. Installation of such RCEs with associated automation, control and communication functions decrease directly the number of power supply interruption as well as shortening the interruption time. Installation supports NAP SG objectives aiming at power quality, reliability, safety and maintainability improvements of end customer power supply and is aiming at achieving the level which is common in E15 countries, along with minimizing bottle necks and integration of DER.

FAULT LOCATION IDENTIFICATION WITHIN LV NETWORK USING SAMRT METERS

Slavomír Veseleňák, Východoslovenská distribučná, a.s.

This application allows for LV network fault localization through SMART meters and customer information associated with interruption. Quick customer identification is based on name, address, consumption point number, EIC code, etc. with following actions such as PING, reading the U1, U2, U3 voltages directly from customer SMART meter (if applicable) or from other customers at the same LV terminal of the same transformer station. Probable fault location is determined based on above mentioned data and repair priority is set considering the fault location and cost effectiveness related to compensating payment.

PROCESS OF UNIFIED COMMITTING OF ELECTRONIC PROJECT DOCUMENTION AND SUBMITTING COMMENTS

Karel Schmidt, PREdistribuce a. s.; Josef Fritschka, Technodat Elektro, s.r.o.

This paper provides description of experience with unified committing of electronic project documentation for building including submitting comments. It is based on transition from file system to object oriented SQL database structure fully integrating project data. Project documentation for buildings in PREdi requires secure data exchange between stakeholder and documentation processors. Unified documentation structure at all levels and unification of their form in compliance with direction no. 499/2009 series are key requirements. The process includes procedure checks for submitted documentation made by stakeholder related both the system view and content. Every participant (whether stakeholder or project organization) has access to documentation and information during each process phase.

SESSION 6: MANAGEMENT, ORGANIZATION, QUALIFICATION

Guarantee: Martin Schneider, PREměření, a.s.

NEW TECHNOLOGIES AND NETWORK OPERATORS

Pavel Círek, Energetický regulační úřad

New trends and technologies are introduced in power industry. This paper deals with impacts of such new technologies on DSOs/TSOs. It deals with question whether DER, power storage, flexibility, e-mobility and integration of market in Europe can change power industry. It provides some hints whether foundation of AirBnB or Uber is possible in power industry. It deals with possible impacts of “winter package”.

IDENTIFICATION OF ILLEGAL CONSUMPTIONS FROM AUTHORIZED EXPERT POINT OF VIEW

Tadeusz Sikora, Karel Skokanský, VŠB-TU Ostrava.

Illegal consumption issue is decided in compliance with directive no. 82/2011 series and sometimes according to Constitutional Court decision no. 668/15. In practice the case is whether consumption is illegal or not in many times. Furthermore, compensation payment needs to be determined. This paper presents several real cases with regard to assessment of evidences and determination of compensation payment.

RELIABILITY AND STRATEGIC OBJECTIVES ASSOCIATED WITH ASSET MANAGEMENT IN PREDI

Radek Hanuš, Zbyněk Brettschneider, PREdistribuce, a.s..

Operation procedures, development and refitting of distribution network need to be revise continuously to achieve reliability required by Regulatory Office and strategic objectives defined by Distribution Code. This paper describes approach applied within PREdi Asset Management.

DECARBONIZATION OF POWER INDUSTRY IN COMPLIANCE WITH EU REQUIREMENTS AND EVEALUATION OF ITS IMPACT ON POWER INDUSTRY IN THE CZECH REPUBLIC

Michal Macenauer, EGU Brno

Ensuring the balance between generation and consumption is the public concern within power industry, heating industry and gas industry are the most important energy systems. Energy market operator (OTE, a. s.) shall create report about the expected electricity and gas consumption to Ministry of industry and trade, Energy Regulatory Office, Transmission System Operator and Transport System Operator at least once in the year and regarding procedures to balance consumption and requirements. This paper deals with possible ways of power and gas industry development and finding troublesome or dangerous trends, as well as specification of limits and risks for 2018 and 2050 period.

CROSSROAD OF POWER INDUSTRY IN THE CZECH REPUBLIC

Hynek Beran, ČVUT

Power industry in the Czech Republic will face several major risks. Some scenarios can be forecasted, one of which will materialize most likely (base on the local conditions, situation and local and/or European trends). There is an energy concept agreed in the Czech Republic though almost nothing has happened since its last update two years ago. This paper deals with increased need of distributed regulation and system options for upcoming period.

SMART METERING DATA UTILIZATION FOR PLANNING, MONITORING AND MANAGEMENT OF NETWORK OPERATION

Petr Toman, Jiří Drápela, David Topolánek, Michal Ptáček, Václav Vyčítal, Petr Mlýnek, VUT v Brně; Juan Zamphiropolos, E.ON Distribuce, a.s.

This paper describes the utilization of measurements acquired at points of consumption/connection for use cases related to planning, monitoring and managing of network operation (particularly LV networks). These use cases were verified based on metering data acquired during the pilot project implemented by E.ON Distribuce.

EXPERIENCE WITH AMM TELECOMMUNICATION INFRASTRUCTURE OPERATION AND FUTURE POSSIBILITIES

Martin Vycpálek, Pavel Glac, PREdistribuce, a.s.

According to experience, the fast and reliable communication infrastructure will play the most important role for AMM and smart grid implementation. This paper describes the pilot project experience associated with such infrastructure operation and outlines the possible ways of future development and utilization of AMM features.

ISSUES ASSOCIATED WITH REVISION OF DEDICATED POWER SYSTEM RESOURCES

Pavel Kraják, ČENES

In compliance with energy law, the license owner shall maintain power system resources safe and reliable according to the law and technical standards. Equipment safety is ensured by regular and default revisions (according to CSN 33 1500 and CSN 33 2000-6). Associated PNE 33 0000-3 for default revision evaluates even the reliability of power equipment. The law requirement is fulfilled this way by single action. Reliability is one of the power quality parameters though it is defined by different terms – continuity indicators. This paper deals with quality of revision itself.

AUGMENTED REALITY IN POWER INDUSTRY

Jaroslav Vrána, David Mansfeld, BM COM s.r.o

This paper aims at the possibilities of using augmented reality in power industry. It describes not only possibilities of how this technology can bring new customers to power utility but remote monitoring of equipment, diagnostics and end user application as well.

INTRODUCTION OF SECUREFLEX PROJECT – SAFE NETWORK USAGE OF POWER FLEXIBILITY IN ENERGY NETWORKS IN THE CZECH REPUBLIC

Ondřej Mamula, David Hrycej, CIIRC/ČVUT, Filip Procházka, Tomáš Pitner, Martin Střelec

The project aims at analytic, calculation and optimization tools and objective-targeted studies, which improve the systematic energy solution for safe power flexibility usage associated with new technology integration and market entities in the Czech Republic. These tools will be developed in close cooperation with system operators. Project timing and project results achieving correspond with expected implementation of medium terms “Winter package” measures that are not covered by suitable tools at this moment.

IMPLEMENTATION OF CYBER SECURITY TO SW/HW SUPPLIER

Jindřich Zoubek, TECHSYS – HW a SW, a.s.

This paper deals with measures that are ensuring data security, implementation of safe SW development, risk analyzation of all products and engineering measures (administrator and used action logging, user management associated with AD/LDAP and securing the telemetric communication (IEC 62351).