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ABSTRACT BOOK

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SESSION 1 – NETWORK COMPONENTS

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

SF6 FREE HV GIS AND BRAKERS

Tomáš Pisarčík, Siemens

The paper introduces new Siemens HV products so called “blue” line or “SF6 free” or “CO2-neutral”, specifically “blue” breakers and encapsulated substations. Prefece of paper deals with the HV vacuum breakers from their MV predecessors and prototypes introduced in 2010 to the enrollment of the whole 3AV1 series with 145 kV limit. The main part of the papers focuses on 8VN1 encapsulated substations with 145 kV limit incorporating vacuum douse and “clean air” insulation medium, which were introduced on trade show in Hannover in April of 2017. Attention is paid to their alternative incorporating unconventional HV transformers. The paper deals with the advantages that HV “SF6 free” equipment offer to the operator under the new and expected EU directions and regulations.

CONTINUOUSLY CONTROLLED COMPENSATING REACTORS

Milan Valečka, ETD TRANSFORMÁTORY

ETD as traditional manufacturer of transformers in Czech Republic acquired the license for utilizing patents used for development and production of continuously controlled compensating reactors. This equipment can be used as continuously controlled compensating reactor or voltage stabilizer for long distance transfer of energy or with condenser battery as reactive power compensator and thus fully replacing rotary or static thyristor compensators. The service life and maintenance claims are comparable with the power transformers. Continuously controlled reactors are working on voltage levels between 6 kV and 500 kV.

BATTERY TRANSFORMER STATIONS POWER STORAGE IN POWER SYSTEM – TRENDS AND EXPERIENCE

Milan Kloubec, ELTRAF, Martin Panáč, Siemens, Michal Jurík, E.ON Distribuce

Due to the decreasing prices of high-capacity batteries, these are more often utilized for power storage in power system. This paper focuses on large battery stations (with capacity of single digits MWh or higher) which are constructed in interconnected European power system, on their technology, service life and usage options. The paper includes the presentation of one of the most important project of this kind in Czech Republic in these days – the battery station in Mydlovary substation area.

TESTING OF BREAKERS GROUNDED ON BOTH SIDES – TEN YEARS OF EXPERIENCE

Václav Straka, Antonín Krňoul, TMV SS

Power breakers are often neglected part of distribution system. Therefore obsolete (either physically or regarding the state of art) breakers can be normally found in real world. The range of breaker types in field is relatively wide and requires diagnostic methods specific for each breaker type. Main emphasis of this paper focuses on the new secure aspect of diagnostics which is testing of breakers grounded

on both sides. Today there are several options available. The paper presents the comparison of “common methods” of diagnostic of single-side grounded breakers, comparison of each method of diagnostic of breakers grounded on both sides (line, generator, placed in GIS) as well as ten years operational experiences with this method.

IMPEDANCE MEASUREMENT IN VARIOUS DISTRIBUTION NETWORKS TYPES

Martin Paar, Jan Souček, František Ženožička, MEgA - Měřící energetické aparáty, a.s.

Due to the nowadays increasing connection of microgeneration into the distribution network, the corresponding impedance of current loop is required. This paper deals with measurement of impedance in various LV distribution network types regarding both the connected microgeneration and larger loads. The variation of impedance in time is evaluated as well as the impedance gained through ad hoc measument.

INDUCED VOLTAGE OF 110 KV CABLE SHIELDING

Milan Singer, PRING, Jan Vočko, PREdistribuce

Specific means of shiled grounding such as SPB (Single Point Bonding) and CB (Cross Bonding) are used to minimize the losses and increase the transmission capacity of 110 kV cables. Both these methods genrate induced ground voltages at non-grounded open terminals of shielding. The value of these voltages needs to be known to ensure the staff safety (during operation) as well as equipment safety (during faults). The over-voltage limiters of cable shielding are designed based on the maximum induced voltages during short-circuits. This paper analyzes the magnitude of these voltages based on real operations, evaluation of maximum voltage values used in reference guides for over-voltage limiters designing and introduction of simplyfied calculations derived from US regulations mostly. Some voltage values were verified on mathematical-physical model as well.

EXPERIENCE WITH IMPLEMENTATION OF 1AYKY-J-OT CABLE IN PREDISTRIBUCE NETWORK

Jaroslav Trojan, Jiří Ullrich, PREdistribuce

This paper deals with experience with implementation of 1-AYKO-J-OT cable (thereinafter called KSK) in PREdistribuce network. KSK is the low voltage cable with polymer tube for subsequent micro-cable instalation. Additionally the paper decsribes selected mearument results including the evaluation of KSK parameters.

STANDARDIZATION OF SUPPORTING POINTS FOR 110 KV LINES

Kamil Čihák, Tomáš Šedivý ČEZ Distribuce, Jan Volek, E.ON Distribuce

The paper deals with standardization development between 2007 and 2017. It includes the examples of final outputs so-called STANDARDIZATION DIRTECTIVES for steel masts used for building up the 110 kV overhead lines which are mandatory documents for DSOs i.e. CEZ Distribuce and E.ON Distribuce. The paper discribes the development history of 110 kV and 110 kV line supporting points from 1918 to nowadays. The last part lists the examples of poles and supporting points of different design for 110 kV lines including the comparison with steel masts.

MONITORING OF ENVIRONMENTAL LOAD ON 110 KV LINES TO IMPROVEING THE OPERATIONAL RELIABILITY

Petr Lehký, Jaroslav Šabata, Lubomír Zeman, EGÚ Brno

Environmental loads on their extreme threaten the reliability of overhead line operation. The knowledge of updated environmental condition is important for operation of power system. Long-term records constitute the important database for statistical evaluation and selection of suitable load level used in overhead lines design. The basic monitoring station network was eshablished in cooperation with overhead lines operators that is going to be reffiled by the system of measurements on conductors. This paper deals with first operation experience of this monitoring system.

SANITATION OF MASTS MADE OF THE WEATHERING STEEL

Filip Řimnáč, E.ON Distribuce

The paper deals with sanitation method of existing masts made of weathering steel which is based on cementing of screws and gaps using the specific putty without the need of overall painting. The paper shows the sanitation technology including sanitation requirements. Along it contains the comparison of that method with sanitation through painting. Finaly the experience gained during sanitation finished so far are summarized.

SESSION 2 – POWER QUALITY AND EMC

Garant: Pavel Santarius, VŠB-TU Ostrava

IMPACT OF NON-LINEAR LOW-RATING APPLIANCES ON POWER NETWORK

Václav Kůs (ZČU v Plzni)

This paper deals with measurements anlysis and results of non-linear appliances which are connected to the LV system. It compares the measurement results in housing estate and satellites. The single standardize family house is used for comparision of power input and harmonic analysis. The analysis of average consumption of housing unit regarding the harmonics is made on statistical calculation basis.

REAL UTILIZATION OF PHOTOVOLTAIC SOURCE WITHOUT POWER STORAGE FOR LOCAL CONSUMPTION OF HOUSING

Petr Wolf, Jan Včelák, ČVUT UCEEB

Most of the photovoltaics builded up in Czech Republic between 2009 and 2010 were implemented in form of field installations therefore there is a big potential that the number of roof implementations used as local power source would be increasing. The pivotal issue of such power source is how to ensure the concurrence of generation and consumption. The house consumption is typical by uneven consumption involving huge morning and evening peaks. This paper analyzes the real share of solar power which can be used for housing or aggregated housing consumption.

DISTURBANCE IN NETWORK INCORPORATING SMALL WATER POWER PLANT

Miroslav Dubovský, Stredoslovenská energetika – Distribúcia, a.s.

EVALUATION OF POWER QUALITY PARAMETERS IN MV AND LV NETWORKS COMPRISING THE DISTRIBUTED GENERATION

Martin Kašpírek, Jan Jiřička, Martin Kurfiřt, Vladimír Štěrba, Bořivoj Kubík; E.ON Distribuce, a.s.

This paper evaluates the measuring seasons in distribution networks comprising the distributed generation (solar plants). The LV measurements were performed at 30 different distribution network in 2017, always simultaneously in the supply station and at the point of connection of plant. MV measurements were performed at the point of connection of MV plant to the network. Power quality measurements were evaluated according to the CSN EN 50160 standard considering the level of each parameter (voltage variation, flicker, unbalance, harmonic distortion and selected harmonic voltages). Additionally the power factor operational values are analyzed in case of MV plants.

DRAFT AND VERIFICATION OF MAXIMUM SHORT-CIRCUIT IMPEDANCES IN LV NETWORK CONSIDERING THE CONFORMITY WITH CSN EN 50160 STANDARD REQUIREMENTS

Martin Kašpírek, E.ON Distribuce, a.s., Kvalita dodávky energií
F.A. Gerstnera 2151/6, 370 01 České Budějovice, Česká republika

E.ON Distribuce, a.s. supplies about 1.5 milion of customers. Most of these customers is supplied through about 40 000 km lines of LV network. DSO shall quarantee the power quality according to the EN 50160 standard on each point of connection. Each quality parameter is then affected by true value of short-circuit impedance which depends on the length of LV terminal. This paper describes the determination of maximum short-circuit impedance values regarding the EN 50160 standard requirements. Suggested values are validated in field utilizing about 2 000 measurements of short-circuit impedance available to E.ON Distribuce. Maximum value of short-circuit impedance is calculated for the maximum length of LV terminal and common profiles conductors. Compliance with the maximum allowable length of LV terminal is then one (but not the only one) of the conditions needed to achieving the compliance with EN 50160 standard requirements and supports the staff with fast tool for drafting the initial network project.

POWER QUALITY MEASUREMENT IN PQA DISTRIBUTION NETWORKS ACCORDING TO PNE 33 3430-9 COMPANY STANDARD OF CEZ DISTRIBUCE, A.S.

František, Rajský, Jaroslav Kloud, ČEZ Distribuce, a.s.

Existing measuring methodology needed to be improved and supplemented due the development and structure changes of appliances and distributed resources concerning the disturbance generation in distribution networks as well as the change in terms of disturbance sensitivity. This paper presents the measurements results.

IMPACT OF NEARBY BUSBAR MAGNETIC FIELD ON CURRENT SENSORS

Tadeusz Sikora, Jan Hurta, FEI TU Ostrava

Based on several identified incorrect current measurements made trough clip-on current measuring transformer the methodology was proposed and tested to detect the affection of current sensors by nearby busbar magnetic field. Clip-on ammemeters and current sensors recorded the current up to 11 A when they were close to the 600 A busbars even if they were not connected to any conductor. The error depended on the sensor position as well as the distance. Some sensors recorded the error value at distance of up to 50 cm from busbar.

ANALYSIS OF POWER FLOW IN 22/0.4 KV DISTRIBUTION TRANSFORMATIONS

Roman, Vykuka, Miloslava Tesařová,
Západočeská univerzita v Plzni, Katedra elektroenergetiky a ekologie

This paper summarizes the analysis results of active and reactive power flows in 94 selected distribution transformers (DTS). The power quality measurements or control measurements on these DTS were made within 4 to 84 days. It results in series of middle values of U, P and Q of ten minutes period measured on each phase of DTS. The analysis of overflow on each phase was made and as well as determination whether the three-phase overflow was recorded. Further, the analysation of overflow level regarding the number of participating phases was made as well as eveluation of duration of each recorded overflow and the frequency of overflow during the day. Regarding to the extent and method used for comparision od variously loaded DTS, this study offers unique and detailed analysis of active and reactive power flow on the 22/0.4 kV boundary.

RES AND THEIR IMPACT ON VOLTAGE

František Žák

Power network development is affected by various factors. One of these factors are changes associated with distribution of power generation. Nowadays trend is subjected to the distribution of power generation support. Another factors affecting the network operation are the increasing portion of cables as well as the change of load characteristics. The reactive power issue within power networks needs to be faced today more often than it used to be. Herewith the reactive power is one the main factors affecting the voltage. Thus these issues needs to be addressed. Reactive power management can affect even the network power flown.

SESSION 3: OPERATION, CONTROL AND PROTECTION

Garant: Petr Toman, VUT Brno

UTILIZATION OF NUMERICAL INVERSE LAPLACE TRANSFORMATION ON SOLUTION OF TRANSIENT PHENOMENON IN ELECTRIC CIRCUITS

Jan Pígl, Eaton Elektrotechnika s.r.o.

Electric circuits are described through integro-differential equations for solving the transient phenomenon. Laplace method can be used for solving these equations with great effect. There are two methods utilized in process of determining the inverse Laplace method – the analytic and numerical. Numerical method can be more suitable in determining the more complex cases in which the analytic method can be way more complicated. This papers focuses on numerical solution of inverse Laplace transformation. The paper aims on Gaver-Stehfest method and Dubner and Abat's method. Usage of both methods would be demonstrated on the example of current transformer operation simulation which are used for protection against fault (short-circuit) in distribution system. Results are compared with analytic solution of the same example. The solution is implemented in C++.

COMPENSATION OF PARALLEL LINES IMPACT THROUGH SETTING OF THE ZERO SEQUENCE COMPENSATION FACTOR OF DISTANCE PROTECTION

Jiří Bermann, ABB s.r.o.

This paper deals with impact of parallel lines on distance protection measurement and the options of its compensation through zero sequence factor. The paper shows the variability of such influance depending on network status. It shows the way of compensation of the biggest natural non-linearity of gradual fault on the protection line itself and the accuracy of the fault detector measurements.

NEW CHARACTERISTICS OF GROUND PROTECTION IN MV NETWORKS WITH INSULATED TRANSFORMER NODE

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

This paper analyzes sorted characteristics of groiund protection above all their selectivity, sensitivity and function. In industrial MV networks (in example the 6 kV auxiliary power), where the sensitivity of slide transformer ratio setting shall be within 2mA and the error shall be up to 1 mA. According to the oversea experience, the directional criterion of reactive power for insulated networks with smal earth currents has suitable sensitivity and selectivity even during various earth faults (arch, metalic, interrupted). The other option of earth current measurement evolves from residual current measurement Izb = (3 I02 – jB2 * U0). New function I0k (directional earth protection) is defined due to the calibration of I0 loop. New localization method is improved based on time synchronization of of I0 current measurements along the MV line.

OPERATIONAL EXPERIENCE WITH PROTECTING CLASS 3 DISTRIBUTION TRANSFORMERS

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

This paper focuses on operational experience with distribution transformers (oil or dry) installed in renewable plants in Czech Republic and Slovakia, in industrial plants with insulated transformer node connection with wide cable networks, with non-linear consumption impact. New methods of protecting the distribution transformers against the overloading, unbalance and earth faults are presented. Improvements of distribution transformers reliability is achieved through suitable diagnostics and operational status monitoring. This paper offers brief evaluation of integration of 400/110 kV auxiliary power and tap changer of T31 auxiliary power three-phase oil transformer (33/0.4 kV, 630 kVA).

EVALUATION OF AUTOMATION TYPES USED FOR GROUNDING OF AFFECTED PHASE

David Topolánek, Petr Toman, Václav Vyčítal, VUT v Brně.

This paper deals with evaluation of various solutions of automation prototypes used for grounding of affected phase, which is used to limiting the fault current during earth connection. Three types of these automations were installed within the distribution systems in the Czech Republic, using direct connection of affected phase with earth-system, grounding through resistor and grounding through reactor. These types are tested and evaluated based on the general distribution system simulation.

MONITORING OF ELECTRICAL VALUES WITHIN MV/LV STATIONS IN E.ON DISTRIBUCE

Jan Jiřička, Michal Jurík, Martin Kašpírek, E.ON Distribuce, a.s., Jan Kraus, KMB systems, David Topolánek, Petr Toman, VUT v Brně

This paper deals with the monitoring of low voltage part of MV/LV distribution transformer station focusing on the MV/LV transformer. It enhances, based on the data gained from LV level measurement, the existing approach of passive monitoring of electrical values for new active protective functions which resulting in quicker localization of fault in 22 kV network. The equipment now in development incorporates the monitoring, distribution transformer station item status signals, logical and protective functions as well as automation acting on action elements of distribution transformer station.

CURRENT SENSOR CHARACTERISTICS WITHIN THE RANGE OF TENS AND HUNDREDS OF KHZ AND THEIR USE IN POWER INDUSTRY

Jan Souček, MEgA - Měřící energetické aparáty, a.s.

There is increasing importance of accurate current measurement including the DC sequence as well as measurement of frequency sequences within tens and hundreds of kHz in power industry. This paper deals with various types of current sensors and their use in build-in and portable measuring instruments. The paper compares the characteristics of particular measuring methods as well as transmission characteristics of sensors using these basics. The paper purpose is to recommend the suitable measuring basics for various applications based not only on functions but from economy point of view as well.

CALCULATION OF GROUND RESISTANCE WITH INCORPORATING USAGE FACTORS ACCORDING PNE 33 0000-4 AND THEIR ACCURACY

Václav Vyčítal, David Topolánek, Petr Toman, Michal Ptáček, VUT v Brně

Fundamental method of grounding designed is provided in EN 50522 standard which provides the formulas for calculation of ground resistances of basic grounding electrodes (rod, belt, circle etc.). The main issue of these formulas is associated with the combination of two or more basic grounding electrodes together. In such case these electrodes affect each other and resulting resistance of such grounding system is higher. Company standard PNE 33 0000-4 provides possible solution for solving mutual impact of electrodes. This standard supports the usage factors for various combination of basic grounding electrodes and therefore allows the simplified formulas to be used for more complex ground system. This paper analyzes single grounding system and shows the accuracy of these factors through comparison of analytic method and results calculated by software that simulates electromagnetic field using the finit set method.

PILOT PROJECT OF IEC61850 PROCESS BUS

Martin Procházka, ABB s.r.o.
Vladimír Nemanský, ČEPS a.s.

This paper describes the technological solution and experiences within deployment of IEC 61850-9-2 process bus in Čechy Střed substation. It is realted to single 400 kV terminal equipped by current sensor and common current instrument transformer. Both measurements are digitized and transmit through IEC 61850-9-2. The receivers of this digital measurement are terminal protection of different vendors, busbar protections and meter.

INFORMATION FLOW REQUIREMENTS OF PLANTS IN DS

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

This paper presents the basic information flow requirements of resources connected to the LV, MV and HV networks that arise from Commision Regulation (EU) 2016/631, 14. April 2016. This is based on the prEN 50549-1 Requirements for generating plants to be connected in parallel with distribution networks – Part 1: Connection to the LV distribution network – Generating plants of Type B or smaller and Part 2: Connection to the MV distribution netwotk – Generating plants of Type B or smaller in the form they were implemented into the revision of Appendix 4 of Distribution System Code.

NARROW BAND PLC COMMUNICATION IN MV NETWORKS

Bedřich Beneš, Martin Tříska, ModemTec s.r.o.

The pilot projects of employment of wide band PLC in MV network shows there are many problems with that system and it is almost unusable for longer distance. The alternative method of utilizing the narrow band communication introduced in this paper allows the reliable communication via MV overhead lines and cables on tens of kilometers. By effective use of frequency spectrum as well as the data communication channel itself, the solid communication network can be builded up within the relatively narrow band, which is suitable for time critical tasks designated for distribution network control and diagnostic.

EXPERIMENTAL MEASUREMENTS AND METHODOLOGY OF SELECTION OF SUITABLE COMMUNICATION TECHNOLOGIES FOR SMART GRID SCENARIOS

Petr Mlýnek, Radek Fujdiak, Pavel Mašek, Jiří Hošek, VUT v Brně
Jan Hlavnička, Juan J. Zamphiropolos, E.ON Distribuce, a.s.

This paper presents the measurements results of specific komunication technologies in real trnasformer stations. The metodology to determine the suitability of each technology regarding the smart grid was defined based on these results. The methodology takes into account the trend of increasing cyber security requirements as well as the costs (CAPEX/OPEX).

LTE EXPERIMENTAL MEASUREMENT OF 450 MHZ

Petr Mlýnek, Radek Fujdiak, Ján Sláčik, Pavel Mašek, Jiří Hošek, VUT v Brně
Dominik Harman, Jiří Pařízek, Jan Hlavnička, Juan J. Zamphiropolos, E.ON Distribuce, a.s.

This paper describes the utilization of 450 MHz frequency for transformer station automation and aims at the results of in field measurements in specific area and various scenarios. It offers the detail comparison with 800 MHz frequency and capability of building penetration by these frequencies.

SESSION 4 – DISTRIBUTED ENERGY RESOURCES AND ELECTRICITY USAGE

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

WIND ENERGY AND RES POTENTIAL

Štěpán Chalupa, Komora OZE

The time of fossil fuel is about to the end. The new clear sources are needed. Consumers become prosumers. Transformation and distribution are now dominated by the RES throughout the continets. Can be RES utilized to energy security in the Czech Republic? Does the government underestimate the RES potential? There is the area for improvement at least in the case of wind power generation.

CEZ FOREIGN ACTIVITIES REGARDING THE RES, EXPERIENCE, MATTERS OF INTEREST

Viktor Chaloupka, Stanislav Průcha, ČEZ a.s.

This paper offers the information of CEZ foreign activities in terms of RES. It presents the RES basic overview operated in foreign countries, last significant purchases and plans for further expansion within the RES area. The paper draws the problematics of new project acquisition (implemented or in development), experience and other matters of interest.

THE REVISION OF DISTRIBUTION NETWORK CODE APPENDIX 4 THE RULES FOR PARALLEL OPERATION OF PLANTS AND POWER STORAGES WITH DSO NETWORK

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

The revision of Network Code Appendix 4 reacts on Committe Direction (EU) 2016/631 from 14. April 2016, which defined the network code regarding the requierements for plants connected to the power system and shall be implemented into nationa legislation. Additionally it is based on other ENs which are in preparation and which would scope on power plants connected into the LV and MV networks. This will require the revision of existing valid PNE 33 3430-8-1 and PNE 33 3430-8-2 standards. The paper informs about the future TS 50549-10 which would be aimed on the compliance tests for plants operated in parallel with DS.

The Appendix 4 revision includes the requirements for the connectibility evaluation of power storage.

INTERFLEX – EUROPEAN PROJECT

Stanislav Hes, ČEZ Distribuce, a.s.

This paper contains information regarding the European project called Interflex for which the CEZ Distribuce is assigned as leader of the Demo2 package. The Interflex project is aiming at increasing of flexibility within the European distributor networks and is cofinanced from European Committee within the Horizon 2020 program. The part of the projected led by CEZ Distribuce (Demo2) is focusing on tests non-standard distribution network functions. The main goal for this package is to improve the distributed resources connectibility and make the implementation of EV recharge stations into the distribution system more effective. Demo2 package scope is as follows: a) integration of PV using

Q(U) and P(U); b) U/Q regulation of plants connected into the MV level (PV, Wind turbines and Biogass stations); c) development and employment of smart EV recharge stations; d) integration of PV with power storage (battery) on customer side.

SMART FEATURES OF PV INVERTERS

Josef Hrouda, František Kysnar, Karel Procházka, EGC-EnerGoConsult ČB, s.r.o.

Thi spaper deals with smart features of recent PV inverters. The basics of active and reactive power regulation of inverter are described as well as the regulation options associated with PQ diagram. Document describes each smart feature of inverters that can be used for power system support regarding the voltage and frequency.

PERFORMANCE OF POWER FLOW REGULATORS IN COMBINATION WITH RES

Petr Mastný, Jan Morávek, Michal Vrána, Jiří Drápela, VUT Brno

This paper focuses on operation of power flow regulators which are currently used in the Czech Republic, usually in combination with photovoltaic installation. Regulators usage became wider due to the changes in connection and operational conditions of micro-sources and is used as one of the measures for minimizing of power overflow into the network. Our facility is performing tests of such power flow regulators. These tests are focusing on declared functions of regulators and their impact on power quality parameters. Based on tests which were made, the basic conditions were defined for their proper use in combination with RES.

APPLIANCES CHARACTERISTICS IN HOME USEGE – FINDINGS RESULTING FROM MEASUREMENT

Jiří Ptáček, EGÚ Brno, a. s.

Homes are using many appliances nowadays and their usage is still increasing. This paper deals with experiences gained from detailed measurements of appliances and power consumption of common household and considers some ways of adequate utilization of appliances, lowering of costs and possibilities of savings. The paper aims at improving of our knowledge about the home appliances and their characteristics, discussing about the tariffs usage and showing some provisions of household appliances. The evaluation is based on electricity usage and characteristics of common four-member family living in five-room family house.

The paper inculdes measurements of electricity consumption profile of each appliances as well as the consumption of whole household. It describes the consumption measurement methodology, the composition of appliances, average costs and the requiremetns for circuit-breaker rate. Additionally the paper contains the evaluation of measured consumption with load profile #4 (TDD4), the continuing power consumption of household, voltage variation and possible savings are offered.

THE IMPACT OF RES ON INERTIA PARAMETERS OF GENERTING MODULES IN POWER SYSTEM, DYNAMIC STABILITY OF POWER SYSTEM

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

This paper features the annual analysis of synchronous modules intertia in power system. Increasing number of renewable sources causes decreasing the overall volume of rotary masses moment of inertia which impacts the primary reagulation of frequency in power system (PS). Additionally the corresponding coordination of frequency realys setting with df/dt (RoCoF – rate of change of frequency) is needed. The autocorrelations of df/dt factor during 2015 in continental Europe. The term “artificial interia” of non-synchronized generating module is exlpained.

DIESEL GENERATORS USAGE FOR AUXILIARY SUPPLYING MV/LV TRANSFORMERS REGARDING THE POWER QUALITY

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

MINIMIZING OF PLANT IMPACT ON RIPPLE CONTROL SIGNAL

Pavel Holoubek, E.ON Servisní, s.r.o., Tomáš Hanžlík, EGC-EnerGoConsult ČB, s.r.o.

The evaluation of plant impact on the ripple control signal in distribution networks is nowadays the common process of evaluation equipment connectivity into the network. Minimizing of such plant impact can be, in reasonable cases, required even retrospective force. This paper presents the measures which can be used for damping of negative impact on ripple control signal level and therefore it corresponds with the measurement results made public at CIRED in previous years.

MV AND LV NETWORK AUTOMATION – SMART TRANSFORMER STATION

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

This paper describes the smart MV/LV transformer station which confirms with high reliability requirements for communication (IPSec, Open VPN) and supplying the power of required quality to the consumers. Developing task ensures the voltage regulation through the load tap changer and monitors the load and its status on the LV side. It works with switches (disconnectors, load interruptor) at the MV side within control and monitoring. It evaluates measurements and information from fault detectors or voltage indicators. It monitors the building status (temperatures, gas, water and entries). The brief description of Self Healing Grid automatic is provided. The paper presents some foreign experience with installations of consumer load reduction systems in LV network. The FBVR (Frequency Based Voltage Regulation) method utilizes the information from network frequency measurements to regulating the load through voltage change in MV/LV transformer station.

SESSION 5: DISTRIBUTION SYSTEM DEVELOPMENT

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

THE WAY, FORM AND UTILIZING OF DATA AQUISITION OF MV POWER EQUIPMENT AND TS

Miloš Šesták, Martin Dlugoš, Východoslovenská distribučná, a.s.

The way, form and utilizing of data acquisition of MV power equipment and TS in Vychodosloveska distribucna a.s. The paper contains the calculation for equipment and maintenance MV power equipment and TS which is used as financial study basis for preliminary plans of CAPEX and OPEX used in the MC Engine. It presents the annual review of maintenance status of MV equipment and TS which working as the input data for “Annual report of equipment status of Vychodoslovenska distribucna a.s”.

PILOT EXPERIENCE WITH EARTHING THE PHASE WITH EARTH-FAULT IN 22 KV NETWORK – J. HRADEC SUBSTATION

Filip Brož, Karel Procházka, EGC – EnerGoConsult ČB, s.r.o., Daniel Kouba, Pavel Jinderle, E.ON Česká republika, s.r.o., Werner Linzmaier

This paper presents the theoretical potential of shunting made on the statistical evaluation basis of faults in J. Hradec substation 22 kV network. Specific faults are then analyzed in details.

SMART ASSET MANAGEMENT: CHALLENGES AND IT SOLUTIONS FOR IMPENDING PREDICTIONS

Petr Lang a projektový tým ; E.ON Distribuce, a.s.

The need of prediction is closely associated with the data digitization. This paper, created by E.ON Distribuce a.s. deals with what such digitization brings in fact, what means the IT implementation of new Business Intelligence tools in power industry and what needs to be focused in similar projects. The paper is based on experience with IT implementation of the Smart Asset Management project. This project is now in phase of data storage development following data structures that are defined base on the use case documents. Achieved milestones will be presented as well as results and the future direction of Smart Asset Management project which started at the beginning of 2017.

FUNDAMENTALS OF MODIFICATION OF MV LINES LEADING THROUGH FOREST AND AT FOREST – ROAD INTERCONNECTIONS

Karol Szarysz, Východoslovenská distribučná, a.s.

The paper deals with the definition of external and internal aspects of MV cable network in Vychodoslovenska distribucna a.s. It presents the analysis of crucial cables regarding their contribution to the unscheduled supply interruptions, increase in SAIDI and selection of “TOP 40” of the most defective lines of class I. The paper describes the use of cables instead of the overhead lines leading to the roads in the areas of heavy terrain to use to improve the reliability of power supply. It presents the arrangement of general cooperation with local government and road managing administration as well as the definition of rules and conditions of road and MV lines interconnections. The paper describes the common materials used by DSO for cable network construction.

BPL COMMUNICATION ON OVERHEAD MV LINE

Josef Havel, Michal Heinl, ČEZ Distribuce, a.s.

BPL communication utilizes the CEZd own infrastructure is one option for data connection of technological objects. The possibility od data connection through overhead line was verified by pilot. The measured data were transferred from selected station that uses the AMM technology and general-purpose MEg40 screens to the CEZd systems. The communication load tests were performed during the pilot as well.

SCENARIOS OF TS COMMUNICATION INTERCONNECTION WITHIN MUNICIPAL CABLE NETWORK

Radek Hanuš, Pavel Glac, PREdistribuce, a.s., Petr Skala, Oto Bucholcer, EGÚ Brno, a.s.

The introduction of communication into the distribution transformer stations (TS) environment is actual topic that becomes important particularly within the network automation (smart grids) and AMM employment. Thus there is a need for building the communication routes to relatively huge number of transformer stations in cable network within dense built-up municipal areas. The creation of communication network in such environment is complicated by many factors.

This paper presents considerations and analysis of selected TS communication interconnection with switching stations and/or HV/MV transformer stations where communication is built already. This analysis task is to estimate the number of TS which are connected into the communication network during defined time period and to evaluate the integrity of gradually created communication interconnection.

EVALUATION OF POWER QUALITY IN 2016

Jan Šefránek, Energetický regulační úřad

This paper deals with evaluation of power quality and associated services in power industry in the Czech Republic in 2016. The paper aims at evaluation of achieved level of continuity indicators including the relationships with incentive power quality regulation. The paper contains updated information regarding the power quality for upcoming regulation period.

EXPERIENCES WITH FAULT LOCALIZATION SYSTEM

Tomáš Škumát, Západoslovenská distribučná, a.s.

This paper deals with issues of the fault localization within the MV network as well as with experiences with fault localization system. New options for analyzation and evaluation of faults within MV network were introduced due to new protection technologies (particularly the digital protections). First, it offers the better overview to dispatcher to where he should send the repair staff when enduring fault (e.g. short-circuit) occurs. Second, it allows for detail evaluation of faults and why they occur repeatedly. The paper focuses on the most frequent causes of these faults. Each case is supported with pictures to better understanding.

ONE YEAR EXPERIENCE WITH UAV OPERATIONS WITHIN E.ON CZECH GROUP

Petr Honsa, Petr Lang, E.ON Distribuce, a.s.

There is a fast development in the unmanned aerial vehicle (UAV) and they can become integral part of many branches. This paper created by E.ON describes experience with real management, registration and operations of UAV system DJI S1000 which was picked through initial project in 2016. The paper describes the current status, areas where it can bring improvements and listed models with perspective for the future use power industry according to the cost/performance/size ratio.

Additionally the paper deals with evaluation of pilot project regarding the UAV utilization for photovoltaic plants survey. Places of possible issues can be effectively localized by infrared camera.

PLANNING IN PREDISTRIBUCE, A.S. USING THE LOAD MAP

Vojtěch Jelenecký, PREdistribuce, a.s.

Common tools that were used to reconstruction and development of distribution system planning are not sufficient enough today. Thus the PREdistribuce a.s. created its own map of the city Prague which is used to cover the trends of load development within and other parameters which are important regarding the management, control and development of equipment in each district. This paper focuses on the existing status of this tool, data sources and the possible future development.

SESSION 6: MANAGEMENT, ORGANIZATION, QUALIFICATION

Garant: Martin Schneider, PREměření, a.s.

FUTURE CHALLENGES IN POWER INDUSTRY

Pavel Círek, ERU

How could the legislation changes, DER development and e-mobility affect the strategy of Regulatory Office. It presents the general principles of regulation.

LOSSES IN POWER SYSTEM

Martin Šafanda, ČEZ Distribuce, a.s.

The paper deals with losses in power system. It briefly summarizes the different types of losses including their fundamental causes. It presents the losses in the Czech Republic and world-wide using publicly available information and deals with their possible future trends with respect to their influence on EU and the Czech Republic legislation. The paper informs about the activity of CIRED international working group: Reduction of Technical and Non-Technical Losses in Distribution Networks (2015-2017)

PREDISTRIBUCE SMART STATIONS PROJECT – SPECIFIC ASPECT OF TECHNOLOGICAL SOLUTION WITH RESPECT TO THE REQUIRED FUNCTIONS, OPERATIONAL CONDITIONS AND MAINTENANCE

Pavel Glac, Lukáš Křivanec, PREdistribuce, a.s.

Following the analysis that was dealing with improving the reliability of PREdistribuce distribution network the smart distribution transformer station project was initialized. The required functions, operational conditions and maintenance were defined. Later this concept was processing into the form of several technological solutions. Several stations were implemented so far within the pilot.

Numerous issues needed to be solved during the designing and implementing of required functions of that station. On one hand the solution needs to be as unified as possible regarding the monitoring, management, remote control, operation and maintenance but on the other hand there was and tendency to try many reasonable solutions and technologies available on market.

The paper presents specific issues which were experienced during the smart transformer station designation and implementation, their impact on selected solution, operational instructions and preventive maintenance period.

PILOT INTEGRATION OF FAST-RECHARGING STATION WITH POWER STORAGE INTO DISTRIBUTION NETWORK

Lukáš Křivanec, PREdistribuce, a.s.

Requirements on distribution network are increasing due to the expected increase of new technology usage within municipal areas as well as in power industry as such, particularly DER and e-vehicles. Power quality requirements are increasing at the same time. Irregular and hardly predictable power generation and/or load can lead to the serious problems regarding the voltage control and power quality at various points of consumption. Connection of local power storage can solve the problem in these situations. The power storage can decrease demands for distribution network elements through the load diagram and can keep the power quality within required range when combine with suitable power electronics.

POWER STORAGE DEVELOPMENT AND LEGISLATION

Miroslav Hladík,Toshiba

This paper focus on the issues associated with power storage systems which are based on secondary cells, particularly li-ion batteries. The paper focuses on technological parameters and requirements supported by existing solutions and how they can be used within the power industry in 21st century from both technological and legislation point of view. Particularly it concerns they use within the distribution and transmission networks for network stabilization purpose, their economics and legislation including the regulatory office point of view. This paper is based on first experience with power storage in EU and overseas, use cases, references and their evaluations.

POWER STORAGE OPTIONS FOR FAMILY HOUSE WITHIN THE HIGH RES GENERATION ENVIRONMENT

František Vybíralík

Today there is still increasing portion of power generated in RES. The volume of power generated from these sources varies depending on the environmental conditions (illumination, wind speed). The new appliances which allow the consumption control based on the power system status are prospected in context of introducing Smart Grinds and Smart Metering. Gradual installation of “smart” appliances (such as washing machines, dishwashers, dryer, etc.) of which the consumption can be remotely controlled is expected. Electric heating and water heating represent another area where smart appliances can be used. Power-to-heat in particular can be important part for power consumption regulation. This paper summarizes the basic types of power storage appliances used for heating and water heating, the fundamentals of their designing and their regulation capabilities.

SMART CITY INFRASTRUCTURE OF MODERN CITY

Václav Vodrážka, PREdistribuce a.s.

Today trend of public infrastructure planning is aiming at the highly integrated elements which form the so called Smart City. It can be expected that e-vehicles, car sharing and autonomous control systems usage would become more common. All of this will be required easily available infrastructure for recharging, accessible high-speed internet connection, area information and many others. This paper describes the supporting mobility elements which allow the implementation of higher number of “smart” features into the municipal environment.

E-MOBILITY DEVELOPMENT – INFRASTRUCTURE FOR RECHARGING

Miroslav Kuželka, ABB s.r.o.

E-mobility development is getting into the key phase in the Czech Republic. This phase includes expected construction of backbone network utilizing incentive from EU. How this would be dealt by Czech power utilities and car factories? Which technologies and concepts can be used so to fulfil the expectation.

ENTHROPY GROW AND MEASURES OF LOWERING THE UNCERTINITY DURING THE POWER NETWORK OPERATION

David Hrycej, Ondřej Mamula, CIIRC

Growing share of RES and DER, improving the self-supporting of prosumers and the changes in consumers behavior increase the information uncertainty during scheduling of power systems operation. Law of physics cannot be broken and thus they allow for the minimum difference between generation and consumption. State-the-art PCs provide the ever increasing calculation power as well as new data sources related to the market actors behavior allow for effective processing of uncertainty and ranked the correcting measures requirements, thus lowering the risks to acceptable level.

RISKS OF EARLY YEARS OF SECOND DECADE – DECENTRALIZED POWER INDUSTRY AND NEED FOR REGULATION TO KEEP THE STABILITY OF POWER SUPPLY

Hynek Beran, Cygni

Numerous fossil fuel power plants will be closed in 2022 (see the paper at following link: www.energetickyklub.cz). Nuclear power plants will be closed in Germany as well power lines not finished. Uncertain future of nuclear power in Dukovany and associated risks was dealt in the previous paper and there are two new ones. One is that the “surplus of regulation energy” comes to the end due to the dumping export. The other one is that the Czech system probably becomes balanced but will be experiencing problems caused by asynchronous generation and consumption during the day. Neither new nuclear power plant nor extensive smart grids can be built in five or eight years. The solution can be the utilization of existing features and options (ripple control together with air conditioning, e-mobility and housework) and introduce the communication (based on the introduction of some smart functions at least into existing MV and LV networks) with smart consumers which would be helping the system instead just keep an eye on the 15-minute maximum. The paper contains specific options and use cases.

QUALITY MANAGEMENT OF INSTRUMENTS MANUFACTURED TO BE USED FOR DISTRIBUTION TRANSFORMER STATION (DTS) MEASUREMENT PROJECT

Ladislav Pospíchal, Jiří Babka, Pavel Kubíček, Petr Dvořák, MEgA - Měřící energetické aparáty, a.s.

For every customer there is important need to buy and operate in the long term the reliable product. The reliability is not inherited feature, the product needs to be designed and manufactured to achieve appropriate level of reliability. The malfunctions cannot be avoided even in case of the most reliable product and thus the customer needs to be supported by necessary service during the whole service life of product. The need for repair does not necessary mean the failure but it can be utilized to improvements. There are methods which are used to make whole process easier. This paper deals with the quality management of development and production.

THE METHODOLOGY OF ASSESSING THE FEE FOR VIOLATING THE POWER FACTOR LIMITS IN CASE OF LARGE SCALE CONSUMERS WITHIN THE CONTEXT OF CONSIDERED BILLING UNIT EVALUATION, COMPARISON WITH EXISTING METHODOLOGY, SUGGESTIONS FOR DETERMINATION OF REACTIVE POWER PRICE CONSUMED OVER THE VALID LIMIT.

Pavel Bürger, EGC – EnerGoConsult ČB s.r.o.

The terms and conditions of fee for violating the power factor limits are discussed nowadays. Regarding the reactive power impact on distribution system it seems to be a right decision to influence the large-scale consumers so they change their reactive power consumption on billing unit basis rather than on month-based ration of active and reactive power consumed. This is important not only regarding the voltage fluctuation on LV and MV points of connection but for the determining of active power losses on lines and transformers as well. This paper provides technological data supporting the proposed solution and drafts the procedures which could be used for assessing the fee for violating the specified power factor range (from 0.95 to 1).