



Conference under the auspices:



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16th CONFERENCE OF THE CZECH COMMITTEE OF CIRED

ABSTRACT BOOK

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Abstract Book

Hotel Dvořák – Kotnov - November 6-7, 2012

SESSION 1 – NETWORK COMPONENTS

Guarantor: Karel Kohout, CEZ Distribucni sluzby, s.r.o.

THE STANDARDIZATION STUDY OF HV / MV TRANSFORMER SUBSTATION

Pavel Potměšil, Kamil Kosnar, CEZ Distribuce, a.s.

The standardization study of HV / MV transformer substation was ordered by CEZ Distribuce, a. s., in order to unify the new and reconstructed power stations in connection with already prepared methodology concerning the conception of these power stations.

TECHNICAL POSSIBILITIES OF THE VOLTAGE CONTROL OF MV AND LV DISTRIBUTION SYSTEMS WITH DISPERSED GENERATION

Jiří Duspiva, CEZ, a.s.

The description and the comparison of different technical possibilities of the voltage regulation of MV and LV distribution systems, especially with regard to the growth of dispersed generation (renewable sources of electricity).

THE PROBLEMS OF DIAGNOSTICS OF SWITCHBOARDS ISOLATED BY SF6

Václav Straka, "TMV SS" spol. s.r.o.

Gas insulated switchboards are of benefit for their compactness, however in terms of diagnostics and lifespan management are often not designed for diagnostic measurements. The paper deals with the possibilities for diagnostics of these elements together with possible measures that would allow this diagnostics.

FRA DIAGNOSTICS OF POWER TRANSFORMERS IN ACCORDANCE WITH THE IEC REQUIREMENTS

Václav Straka, Pavel Zítek, "TMV SS" spol. s r.o.

FRA diagnostic method reached the stage of wide acceptance and is now not only the recommended method, but in certain cases the method prescribed. In the international standards there is not only defined the required measurement range, but even the requirements concerning the measurement



and minimum requirements for HW resources. The paper is not only dedicated to these aspects, but also - for example – deals with the impact of the voltage measuring on the measuring repeatability and best practices.

THE ELECTRICAL EQUIPMENT PROTECTION

Jiří Horák, CEZ Distribucní služby, s.r.o.

The paper deals with the organization of diagnostics implementation, provides an overview of methods and specific examples of good practice in terms of the CEZ Group.

A STATISTICAL ANALYSIS OF DATA FROM THE MEASUREMENT IN THE DTS

Jan Souček, MegA a.s.

The paper focuses on the collective assessment of long term data measured in the DTS on the low voltage in real MV network. Parameters studied are primarily load and losses of distribution transformers. Other important parameters are the events on the voltage, their distribution in the network, identification of critical areas in terms of outage and potential impacts of overvoltage and voltage dips on the LW network powered from the DTS.

COMPOSITE HIGH-TEMPERATURE CONDUCTORS

Tomáš Šedivý, CEZ, a.s.

The paper deals with the analysis of the possibility to use high-temperature, high-capacity conductors and conductors with a smaller deflection of the conductor as a replacement for existing AIFe conductors on MV and HV overhead lines.

WOODEN POLES IN CEZ DISTRIBUCE, A. S. NETWORKS

Ondřej Novák, CEZ Distribuce, a.s.

This paper addresses the use of wooden poles for overhead power lines of medium and low voltage with a special focus on their impregnation. This paper describes the history of the use of wooden poles in the former regions of the current CEZ Distribution, a. s, the types of poles used with regard to the existing technology so called pressure impregnation by Kreosot oil. It describes problems by the Annex - the Directive on biocidal products. It includes the proposal of the alternative solution in cooperation with the Research and Development Timber Institute, Prague, s. p. and others.

MV OVERHEAD LINE BRACKETS ON CONCRETE POLES AND THEIR IMPACT ON THE ENVIRONMENT (PROTECTION OF BIRDS FROM ELECTRIC CURRENT ACCIDENT)

Jiří Hlach, E.ON Czech Republic

Gradual changes in the development of the Pařát bracket caused by gradual changes of ideas and encounters of birds with the MV overhead lines. Modifications in the design and the economic impact of these changes. The adjustment of switches in the overhead lines outside a built-up area.



THE SELECTION OF SESSION 1 PAPERS FROM THE CONFERENCE OF THE CROATIAN COMMITTEE OF CIRED

František Vybíralík

The third conference of the Croatian Committee of CIRED has been held this year. In the paper there will be described the selected experience from the presented papers of the session 1 concerning the power stations, overhead lines and cables.

SESSION 2 – POWER QUALITY AND EMC

Guarantor: Pavel Santarius, VŠB-TU Ostrava

THE PROBLEMS OF PROVING AND SUPPRESSION OF IMPACT OF BIG CONTRIBUTORS

Martin Kašpírek, E.ON Czech Republic

The paper deals with the identification of sources of energy interference in the distribution network and with the problems of proving illegal impacts (flicker) to industrial plants or business premises with consumer-mounted devices which negatively affect the quality of electricity supply of other customers. The basic prerequisite for proving the excess impact of "suspected" customer is in addition to measuring the voltage quality also the measurement of the load of this customer. There is not always sufficient the evaluation of the consumed current in the form of mean average effective values for the evaluation interval of 10 minutes, sometimes it is necessary to evaluate the load by using one-period extremes recorded during the period of 10 min, not all PQ analyzers, however, enable it. When there is the accumulation of plants in the grid with the same or similar shifts operation then we can no longer measure only one customer, but to unequivocally demonstrate the impacts, it is necessary either to carry out measurements simultaneously of more customers, or rewire the network so that the potential big impact contributors could not influence each other. The above theoretical considerations are illustrated with concrete examples and analyzes of practical measurements resulting from the real operation of a distribution network. There are made proposals of measures which electricity distributor can take. Finally, it assesses the energy legislation on the impacts on the supply network with regard to the rights and obligations of both consumers and the distribution network operators.

THE COMPARISON OF VOLTAGE QUALITY PARAMETERS IN LV DISTRIBUTION GRIDS WITH AND WITHOUT CONNECTED PV PLANTS

Martin Kašpírek, E.ON Czech Republic

The paper presents a comparison of voltage quality parameters (VQ-voltage quality) in low voltage distribution networks with PV plants in operation and without connected PV plants. The analysis of LV grids without PV plants is performed on a sample of 20 grids evenly spread in the supply area of E.ON Distribuce, a.s. that in the years 2006-2012 were monitored weekly each year. In 2011 there was carried out the measurement of 23 LV networks with PV plants in operation, which was again repeated on the same sample of networks in 2012. The aim is to assess the level of VQ parameters in the network of E.ON Distribuce, a.s. but especially to analyze the impact of the operation of PV plants on compliance of permitted deviations for low-voltage network according to the ČSN EN 50160 standard and to assess how the voltage level differs from networks without PV plants. The attention is also paid to the development of VQ parameters in individual grids.

THE LEVEL OF ELECTRICITY QUALITY IN THE DN OF 110KV AND MV IN THE CR

Radim Dušek, František Kysnar, Karel Procházka, EGC – EnerGoConsult ČB s.r.o.

The paper is a follow-up to the previously presented results of continuous monitoring in the CR. The results presented thus give an overview of the level of the indicative voltage characteristics for the year 2012 in the interchange points between the TN and the DN, the delivery points of 110kV and the

output voltage of 110kV/MV stations. Due to the long-term monitoring and evaluation the paper also deals with the interannual development of the power quality levels at these points of the DN. The paper also deals with comparison of quality levels across the EU presented in the 5th benchmarking report of the European regulators.

RES AND THE LEVEL OF ELECTRICITY QUALITY IN LV NETWORKS

František Kysnar, Filip Brož, Karel Procházka, EGC – EnerGoConsult ČB s.r.o.

The conditions in distribution networks in the CR in the previous period changed considerably due to the significant role of dispersed generation. With this in mind, operators of distribution companies carry out continuous monitoring of power quality, which aims to map the impact of significant representation of dispersed generation in the DN on the electricity quality. The paper presents the results of the second extensive campaign in LV networks, within which 80 CR networks were measured at their beginning, middle and end of networks. The presented results are the follow-up to a similar campaign carried out in 2011.

THE RULES D-A-CH-CZ FOR THE ASSESSMENT OF IMPACTS IN HV NETWORKS

Tomáš Hanžlík, EGC – EnerGoConsult ČB s.r.o.

The presented paper is logically linked to the previous so-called "Basic Document" from 2007, concerning the assessment of the impact of individual devices connected to low voltage and medium voltage networks, whose principal parts were adopted to PNE 33 3430 – 0. The rules for HV networks include assessment procedures which are always divided into two steps; in the first step there is compared the ratio of the short-circuit power of connected equipment and its performance with a given constant. If the device fails in the first step, the second step follows. The rules also include an overview of the main measures to limit impacts.

A CONTRIBUTION TO THE CONNECTIVITY CONDITIONS OF RESISTANCE WELDING MACHINES

J. Drápela, J. Šlezinger, UT Brno

Resistance welding is a technology which is used in many industrial sectors from which the automotive industry occupies the largest share. Resistance welding machines are a combination of semiconductor converters with reducing transformers where the own welding is performed by electric current passing through the welded joint. The course of welding pulse has large amplitude of the welding time in hundreds of milliseconds and with welding pulse period in the units up to tens of seconds. The input circuits of welding machines regarding their technical possibilities and performance are designed as a one- or three-phase. From the network is then consumed deformed / unbalanced and pulsed current whose effective value changes from maximum to nearly zero value. The current waveform in one period, its deformation depends on the type and topology of the converter whose solution determines the degree of load imbalance of power networks. Time inequality is then given by the frequency of the pulse welding. The result of operation of resistance welding machines is primarily voltage deformation, a fluctuation of effective voltage value and voltage unbalance in supply, which may depending on the conditions of connection exceed the permitted limits. The aim of the article is, on the basis of compiled models and simulations of selected types of resistance welding machines and operating conditions, to elaborate the methodology for their connection to the public supply network in terms of classical proposed methods, and particularly with regard to the indicators of quality of electricity at the connection point (at the interchange point).

THE HYBRID REGULATION OF REACTIVE POWER OF PHOTOVOLTAIC POWER PLANTS

Vladimír Korenc, Tomáš Bůbela, ELCOM, a.s. Prague

Operators of photovoltaic power plants with installed capacity of 100 kW have to under legislation retrofit the plant not only with active power control, but there is also required reactive power control. This paper deals with problems and experience with operating of the hybrid method of power factor managing which combines switching and continuously controlled compensation. The requirement for the creation of this device was primarily economic, by combining of passive and active parts the investment costs have been reduced and due to lower losses some operating costs have been also partly reduced. However, from a technical point of view high dynamics and flow control has been achieved.

A QUALITY ANALYSIS OF THE LARGE SHOPPING CENTRE DURING SWITCHING RESOURCES AND AIR CONDITIONING IN OPERATION

Miroslav Dubovský, SSE Žilina

The paper deals with a comprehensive analysis of the quality of a large shopping centre. The reasons were problems with a very short lifespan of lighting and failure rate of sensitive electronic equipment. The paper deals mainly with the harmonic analysis of voltage and current; there is also analyzed the load of a neutral conductor when switching power sources and air conditioning are in operation.

THE ASSESSMENT OF VOLTAGE CHANGES CAUSED BY SINGLE-PHASE AND DOUBLE-PHASE SOURCES CONNECTED TO LV NETWORK

Jan Jiříčka, E.ON Czech Republic

Miloslava Tesařová, UWB in Pilsen

The photovoltaic sources connected into LV networks can be designed as single-phase, double-phase or three-phase equipment depending on their output. Before connection of a LV source into a distribution network, there is necessary to determine voltage changes due to its operation. The paper elaborates performance of LV sources in detail depending on their connection arrangement. It defines a method for voltage change calculation and compares calculated results with real measured dates in LV networks. Conclusions of the paper were implemented into the E.ON guidelines for LV sources connection.

INTERHARMONICS - ORIGIN, MEASUREMENTS, PROBLEMS

V. Kús, UWB in Pilsen

The article describes the method and explanation of interharmonics in power systems. Firstly, a theoretical analysis is carried out. Due to this analysis there is proven a technical definition of interharmonics. In the second part there are demonstrated the possibilities of real resources. Than follows the interpretation of interharmonics which we receive through the analyzers. In conclusion, there is introduced the reason why it is necessary to pay attention to interharmonics.

THE WPP AMM RESULTS OF THE CEZ GROUP

F. Müller, CEZ Mereni



The WPP AMM project of the CEZ Group is not only a source of information for the Group itself, but also served as one of the main bases of the national study in accordance with the Directive 2009/72/EC on the decision on the method of smart measurement implementation.

Authors of the paper believe that the information and knowledge observed enable to find a way to meaningful implementation of this technology in the EPS of the CR.

RECORDS OF RAPID CHANGES OF VOLTAGE AND CURRENTS

L. Pospíchal, MEgA

Rapid changes in voltage are mainly caused by transient current consumption when changing modes of operation of appliances. Their monitoring is useful for the identification of appliances with significant changes of consumed currents, of which operation the voltage quality of appliances in the vicinity can be reduced.

THE ELECTRICITY QUALITY FROM THE PERSPECTIVE OF COMPLAINTS ABOUT THE ELECTRICAL ENERGY SUPPLY

Petr Krejčí, Petr Rozehnal, Jan Unger, Faculty of Electrical Engineering and Computer Science-TU Ostrava

The justification of complaints, filing a formal complaint and the complaint process. An analysis of complaints depending on the location, number and time of solving. The relationship between complaints, failures, non-supply and renewable energy sources.

A COMPARISON OF OPTIONS OF TECHNICAL EQUIPMENT FOR FLICKER COMPENSATION IN INDUSTRIAL APPLICATIONS

Zdeněk Müller, Libor Straka, Jan Švec, Josef Tlustý, CTU Prague

The aim of the paper is to compare the effectiveness of various filter-compensative devices particularly to reduce flicker voltage range and flicker in distribution networks with industrial consumption. The comparison is carried out on the basis of mathematical simulation of power electronic devices such as SVC, STATCOM, UPQC. The aim is to show the possibilities of combining several types of compensative devices to achieve the best results

MONITORING OF FLOW OF ELECTRICITY IN THE NETWORK OF PREDISTRIBUCE

Tomáš Sýkora, Zdeněk Reimar, PREDistribuce, a.s.

The article deals with the practical experience with the measurement of transmitted electricity in the distribution network of PREDistribuce, a. s. The measurement results are stored in scheduled time intervals in the database (manually and automatically according to the nature of data), where there are checked and processed. The authorised user can work with them and carry out the evaluation. The article also mentions the possibility of further development of this system of collecting and processing data in response to current trends in long-distance communication (Smart Grids).

SESSION 3: OPERATION, CONTROL AND PROTECTION OF NETWORKS

Guarantor: Petr Toman, UT Brno

THE VERIFICATION OF THE POTENTIAL OF COMPENSATION OF GROUND CAPACITIVE CURRENTS FOR IMPROVING THE CONTINUITY OF 22KV PRAGUE DISTRIBUTION CABLE NETWORK

Karel Procházka, Filip Brož, EGC – EnerGoConsult ČB s.r.o.

Jiří Hradecký, PRedistribuce

Prague networks are operated mainly with resistance grounding node, in which all single-failures are quickly shutdown followed by the cutting off distribution for customers. As a possible approach to reduce the impact on customers, assessed by the usual SAIDI and SAIFI indicators, is considered and tested in a pilot project the transition to the operation of networks with compensation of power ground capacitive currents by arc-suppression coils and by operating of networks with single-pole failures until their defining without disturbing our customers. The paper is based on the current number of failure events and their structure and shows what theoretical improvements of SIDI and SAIFI indicators could the change of the method of neutral node operation bring and what cost would be needed for this improvement.

THE IMPACT OF A COMPENSATED NETWORK OF A LARGE CAPACITIVE RANGE ON THE SIZE OF TOUCH VOLTAGE

David Topolánek, Jaroslava Orságová, Petr Toman, UT Brno

Jaromír Dvořák, E.ON Czech Republic

The paper presents analysis and experimental measurements carried out in the urban and non-urban MV distribution network with capacity ranges of about 300A and 800A. During measurements the metal and the arc earth fault were artificially carried out, during which, among other things, was tested the impact of the size scale network capacity on the size of the touch voltage in a situation before and after grounding of the affected phase in a substation.

AN INDICATION OF FAILURES AND REMOTE MEASUREMENTS OF MV NETWORKS WITH CAPACITIVE VOLTAGE DEVIDERS

Karel Hoder, Ladislav Pospíchal, Drahomír Pernica, MEgA – Measuring Power Apparatus,plc.

Capacitive voltage dividers are in some cases an alternative to the instrument voltage transformers. Capacitive voltage dividers are generally less accurate and less thermally stable, but they are cheaper, lighter, and operationally more reliable and have better frequency characteristics. Unfavourable properties of capacitive voltage dividers can be significantly adjusted and corrected by further digital measurement. Capacitive voltage dividers, however, can be also used to power measuring and indicating instruments.

MV SENSORS AND EARTH-FAULT PROTECTIONS

Václav Prokop, ABB, s.r.o.

Earth-fault protections are now an essential element of protection for earth faults. To operate correctly they need to measure the behaviour of ground current accurately. Although there are several ways how to measure the ground current (Holmgreen connection, bushing-type instrument transformers of current, etc.), detection of very small residual currents at earth faults in compensated or small isolated networks is still a challenge and in most cases are now dealt with using bushing-type instrument transformers. Modern protections already enable the calculation of residual current as a vector sum of the individual phases.

The paper describes the possibilities of using the calculation of the non-rotating sequence of current for ground protection when using medium voltage sensors for the phase measuring of currents. Due to the high precision of MV sensors in the measuring range we can use this application in networks where during earth faults appear small residual currents and their detection by conventional methods is either difficult or represents an investment in additional equipment.

TRANSFER IMPEDANCE OF UNAFFECTED PHASES IN A PAUSE OF 1-PHASE RT

Jiří Bermann

To set the distance protection there is, besides other things, also important minimum transfer impedance, which is "bypassed" by the protection and does not respond to it. It is normally expected in normal operation, i.e., 3-phase. Experience has shown that distance protection sometimes interrupts already started 1-pole RT, finally shuts down and prevents the otherwise successful RT. The paper deals with unresolved issues of transfer impedance of the healthy phases in voltage-free pause of 1-pole RT and a review of setting of the impedance characteristics in the part for the separation of operating conditions.

MODERNIZATION OF THE PROTECTION OF SYNCHRONOUS COMPENSATORS OF INDUSTRIAL PLANTS

Jaroslav Pospíšil, Josef Toušek, Tomáš Effenberger, Pavel Tureček, PROTECTION & CONSULTING, s.r.o.

In an industrial plant with the consumption of tens of MW is necessary to address issues of compensation of electrical energy, also in older versions using rotating synchronous compensators. As an example, there is shown a rolling mill with synchronous compensators with power of 15 MVA_r. In the past a system of protection was handled with the help of electromechanical protections is now modernized using digital protection with settings according to the results of load measurement modes. There are used multi-purpose current and voltage-frequency protections, differential protections and a system of earth-fault protections of the stator and rotor. To set the stator earth-fault protection it is necessary to implement the primary test in MV distribution.

AN INNOVATION OF THE PROTECTION SYSTEM OF RENEWABLE SOURCES PLANTS

Jaroslav Pospíšil, Pavel Tureček, PROTECTION & CONSULTING, s.r.o.

There is still more important the fact that RES support, after short interruptions of voltage, the stability of power supply. In the past, these sources were often switched off during failures in the network. If generators remain connected, it is necessary to ensure they do not take reactive power, which could cause voltage problems in the electricity system.

For this reason in German practice in renewable sources plants there is used the principle of directional reactive power protection and under voltage criteria simultaneously (protection $Q \rightarrow$ & $U <$).

This article is primarily an analysis of the mentioned protection function and discusses the setting of voltage- frequency functions of decentralized sources of RES.

SELECTED PROBLEMS IN THE ASSESSMENT OF OUTAGES AND FAULTS OF PVP

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

The paper briefly describes the unusual behaviour of PVP connected to 35 kV network with frequent interruptions in operation and gradual unsuccessful search for their causes by usual measurement of the voltage quality at delivery point of its operator. It also describes a fault caused by the accident of a surge arrester in 35 kV part.

The subsequent analysis of the measurements carried out by the operator and the analysis of the project documentation has shown that frequent interruptions of voltage and frequency protections were caused by inappropriately connected protection at the delivery point to the DN.

The cause of the accident of the surge arresters was their inappropriate design for the network of 35 kV.

THE PVP RALSKO 56MWP

Vlado Kubic, CEZ a.s.

This paper analyzes the operational characteristics of photovoltaic power plant Ralsko. It shows the possible extent of control of the power factor, including the speed of required changes, as well as the size of possible supply of reactive power to the 110 kV network and the impact of PVP on the voltage distribution system of 110 kV. There are described the relations between the supply of active power P and reactive power Q and in conclusion there is carried out an analysis of a practical use in 110 kV DN.

CYBER SAFETY IN PROTECTION AND CONTROL SYSTEMS

Pavel Glac, Siemens, s.r.o.

With the expanding solutions based on smart networks, protection and control systems are becoming more complex and affect a wider area of electricity supply. The communication network connecting protection and control components is used for many other services (diagnostics, remote access, fault records management ...). Standardization of communication protocols and interfaces give access to a wider range of suppliers to the market and reduces the cost of components. This creates larger and more sophisticated units, whose disruption may have unpredictable consequences. The jeopardy of cyber-attack of smart networks and its prevention is becoming an increasingly important topic.

The paper deals with potential risks of attacking of protection and control systems, as well as summarizes the basic standards in this field, and finally presents several technological innovations that contribute to a substantial increase in cyber security of components (e.g. protections) as well as the whole system.

SOME EXPERIENCE FROM WAMS OPERATION IN THE DISTRIBUTION NETWORK

Antonín Popelka, AIS spol. s.r.o.

The paper will provide information on the results of nearly two-year trial operation of Wide Area Monitoring in 110kV network. Audited functions, in addition to the monitoring of static and dynamic



network behavior, addressed the network stability, voltage and power oscillations, support for estimation state and on-line evaluation of line parameters.

The evaluation of the current transmission capacity can be of an important benefit of this technology in case of solving some problem situations.

THE IMPACT OF SINGLE-PHASE AC TRACTION ON UNDERGROUND STORAGE DEVICES

Ivan Cimbolínek, CTU Prague

The operation of traction systems, especially the operation of DC traction systems, causes considerable problems to operators of underground storage devices. It is known that for conventional electrified lines with an operating voltage of 3000 V, there goes back to traction substation through the ground up to 60% of return traction current that would flow under ideal conditions through rails. If there are near the electrified tracks the metal storage devices with poor insulation surface, the traction return current can go through the parts of the storage devices and cause their damage. The new corridor lines are dealt in a completely different way, there, thanks to the new technology, and especially thanks to the new gravel layer below the rails, was radically restricted the flow of reverse traction currents through ground. This positive change, however, brings other minor problems, which include mainly an increase in voltage of rails against ground potential caused by the relatively large flow of rail current. In the Czech Republic these currents often reach the value of 3000 A.

It is different in the case of single-phase traction system of 25 kV, 50 Hz, AC, which is also operated in the Czech Republic. Although AC traction does not have such devastating effects on underground storage devices such as DC traction, under certain conditions it can cause malfunction of some storage devices and electrical equipment faults. This paper just deals with the negative impacts of AC traction on some parts of the technical infrastructure and on the basis of data of the real events evaluation it describes the mechanism of these impacts.

SESSION 4 – DISPERSED GENERATION, UTILISATION OF ELECTRICITY

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

THE IMPACT OF THE SHUTDOWN OF NUCLEAR POWER STATIONS IN GERMANY ON THE EPS IN THE CR

Jiří Ptáček, Petr Motlitba, Milan Krátký, EGÚ Brno, a.s.

Putting out of operation the nuclear power plants in Germany, which was announced by the German government after Japan's nuclear accident in Fukushima, will influence the future of not only the German electric power system, but the electric power system throughout Central Europe. A power-balance character of the EPS in Germany will change and there will also be a change in the distribution of major power flows in transmission networks both in the inner parts of Germany, as well as on cross-border interconnections with neighbouring systems. The German EPS as one of the dominant European system of cooperating ENTSO-E system is already characterized by a large share of RES in electricity production - especially in wind power plants on the northern coast of Germany and also in photovoltaic power plants, whose installed capacity has recently increased significantly. The share of these resources in the composition of the production base will continue to increase, along with the gradual shutdown of nuclear resources will cause even greater impact on the distribution of power transmission lines and a higher loading of the transmission network in Germany and the neighbouring grids. The paper discusses the main influences and impacts on the transmission system (EPS) in the CR, which can be expected in relation with the decommissioning of NPP and a higher proportion of RES in the German EPS.

THE ASSESSMENT OF THE OPERATION OF RES IN CEZ DISTRIBUTION IN 2011

Pavel Derner, CEZ Distribuce, a.s.

A large increase in renewable energy sources connected, especially photovoltaic ones, into distribution networks caused the need to assess the impact of operation of dispersed generation on the distribution network.

The paper presents an analysis and evaluation of operation of RES (dispersed generation) connected to the HV and MV distribution network on the territory of CEZ, a. s. for the period 02-12/2011. Based on the measured values the assessment is focused on the evaluation of delivery of P, Q, and the analysis of the installed and contemporary power of RES, the evaluation of active power, reactive power, the course of maximum contemporary power, evaluation of time of full power of OZE, changes in active power.

THE STATE OF RES CONNECTION IN ZSE DISTRIBUTION, A. S AND SELECTED PROBLEMS CONCERNING CONNECTING

Miroslav Jalec, ZSE Distribúcia, a.s.

The aim of the paper is to outline the development of connecting conditions into the distribution network in the SR distribution system. At the same time it presents the number of applications as well as connected sources in ZSE Distribution, a. s. according to a type, location and power sources

themselves, and the attention is paid to the actual production of electricity in different time periods. In the analysis of the problems it focuses on work safety in low voltage lines to which mainly photovoltaic sources are connected.

THE WIND FARM IN KRYŠTOFOVY HAMRY AFTER THE FOURTH YEAR OF ITS OPERATION

Vladimír Velek

The results of statistical processing of farm production for the fourth year of its operation and a summary for the entire four-year period. Information on the results of the wind farms U tří pánů in the year 2011.

RES AND THE EUROPEAN LEGISLATION

František Kysnar, EGC – EnerGoConsult ČB s.r.o.

The review and creation of relevant documents from the field of connection and operation of dispersed generation, such as EN 50438, IEC / TR 61000-3-15 has been going on the CENELEC ground in the year 2012. The paper comments on the selection of paragraphs that bring new requirements or recommendations just for the field of dispersed generation. The paper does not omit the emerging European Transmission System Code, whose ambition is, according to the latest draft, among other things, impose properties for sources with power from 800W.

THE ANNEX 7 OF THE DISTRIBUTION NETWORK CODE IN THE YEAR 2013

František Kysnar, EGC – EnerGoConsult ČB s.r.o.

Vaculík, E.ON Czech Republic

Kozák, E.ON Distribuce, a.s.

Vlado Kubic, CEZ Distribuce, a.s.

Jiří Hradecký, PREDistribuce, a.s.

The paper deals with the revision of the Annex 7 of the Distribution Network Code focusing on support services of resources connected to the networks of DSOs.

THE EU ENVIRONMENTAL POLICY AND PROFESSOR PARKINSON'S LEGISLATION

Vladimír Velek

Ill-conceived, non-conceptual and inconsistent EU environmental policy. The consequences of incompetent decisions.

BEHAVIOUR OF RES DURING FAULTS IN THE HV NETWORK FROM THE PERSPECTIVE OF THE DISPATCHING CONTROL OF DN

Petr Vaculík, E.ON Czech Republic

In connection with the increasing number of renewable energy sources connected to the DN it is necessary to pay attention not only to their methods of operation and dispatching control, but also their behaviour during the faults in the surrounding network. This paper analyzes the response of resources connected to 22kV E.ON DN during short-circuit at high voltage networks. The analysis is primarily

based on the data transmitted to the dispatcher control systems of the Operational dispatching centre E.ON.

THE SOLUTION OF VOLTAGE CONDITIONS IN THE NETWORKS WITH A LARGE SHARE OF RES

Karel Procházka, Michal Baloun, EGC – EnerGoConsult ČB s.r.o.

David Mezera, E.ON Czech Republic

In distribution networks of medium and low voltage connected dispersed sources can cause significant voltage changes, which the usual control of voltage using taps switching of power supply transformers with taps switchable under load can neither see them nor respond to them in an appropriate and effective way.

Given the proven impact of reactive power on voltage at the connection point of sources far from power transformers, in the proposed solution there is preferably used so-called support of network-by static voltage control of connected sources by changing the power factor, or supplied or consumed reactive power.

For LV networks powered by MV networks with strong voltage fluctuations there are being used MV / LV transformers with voltage regulation through tapping under load.

This paper describes a model solution for networks with sources in MV network as well as powered LV networks, in which it optimizes regulatory interventions according to the following priorities:

Voltage changes in 110 kV network - addresses the regulations of the transformer 110 kV / MV.

Voltage changes in the MV network - primarily deals with the change of reactive power of sources starting from the point of exceeding the tolerance voltage area, if not sufficient, then there is assessed the possibility to change the tapping of the power transformer 110 kV / MV, eventually decreasing active power sources supplied.

Voltage changes in LV network - preferably a Q change for sources (if possible), then the change of the tapping of the MV / LV transformer.

THE SETTING THE COEFFICIENTS OF SIMULTANEITY OF PVP PRODUCTION DEPENDING ON THE STABILITY OF EXPOSURE

Jan Jiříčka, E.ON Czech Republic

The paper focuses on practical experience with operation of distribution networks with high share of distributed generation. On the basis of a case study of simultaneously operated photovoltaic plants, there are determined coincidence factors (also simultaneity factors) depending on a constancy and intensity of exposure. The coincidence factors can be used for estimation of operation performance of MV and LV networks with high penetration of distributed generation.

MEASURING THE IMPACT OF RES ON THE LEVEL OF MRC SIGNAL IN THE NETWORK

Tomáš Hanžlík, EGC – EnerGoConsult ČB s.r.o.

To assess the real impact of equipment connected to the network in the MRC signal it is important, in addition to calculations, to carry out also the subsequent measurement. On this basis it is then possible to suggest possible measures to limit the impacts on the MRC signal in the network. The paper is focused on the measurement method and presents practical examples of its results.

AN INNOVATION OF THE MANAGEMENT OF RES PLANTS ACCORDING TO THE AMENDMENT ENERGY ACT No. 458/2000 Coll.

Jaroslav Pospíšil, Josef Toušek, Tomáš Effenberger, Roman Málek, Pavel Tureček

The aim of this paper is to analyze the energy requirements to supplement the regulation of active and reactive power concerning renewable sources, particularly wind and photovoltaic plants. There are presented the results of measurements of the dynamic behaviour of selected RES plants, using appropriate monitoring systems. When all technical requirements of the regulation of active power, voltage regulation and reactive power are accomplished, then the standards of power quality are simultaneously monitored.

DIAGNOSTICS OF OPERATION OF PHOTOVOLTAIC POWER PLANTS

Pavel Tureček, Petr Pospíšil, Roman Málek, Luboš Vlach

The article is devoted to problems of measurement and evaluation of the effectiveness of photovoltaic panels and the entire installed technology on conversion and distribution of electrical energy produced, depending on the time of installation and environmental influences. The aim of the authors is to determine what proportion on the overall efficiency of the panels have the aging of materials, used in construction panels, dust and also to determine patterns of aging of common types of photovoltaic panels. There are presented the results of measurements and the results from the monitoring system during operation of 1 MW PVP. In the medium term there is monitored the economic impact of decline in the efficiency of panels and there are provided conclusions to assess the actual reduction in output from photovoltaic panels and their lifespan.

STABILITY OF OPERATION IN ISOLATED SYSTEM WITH SMALL HYDROELECTRIC POWER STATIONS

Zdeněk Müller, Jan Špetlík, Jan Švec, Josef Tlustý, CTU in Prague

The paper analyzes the possibilities of stable operation of small isolated industrial network powered by small hydroelectric power stations and standby diesel generators. It is a system with a total consumption of about 1 MW with expected sharp changes in load up to 20% Am. The aim is to perform sensitivity analysis of the impact of selected parameters of the system on maintaining stable operation of the network during dynamic phenomena.

THE IMPACTS OF DISPERSED SOURCES ON THE CHARACTER OF SHUNT FAULTS IN DISTRIBUTION SYSTEMS

Petr Mareček, Miroslav Müller, Zdeněk Müller, Jan Švec, CTU in Prague

The paper deals with faults in distribution networks with installed dispersed and renewable energy sources. There is carried out an analysis of the impact of network topology on fault currents. The analysis concerns the steady short-circuit currents and dynamic phenomena in the formation and shutdown faults. The aim is to highlight some specific aspects of operating systems with different locations of dispersed sources

SESSION 5: DEVELOPMENT OF A DISTRIBUTION SYSTEM

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

DISTRIBUTION NETWORK PLANNING WITH RES

František Vybíralík, EEC

At present there are smaller plants based on renewable energy sources, especially PVPs, connected to low voltage distribution networks. These sources are characterized by the considerable fluctuation of power, therefore in low-voltage networks can be bigger voltage variation. The article will describe the possibility to use data from network measurements or data from smart meters during the reconstruction of the network.

DEVELOPMENT OF A PILOT PROJECT AND A DESCRIPTION OF TECHNICAL SOLUTIONS OF A DISTRIBUTION PART OF THE SMART REGION PROJECT

Vlastimil Novotný, CEZ Distribuce, a.s., Martin Machek CEZ, a.s.

The paper deals with current developments in the Smart Grids pilot project of the CEZ Group, the anticipated next steps and in detail introduces with the technical solution of the distribution part of the project in the area of low, medium voltage and also mentions protection issues.

PRINCIPLES OF MV NETWORKING IN CITIES

Tomáš Kocourek, PREdistribuce, a.s.

Viktor Blažek, E.ON Distribuce, a.s.

František Štefek, CEZ Distribuce, a.s.

Josef Tomčík, Východoslovenská distribuční a.s.

The existing medium voltage networks do not meet the new requirements for the operation of distribution networks and ignore the new possibilities of using automated features and remote network control. Therefore, the distribution companies created the new concepts for the construction and operation of medium voltage networks in cities. These networks should be operationally easier, more reliable and cheaper.

In the paper there are presented the charts of the newly constructed network, there is mentioned the use of new technologies, new uses of individual lines, types of distribution and power stations.

The aim of the paper is to compare existing networks of medium voltage and newly designed medium voltage networking concepts in the cities, both in individual distribution companies and also between the distribution companies.

In conclusion, the paper describes the anticipated benefits of these networks for customers (reliability) as well as for a distributor.

DEVELOPMENT OF THE TRANSMISSION SYSTEM IN THE CR

Petr Hamouz, Jaroslav Čermák, ČEPS, a.s.

The theme deals with long-term development plans of the transmission system (TS) in the CR at the voltage levels of 220 kV and 400 kV (HV, EHV) of the TS operator ČEPS, a.s. The transmission system in the CR is currently being determined by certain internal and external factors that negatively affect the safe and reliable operation of the TS. Eliminating / mitigating of these negative impacts will be achieved due to the planned strengthening of TS.

DISTRIBUTION TRANSFORMERS WITH REGULATION UNDER-LOAD AS ELEMENTS FOR LV VOLTAGE STABILIZATION

Martin Kašpírek, E.ON Czech Republic

The paper deals with the stabilization of the voltage in LV distribution network using regulated transformers. In the introduction there is assessed the possibility of voltage regulation using a standard distribution transformer 22/0, 4 kV with switching taps in the state without the load. In the past, there were described the under load regulated LV/LV transformers used in long LV distribution lines to solve the problems with low voltage at its ends. Currently, on the contrary there is a problem with overvoltage because of the RES operation and this element can be used for its elimination. Another way how to manage the voltage in the LV distribution grid is the use of self regulated distribution transformer 22/0, 4 kV, when several manufacturers are already offering transformers with under load regulation. Principles of regulation for individual manufacturers vary considerably. Finally, there is presented the review of the available under load regulated transformers with regard to the principles of regulation, regulation ranges, size and cost of transformers.

AN EFFICIENCY ANALYSIS OF THE SHUNTING METHOD USING THE THEORY OF TWO-PORTS

Daniel Kouba, E.ON Czech Republic

As a proper solution of the ever-increasing capacity current and capacity areas of large-scale some results of the tests and also journals refer to the method of shunting. This method is still missing a certified physical description that would accurately simulate the different steady states that may occur during the so called "shunted earth fault." Connecting of shunting resistance can be understood as resulting fault in the network with earth fault, so to describe such a state we must deal with simultaneous failures. These belong among the most complex phenomena faults, but the application of the theory of two-ports provide a transparent solution of simultaneous faults and ensure physical verification for the theoretical description of the effectiveness of the investigated method. This paper explains the theory of two-ports used for the analysis of the shunting method, thus its application in compensated MV networks. The obtained simulations and their conclusions will support the research in this area.

ASSET MANAGEMENT TOOLS FOR LONG-TERM PLANNING AND DETERMINATION OF PRIORITIES OF RENOVATION AND MAINTENANCE

Peter Frák, Východoslovenská distribučná a.s.

The paper deals with the long-term planning investments in the electrical power engineering sector. For reasons of increasing transparency and promoting reasoning in decisions about the direction of investment in electricity networks it is needed to find ways and tools that can predict the impact of individual measures, taking into account the set regulatory framework. In the long-term planning it is necessary to monitor the scope and structure of networks, their age and technical condition with implications for their reliability, as well as cost indicators that describe the difficulty of individual measures. Through empirical research of the reliability of elements it is possible to describe

mathematical dependencies of probability of faults based on age or the state of facilities using appropriate probabilistic model. The second theme of this paper is a description of the approach to the setting of priorities in the renovation and maintenance.

THE QUALITY OF THE ELECTRICITY SUPPLY AND RELATED SERVICES IN THE ELECTRICAL POWER ENGINEERING IN THE YEAR 2011

Jan Šefrámek, ERO

The paper deals with evaluating the quality of electricity supply and related services in the electrical power engineering from the perspective of the Energy Regulatory Office. The paper gives a detailed evaluation of the implementation of quality standards and performance levels of continuity of electricity supply. Furthermore, the paper deals with the introduction of incentive quality regulation in the CR.

THE LEVEL OF THE QUALITY OF ELECTRICITY SUPPLY IN THE CR, PLANNED DEVELOPMENT IN ITS MONITORING

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

The paper, in addition to the usual evaluation of key indicators of SAIDI and SAIFI of regional DNOs, contains a more detailed classification of events according to the classification in the Appendix 4 to the Decree No. 41/2010 as well as the classification according to a category and a level of the interruption. For three-year period from 2009 to 2011 there are also assessed their variances. For the internal needs of the DNOs, the orientation on the measures with the greatest contribution to reducing SAIDI, SAIFI, we expect the evaluation of indicators for the administrative part of the supply area as well as individual power areas.

RELIABILITY PREDICTIONS AS A PART OF A COST-BENEFIT ANALYSIS MEASURES AFFECTING THE RELIABILITY OF MV DISTRIBUTION NETWORKS

Petr Skala, Václav Dětrich, EGÚ Brno, a.s.

This paper will focus on incorporation of outputs from simulations of reliability of the Monte Carlo type into the cost-benefit analysis in cases of considered measures that should lead to improvements in aspects of continuity of MV distribution networks. The MBCA method is mentioned, which is one of the alternatives of the cost-benefit analysis and is usable in the field of distribution networks. Thanks to that method you can obtain the optimal sequence of sets of measures, there can be included more MV terminals with a greater number of variants of measures. Linking MBCA with Monte Carlo simulations, however, requires an adequate work with inputs that have the character of random variables.

EVENTS WITH THE HIGHEST IMPACT ON THE RELIABILITY AND CONTINUITY, FROM THE PERSPECTIVE OF THE DNO AND THE CUSTOMERS

Michal Konč, CEZ distribuce, a.s.

In the paper there will be discussed two views on the importance of events in relation to reliability and continuity. The first view has a significant impact on the reporting of indicators of reliability and continuity, thus the events from the perspective of distributor. The second, where will be presented the experience with the severity of the events at the suggestions of customers.

CONTINUITY OF ELECTRICITY SUPPLY - THE INDIVIDUAL INDICATORS OF RELIABILITY

Mária Nováková, Iveta Chudá – ZSE Distribúcia a.s. Bratislava

The paper's aim is to present the work that we devoted to the monitoring of the flow of electricity within ZSE Distribution at the level of global indicators SAIDI, SAIFI. The work analyzes the proportion of different types of events in general, as well as suggestions for improvement. The main theme for our location is the new look at the continuity of supply, not only through systematic statistical indicators, but primarily through individual indicators, based on the individual place of energy consumption. As in the system variables, we can identify the relation between the number of outages, its type and different types of events and voltage level, which is the source of the failure. The work is an inspiration for the approach to the management of networking and elimination of the faults in the future, where the individual indicators and financial compensation for their non-compliance are to expect with high probability in each of the electricity distribution company in Europe.

THE USE OF DATABASES FOR A RELIABILITY ANALYSIS OF DISTRIBUTION NETWORKS

Radomír Goňo, Stanislav Rusek, Tadeusz Sikora, Vít Houdek, VŠB-TU Ostrava

The paper analyzes a database of faults and failures in the supply of distribution networks. The result of this analysis are the reliability parameters of important equipment entering the calculation of the reliability and further the number of faults and defects in various parts of the network necessary for reliability-oriented maintenance.

THE SW SUPPORT FOR THE OPTIMIZATION OF A PLACEMENT OF REMOTE SWITCHING DEVICES IN MV NETWORKS IN TERMS OF COSTS AND BENEFITS

Filip Brož, Michal Baloun, EGC – EnerGoConsult ČB s.r.o.

In connection with the introduction of the incentive regulation (ERO methodology for the third Regulatory period), there is the requirement for the development of distribution networks in order to comply with the required level of services provided in relation to their price.

On the model of the selected parts of the distribution network using the computing software there is shown the benefits of remote-controlled switching elements of the DOU and Recloser type and their combinations, including the proposal of optimum deployment of the newly installed network elements. The appropriateness of the selected reliability measures is assessed not only in relation to the level of continuity indicators and the quantity of undelivered energy, but also in terms of economic return on investment.

SESSION 6: CONTROL, ORGANIZATION, QUALIFICATION

Guarantor: Martin Schneider, PREměření, a. s.

THE RESULTS OF THE ECONOMIC ASSESSMENT OF THE FEASIBILITY OF THE APPLICATION OF SMART METERING IN THE CZECH ELECTRICAL POWER ENGINEERING

Ladislav Havel, MIT

The subject of the paper is a presentation of the results of the economic assessment of the feasibility of the application of smart metering in the Czech electrical power engineering and the impacts of this assessment on the adoption of smart metering in the CR.

EXTERNAL IMPACTS ON THE DISTRIBUTOR

Pavel Kraják, CEZ a.s.

The annotation will be delivered at a later date.

THE LIBERALIZATION OF ELECTRICITY MARKETS AND A COMPARISON OF THEIR DEVELOPMENT

Milan Kloubec, AZ-Elektrostav, a.s.

The liberalization of the electricity industry during the past two decades has spread to most developed countries. Still, not all experience, associated with it, is positive and results in some cases far from their anticipation. In order to avoid errors that occurred in countries that started with the liberalization of their electricity industry much earlier than the CR, it is necessary to focus on a comparison of foreign development and learn from their experience with unbundling.

STRATEGIC CHANGES IN THE GRIDS MANAGEMENT

Milan Kloubec, AZ-Elektrostav, a.s.

With the advent of Smart Grids it is needed to use their potential not only for the smart management of the transmission system but also for the distribution systems. Given the ambitious EU goals in the field of decentralized renewable electricity sources, the introduction of Smart Grids and others, management of distribution systems capable of responding in real time on the distribution of production and consumption capacities will play more and more important role. Among other things, the adoption of Smart Grids will save a substantial part of the cost which otherwise would be inevitable for strengthening of distribution systems capable of coping with the challenges of the 21st century.

AN ANALYSIS OF THE TRANSFER OF SIGNIFICANT INFORMATION FROM THE DTS MEASUREMENT

Pavel Kubíček, Jan Souček, MEG A a.s.

The analysis of quantity, frequency and time of data transfer measured in an extensive network of DTS distribution substations is essential for the proper sizing of the communication system. In this paper, there is the information obtained from the annual measurements. The data analysis focuses on the frequency of broadcast messages and ways to reduce the amount of transmitted data based on



the change of delta criteria and integral criteria while maintaining the information value of data. It also deals with the issues of possible redundancy of transmitted data from different sites of MV network.

EXPERIENCE WITH THE AMM PILOT PROJECT IN CEZ, A.S.

Ondřej Mamula, František Müller, CEZ a.s.

The annotation will be delivered at a later date.

EXPERIENCE WITH THE INSTALLATION OF SMART METERS WITH THE STANDARDIZED COMMUNICATION

Aleš Mikula, ZPA

The experience with the adoption of smart meters with the PRIME standardized communication in locations in the Middle East. The character of distribution networks in these countries is a considerable challenge for both the company and for installing the PLC technology. In the presentation there will be mentioned the specifics of the parameterization of electric meters and experience with the installation in these conditions.

EXPERIENCE WITH USING THE DATA FROM THE STATISTICAL ELECTRIC METERS AND THE AMM TEST IN PRE

Tomáš Šlapák, Jindřich Nerad

The annotation will be delivered at a later date.

ARE ALL THE REQUIREMENTS FOR THE EFFICIENT AND RELIABLE AMM FULFILLED?

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

The paper summarizes information on the current requirements for the AMM systems and introduces the approach of selected countries with the adoption of the AMM. It also mentions the standardization activities without their completion and use in the individual elements of the AMM and information transfer there cannot be guaranteed the desired properties, including reliability, interoperability, security and data protection.