R&D NESTER

9 NL
Feb 2017

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EDITORIAL

Dear Reader,

Managing the integration of renewable energy sources in the power network and digitalization / integration of ICT in the power systems are two of the hottest topics currently addressed by the power industry.

In this edition of the information we periodically bring to you, we reinforce that tendency. Regarding the integration of renewables we inform on a set of methodologies and tools, entirely designed by R&D Nester, to support the decision making process of network operators when facing the need to curtail wind power, and guarantee smart decisions. Furthermore, update on the R&D Nester project "Renewable Energy Dispatch Tools" is also mentioned below. Regarding the ICT-on-Power Systems topic, we highlight our development breakthrough in combining power systems simulation and ICT simulation, an important tool required to study Smart Grids in general, and our innovative methodology related to IEC61850 communication network. More on these two topics can be found below.

Also worth mentioning is the fact that the Joint Research Centre (JRC) of the European Commission published the second release of the inventory of Smart Grid Laboratories worldwide, and R&D Nester laboratory is included in that relevant list, with its real-time power systems and communications capabilities (see more on R&D Nester laboratory in http://www.rdnester.com/en-GB/lab/).

As in the previous editions, the Newsletter is also enriched with some relevant links and information EU developments, namely the New Package from November.

Do continue to test your knowledge on power systems with our popular "Quiz" section, and don't forget to follow us on our LinkedIn page (https://www.linkedin.com/company/r&d-nester?trk=top_nav_home), where these and other updates are often highlighted. We hope you find these minutes spent with us both relevant and rewarding.

Enjoy your reading and please continue to share with us your feedback!

Sincerely,

Nuno de Souza e Silva
General Manager

HIGHLIGHTS

R&D NESTER PRESENTS WIND POWER MANAGEMENT SOLUTIONS AT IEEE PES ISGT EUROPE 2016

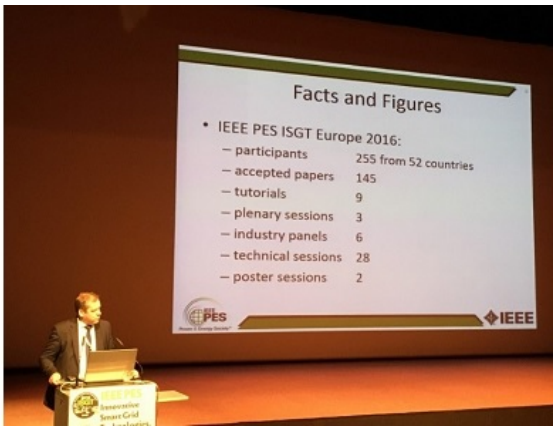
R&D Nester has been at the Innovative Smart Grids Technologies Europe 2016 conference, organized by the IEEE Power and Energy Society, to present a paper entitle "Wind Power Curtailment Optimization for Day-Ahead Operational Planning", produced in the scope its recent innovations in the area of renewable energy management.

The conference has gathered experts in the subject of smart grids from different sectors, including universities, research centers, electricity network operators and industry. Three plenary sessions have taken place, where smart grid trends and innovations were debated by utilities, technology providers and regulators. The role of digitalization and energy storage in future power systems has been among the most popular topics under discussion.

The work developed at R&D Nester, in the scope of the project ‘Power Systems Simulation', was presented at the technical session entitled ‘Distributed Energy Resources and Network Integration'. A set of methodologies and tools, entirely designed by R&D Nester, to support the decision

making process of network operators when facing the need to curtail wind power has been revealed. By providing optimal wind power curtailment solutions for day-ahead operational planning, this kind of tools allows network operators to take smarter decisions, thus operating the system in a more efficient manner.

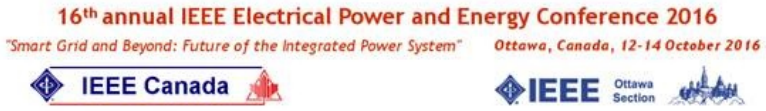




R&D NESTER PRESENTS DEVELOPMENTS ON NOVEL SIMULATION OF PROTECTION SCHEMES FOR FUTURE GENERATION SUBSTATIONS

R&D Nester was present at the 16th annual IEEE Electric Power and Energy Conference EPEC 2016 to present a paper produced in the scope of the Substation of the Future entitle "Integrated Simulation Model of Power System Protection Schemes and Process Bus Communication Networks". The presented work is related to the development breakthrough in combining power systems simulation and ICT simulation, an important tool required to study Smart Grids in general, Protection and Automation Systems based on IEC 61850, System Integrity Protection and many other active topics of our industry.

The EPEC 2016 was focused on "Smart Grid and Beyond: Future of the Integrated Power System" and brought the attention to new concepts and technologies that are being developed, deployed, and integrated in the evolving Smart Grid. Smart Grids were discussed as a confluence of many hi-tech and traditional power engineering disciplines that are advancing individually and are merging together.



R&D NESTER PRESENTS AN INNOVATIVE METHODOLOGY IN THE AUTOMATIC PARAMETERIZATION OF THE SUBSTATION COMMUNICATIONS NETWORK

R&D Nester participated in the international conference "IEC 61850 Europe 2016,", and made a presentation that describes an innovative methodology developed in the framework of that project, consisting in the automatic parameterization of the substation communications network, regarding real time messages.

This approach will allow a substantial reduction in setup time both of the communication switches and the equipment that produce the network traffic, called IED (Intelligent Electronic Devices), minimizing parameterization errors. The developed methodology has as a major goal the easy and fast filtering of the traffic that flows in the communications network deployed inside the substations, avoiding situations of traffic congestion.

This conference, which included an exhibition, a network forum and a workshop, was addressed to experts in the application of the international standard IEC 61850, which aims the interoperability between elements of the control and protection system of substations. This standard is being intensively applied in the ‘Substation of the Future' project of R&D Nester.





NARI GROUP VISITED R&D NESTER

A delegation of NARI, a group of Chinese companies supplying equipment and systems for production, transmission and distribution of electricity, headed by vice-president Hu Jiangyi, visited R&D Nester.

During the visit, a Memorandum of Understanding was signed between the two entities. This document was signed by Lu Hongshui, Chief Engineer of Tech-Center of NARI Group and Nuno Souza e Silva, General Manager of R&D Nester, having as goal the collaboration in the research of solutions in the field of protection and automation systems for substations.

NARI is one of the companies having a collaboration in the R&D Nester ‘Substation of the Future' project, by loaning devices that will be installed in the testing platform established under the scope of the mentioned project.

After the signature, NARI delegation visited the REN's National Dispatch Center and went to the R&D Nester laboratory, where some test cases have been undertaken.



R&D NESTER PARTICIPATED IN THE 1ST EDITION OF ECONOMIC FORUM PORTUGAL-CHINA

R&D Nester was present at the 1st edition of the Portugal-China Economic Forum, an event organized by the AIP Foundation and the Portuguese-Chinese Chamber of Commerce & Industry. This Forum, held in Lisbon, on November 15th and 16th, at FIL, Parque das Nações, aims to strengthen the interaction between companies and institutions in both countries.

The Center for Energy Research and Development was also represented at one of the Forum's business conferences, a roundtable discussion on "Industry and Energy" which analyzed the energy sector as the receiver of the largest volume of bilateral direct investment (acquisition of Portuguese State holdings by SOE's of China) and its strong potential for capitalization in the Portuguese community space. Nuno Souza e Silva, Director General of R&D Nester, joined the roundtable, where he shared the experience of the Center for Energy Research and Development in Portugal-China collaboration and the interrelationship dynamics of these two cultures, as well as the challenges they pose as well the opportunities and advantages resulting from the merger of both visions and know-how. The conference was also attended by EDP Innovation, The Navigator Company and Filkemp, under moderation of ADENE.

Nuno Souza e Silva, ranked the participation of R&D Nester in this event as "an excellent opportunity to make known to the remaining areas of business activity, where Chinese culture is present, the activity and developed work of R&D Nester as well as provided the opportunity to promote the innovative work that R&D Nester has been developing in different areas of research that highlights the Renewable Integration and Substation of the Future projects, as well as the services that R&D Nester can provide such as laboratory testing , renewable production forecasting tools and storage management, among others".

R&D Nester, created by REN and the State Grid Corporation of China, was represented with a stand at the Fair of Products, Trade and Investment which will take place in the two days of the Forum. The Ambassador of the Republic of China in Lisbon, Mr. Cai Run and the President of the Portuguese Agency for Investment and Foreign Trade (AICEP), Miguel Frasquilho, were two of the several personalities and entities that visited the stand.

On the last day of the Forum took place the III Gala Portugal-China, an initiative that annually awards the Portuguese-Chinese Business Merit, which was attended by João Conceição, Board Member of REN and Nuno Souza e Silva, Director General of R&D Nester, as well as some of the Project Leaders of the Centre for Research and Development in Energy.





R&D NESTER PRESENT AT ‘BUILDING SMARTER SUBSTATIONS’ COLLOQUIUM

R&D Nester was present at ‘Building Smarter Substations' colloquium, organized jointly by the CIGRE Study Committees B3 (substations), B5 (protection and automation) and D2 (information systems and telecommunications).

The objective of this event was to put in contact participants from those three areas, which are becoming more and more interconnected in the so-called ‘Smart Substation', that is, a substation with a high level of integration of the protection, automation and control (PAC) system. In a Smart Substation, each device can have a panoramic view of the whole system, since all equipment is connected via the local communication network.

R&D Nester presented the paper ‘Using the IEC 61850 formal description capabilities towards a vendor-independent PAC specification' that describes the engineering process for the specification and configuration of a substation PAC system, which was one of the results of the work developed under the scope of the ‘Substation of the Future' project.

The event consisted in oral paper presentations, tutorials and discussion panel sessions. Addressed issues included the use of the IEC 61850 standard inside and between substations, the design of systems with devices from several manufacturers, the importance of the on line condition monitoring of the substation assets, the utilization of mobile devices for the monitoring of the substations and the decoupling of the software from the hardware, with the possible use of cloud computing.

The major conclusions of this event are the necessity of the creation of multidisciplinary teams in the electric power utilities (encompassing all knowledge areas needed for the Smart Substation), the need for training in these areas and the increasing importance of the cyber security.





TECHNICAL INFORMATION

R&D NESTER PRESENTS “RENEWABLE ENERGY DISPATCH TOOLS” PROJECT IN BEIJING

On December 15th 2016, in the headquarter of CEPRI (Chinese Electric Power Research Institute) in Beijing, China, R&D Nester presented results of the project entitled Renewable Energy Dispatch Tool to a panel of experts from CEPRI and several universities in China.

This project was develop by R&D Nester, a research and development center owned by REN (Portuguese TSO) and State Grid of China.

The work of the last 3 years, which includes several deliverables and tools with reports, was presented and discussed.

The main goal of the project is to deploy new and improve existing tools to be used by the system operators to manage high level of intermittent renewable energy such wind and solar.

The project is split in six tasks:

Task 1: Improve the accuracy of the wind power forecast tool including off-shore, by increasing the amount of forecasted power, better dynamic combination of forecasts with real time data from the SCADA, advance methods for extreme wind condition.

Task 2: Dimensioning the amount of additional reserves needed due to the forecast error, based on stochastic data.

Task 3: Technical criteria for curtailment of renewable generation.

Task 4: Implement a solar power forecast tool taking advantage of having solar radiation sensors installed at TSO

substations spread in the country. Use of sky cameras for assessing cloud index.

Task 5 & 6: Assess and demonstrate the technical capability of renewable generation to provide frequency and voltage control.

R&D Nester also addressed the several articles that were published as a result of the work performed, namely:

- "Ensemble-Based Estimation of Wind Power Forecast Uncertainty", EEM15 - 12ª Conferência Internacional do Mercado Europeu da Energia, May/2015,
- "Improvements in wind power forecast", IO15 - XVII Congresso da APDIO, Sep/2015,
- "Wind power forecast uncertainty using dynamic combination of predictions", DEMSEE 2015, Sep/2015,
- "Wind power forecast uncertainty using dynamic combination of predictions", Periodica Polytechnica Electrical Engineering and Computer Science, 59(3), pp. 78-83, Aug/2015,
- "Probabilistic dimensioning of tertiary control reserve driven by the intermittency of renewable generation in Portugal", Cigré Session 46, Paris, Aug/2016.

The work performed gives a strong contribution to the risk management of further integration of renewable energy in the electric system, and provides practical tools for Network and System Operators.

Some of the achieved results are already in real operation.



R&D NESTER PRESENTS “MULTI-ATTRIBUTE ENERGY STORAGE PLANNING” PROJECT IN BEIJING

The headquarter of CEPRI (Chinese Electric Power Research Institute) in Beijing, China, received R&D Nester for the presentation of results achieved with the project entitled "Multi-attribute Energy Storage Planning" to a panel of experts from CEPRI and several universities in China.

This project was developed by R&D Nester, a research and development center owned by REN (Portuguese TSO) and State Grid Corporation of China (Chinese TSO and DSO).

The work performed in the last 3 years, which included several reports, a methodology and a tool for planning energy storage, was presented and discussed.

The main goal of the project was the development of a Multi-scenario and Multi-attribute methodology for energy storage planning in electricity transmission networks.

The project was divided into five tasks:

Task 1: Perform an overview on energy storage projects worldwide and survey on regulatory frameworks and trends for energy storage. Similarly, study the operational fundamentals of power markets and ancillary services, and the potential role of energy storage for RES integration in a market environment.

Task 2: Assess the system's flexibility requirements, studying the transmission network development options and build network models for the horizon 2020.

Task 3: Develop an optimization algorithm for the selection of the preferred sites and sizing of the energy storage alternatives taking into account the level of flexibility requirements.

Task 4: Build and simulate scenarios for network planning allowing both conventional and energy storage alternatives.

Task 5: Perform multi-attribute and multi-scenario analysis. Build and apply the decision-aid methodology for alternative selection, through the use of trade-offs and risk indices. As final task, perform a regulatory survey on the use of energy storage by multiple electricity system actors.

During the last three years R&D Nester also published several articles as result of the work accomplished, namely:

- "Planning Energy Storage in Power Transmission Networks", IGESC 2014 - IEEE Green Energy and Systems Conference 2014, Nov/2014, California, USA;
- "Siting and Sizing Dispersed Energy Storage in Power Transmission Networks", IGESC 2015 - IEEE Green Energy and Systems Conference 2015, Nov/2015, California, USA.

The work performed during the last 3 years gave a strong contribution for the understanding of the potential multiple roles of energy storage in the electrical system, as well as the technologies involved and their main characteristics. This project also contributed for the development of an in-house methodology and a tool for energy storage planning, which allows the

comparison of different technologies and solutions which can be used by Network Operators or other energy actors to plan their infrastructures including energy storage solutions.



R&D NESTER PRESENTS “SUBSTATION OF THE FUTURE” PROJECT IN BEIJING

The headquarter of CEPRI (Chinese Electric Power Research Institute) in Beijing, China, received R&D Nester for the presentation of results of the project entitled "Substation of the Future" to a panel of experts from CEPRI and several universities in China.

This project was developed by R&D Nester, a research and development center owned by REN (Portuguese TSO) and State Grid Corporation of China.

The goal of this three-year project was to develop the specification for the next generation of PAC (protection, automation and control) systems for transmission substations.

The project had the following main steps:

- Writing of the "Vision" document - the base for the project, containing ideas, concepts and concerns.
- Writing of the "Reference Guide" document - containing requirements for the PAC system, from all stakeholders that use it.
- Construction of the simulation center, a set of hardware and software items, for the testing of the specified system.
- In parallel, specification of the PAC system.
- Finally, the execution of test, as a proof of concept of the developed system.

The initial set of tests included equipment from several international reference manufacturers of protection and automation systems and communication devices.

These devices were integrated in the simulation center, which main element is a RTPSS (real time power system simulator), enabling the execution of closed-loop tests, in which the RTPSS simulates a part of the Portuguese transmission network, interacting with the secondary system (protection and automation).

In this project, due to its increasing importance, the study of the communication network in the substation has been addressed. To do this task, a network analyser and generator (hardware) was integrated in the simulation center and the RTPSS was used to perform co-simulation, which is the combined simulation of the power system and the communication network.

The international standard IEC 61850, which main purpose is the interoperability of devices from different manufacturers, was used to specify and configure the system, using a third-party tool.

Regarding IEC 61850, it was tested the conformance of the data models and services of the IEDs and the interoperability comprising GOOSE and Sample Values communication between IEDs and client-server communication (MMS) between IEDs and the local SCADA.

The IEDs were assembled to form a control and automation system of an Extra High Voltage transmission line, connected to the RTPSS. Interaction between IEDs was tested functionally, including distance and overcurrent protection functions, reclousure, emission of commands from local and national and local SCADA, acquisition of sampled values from the merging units by the main unit, sending of the measurements to the local SCADA, redundancy between IEDs, acquisition of time synchronization using PTP protocol.

The performance of the communication switches was also tested, by measuring latency and jitter and transparent clock behaviour.

The executed tests confirmed that the system was properly designed and can be applied to a real substation.

As a result of this project, several scientific and technical papers have been published, namely:

- 'A joint research on the substation of the future between Portugal and China", presented at APAP (Advanced Power System Automation and Protection), held in Nanjing, China, in September 2015.
- "Enhanced testing platform for the Smart Substation", presented at PAC World Conference, held in Ljubljana, Slovenia, in June 2016.
- "Integrated Simulation Model of Power System Protection Schemes and Process Bus Communication Networks", presented at the EPEC (Electrical Power and Energy Conference) 2016, held in Ottawa, Canada, in October 2016.
- ;"Using the IEC 61850 formal description capabilities towards a vendor-independent PAC specification" presented at the CIGRE Colloquium ‘Building Smarter Substations', held in Mexico City, in November 2016.

Also, a provisory patent was successfully submitted.

The work performed allows Network Operators to prepare their substations specifications and new deployments to the benefits and challenges of new "smart" network capabilities.



R&D NESTER PRESENTS “POWER SYSTEM SIMULATION” PROJECT IN BEIJING

The project P4 - Power System Simulation in cooperation with CEPRI aims to achieve the following objectives:

O1 - Provide R&D Nester with capacity calculation for simulation of events in the time domain involving, amid others, control and protection systems, with potential application to the Portuguese electrical system;

O2 - Investigate the exchange of information between transmission and distribution system operators taking into account the regulatory provisions published by the European Commission;

O3 - Develop optimization algorithms for decision support in the areas of operation and planning to be applied within the scope of the Portuguese electricity system.

In December 2016, the main results of the project were presented, reflecting the three dimensions mentioned above:

R1 - A RTPSS (Real Time Power System Simulation) laboratory has been specified and installed that enables real-time simulation which significantly extend the type of studies that have been performed so far. The models used for the simulation of several events were also extensively tested and validated;

R2 - The exchange of information between TSO and DSO was analyzed and evaluated taking into account technical regulations published by the European Commission. This project was carried out in close collaboration with REN (Portuguese TSO) and EDPD (Portuguese DSO) and was implemented in a pilot area of the network involving two EHV/HV substations of REN (Lavos and Pombal);

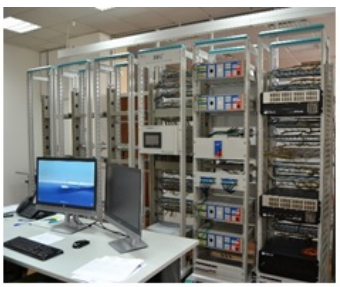
R3 - With regard to operation, an algorithm was developed that based on information received in the day ahead provides a set of actions to be followed by the operator in order to minimize the curtailment of wind production. The other set of algorithms developed in R&D Nester addresses the determination of the maximum nodal injection of RES that can be safely accommodated by the TSO. Both algorithms were tested with networks with similar size of the Portuguese network, revealing great potential of application.

In addition to the work developed scientific articles were published in the following international fora:

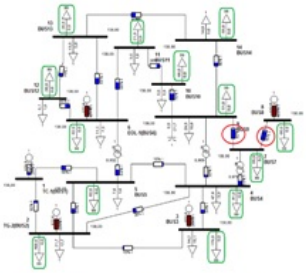
- "TSOs and DSOs Collaboration: The Need for Data Exchange", 10th Jubilee International Conference on Deregulated Electricity Market Issues in South Eastern Europe (DEMSEE'15), Budapest, Hungary, Set/15;
- "Improving Power System Operation in the Presence of RES", IO'15- XVII APDIO Congress, Set/15;
- "Wind Power Curtailment Optimization for Day-Ahead Operational Planning", IEEE PES Innovative Smart Grid Technologies Europe Conference, Ljubljana, Slovenia, Out/16.

The existing results of the project were presented to a panel of CEPRI experts who approved in full all the results obtained.





RTPSS LAB - Infrastructure currently available for real-time simulation



Snapshot of results obtained applying an optimization algorithm for Planning



R&D NESTER IN THE H2020 “BIGDATAOCEAN“ EUROPEAN PROJECT

BigDataOcean is an H2020 funded project whose main objective is to enable maritime big data scenarios for EU-based companies, organisations and scientists, through a multi-segment platform that will combine data of different velocity, variety and volume under an inter-linked, trusted, multilingual engine to produce a big-data repository of value and veracity back to the participants and local communities.

Nuno Amaro represented R&D Nester at this kick-off meeting of the H2020 project BigDataOcean of which R&D Nester is a consortium member, together with other companies and academia from Greece, UK, Germany, Portugal, Italy, Cyprus and Israel.

R&D Nester contribution is in the energy related topics and applications envisaged by the project.

Follow all updates regarding the BigDataOcean project at the official website

http://www.bigdataocean.eu/site/

More information about the project is also available at social media, on

https://twitter.com/big_data_ocean

https://www.facebook.com/Big-Data-Ocean-1860577064227045/

https://www.linkedin.com/groups/13505618/profile



R&D NESTER Lab listed on ‘Smart Grid Laboratories Inventory 2016’

The Joint Research Centre of the European Commission published the second release of the inventory of Smart Grid Laboratories worldwide. R&D NESTER was been identified as a new European laboratory, relevant in the field of Smart Grids. The report containing aggregated technical information about the smart grid activities carried out by smart grid laboratories in Europe and has been published in the end of 2016.

Includes technical data about 69 smart grid laboratories. The majority of the participant laboratories are located in Europe (85.5%), covering a large number of countries. The major part of labs is in Italy and Spain (16%) with Portugal to follow (10% - 7 Laboratories).

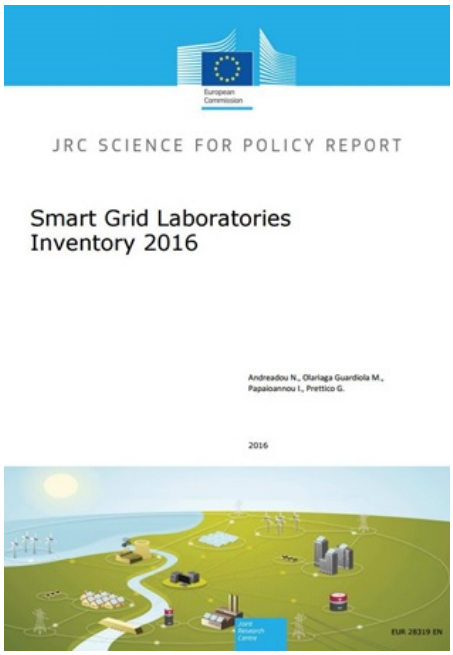
Some general conclusions achieved were:

The main customers of the smart grid labs are utilities, the academia and industrial companies.
The initial budget for setting up the lab is, on average, around 2 M€, but for large institutions it reaches up to 30 M€.

On average, the estimated total annual running cost amounts to a median value of 135 k€.
IEC 61850 is the mostly used standard (in 7 out of the 13 categories) for: Distribution Automation, Grid Management, Storage, Generation & DER, Electromobility (for communication purposes), ICT and AMI activities. For the other categories, more specific standards are adopted.
Survey sample has shown that among the 13 categories identified, those that attract mostly the scientific interest are: Generation & DER, Demand Response, Grid Management and Storage. This comes in accordance with the conclusions drawn from the extended sample of 100 laboratories, where the top categories are proved to be again Generation & DER, Grid Management and Storage.
A minimum of 40% of the total number of laboratories (100) use a real-time simulator.
At least 47% of the laboratories perform research on microgrids.

For additional information, please visit Joint Research Centre publications webpage.

To download the report containing aggregated information about the smart grid activities here



LITERATURE REVIEW

Energy package: Commission proposes new rules for consumer centred clean energy transition

On 30 November 2016 the European Commission presented its plans for the next steps in the Energy Union to speed up the clean energy transition and boost growth and job creation in the EU.

"The Commission wants the EU to lead the clean energy transition, not only adapt to it. For this reason the EU has committed to cut CO2 emissions by at least 40% by 2030 while modernising the EU's economy and delivering on jobs and growth for all European citizens."

The package pursues three main goals:

- Putting energy efficiency first;
- Cementing the EU's global leadership in renewable energies;
- Providing a fair deal for energy consumers.

The Clean Energy for All Europeans legislative proposals cover : i) Energy Efficiency; ii) Renewable Energy; iii) the Design of the Electricity Market; iv) Security of Electricity Supply and v) Governance rules for the Energy Union.

In addition the Commission proposes a new way forward for eco-design as well as a strategy for connected and automated mobility.

The package also includes actions to accelerate clean energy innovation and to renovate Europe's buildings. It provides measures to encourage public and private investment, promote EU industrial competitiveness and mitigate the societal impact of the clean energy transition.

Related Content is available on:

- Clean Energy package documents
- Commission press release: Clean Energy for All Europeans - unlocking Europe's growth potential

EVENTS

24 -24 Mar 2017

FLORENCE, ITALY

FSR POLICY WORKSHOP: CYBERSECURITY IN THE ENERGY SECTOR

28 -30 Mar 2017

AMSTERDAM, THE NETHERLANDS

SMART GRID TECHNICAL FORUM, SGTECH EUROPE 2017

3 -5 Oct 2017

AMSTERDAM, THE NETHERLANDS

EUROPEAN UTILITY WEEK

28 -30 Nov 2017

VIENNA, AUSTRIA

EUROPEAN POWER STRATEGY AND SYSTEMS SUMMIT

26 -31 Aug 2018

PARIS, FRANCE

47TH CIGRE SESSION 2018

LINKS

Some useful links:
ON RESEARCH, DEVELOPMENT AND INNOVATION

Portugal:

- Portugal 2020
- Programa Operacional Competitividade e Internacionalização (COMPETE 2020)
- Agência Nacional de Inovação
- COTEC Portugal

Europe:

- Energy Research Center of the Netherlands (ECN)
- European Energy Research Alliance (EERA)
- Horizon 2020
- Nordic Energy Research
- JRC Publications - Joint Research Centre - Smart Electricity and Interoperability
- ETIP SNET - European Technology and Innovation Platform Smart Networks for Energy Transition

Rest of the World:

- American Energy Innovation Council (AEIC)
- China Electric Power Research Institute (CEPRI)
- Electric power research institute (EPRI)

OTHER ORGANIZATIONS

Portugal:

- Laboratório Nacional de Energia e Geologia (LNEG)
- Polo de Competitividade e Tecnologia da Energia (EnergyIn)
- Associação de Energias Renováveis (APREN)

Europe:

- European Network of Transmission System Operators for Electricity (ENTSO-E)
- The European Wind Energy Association (EWEA)
- World Wind Energy Association (WWEA)

Rest of the World:

- CIGRE - International Council on Large Electric Systems

QUIZ

1) IN WHICH GERMAN CITY THERE IS A RADIO STATION, EMITTING A LONG WAVE TIME SYNCHRONIZATION SIGNAL?

- ◯ Berlin
- ◯ b) Mainflingen
- ◯ Frankfurt
- ◯ Hannover

2) WHICH OF THESE IS A VALID REASON FOR THE PRESENCE OF TIME SYNCHRONIZATION FUNCTION IN SUBSTATIONS?

- ◯ Because some control and automation functions are disabled at night.

4) WHICH OF THE FOLLOWING IS A TIME SYNCHRONIZATION PROTOCOL?

- ◯ a) SNTP
- ◯ PRP
- ◯ HSR
- ◯ SNMP

5) PTP IS A TIME SYNCHRONIZATION PROTOCOL. WHAT DOES 'PTP' MEANS?

- ◯ Point to point
- ◯ Protection timing protocol

◯ To control the working hours of the employees.
◯ c) Because the substation events must be time-tagged.
◯ Because the local operators have to wait for the proper time to issue the commands to the circuit breaker.

3) IRIG IS A SERIES OF TIME SYNCHRONIZATION SIGNALS. WHICH OF THE FOLLOWING VARIANTS IS THE USED FOR THE SYNCHRONIZATIONS OF IEDS?

◯ IRIG-A
◯ IRIG-B
◯ IRIG-C
◯ IRIG-D

◯ Power trusted timing
◯ d) Precision time protocol

6) IN A SUBSTATION COMMUNICATION NETWORK, USUALLY A COMMUNICATION SWITCH ACTS AS A:

◯ Boundary clock
◯ Slave clock
◯ c) Transparent clock
◯ Master clock

Correct answers will be provided to you soon.
If you have problems answering this quiz, click here to answer this via browser.

Answers of the 8th edition Quiz

1) In May 2016 Portugal energy consumption was satisfied 100% by renewables energy sources for how many days?

Answer: d) 4 days

2) Which country has the highest installed power capacity?

Answer: c) China

3) The biggest photovoltaic power plant in the world is located in Rosamond, California USA. Can you guess the total installed capacity?

Answer: c) 579 MW

4) From January 2016 until August 2016, in Portugal, how much power demand was fulfilled by renewables sources?

Answer: c) 73%

5) The record for the laboratory concentrated solar cell efficiency is…

Answer: d) 46%

6) Since 2015 which country has the biggest installed photovoltaic power capacity?

Answer: d) China

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