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EDITORIAL



Dear Reader,

In this edition's Technical Information section we bring you two topics which are experiencing tremendous growth in the power systems arena worldwide.

On one side the standard IEC61850, in its Edition 2 since 2011, is further establishing itself as a critical element not only for network operators but for other players as well, for the protection, automation and control systems, and for interoperability.

On the other side, HVDC is also gaining ground in Europe, with the related Network Code process entering its final stages before release.

These are two topics that will continue to contribute to the change of the landscape in the electric sector and to the Energy Transition, with particular implications to the Network Operators and with close relationship to R&D and Innovation activities.

Read more on this and on R&D Nester latest activities in the notes below. Enjoy the reading!

Sincerely,

Nuno de Souza e Silva
General Manager



HIGHLIGHTS



R&D Nester in China with CEPRI

In December, R&D Nester was in China to discuss innovations in the power networks system. During two days, R&D Nester team discussed with several panels of experts from CEPRI, from the industry and from academia. The topics addressed ranged from integration of renewable energy in the power network, usage of storage, smart substations, power systems simulation and HVDC.



R&D Nester get certification in Research, Development and Innovation

On 10 December 2015 R&D Nester became a Research, Development and Innovation (RDI) certified company, in accordance with Portuguese standard NP 4457:2007.⁽¹⁾

Since first starting out in business, R&D Nester has recognised the strategic importance of implementing an RDI management system according to this standard. The aim of this is to improve the effectiveness and performance of its activities in the search for innovative solutions in the field of energy systems, as well as ensuring a improved flow of information throughout the organisation, improving recognition and understanding of its responsibilities and organisational inter-relations.

The RDI system implemented by the company, and now with NP 4457:2007 certification, meets a wide range of requirements that drive the company to develop and implement a Research, Development and Innovation policy that will improve the effectiveness and efficiency of its R&D projects within an organisational culture focused on Innovation (RD&I).

In this respect, it is noted that the focus of this RDI standard is comprehensive; that is, the set of good practices contained within it seek to guide the company to innovate in four areas: product (e.g. the result of R&D projects), organisation (e.g. implementation of methodologies that foster a culture of innovation within the company), marketing (e.g. the company's image in the marketplace) and processes (new organisational processes that seek to improve the efficiency of a particular activity).

The RDI management system implemented by R&D Nester concentrates on the three key organisational processes within our field of activity: Management of RDI Projects; Management of Interfaces and Knowledge; and Management of Ideas.

Among other advantages, this certification will permit the redefinition and systematisation of some methodologies, the promotion of creativity and management of ideas and opportunities, the organised monitoring and systematisation of RDI results, and improvements to the efficiency and efficacy of RDI projects.

With this RDI certification, R&D Nester undertakes to "consolidate a spirit of innovation and the generation of ideas that ensure the involvement of staff and promote knowledge management with the aim of enhancing human capital." It further undertakes to "improve the close collaboration between Scientific and Technological System Bodies in researching new products and knowledge production processes that enhance the differentiation, competitiveness and the promotion of the company's leadership, continuing the strategy of developing products with innovative results that contribute towards the sustainability of the business and of the energy sector."

Finally, it is noted that RDI standard NP 4457 is compatible with other management system standards currently employed by R&D Nester, particularly standards EN 9001 (Management Quality System), EN ISO 14001 (Environmental Management System) and NP 4397 (Occupational Health and Safety Management System), which enables its integration into the QAS management system used by R&D Nester and other REN group companies since December 2014.

(1)

"The NP 4457:2007 standard is based on an innovation model, supported by interfaces and interactions between scientific and technological knowledge, knowledge about the organisation and its operation and the market or society in general. The concept of innovation underlying this standard stems from its meaning as a wealth-generating mechanism, the impact and usefulness of which benefits the organisation and society.

The standard's principal objective is the definition of an effective Research, Development and Innovation (RDI) management system, enabling the organisation that adopt this standard to define an R&D policy and achieve their innovation objectives... Innovation is understood in its widest sense, according to the OECD Oslo Manual (2005), including new products (goods and services), processes and new marketing or organisational methods. Thus, while technology is one of the key results of research and development, the standard is not restricted to this area - that is to say, it is also aimed at organisations seeking to innovate in fields other than the technological."



Portugal Energy Tour Visits R&D Nester

R&D Nester received a visit from Portugal Energy Tour (PET), a Luso-American Development Foundation (FLAD) initiative.

FLAD, accompanied by a delegation of North American business people and managers of industrial associations from New England and New York, has an ongoing roadshow in Portugal demonstrating the best of what is happening in the national energy sector.

"This visit represents recognition of our centre as an important body in the national energy field." That was how Nuno Souza e Silva, Managing Director of R&D Nester, viewed the PET visit to the REN and State Grid R&D Centre. The visit on 7 December included a presentation by R&D Nester's Managing Director about the work carried out at the R&D Centre.

"The possibility of cooperating with international partners where we can contribute with our know-how is something we always value", said Nuno Souza e Silva, for whom this visit also allows "sharing the important work we are developing in several areas, such as renewables integration, storage and grid planning, which aroused a great deal of interest among our American colleagues."

PET's goal is to examine the energy sector in Portugal through visits to facilities and projects related to the grid management, with smart energy grids, and with various primary energy sources, particularly solar and wind energy. Other goals are to identify business opportunities for American companies

Chinese Ambassador visits R&D Nester

In the end of 2015 R&D Nester received the Ambassador of the People's Republic of China, Mr. Cai Run. The aim of the visit was to witness Portuguese and Chinese collaboration in future electricity, natural gas and R&D projects.

To Nuno Souza and Silva, R&D Nester's General Director, the visit of the Ambassador of the People's Republic of China was "an honour" for the opportunity it provided to "demonstrate first-hand the excellent collaboration between the two countries under the theme "energy", an area that is so important technologically, economically and socially, and which highlights the research and innovation that is being developed to benefit the energy system and the population in general."

This visit ended with visits to the Dispatch Centre of Rede Eléctrica and the R&D Nester Laboratory.



TECHNICAL INFORMATION



Renewable Energy Accommodation Capability Evaluation Based on Time Series Production Simulation was researched and used in Dispatch Center in China

With the rapid development of wind power and PV power in China, it is big challenge for grid operator to reduce wind or PV power curtailment and to increase capacity for renewable energy. Annual renewable energy accommodation capability is the key point to optimize power system operation arrangement and to obligate renewable energy electricity space. After review of current research situation, a new method was proposed by CEPRI (China Electric Power Research Institute) for annual renewable energy accommodation capability assessment based on time series production simulation. A mixed integer programming model for the constraint of starting and stopping of the generation unit is also established.

Based on proposed algorithm, REPS (Renewable Energy Production Simulation) Platform was developed by CEPRI, which was adopted by national dispatch center of SGCC (China State Grid). The annual renewable energy accommodation capability of 2015 is evaluated by REPS and the comparison with field data in first quarter shows the accuracy and adaptability of proposed method.

Original source:

DONG Cun, LI Mingjie, etc, Research and Application of Renewable Energy Accommodation Capability Evaluation Based on Time Series Production Simulation, China Electric Power, Vol 48, No. 12, Dec 2015, p 166-172.

Edition 2 of IEC61850 - Communication networks and systems for power utility automation

IEC 61850 is a standard for communication networks and systems in power systems installations, such as substations, power plants and wind farms, which first edition was published in 2004; at that time only substations were considered in the standard.

Since then, many power system utilities have been implementing this standard worldwide, in the protection, automation and control systems.

Interoperability was the major motivation for the development of this standard: to create a "language" that every device installed within a substation could speak and understand. This Standard intended to replace a large number of protocols, some of them proprietary, like Profibus or LONBus. Furthermore, the IEC 61850 defines a data model for functions and devices, creating a semantic; this way, the same function will always have the same name, independently of everything else.

Current main communication services in IEC61850 are:

- Client-server, also referred as MMS (Manufacturing Message Specification); used for the communication between the servers (the IEDs) and the clients (e.g. local HIM, SCADA and gateways); this type of communication uses MMS over TCP/IP
- GOOSE (Generic Object Oriented Substation Event); It is used for rapid information exchange among IEDs (e.g. interlocking or trip commands)
- SV (Sampled Values): used to the transmission of measured values from the current and voltage transformers to IEDs, over the so called process bus.

The use of Process Bus within substations brings considerable advantages. Among them:

- Elimination of a great amount of copper wires that can be replaced by a small amount of optical fibers;
- Practical elimination of Current Transformer Saturation;
- Improvements in safety of the substation;
- Improvements in flexibility of the protection system.

Also, the aforementioned standard allows having a full engineering workflow when designing a substation, by using a description language defined in IEC61850-6: the SCL (Substation Configuration Language). It is possible to specify a substation using a so called System Specification Tool.

This tool can produce an SSD (Substation Specification Description) file that can be sent to manufacturers in order to produce their devices as per required. Then, a System Configuration Tool establishes the communication between IEDs. SCD (Substation Configuration Description) is the output file of this tool. This file can be imported by the IED Configuration Tool which will configure each IED accordingly to what was specified.

Edition 2 of IEC61850 was released in 2011 and covers new applications and improves interoperability and also clears technical issues compared to Edition 1. The number of available devices that support Edition 2 of the Standard is increasing and now specialists are concerned about the backward compatibility to Edition 1 in the case of having both editions in the same substation (in a case of a substation refurbishment, for instance). Amongst other new features, in Edition 2 we can find:

- Modeling for Power Quality;

- Redundancy (possibility to have IED's with dual connections);
- Enhanced features for testing support;
- New models for mechanical equipment and measurements of non-electric quantities;
- GOOSE and Sampled Values between substations (modeling of gateways).

Edition 2.1 is being produced by IEC, which adds even more corrections to technical issues. From this edition, there are parts that have been published as "Committee Draft for Vote", parts that have been finalized by the Working Group and are now in process to be published by IEC and others that are still under development.

See more:

<http://blog.iec61850.com/>

http://www.cired.net/publications/cired2011/part1/papers/CJRED2011_0794_final.pdf

HVDC grows in Europe

When concerning power systems, Europe has an important objective of creating a European energy market and a robust grid at a continental level, which will bring additional security and quality of service for the grids of each country, together with a higher level of independence of foreign energy imports. Different aspects contribute to such context, particularly the continuous increase of levels of energy generated using renewable sources in the different countries.

HVDC (High Voltage DC) plays an important role in a European scale power grid, because this technology can be used in the implementation of interconnections between European countries. According to a study performed by a market studies company based in the UK, Europe is already the largest market for HVDC Converter Stations, which indicates that the different countries are going through an investment and an implementation of this technology. Different connections are being considered using both, subsea cables which are mainly used in the Northern Countries and overhead lines in continental Europe.

From the technology implementation point of view, things are also in a continuous movement. In October 2015, ENTSO-E Comitology voted positively on the new HVDC network code which enables the utilization of this technology and establishes a main view that can be used in the different countries. The HVDC code will specify requirements for long distance DC connections, links between different AC systems and DC-connected modules such as offshore wind farms which are becoming increasingly prominent in Europe. The created network code is now going through scrutiny by the European Parliament and Council and ENTSO-E expects that during the spring of 2016 the code will be released.

In summary, Europe leads investment in a technology which is estimated to grow from 9.9\$ billion in 2014 to 12.7\$ billion in 2019 at a CAGR of over 5.1%. The growth of this technology can be seen both at the market level but also at the technical level in which main European groups such as ENTSO-E are performing an effort to launch the large scale utilization of this technology in Europe.

Sources:

<http://www.marketsandmarkets.com/Market-Reports/hvdc-converter-station-market-243369221.html>

<https://www.entsoe.eu/major-projects/network-code-development/high-voltage-direct-current/Pages/default.aspx>



EVENTS



13-17 Feb
2016

BENGALURU, INDIA

[ELECRA 2016](#)

15-16 Feb
2016

MADRID, SPAIN

[5TH GRID + STORAGE
REGIONAL WORKSHOP](#)

19-20 Feb
2016

CHAMPAIGN, USA

[2016 IEEE POWER AND
ENERGY CONFERENCE AT
ILLINOIS \(PECI\)](#)

1-3 Mar
2016

DUBAI, UNITED ARAB
EMIRATES

[MIDDLE EAST
ELECTRICITY](#)

1-3 Mar
2016

LISBON, PORTUGAL

[GREEN BUSINESS WEEK](#)

O desafio energético da mobilidade eléctrica

12 March, Angra do Heroísmo, Azores, Portugal

see +

2016 IEEE PES Transmission and Distribution Conference and Exposition (T&D 2016)

2-5 May, Dallas, TX, USA

see +

19 May, Brussels, Belgium

see +

Building the Energy Future Together

13-17 June, Brussels, Belgium

see +

GENERA - Feria Internacional de Energía y Medio Ambiente

15-17 June, Madrid, Spain

see +

CIGRÉ 2016 Session - National Committee

21-26 August, Paris, France

see +



LITERATURE REVIEW



R&D and Innovation

Evaluation of EU's 7th Framework Programme (FP7)

The Commission adopted in January a package on the ex-post evaluation of the 7th Framework Programme. This consists of a Communication responding to the recommendations of an external High Level Expert Group and a Staff Working Document in which the Commission services have evaluated FP7 on the basis of the five evaluation criteria of the Better Regulation package (efficiency, effectiveness, coherence, and relevance and EU added value).

European Commission Press release and Fact Sheets published, presents some of the main findings of the evaluation of EU's 7th Framework Programme (FP7) .

According to the reports the Investment in research and innovation from the EU budget between 2007 and 2013 has greatly improved scientific excellence in Europe and strengthened its competitiveness by improving industry's capacity to innovate.

Referring to the support achieved by Portugal in FP7, Carlos Moedas, wants Portugal to expand its participation in the programme Horizon 2020, especially in the business area, hoping the country exceeds the amount of 522 million euros, received in the previous framework programme with a total budget of 55 1000 million euros.

Source: https://ec.europa.eu/research/evaluations/index_en.cfm

Main Science and Technology Indicators

Provisional data for 2015 indicates that public R&D budgets in the OECD area continued their downward trend since 2010 after briefly stabilising in 2014. Among countries for which 2015 data are available, two thirds have decreased their R&D budgets in real terms and the estimated area total has dropped by 1.3%. In a number of cases, this decline may have been mitigated through growing support through R&D tax incentives, which have been increasing in relative importance over time. On the basis of leading budget data, it is expected that R&D performed in government and higher education institutions in the OECD also declined in 2015.

Source: OECD <http://www.oecd.org/sti/msti.htm>

Measuring R&D Tax Incentives

R&D tax incentive indicators illustrate the extent to which governments support R&D through tax relief, over time and relative to other mechanisms. They also show the gap between the theoretical level of support provided per unit of R&D expenditure and actual costs incurred by different governments.

[Overview of schemes used by countries to provide tax support for R&D View the latest R&D tax incentive indicators](#)

Source: OECD <http://www.oecd.org/sti/rd-tax-stats.htm>

Which countries contribute to global innovation and which detract from it?

Find out the ranking in [report](#) published last January by American Foundation for the Information technology and innovation.

Portugal is in 17th position among the 56 countries whose economic and commercial policies more positively contribute to innovation at a global level.

Source: Information Technology & Innovation Foundation Web page

EU Sustainable energy security package

[Towards Energy Union: The Commission presents sustainable energy security package](#)

Source: European Commission

World Energy Finance

[Clean energy investments in 2015 hit a new record of \\$329bn](#)

Source: Bloomberg

“Global Energy Interconnect - the internet of energy interconnections”

<http://globalcompact15.org/interviews/liu-zhenya>

<https://www.elsevier.com/about/press-releases/science-and-technology/state-grid-corporation-of-china-president-zhenya-liu-authors-new-elsevier-book-on-global-energy>

Report by the World Energy Council “E-storage: Shifting from cost to value”

http://www.worldenergy.org/wp-content/uploads/2016/01/Resources-E-storage-2016.01.14_final_version.pdf

Report by BP “BP Energy Outlook: Outlook to 2035

<http://www.bp.com/en/global/corporate/energy-economics/energy-outlook-2035.html>



LINKS



- [American Energy Innovation Council \(AEIC\)](#)
- [Associação de Energias Renováveis \(APREN\)](#)
- [China Electric Power Research Institute \(CEPRI\)](#)
- [Electric power research institute \(EPRI\)](#)
- [Energy Research Center of the Netherlands \(ECN\)](#)
- [European Energy Research Alliance \(EERA\)](#)
- [European Network of Transmission System Operators for Electricity \(ENTSO-E\)](#)
- [The European Wind Energy Association \(EWEA\)](#)
- [Horizon 2020](#)
- [Laboratório Nacional de Energia e Geologia \(LNEG\)](#)
- [Nordic Energy Research](#)
- [Polo de Competitividade e Tecnologia da Energia \(EnergyIn\)](#)
- [Redes Energéticas Nacionais \(REN\)](#)
- [State Grid Corporation of China \(SGCC\)](#)
- [World Wind Energy Association \(WWEA\)](#)



QUIZ



1) IN 2015, THE ELECTRICITY PEAK LOAD IN PORTUGAL WAS:

- ☐ A) 6 618 MW
- ☐ B) 7 618 MW
- ☐ C) 8 618 MW
- ☐ D) 9 618 MW

2) IN 2015, THE ELECTRICITY CONSUMPTION IN PORTUGAL WAS

- ☐ A) 38 964 GWh
- ☐ B) 48 964 GWh
- ☐ C) 58 964 GWh
- ☐ D) 68 964 GWh

3) IN 2015, THE SHARE OF WIND ENERGY IN THE PORTUGUESE ELECTRICITY CONSUMPTION SUPPLY WAS

- ☐ A) 13%
- ☐ B) 23%
- ☐ C) 33%
- ☐ D) 43%

4) IN 2015, THE SHARE OF SOLAR ENERGY IN THE PORTUGUESE ELECTRICITY CONSUMPTION SUPPLY WAS

- ☐ A) 1%
- ☐ B) 1.5%
- ☐ C) 2%
- ☐ D) 2.5%

5) THE FIRST TIME WIND POWER PRODUCTION EXCEEDED THE LOAD DEMAND IN THE PORTUGUESE POWER SYSTEM WAS AT

- ☐ A) January 28th 2013
- ☐ B) January 28th 2014

- ☐ C) January 28th 2015
☐ D) January 28th 2016

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

Send

Answers of the 6th edition Quiz

1) The nominal power of the biggest wind turbine commercially available is:

Answer: b. 10 MW, SeaTitan - AMSC
(<http://www.amsc.com/documents/seatitan-10-mw-wind-turbine-data-sheet/>).

3) The surface area of the wings of the biggest commercial airplane, Airbus A380-800 is approximately:

Answer: B. 845 m² according to Airbus Website (www.airbus.com)

2) In 2012, the average volume of fossil fuels CO2 emissions per capita in Portugal in tones/inhabitant was:

Answer: A) 4.9 (www.pordata.pt)

4) The kinetic energy (wind energy) generated inside a mature hurricane, with sustained winds of 40 m/s and 60km radius is approximately:

Answer: C. 36TWh/day according to the NOAA website
(<http://www.aoml.noaa.gov/hrd/tcfaq/D7.html>)



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Tel.: +351 21 001 13 00

Email: info@rdnester.com

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