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EDITORIAL



Dear Reader,

Innovation, R&D and new challenges continue to be hot topics in the energy sector.

Examples of such reality are the publishing on February 25th this year of the European Union Package by the European Commission (COM(2015) 80), and the IEEE Power & Energy Magazine issue from February almost fully dedicated to European R&D.

The European Union Package document identifies five dimensions for the Energy Union strategy, being one of them entitled "Research, Innovation and Competitiveness".

On the other hand, the IEEE PES magazine dedicates seven articles to R&D topics including Grid Architecture, Network Planning and Operation, Market Design, Asset Management, TSO/DSO coordination and Regulatory framework and experiences regarding R&D activities.

In the Highlights section this issue we bring you developments of our activities that we would like to share with you.

One of them relates to our efforts in the field of integration of renewables in the electricity network. With the aim of efficiently integrating renewables in the network, having in mind the objective of minimizing system risks and costs, benefiting the energy system, we have developed a mechanism to help forecasting the solar power production and feed that knowledge in the daily system operation.

The other one relates to our ongoing project on energy transmission network planning in the presence of storage.

In what concerns Technical Information, this time we bring you updated information on Dynamic Line Rating, Demand Side Management, with news from the UK, and the impact of connection lines in markets, with the example in Chile.

On our informative Legislation section we call your attention to the news regarding self-consuming facilities and to the tariffs, prices and parameters for the regulatory period 2015-17.

As in the previous edition, this section is also enriched with some interesting links and curiosities. Also don't forget to test your knowledge with our popular section "Quiz", this time with a particular bias towards the storage experts!

You will find more on this and other topics in the notes below. We hope that you find the minutes spent with us both relevant and rewarding. Sincerely,

Nuno de Souza e Silva
General Manager



HIGHLIGHTS



R&D Nester develops tool to forecast photovoltaic power production

The R&D Nester has recently developed a prediction model for photovoltaic solar production. This is a source of energy that is now starting to grow, with production levels close to 400 MW and prospects of growth of 700 MW by 2020.

The photovoltaic power production forecasting tool is being developed by R&D Nester, under the Project 1 "Renewable Energy Dispatch" and aims to support operators managing the grid. Currently, the model is being applied to 15 photovoltaic power plants for a horizon of seven days based upon two indicators: solar irradiance and type of photovoltaic systems. The combination of these indicators allows planning and management of the grid for day ahead with higher reliability and, hence, with lower costs.

By developing these predictive models, one is able to strategize the most appropriate operation technique and to minimize the need for ancillary services. For now, roughly 100 MW are being forecasted, but nonetheless, in a near future more power plants will be added to the tool and at the end of the year costs are likely to decrease.

The model is pioneer in REN and has the same principles of the forecasting model used in wind power. However, solar energy is a more intermittent and unpredictable source than wind. Although it may vary in magnitude during the day, wind production is rather constant throughout the day. For solar energy, the latter premise would be inaccurate. Indeed, clouds momentarily passing across the location of a photovoltaic power plant may cause more rapid ramps. To overcome this problem, the predictions are performed at the national level guaranteeing a more robust model.

http://www.rdnester.com/fields_and_projects/projects/

Multi-attribute Energy Storage Planning

The European transition towards a decarbonized energy system is the main precursor for the integration of renewable energy sources. This new energy paradigm brings a set of demanding challenges to the Transmission System Operators (TSOs), such as REN and SGCC, as result of the integration of renewable variable sources. These challenges include power flow inversion in EHV/HV substations, increase of network congestions at daily off peak periods, balancing of generation surplus in valley hours and risk of lack of regulating capacity margins.

To deal with these challenges, TSOs will have to ensure system's stability, flexibility and reliability through a set of solutions, which can include new peaking plants, expansion and reconfiguration of transmission networks, increase cross-border interconnections capacity or the implementation of energy storage systems.

Energy Storage is seen as an inevitable strategy to deal with renewables variability, even at transmission level. So, how can a TSO plan energy storage systems in its network?

R&D Nester is trying to answer to that question through the development of a Multi-attribute Energy Storage Planning methodology regarding the use of distributed energy storage systems in transmission networks. This methodology will allow the planning and evaluation of energy storage solutions, including the sizing and siting of the energy storage facilities in the transmission network and its comparison with other different solutions available, such as network reinforcements.

Italy's Transmission System Operator Terna has announced plans to develop 130 MW of batteries to store electricity in the next three years, riding a wave of renewable energy boom.

Generous production incentives prompted the exponential increase in the number of wind and solar farms in Italy in the past few years and have led to a need to develop systems to store Italy's intermittent production.

Focusing attention in the direction of renewable energy the batteries would be installed in Italy's southern regions of Puglia, Basilicata, Campania and Sicily where wind power generation has been growing rapidly in the past few years with total investments estimated at several hundred million Euros. According to Terna, the batteries are expected to be on stream within the next three years, or even sooner. In 2013, the company invested €31m in energy storage projects and its chief executive, Flavio Cattaneo, has stated this level will grow to €120m in 2014. Meanwhile, two energy storage projects of 24MW, in the region of Campania, have been authorized by the Ministry of Economic Development and the Ministry of Environment, with a public tender being won by NGK of Japan. Several projects have been approved since then. Terna is expected to deploy 10MW of lithium-ion batteries supplied by BYD of Shenzhen, China, in a deal worth €3m.

Other energy storage active players in the market include Samsung, Younicos, Toshiba, Saft, Siemens, FIAMM, Nidec ASI and GE.

Source:

1. <http://energystoragereport.info/energy-storage-takes-a-hold-in-italy/>
 2. <http://www.energystorageforum.com/europe/news/terna-develop-130-mw-storage-systems>
 3. http://www.rdnester.com/fields_and_projects/projects/
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TECHNICAL INFORMATION



Dynamic Line Rating in Power Systems with High Wind Power Penetration Levels

The growing impact of renewable energy sources (RES), in particular of large wind power plants, is changing power flows in transmission networks. In specific cases, overhead lines (OHLs) are being explored closer to their thermal limits, thus increasing the likelihood of bottlenecks. Alternatively to the costly measure of expanding transmission networks to face eventual congestions, a further efficient and flexible operation of transmission lines is needed [1].

Transmission capacity of OHLs is limited by thermal constraints. The maximum allowable current flowing in a line (ampacity) is defined by its sag and conductor's annealing [1]. Static Line Rating (SLR), where line's ampacity is calculated accordingly with constant weather conditions, is the traditional approach of system operators to ensure that the maximum conductor's temperature is not reached. SLR is normally estimated on a seasonal basis (winter/summer), having into consideration conservative weather conditions: low wind speed; high seasonal temperatures and full solar heating [2]. This frequently results in underestimation of the real transmission capacity of OHLs during the great majority of time.

Opposing to the inefficient SLR methodology, the Dynamic Line Rating (DLR) is a smarter approach to better evaluate the true real-time capacity of transmission lines. DLR estimates OHLs real-time ampacity by monitoring the dynamic behavior of weather conditions having into account air temperature and wind speed variations [3]. DLR considers the additional conductor's cooling provided by high wind speed and low air temperature, resulting in increased ampacity estimation when compared to SLR. Dynamic Line Rating systems are already being applied by different utilities within Europe, showing promising results with increasing OHLs' transmission capacity rates of over 50% in specific day periods [1].

The implementation of DLR plays a key role in increasing wind power penetration levels in highly loaded power networks. The existing correlation between the additional line rating and the increased wind power generation achieved under high wind speed conditions, where the extra cooling effect of wind speed provides the alleviation of congestions and the consequent accommodation of higher wind power levels, highlights the importance of DLR as a tool to ensure increased penetration of RES into overloaded power systems [4].

In short, Dynamic Line Rating presents as a more efficient and low cost alternative to the expansion of power networks with the purpose of increasing OHLs ratings and enhance system's flexibility. The application of Dynamic Line Rating might also significantly contribute to increase penetration levels of wind power generation during high wind speed conditions.

¹ W. Winter, K. Elkington, G. Bareux e J. Kostevc, "Pushing the Limits," IEEE Power & Energy Magazine, 7 January 2015

² Working Group on Monitoring & Rating of Subcommittee 15.11 on Overhead Lines, "Real-Time Overhead Transmission Line Monitoring for Dynamic Rating," December 2014

³ E. Fernandez, I. Albizu, M. T. Bedialauneta, A. J. Mazon e P. T. Leite, "Dynamic Line Rating Systems for Wind Power Integration," July 2012

⁴ J. Fu, S. Abbott, B. Fox, D. J. Morrow e S. Abdelkader, "Wind Cooling Effect on Dynamic Overhead Line Ratings"

Novelties in Demand Side Management (DSM)

Demand response mechanisms are taking initial steps in Europe. Below are some examples developing in the UK.

The demand-side response, whether domestic or industrial, uptake has been low to date but the Capacity Market Design, part of the Electricity Market Reform Program, is being introduced to deliver long-term security of supply in the UK.

This is a first major demand-response mechanism which is going to be implemented (addressing new and existing power stations, electricity

storage and capacity provided by voluntary demand reductions). From December 2014, companies are able to bid for contracts (delivery of capacity from winter 2018/19) to provide capacity in the government-run auctions. The Capacity Market offers capacity providers a steady and predictable revenue, so-called capacity payments, which will help those capacity providers to align their future investments. In return they have the obligation to deliver energy when needed or otherwise face penalties. Due to the competitive auctioning process (setting up the level of capacity payments), the costs to consumers will be minimized.

On the domestic consumers side there is a price-based mechanism. Domestic consumers can benefit from the “Economy 7” tariff. This is an electricity tariff, where customers pay lower electricity prices at night when the overall demand on the grid is low. This is already common in many countries around Europe.

National Grid, the TSO for England and Wales, launched a demand response program to balance supply and demand at peak hours thus maintain the UK’s power supplies. When users are large enough (big industrial companies) they can negotiate deals directly with National Grid and receive payments for stopping production (or reduced electricity consumption). However, most companies deal through an aggregator such as KIWI POWER or REstore with the TSO. These aggregators sell the capacity to the TSO. The companies participating save energy and also benefit from an additional revenue stream. At the moment, this is only slowly taking up.

Impact of connection lines on price volatility - The Chilean SIC-SING interconnection

Some authors claim that one of the benefits which are pursued in the construction of a new network facility is the **reduction of price volatility** on the spot market, in particular in electrical systems with high dependency on non-programmable resources (renewable) and scarce availability of cheap fossil generation facilities.

One such example is Chile, a country which has 2 main currently unconnected electrical systems: the SIC (Sistema Interconectado Central, in the center of the country, which include 74% of total installed capacity in the country and serving the capital Santiago) and the SING (Sistema Interconectado del Norte Grande, in the north of the country, 25% of capacity), with two different system operators (www.cdecsic.cl and www.cdec-sing.cl respectively). Both systems are almost isolated (power interconnection exists with Argentina, but is not currently used).

The SIC system has the following characteristics:

- 1) high dependency on hydro production, and draught has severe impact on the generation mix (very expensive fuels have to be used in low hydro production years);
- 2) little natural gas availability, as the country used to purchase gas from Argentina (before Argentine gas crisis, after which become importer of gas), and just one LNG facility available in the SIC;
- 3) the center of load (Santiago/Valparaiso region) is far (and sometimes very far) from the production locations.

In the SIC nodal prices can have very high spreads among them.

On the contrary, the SING:

- 1) Has no available hydro resources (desert region) and currently low renewable capacity, and most of the production comes from coal power plants, and
- 2) Has power load in a much more distributed area (industrial demand, mainly mines).

The regulator (CNE) proposed a [study](#) of social and economic impact of a connection line between the two systems. The recommended investment should be a 610 Km, 500 KV HVAC, 1500MW line between Cardones (SIC) and Encuentro (SING).

The most relevant result mentioned in the document is the reduction of volatility of the spot prices in the two systems, which amounts to an average of 46% for SIC and 64% for SING in the identified scenarios; this is considered even more important than the reduction of the average spot prices (-1.9% SIC and -5.8% SING) and the increase of competition, with reduction of the power prices for final customers.

This example reinforces that considerations on prices volatility, as a complement view to the security of the system problem, have to be taken in high consideration, in particular when Europe is heading towards a renewable-dominated power system.



LEGISLATION AND CURIOSITIES



LEGISLATION

Portaria n.º 14/2015, de 23 de janeiro

Establish the licensing proceeding regarding self-consuming facilities.

[Read Document](#)

Portaria n.º 15/2015, de 23 de Janeiro

Establish the reference tariff within the Decreto-Lei n.º 153/2014, de 20 de outubro.

[Read Document](#)

Portaria n.º 57-B/2015 de 27 de fevereiro

Establish the conditions to accede and the rules for funding within POSEUR (Portugal 2020 regulation for renewable energy and energy efficiency projects).

[Read Document](#)

Diretiva n.º 4/2015, 12 de Fevereiro, Entidade Reguladora dos Serviços Energéticos

Establish the parameters for the calculation of the remuneration to be applicable to the transference of the allowed revenues regarding the acquisition of electricity produced by the special regime generation)

[Read Document](#)

Declaração de retificação n.º 172/2015

Amends Directive No. 1/2015 regarding the tariffs for electricity and other services in 2015 and parameters for the regulatory period 2015-2017.

[Read Document](#)

Portaria n.º 60-E/2015, de 2 de Março

Updates the procedures regarding self production new legal framework under the Decree-Law No. 153/2014 of 20 October.

[Read Document](#)

Despacho N.º 3/SERUP/DGEG/2015

Instructions regarding the new website of DGEG for the self production and microproduction and miniproduction procedures.

[Read Document](#)

Portaria n.º 102/2015, de 7 de abril

Establish the procedures for the use of additional wind capacity in wind farms.

[Read Document](#)

New legal framework regarding the use for eletricity production of windmills and watermills

[Read Document](#)

Portaria n.º 57-A/2015 - Diário da República n.º 41/2015, 1º Suplemento, Série I de 2015-02-27

Presidência do Conselho de Ministros e Ministério da Economia Establish the regulation regarding Portugal 2020 projects under competyity and internacionalization programs

[Read Document](#)

CURIOSITIES

Boost the National Talent

The development of talent in Portugal was the theme of the 11th National Innovation

COTEC event, where our highlights goes to:

> Study Transforms Talent Portugal , presentation of the main conclusions achieved.

A work led by COTEC Portugal and by Fundação Calouste Gulbenkian, in partnership with Everis, and that account with the high Patronage of His Excellency the President of the Republic, with the scope of getting the State of Talent in Portugal and identify the main problems and the measures that must be taken to boost to Maximum the Talent nationally.

> Marc Alba, communication, speaker of the event , Managing Partner of the Group everis, Global Chief Innovation Office and Advisor of the Foundation Transforms España, about the subject "the Transformation of Talent and its Impact on the economies of Modern".

© COTEC Portugal (Portuguese: Newsletter n° 52)

More information available on www.cotec.pt

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R&D and Innovation Information

New national Energy Technology innovation network - RITE (Rede de Inovação e Tecnologia em Energia)

R&D Nester was present at the official launch ceremony which took place on March 25 at CCDR-C, Coimbra.

It is a joint initiative between the EnergyIN (pole of Competitiveness and energy technology) and RNAE (Association of energy and environment Agencies). The creation of this network of innovation and technology in Energy aims to consolidate a collaborative network in the area of energy in Portugal, fostering synergies between companies and I&D entities of the sector, stimulating the business competitiveness, and regions of the country.

(Competitividade e Tecnologia da Energia) e a RNAE (Associação das Agências de Energia e Ambiente).

Portuguese Press release available [here](#).

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R&D Nester visits IET in London

R&D Nester, was invited to visit IET in London on April 14th.

This meeting intended to present the areas of expertise and interest of both entities in the fields of innovation and R&D, including ongoing projects both in Portugal and in the UK.

The visit also included the presence of Mr. Haibin Wan, Chairman of R&D Nester.

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R&D Nester welcomes Brunel University

R&D Nester, received a delegation from the Brunel University of London on May 8th.

The meeting intended to present the areas of expertise and interest of both entities in the fields of innovation and research and development, including ongoing projects both in Portugal and in the UK.

The visit also included the presence of the Chairman and CEO of REN, Rodrigo Costa, who met with the delegation from Brunel University of London. Mr. Haibin Wan, Chairman of R&D Nester, was also present.

http://www.rdnester.com/media/press_release/detail/r_d_nester_welcomes_brunel_university/



EVENTS



16-19 APRIL
2015

BRAGA, PORTUGAL

[SUSTAINABLE AND
INTELLIGENT COMMUNITIES
INTERNATIONAL FORUM](#)

27-30 APRIL
2015

ROME, ITALY

[ENERGY STORAGE
WORLD FORUM](#)

06-09 MAY
2015

GLASGOW

[ALL ENERGY 2015](#)

20-22 MAY
2015

LISBON, PORTUGAL

[12TH INTERNATIONAL
CONFERENCE ON THE
EUROPEAN ENERGY
MARKET](#)

25-28 MAY
2015

LUND, SWEDEN

[INTERNATIONAL
SYMPOSIUM CIGRÉ](#)

5th International Scientific and Technical Conference

1 to 5 June, Sochi, Russia

see +

EU Sustainable Energy Week 2015

15 to 19 June, Brussels, Belgium

see +

International Workshop CIGRE 2015

26 to 28 August, Milano, Italy

see +

The 10th Deregulated Electricity Market issues in South-Eastern Europe (DEMSEE 2015)

24 to 25 September, Budapest, Hungary

see +

14th Wind Integration Workshop

20 to 22 October, Brussels, Belgium

see +

EWEA 2015 Annual Event

17 to 20 November, Paris, France

see +



LINKS



- [American Energy Innovation Council](#)
- [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](#)
- [EnergyIn](#)
- [Redes Energéticas Nacionais \(REN\)](#)
- [State Grid Corporation of China \(SGCC\)](#)
- [World Wind Energy Association \(WWEA\)](#)



QUIZ



1) WHICH OF THESE IS NOT AN ELECTRO-CHEMICAL BATTERY ENERGY STORAGE TECHNOLOGY:

- ☐ A) Flow battery
- ☐ B) Lithium-ion
- ☐ C) Flywheel
- ☐ D) Metal-air

3) FROM THE FOLLOWING LIST WHICH ONE WAS INVENTED BY NIKOLA TESLA?

- ☐ A) Remote control
- ☐ B) AC motor
- ☐ C) Tesla coil
- ☐ D) All the above

5) DURING THE SOLAR ECLIPSE OF LAST MARCH 20TH, WHICH WAS THE MAXIMUM REDUCTION OF PV GENERATION THAT WAS EXPERIENCED IN THE CONTINENTAL EUROPEAN POWER SYSTEM COMPARED WITH CLEAR SKY CONDITIONS?

- ☐ A) 20,3 GW
- ☐ B) 34,5 GW
- ☐ C) 29,7 GW
- ☐ D) 39,7 GW

2) WHICH IS THE BIGGEST PROJECT USING ELECTRO-CHEMICAL BATTERY ENERGY STORAGE FULLY OPERATIONAL IN THE WORLD IN TERMS OF INSTALLED POWER?

- ☐ A) AES Laurel Mountain, USA
- ☐ B) Duke Energy Notrees Wind Storage Demonstration Project, USA
- ☐ C) AES Angamos Storage Array, CHILE
- ☐ D) Kahuku Wind Farm, USA

4) WHICH IS THE BIGGEST PROJECT USING ELECTRO-CHEMICAL BATTERY ENERGY STORAGE FULLY OPERATIONAL IN THE WORLD IN TERMS OF STORED ENERGY?

- ☐ A) Duke Energy Notrees Wind Storage Demonstration Project, USA
- ☐ B) Auwahi Wind Farm, USA
- ☐ C) AES Los Andes Battery Energy Storage System, CHILE
- ☐ D) Rokkasho Village Wind Farm, JAPAN

6) BY THE END OF 2014, THE TOTAL AMOUNT OF WIND POWER GENERATION INSTALLED IN EUROPE (EU-28) WAS APPROXIMATELY:

- ☐ A) 115 GW
- ☐ B) 129 GW
- ☐ C) 135 GW
- ☐ D) 149 GW

Answers of the 3rd edition Quiz

1) Usually, a substation is divided into:

Answer: B) Bays - 100% voters

3) In a substation, we can find:

Answer: C) Both primary and secondary systems - 100% voters

5) PAC stands for:

Answer: A) Protection, automation and control - 100% voters

7) Which of the following is a communication service defined by the IEC 61850?

Answer: C) GOOSE - 75% voters

9) You are reading a document about engineering process defined by the IEC 61850 and see the abbreviation SCL. What does it mean?

Answer: D) Substation configuration language - 88% voters

2) Which from the following exists in a substation?

Correct: D) Switchyard - 100% voters

4) IED is an abbreviation for:

Answer: C) Intelligent electronic device - 88% voters

6) What is the IEC 61850?

Answer: B) A standard defining communication networks and systems for power utility automation - 100% voters

8) Which of the following is a fundamental concept of the IEC 61850?

Answer: A) Logical Node - 25% voters

10) How many pages the first edition of the IEC 61850 approximately had?

Answer: C) 1000 - 75% voters



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