R&D NESTER

12 NL abr 2018

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EDITORIAL

Dear Reader,

Integration of renewable energy sources, such as wind and solar, into the electricity grid continue to be a key aspect of the development of energy systems in the 21st century.

Solar is having a significant boost due in particular to its' improved economical competitiveness. This is creating an increasing pressure on System and Network Operators who have to integrate these energy sources while ensuring an extremely high quality of service and system security. Forecasting solar energy generation is therefore a fundamental element in current and future energy systems and that was exactly the topic of a recent R&D Nester communication that received a recognition award, as we discuss below.

This renewable sources integration capability also benefits from an improved coordination between operators of both the distribution network and the transmission network, in order to allow for a more efficient and risk-controlled operation of the network, as fluctuations in generation and load occur during the day. The EU H2020 R&D project "Coordination of Transmission and Distribution data eXchanges for renewables integration in the European marketplace through Advanced, Scalable and Secure ICT Systems and Tools" (TDX-ASSIST), which R&D Nester recently won together with 12 partners from 6 countries, addresses precisely this aspect and is further explored below.

The innovations required in the energy system due to such development and others, are well evident in the initiatives that players such as National Grid, California Energy Commission and Elia have recently communicated and which are described below.

We hope you enjoy your reading related to these and other topics below.

Sincerely,

Nuno de Souza e Silva

Managing Director

HIGHLIGHTS

R&D NESTER SPEAKER AT NEXTGEN SCADA EUROPE 2018



R&D Nester was represented at 5th annual NextGen SCADA Europe conference and exhibition forum, with core on integrating high functionality cyber secure SCADA systems into the digital grid.

The main conference, held on 30 - 31 January 2018, in Amsterdam, allowed for sharing lessons learned from upgrading SCADA infrastructure to meet the needs of the digital grid and from integrating distributed energy and flexibility resources into the grid. On February 1, there was a full day seminar dedicated to cyber-security.

The event included the presentation of case studies on system architecture, integration, functionality, cooperation between system and market operators, the harmonization between IEC 61850 and CIM (common information model), data processing, forecasting and cyber-security, aiming at providing insights into decision-making process, implementation experiences and future roadmaps.

Nuno Pinho da Silva, researcher at R&D Nester, was speaker in this event, and shared R&D Nester's experience on forecasting electricity production from renewable energy sources. The presentation addressed the integration of multiple sources of information to improve deterministic and probabilistic forecasting models, the evaluation of the models' results, the application of forecasting in renewable energy management and the use of valuation methods to perform cost benefit analysis of forecasting models.

More information at: https://www.nextgenscada-europe.com/

RESEARCH OF R&D NESTER AMONG THE BEST AT THE 7th SOLAR INTEGRATION WORKSHOP



R&D Nester presented the article "Forecasting PV/CPV at National Level - Portugal Experience" at the seventh Solar Integration Workshop. It was chosen as one of the six best articles presented at the workshop held in Berlin, last October.

Nuno Souza e Silva, director of R&D Nester, believes that the research carried out in relation to this article could lead to an "improvement in the forecasting of the amount of solar energy that the electricity grid should be able to accommodate" since "it allows the network operator to manage the network with lower risk, in a more efficient way and ensuring greater penetration of renewable and endogenous sources".

João Esteves of R&D Nester, and one of the authors of the article, shares the same opinion, stating that "with the growing increase in the installed power of solar power plants, solar forecasting is a very important tool for the system operator as it aims to mitigate the uncertainty and variability of the system's performance". The researcher also highlights that he believes "the developed methods contribute to the sustainable integration of more solar energy in the power grid".

The article will be published by The Institution of Engineering and Technology (IET), which has 165,000 members from 150 countries, in its "IET Renewable Power Generation" Special Issue. This publication is, according to Nuno Souza e Silva, an "enhanced endorsement of the work and its authors" and that the recognition "shows that the work being developed is in line with the interests and needs of the actors of the international energy system". João Esteves also emphasizes the pride with which the team received the distinction, and explains that it "represents all the effort made in this area and is an incentive to continue to work and look for new ways for us to contribute to the construction of a more sustainable future".

The featured article, available on the workshop website, is also significant for R&D Nester and all the other entities involved as it contributes to "enhancing the visibility and international reputation of R&D Nester and, consequently, the partnership between REN and SGCC/CEPRI" says Nuno Souza e Silva. In the opinion of João Esteves, "this award reinforces R&D Nester's position as a research centre of excellence and it ensures this work reaches a larger number of people", adding that "R&D Nester has been focusing on research and development in the solar energy field, and it was a pioneer in the forecasting of national solar production (in 2015), as well as in the acquisition and installation of the first 'sky camera' in Portugal".

You can view the 2015 issue of the "IET Renewable Power Generation" Special Issue at:

http://digital-library.theiet.org/content/journals/iet-rpg/11/3;jsessionid=569kdj8tcqjr1.x-iet-live-01.

R&D NESTER PARTICIPATES IN THE 3RD EDITION OF THE “PHOTOVOLTAICA” CONFERENCE



The third edition of the "Photovoltaica: International Renewable Energy Exhibition and Conference" took place in Marrakech, Morocco, with the presence of REN's Chairman and CEO, Rodrigo Costa, of the Chairman of the Board of Directors of R&D Nestor, Xin Zhang, and included as guest speakers the Secretary of State for Energy, Jorge Seguro Sanches and the General Manager of R&D Nester, Nuno Souza e Silva.

Jorge Seguro Sanches was responsible for the meeting's welcome session, with R&D Nester participating in the first panel of the first day with a topic dedicated to the "reality of solar energy in Portugal", where the work developed by the Research Centre in cooperation with REN on this topic was also mentioned. This panel was also attended by the CEO of Siemens Morocco, by the CEO of ACWA Power, by the CEO of PVNano USA and by the Regional Manager of ENEL Green Power. In addition to the panels, the event also included an exhibition, where R&D Nester was present with its own stand.

This conference, held for the first time in 2014, has a particularly strong focus on solar energy, whilst simultaneously addressing several aspects related to renewable energies, including wind power, storage and hydrogen.

According to Nuno Souza e Silva, this event was important for R&D Nester by enabling the Research Centre to share "the works it develops with potential partners and customers in a geography where they are especially relevant". Additionally, and according to Nuno Souza e Silva, this participation increases the "opportunity to lend visibility to the shareholders of R&D Nester REN and SGCC/CEPRI and to the excellence of the work it develops".

The Research Centre's General Manager also highlights the importance of this event, which has the High Patronage of the King of Morocco, thus "becoming a reference in the region and periodically bringing together the Ministers and policy makers of several African countries". Nuno Souza e Silva concludes by emphasizing that the presence of the Moroccan Minister of Energy and of the Portuguese Secretary of State for Energy in R&D Nester's stand "bears witness to the event's relevance in the region and enables reinforcing existing relationships".

https://www.photovoltaica.ma/

R&D NESTER PARTICIPATES IN THE TDX-ASSIST PROJECT FROM EUROPEAN PROGRAM HORIZON2020



R&D Nester is one of the Consortium members of the project TDX-ASSIST (Coordination of Transmission and Distribution data eXchanges for renewables integration in the European marketplace through Advanced, Scalable and Secure ICT Systems and Tools).

The project has a duration of three years and is funded by H2020 (LCE-5-2017). It has 12 partners from six countries (UK, France, Germany, Portugal, Belgium and Slovenia). Total EU financing for the project is approx. 4.2 Million Euros.

The project focuses on the interoperability of equipment and the coordination of actions with different objectives (congestion management, reactive control, flexibility management provided by renewable energy sources, improvement of network observability) in different time windows (real time, close to real time, operational planning, long-term planning) on the TSO-DSO border.

The project focuses on equipment interoperability . In that sense interface specifications for TSO-DSO information exchange based on specific Use Case will be developed and mapped to IEC standards (e.g. 61970/61968/62325) in order to support automated information exchange and network analysis between system operators and other relevant actors in the electrical power sector.

The main contributions of R&D Nester for this project will be focused on demos applied in the context of the Portuguese electrical system but taking into account European trends and best practices in each of the above domains. In this sense, the use of the R&D Nester laboratory to test the solutions developed is central to this project.

The Project kick-off meeting took place on the 2nd and 3rd October 2017, hosted at Brunel University London.

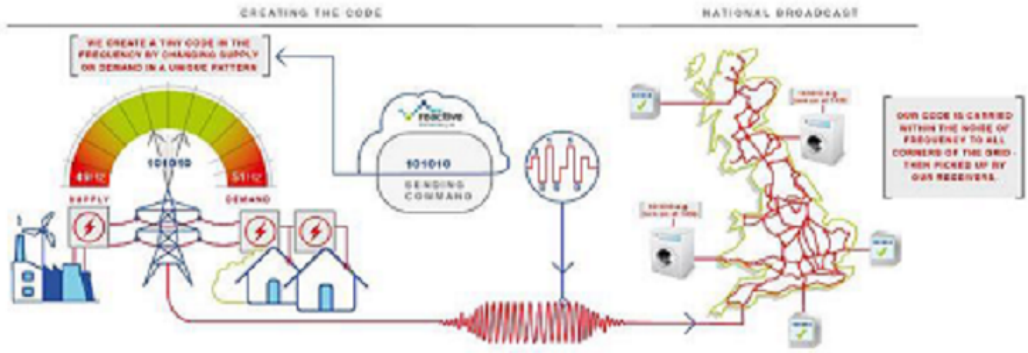
http://tdx-assist.eu/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 774500

TECHNICAL INFORMATION

ASSESSING SYSTEMS INERTIA IN REAL-TIME

National Grid (NG) makes an innovative breakthrough with the SIM project by analysing the frequency signal with very high sampling to capture the 'distortion' in the signal due to small load activation on the grid that allows inertia to be calculated in real time.



SIM stands for "Samuel Inertia Element", a follow up the initial project SAMUEL that put in place a national wide system: Grid Data and Measurement Systems (GDMS) in Great Britain.

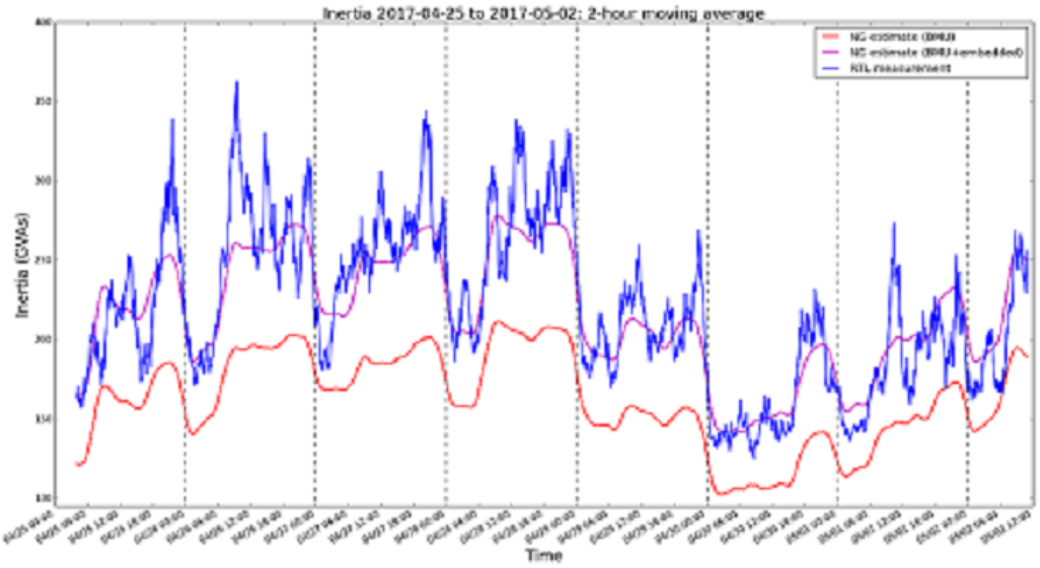
Technologies uses the system frequency as a communication means to achieve instant 100% national coverage of all electrically connected devices of demand side loads and generation using an existing infrastructure. The GDMS system consists of a transmitter network made up of a number of load devices (resistive heating elements) whose power consumption is modulated in a desired pattern (i.e. a "code"). This pattern is then turned into minute (imperceptible at an operations level) changes of the grid frequency (modulation), and this modulation is subsequently decoded by the other part of the GDMS system - the receiver devices.

The motivation for the SIM project is that system inertia on the GB system is slowly declining, with the closure of aging power stations and the increased levels of renewable generation displacing conventional power stations. There is currently no known method, nor operational tools, to take a direct real-time measurement of system inertia. The real-time value of inertia on the GB system is currently estimated from known synchronised generator design parameters and an estimated value for that inertia contribution provided by the embedded generation within the Distribution Networks.

This project will utilise the Grid Data Measurement System technology demonstrated in Project Samuel to undertake a six month study of the GB transmission system inertia. The project will reuse the existing 5 load banks of 600kW each installed in the Samuel project to induce small changes in the system frequency by switching the loads on and off.

The GDMS is an existing technology by Reactive Technologies Ltd.

NG uses the market information of the committed BMU - Balancing Mechanism Units to make the base estimation of the system inertia, since the properties of these large synchronous generators are known. Then adds the contribution of the embedded generation and demand, by using an multipliers (x 1.8325) from a large past event in 2003.



Using Reactive's signalling equipment in a blind test, inertia has been directly measures on the Grid.

Of particular interest was the bank holyday weekend in the end of April 2017 where measurements indicate National Grid was very close to and below the 130 GVAs limit.

SAMUEL was supported by Network Innovation Allowance NIA_NGET0119 project of NG, UK

SIM was supported by Network Innovation Allowance NIA_NGET0192 project of NG, UK

ENERGY REGULATORS ENABLE MULTIPLE REVENUES STREAMS FOR ENERGY STORAGE

One of the key economic aspects related to the investment on energy storage solutions is their capability to provide multiple services through the same platform enabling the capture of multiple revenue streams. The Revenue Stacking is pursued as the Holy Grail for energy storage projects as they have the unique characteristic of being able to behave both as load and as generator, with multiple operation modes and response speeds, sometimes simultaneously.

However, the use of energy storage for multiple purposes is still not clear from the regulatory point of view, what is limiting their full potential from being deployed. Fortunately, in the last months there were some good news for energy storage supporters as some Energy Regulators are addressing this regulatory issue by defining a set of rules that allow the revenue stacking for energy storage projects.

The California Regulator (California Energy Commission - CEC) was the first that, in mid-January, provided a new regulatory framework that allows revenues stacking for energy storage projects. Although this framework is more a starting point than a final document, it lights up the path for this claimed need. In the same line, the UK energy regulator (Office of Gas and Electricity Markets - Ofgem) has also updated the regulations and market rules on energy storage in the past mid-February allowing battery storage revenue streams to include a mix of capacity market payments, TRIAD revenue (system's support benefit dedicated to small generators), frequency response and power supply payments.

In the case of the rules set by the California Regulator, they address the following issues:

• Rules 1 through 3 establish that system services provided by energy storage resources can only be provided within the network level in which they are connected or to a higher level. This means that distribution connected storage can provide services at transmission level, but the opposite is not allowed.

• Rules 4 through 8 address the use of energy storage for reliability services. These rules establish the priority of the use of energy storage for reliability services over non-reliability services as result of the importance that some of these services have for the system. Moreover, it allows that a single storage resource may contract for resource adequacy capacity and provide wholesale market reliability services using the same capacity and over the same time period.

• Rules 9 through 11 establish that an energy storage provider should inform about any additional services it's providing when responding to a solicitation as well as comply with availability and performance requirements. It will receive compensations only for incremental/ distinct and measurable services.

The challenge now is to build energy storage facilities that can take advantage of multiple revenue streams and can deliver returns against capital expenditure to secure funding.



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Bird&Bird, "UK: Recent regulatory and market updates on energy storage", 12FEB2018:

https://www.twobirds.com/en/news/articles/2018/uk/energy-storage-recent-regulatory-and-market-updates-in-the-uk

UtilityDive, "California regulators first to allow multiple revenue streams for energy storage", 13FEB2018:

https://www.utilitydive.com/news/california-regulators-first-to-allow-multiple-revenue-streams-for-energy-st/516927/

LITERATURE REVIEW

ADEQUACY REPORT FROM THE BELGIAN TSO (ELIA) FOR THE PERIOD 2017-2027

This Report (only available in French and Dutch) has a full section dedicated to "Flexibility" (section 3.5).

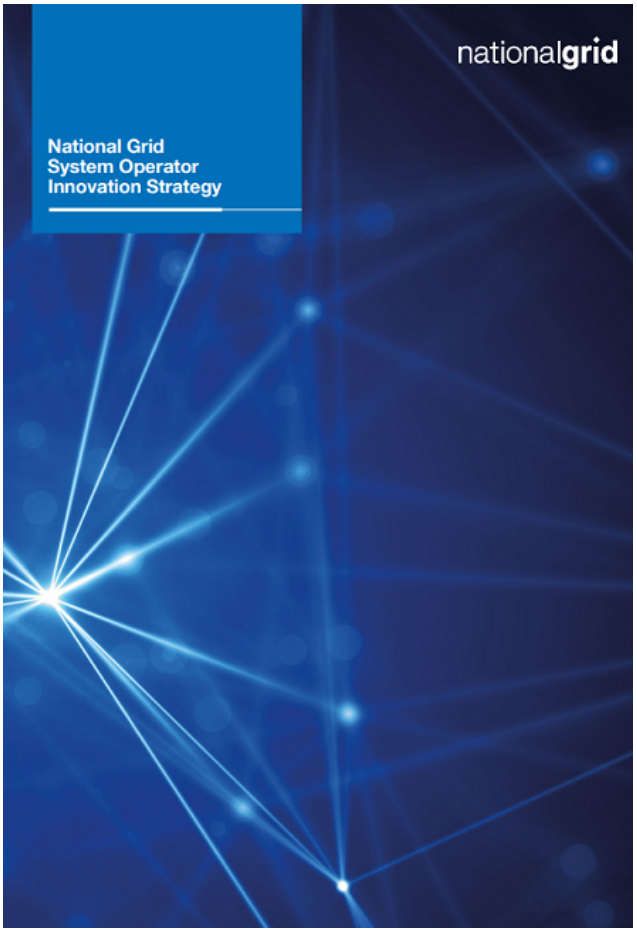
http://www.elia.be/~/media/files/Elia/publications-2/studies/160421_ELIA_AdequacyReport_2017-2027_FR.pdf



NATIONAL GRID SYSTEM OPERATOR INNOVATION STRATEGY

«This is the first ever System Operator Innovation Strategy. It sets out our innovation priorities for 2018 and how we plan to work together with industry partners to solve the challenges facing Britain's energy system»

https://www.nationalgrid.com/sites/default/files/documents/SO%20Innovation%20Strategy%20%281%29.pdf



R&D NESTER RECENT FLYER PRESENTED AT “PHOTOVOLTAICA” CONFERENCE

"Renewables & Storage Optimization Tool for Multi-Service Market Participation"



EVENTS

11 -13 Apr 2018
LISBON, PORTUGAL
GREEN BUSINESS WEEK

10 -15 Jun 2018
WAIKOLOA, HAWAII
WORLD CONFERENCE ON PHOTOVOLTAIC ENERGY CONVERSION (WCPEC-7)

11 -15 Jun 2018
DUBLIN, IRELAND
POWER SYSTEM COMPUTATION CONFERENCE (PSCC) 2018

25 -28 Jun 2018
SOFIA, BULGARY
PAC WORLD CONFERENCE 2018

27 -29 Jun 2018
ŁÓDŹ, POLAND
15TH INTERNATIONAL CONFERENCE ON THE EUROPEAN ENERGY MARKET 2018

26 -31 Aug 2018
PARIS, FRANCE
47TH CIGRE SESSION 2018

3 -5 Sep 2018
PORTO, PORTUGAL
COURSE "ADVANCED DATA ANALYTICS FOR ENERGY SYSTEMS"

24 -28 Sep 2018
BRUSSELS, BELGIUM
35TH EUROPEAN PV SOLAR ENERGY CONFERENCE AND EXHIBITION

6 -8 Nov 2018
VIENNA, AUSTRIA
EUROPEAN UTILITY WEEK

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 TRANSMISSION SYSTEM, THE WEIGHT OF COPPER USED IS PROPORTIONAL TO:

- a) Voltage
- b) 1 / voltage
- c) 1 / (square of voltage)
- d) Square of voltage

2) THE GREATER THE POWER FACTOR THE _____ IS THE VOLUME OF COPPER REQUIRED?

- a) Smaller
- b) Greater
- c) Depends on the level of transmission
- d) There is no relation

3) THE MOST IMPORTANT DISADVANTAGE OF USING THE HIGH VOLTAGE FOR TRANSMISSION IS:

- a) The increased cost of transformers and switchgear
- b) The increased cost of insulating the conductors
- c) Both (a) and (b)
- d) There is a reduction in the corona loss

4) WHAT IS THE MAIN REASON FOR USING THE HIGH VOLTAGE FOR THE LONG DISTANCE POWER TRANSMISSION?

- a) Reduction in the time of transmission
- b) Reduction in the transmission losses
- c) Increase in system reliability
- d) Other

5) BY INCREASING THE TRANSMISSION VOLTAGE DOUBLE OF ITS ORIGINAL VALUE, THE SAME POWER CAN BE DESPATCHED KEEPING THE LINE LOSSES _____:

- a) Double the original value
- b) Half of its original value
- c) Equal to its original value
- d) One-fourth of the original value

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 11th edition Quiz

1) IEEE 1588 (also known as Precision Time Protocol - PTP) is a high accuracy time synchronization standard that runs over Ethernet data networks and its current version is the version 2. What was the year that its first version (version 1) was approved?

5) When was "leap seconds" value updated (added one second) last time?

Answer: b) 31st December 2016

Answer: b) 2002

2) In 2008, International Electrotechnical Commission (IEC) has adopted the version 2 of IEEE 1588 (IEEE1588 V2). What is the label of this PTP standard under IEC?

Answer: b) IEC 61588 Ed. 2

3) TAI stands for International Atomic Time and is a time scale that provides the exact speed at which our clocks tick. How many atomic clocks are part of TAI clock system worldwide?

Answer: d) About 400 atomic clocks

4) Universal Time (UT1) is a time scale directly related to Earth's rotation and so it considers the slowing rotation of Earth. TAI is constantly compared to UT1 and before the difference between them reaches 0.9 seconds, a "leap second" is added to UTC (Universal Time Coordinated). This is done since 1972. What is the current value for "leap seconds"?

Answer: c) 27 seconds

6) The epoch is the origin of the timescale. What is the PTP epoch?

Answer: b) January 1st 1970 00:00:00 TAI

7) Which of the following is an IEEE 1588 V2 profile that is suitable to be applied for substation automation?

Answer: c) Power IEEE C37.238

8) IEEE 1588 considers several clock types. Which of the following cannot be used (except for time domain separation) if Power IEEE C37.238 profile is adopted?

Answer: d) Boundary clock

Answers of the 12th edition Quiz

1. Answer: a) Voltage

2. Answer: a) Smaller

3. Answer: c) Both (a) and (b)

4. Answer: b) Reduction in the transmission losses

5. Answer: d) One-fourth of the original value

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