R&D NESTER

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EDITORIAL

Dear Reader,

The European Commission recently reshaped and integrated the EU framework for R&I planning, through the creation of the ETIP-SNET: European Technology and Innovation Platform - Smart Network for Energy Transition.

This new framework results from the previous EEGI (European Electricity Grid Initiative), Grid+ and Grid+Storage initiatives, and the European Technology Platform (ETP) Smartgrids.

According to this new framework, three paradigm shifts for the energy system in Europe and worldwide create intensive R&I needs: climate protection/renewable energy; digitalization; and markets.
In this context, the ETIP-SNET addresses the innovation challenges in energy system and market evolution necessary for achieving climate protection and renewables integration with affordability and security of supply, beyond smart electricity grids.

As you can read below, R&D Nester is deeply involved with this process, with the participation in 3 of the 5 Working Groups established.

We also bring you updates on R&D Nester's participation in EU H2020 project that we want to share with the community. We hope it is valuable for you.

Also worth a particular mention and detailed below, is the fact that the real time simulation laboratory for power systems and communication networks of R&D Nester has been incorporated in DERlab repository which includes some of the most relevant smart grid research infrastructures in Europe. DERlab is an association that dedicates its activity to promote testing and consulting services to support the transition towards more decentralized power systems.

On the technical side, in the Technical Information section below, we address 2 topics that continue to be critical cornerstones in the development of future power networks and systems: the IEC61850 protocol that strongly stimulates the digitalization of the power system, and solar forecast that is key for the further integration of renewables with affordability and security of supply.

In the Literature Review section, we highlight recent publications that we believe you will find interesting.

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

Sincerely,

Nuno de Souza e Silva
Managing Director

HIGHLIGHTS

THE NEW EUROPEAN TECHNOLOGY & INNOVATION PLATFORMS: R&D NESTER SELECTED TO BE REPRESENTED IN 3 WORKING GROUPS OF ETIP-SNET



The European Technology & Innovation Platforms (ETIPs) have been created by the European Commission in the framework of the new Integrated Roadmap Strategic Energy Technology Plan (SET Plan) by bringing together a multitude of stakeholders and experts from the energy sector.

The ETIP Smart Networks for Energy Transition (SNET) role is to guide Research, Development & Innovation (RD&I) to support Europe's energy transition, more specifically, its mission is to:

- Set-out a vision for RD&I for Smart Networks for Energy Transition and engage stakeholders in this vision.
- Prepare and update the Strategic Research and Innovation Roadmap.
- Report on the implementation of RD&I activities at European, national/regional and industrial levels.
- Provide input to the SET Plan action 4 which addresses the technical challenges raised by the transformation of the energy system.
- Identify innovation barriers, notably related to regulation and financing.
- Develop enhanced knowledge-sharing mechanisms that help bring RD&I results to deployment.
- Prepare consolidated stakeholder views on Research and Innovation to European Energy Policy initiatives.

http://www.etip-snet.eu/

R&D Nester is represented in 3 Groups of ETIP-SNET - The European Technology and Innovation Platform Smart Networks for Energy Transition.





Rui Alves is a researcher in R&D Nester and was nominated to collaborate with Working Group 1 - Reliable, economic and efficient smart grid system.

This Work Group addresses business and technology trends contributing to the overall energy system optimization at affordable investment and operation costs. It will focus on system aspects, addressing the main functionalities, quality and efficiency of the electricity system as such and consider the benefits of its integration with the other energy vectors. The flexibility options investigated in WG1 are: new transmission and distribution technologies (power electronics for instance), setting up interfaces with storage, demand response, flexible generation and synergies with other energy networks (i.e. how to couple the electricity networks with the gas and heat networks). WG1 also follows Set Plan Action 4 related to grid smartening in the sense of grid observability and controllability (i.e. tools for managing the variability and uncertainty of operational conditions at several timescales), increased grid hosting capacity and economic efficiency of the system through the use of ICT.



Bruno Soares was the researcher nominated to represent R&D Nester in this work group.

Work Group 4 addresses the use and impact of the Information and Communication Technologies as a pervasive tool along the entire value chain of the power generation, transportation and use. The communication layer is one of the pillars of the smart energy system, enabling system observability, monitoring, control and protection, specifically enabling a radical change in the relation between the final user and the energy system. New digital tools (i.e. from smart meters to social networks) linked to the Internet of Things will aim to favour Customer participation in all stages of the development and expansion of the energy system thanks to the analysis of big data generated. The widespread use of digital technologies however needs to be accompanied by suitable measures for data and information protection from malicious intrusions and attacks (cybersecurity) and from uncontrolled use of customers data (data privacy).

In order to address all these topics, inside the group, three task forces were created:

- Task Force 1: Digital Technologies and reference architectures and standards;
- Task Force 2: Digital Energy Disruptive Use Cases;
- Task Force 3: Digital Cyber-security recommendations.

R&D Nester is monitoring all task forces and participating on Task Force 3, which is particularly relevant in the context of the current R&D Nester activities.

The number of applications to participate in this Work Group reached 100 and only 60 were selected as active members. Among the members, there are participants from all over the world and from the most relevant stakeholders: TSOs, consumers (electricity retail companies), DSOs, ICT Technology providers, Renewable Energy resources, research and academia and telecommunication service providers.

By participating in WG4, R&D Nester improves its visibility not only in power systems domain, but also on communications network field, taking advantage of the networking and knowledge sharing opportunity provided.

It is also allowing R&D Nester understanding the roadmap for European RD&I concerning power systems digitalization and contributing for this roadmap to go in the best direction, holistically anticipating the future needs of all stakeholders.



Innovation implementation in the business environment

Nuno Pinho da Silva and Rui Alves were the researchers nominated to represent R&D Nester in this work group.

Work Group 5 (WG5) focuses on how the R&D of Europe (national or European) in the Energy area can be utilised in support of innovative activities that will positively transform the business environment in Europe. It adopts a helicopter view of the activities carried out in the projects within the perimeter of the ETIP about the energy transition in order to:

- Build homogeneity in the qualitative and quantitative analysis of projects, work done and lessons learned
- Create a common platform for analysing the progress made with technologies, systems and solutions through-out the EU and facilitate their scalability and replicability;
- Build a methodology to judge system needs in the energy transition capable of identifying tangible needs for building on progress made and give feedback to the other WGs for populating their R&I needs in the years ahead;
- Identify the barriers which may slow down business model deployment;
- Search for innovative solutions that will maximize the benefits of the innovation process that EU achieves through R&I activities in the area of Energy.

WG5 includes members from manufacturers, producers, gas and electricity transmission and distribution network operators, retailers, consultants, innovation platforms, research centres and universities.

By partaking in WG5, R&D Nester benefits from an international networking and knowledge sharing environment with holistic awareness of the European RD&I outputs in the Energy area, deployment barriers and Energy systems needs to anticipate its clients' needs and timely develop innovative solutions well-tuned to the new energy paradigm.

R&D NESTER LABORATORY INTEGRATED IN DERLAB DATABASE

The real time simulation laboratory for power systems and communication networks of R&D Nester has been incorporated in DERlab repository which includes some of the most relevant smart grid research infrastructures in Europe. DERlab is an association that dedicates its activity to promote testing and consulting services to support the transition towards more decentralized power systems.

Besides R&D Nester laboratory, the DERlab database contains information related to +50 other smart grid research laboratories belonging to different European and American institutions, including utilities, technology providers, research centers and universities.

In operation since 2016, the R&D Nester laboratory includes cutting edge technology that not only allows the simulation of power systems' behavior, but also the testing of critical equipment essential for an adequate functioning of the power system. In addition, the laboratory permits to study the impact of the proliferation of communication networks into power systems, a very important topic at a time when the digitization of the energy sector is becoming further relevant.

Additional information about the real time simulation laboratory of R&D Nester is available at:

- infrastructure.der-lab.net/research-infrastructure/rd-nester/
- infrastructure.der-lab.net
- rdnester.com/lab

Database of DER and Smart Grid Research Infrastructure

R&D Nester



Country: Portugal

Website

R&D NESTER

EU H2020 PROJECT BIG DATA OCEAN

Under the framework of the project BigDataOcean (H2020), Nuno Amaro represented R&D Nester in a workshop related to the identification of stakeholders to the pilot case related to wave energy. This pilot is one of the four considered in the BigDataOcean project and is led by R&D Nester.

The workshop was also attended by UNINOVA, a BigDataOcean consortium partner who was the main organizer of the event, ENONDAS, WavEC and Instituto Hidrográfico (Hydrographic Institute) from the Portuguese Navy as potential stakeholders of the project. Several requisites for the pilot were identified together with the identification of its value chain.

More details about the pilot and the project can be consulted at the BigDataOcean official website: http://www.bigdataocean.eu/site/ .

BIG DATA OCEAN

R&D NESTER PRESENT AT CGI'S CENTRAL MARKETS DEBATE EVENT

It was held in May the CGI's Central Markets Debate Event "The growing need for seamless information exchange between the TSOs and DSOs".

The event consisted in oral paper presentations, tutorials and discussion panel sessions.

The conference has gathered experts in the Energy area, including representatives from European Commission, regulators, research centers, electricity network operators and industry.

R&D Nester was represented by Nuno Souza e Silva, Managing Director, and Francisco Reis, Chief Engineer.

On 1st day, Francisco Reis had a participation with the presentation "TSO and DSO cooperation and data exchange in the context of the network codes", due to the existing changes in the power sector one of the key issues is developing and improving the current interaction between TSOs and DSOs towards more efficient power system's operation. Under the framework of confidentiality , scalability and neutrality, rights and operation of data exchange between system operators should be transparent and well defined. This presentation approached the principles for data exchange (including, but not limited to the level of granularity of the information to be exchanged that has an impact on the corresponding ICT architecture) and the fact that TSOs may not have the required degree of observability as well as the accompanying controllability. The emphasis of this presentation was addressed with special focus and application to the Portuguese case of the future requirements set in recent published regulations (network codes).

On second day, Nuno Souza e Silva participated in a panel discussion on security and privacy aspects with respect to datahubs, where he presented "The growing need for seamless information exchange between the TSOs and DSOs"".



8th DoCEIS 2017 CONFERENCE, CAPARICA (LISBON), PORTUGAL

The work and paper "Stochastic optimal operation of concentrating solar power plants based on conditional value-at-risk" was presented at the 8th DoCEIS 2017 Conference, held in Caparica (Lisbon), 3-5 May 2017.

http://sites.uninova.pt/doceis/

This resulted from the work developed by João Esteves, researcher of R&D Nester, in his master thesis.

The purpose of this Conference is to bring together PhD students to share their work and to network with students from a variety of technical areas.

The organization also invited speakers to talk about some technical issues and to share their valuable knowledge.

All the papers were published in a book format edited by Springer.



R&D NESTER REPRESENTED IN 14TH NATIONAL MEETING OF INNOVATION OF COTEC

As an associate, R&D Nester was represented at the 14th National Meeting of Innovation of COTEC under the motto 'Invent the future - Leading for collaborative innovation'.

More than 500 entrepreneurs, managers, entrepreneurs, academics, decision-makers and public managers were present at this meeting, which aimed to discuss the challenge for business leaders to reconcile the organizational tension inherent in the search for greater efficiency in the present and, simultaneously, the generation of new options for future growth.

The importance of collaborative innovation networks as a source of market leadership and new growth was another topic discussed.

The event program included the keynote address of Roland Kupers, Strategy, Complexity and Resiliency Consultant and Associate Fellow at Oxford University, and included also two panel discussions entitled 'Define Strategies: Knowing Trends, Planning and Anticipating Impacts' and 'Exploring the future: Preparing the organization, processes and networks of knowledge'.

The study 'Destination: growth and innovation' was also presented, carried out by COTEC Portugal in collaboration with Deloitte and which outlines the profile of the most innovative Portuguese companies, analyzing the relationship between innovation and economic and financial performance.

His Excellency the President of the Republic, Honorary President of COTEC, attended the closing ceremony where the COTEC-ANI Product Innovation Award was presented.



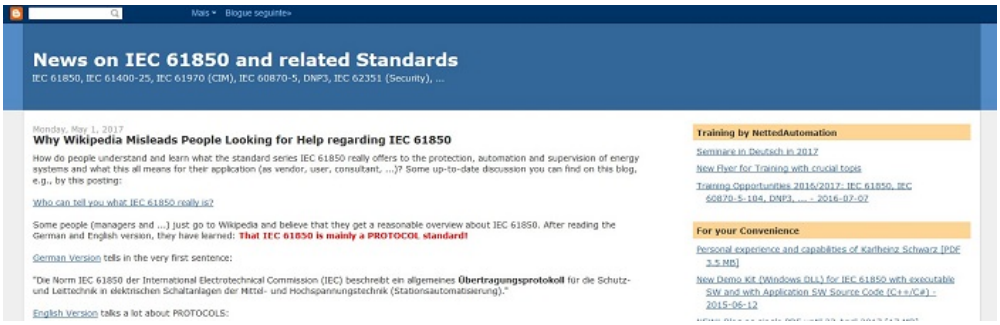
TECHNICAL INFORMATION

IEC 61850: MORE THAN A COMMUNICATION STANDARD!

Besides the already existing SCL file types, in order to improve IED specification by the utilities using IEC 61850, it is under discussion by the international community the creation of the ISD (IED Specification Description) file type. With this file, new tools that would allow comparing the specification within an ISD file to the real IED are being proposed by the vendors. Hence, IEC 61850 is increasing its importance for the specification and procurement of Substation Protection and Automation Systems.

The system design and engineering aspects were taken very much into consideration in the project "Substation of the Future" (resulting in some papers and conference presentations), in which a top-down engineering approach was used. This solution is being improved and will be tested in real Portuguese power transmission substation, under the project "Smart Substation Testing and Implementation". This project is running since beginning of 2017 and is a follow-up of the previous "Substation of the Future".

Follow blog.iec61850.com, in order to have updated information on IEC 61850, where you can find more information about this topic on: http://blog.iec61850.com/2017/05/why-wikipedia-misleads-people-looking.html.



R&D NESTER CONTINUES RESEARCH ON SOLAR FORECAST

With the increasing installation of solar energy power plants all over the world to accomplish the goal of decarbonization a concern is raising regarding the electricity network safety and stability. The uncertainty of the solar radiation, energy source of solar power plants, new strategies must be design regarding the electricity network planning and the market mechanisms to allow more renewable integration.

In Portugal, the solar energy installed capacity is still low compared with the total installed capacity of the Portuguese energy mix and potential. However, short-term changes are expected, recent government commitments are expected to boost the investment of solar energy power plants throughout the country.

The solar forecast represents an important and necessary tool for the transmission system operator (TSO) in order to optimize the electricity network planning and safety. R&D Nester has conducted a study regarding the forecast of solar ramps in the electricity system. The goal is to provide the TSO a measure of awareness of the solar ramps by defining a set of alarms.

In this study, R&D Nester analyzed the forecasted and real power from the solar power plants at national level applying the developed solar ramp algorithm. A statistical analysis of false positive vs false negative, regarding the alarms, was performed. This analysis revealed that the false negative alarms were almost zero, this means that almost no alarms will be missed. The false positive error is still high meaning that we need to improve the solar forecast.

ENHANCING POWER SYSTEM OBSERVABILITY WITH PHASOR MEASUREMENT UNITS

In recent years, the proliferation of distributed renewable energy sources has been raising the need for increasing the awareness on power systems' operational conditions. The exponential growth of power electronics interfaced devices connected to the grid is changing power systems' dynamic behavior, thus making it further important to be closely monitored. It is under this framework of change that Phasor Measurement Units (PMUs) might be of extreme usefulness to power system operators.

One big motivation in favor of the use of PMUs is the possibility of acquiring time-stamped data, by means of a GPS signal, to ensure time synchronization between measurements in different locations of the power system [1]. Indeed, unsynchronized data is a barrier impeding system operators to clearly understand certain power systems' phenomena. Besides, another driver for the implementation of PMUs in power systems is the possibility to get valuable information on phasor angles. Angles are great indicators on the health of the power system, thus having a global view on phasor angles across the system is key to motivate remedial actions to prevent power systems from collapse events [2]. In addition to all this, PMUs also allow for very high sampling rates (around 128 samples/cycle in modern devices) that enable the accurate monitoring of power systems' dynamics.

There are many applications for the use of PMUs in which the enhanced monitoring capabilities allow for better informed and faster control actions by system operators. Popular applications include: state estimation; wide area monitoring; stability analysis and post-disturbance analysis. In the case of state estimation, the availability of additional angle measurements, provided by PMUs, simplifies the mathematical formulation of the problem and improves the accuracy of obtained results [1]. Regarding stability analysis, PMUs can also support system operators in the on-line calculation of a set of stability indexes such as for real-time frequency and voltage stability monitoring, as well as for oscillations monitoring.

Although not yet widely used, PMUs are already a mature technology with great potential for growth in term of units installed in future power systems. The benefits and applications of PMUs are well established, with the promise of enhancing observability levels of power system operators and consequently facilitate improved control actions.

References

[1] - "Synchronized Phasor Measurements and Their Applications", A.G. Phadke, J.S. Thorp, Springer US, 2008

[2] - "Emerging Techniques in Power System Analysis", Z. Dong, P. Zhang, Springer Berlin Heidelberg, 2010

ENERGY ENTREPRENEURS REPORT 2017

This short report provide some insights on the evolution of solar PV and Energy Storage in the UK.

It is interesting to see that Solar PV has surpassed on-shore wind, accounting for 44% of independent generators capacity in UK.

UK is also planning to deploy 2.3GW of energy storage projects over the next 4 years.

Check https://lnkd.in/dZJ-jvP



REPORT ON REGULATION ON POWER TRANSMISSION SYSTEM REGULATION

Report by Florence School of Regulation on Power Transmission System regulation.

Presentation in Brussels: FSR report of the EU frame for Power Transmission System Regulation

11 May 2017 @ 11:00 am - 12:30 pm CEST



http://fsr.eui.eu/event/presentation-brussels-fsr-report-eu-frame-power-trasmission-system-regulation/

ENTSO-E R&I IMPLEMENTATION PLAN 2017-2019

Check the recently published ENTSO-E R&I Implementation Plan 2017-2019 with highlights on:

- the integration of storage into the electricity system;
- innovative control systems;
- power market operations; and
- the much needed cooperation between TSOs and DSOs on demand-side response and balancing/ancillary services

https://www.entsoe.eu/publications/research-and-development-reports/rd-implementation-plan/Pages/default.aspx

R&I IMPLEMENTATION PLAN 2017–2019

WITHIN THE FRAMEWORK OF THE RESEARCH, DEVELOPMENT & INNOVATION ROADMAP 2017–2026 JUNE 2017



European Network of Transmission System Operators for Electricity

entsoe

EVENTS

26 -28 Sep 2017

AMSTERDAM, THE NETHERLANDS

4TH ANNUAL IEC 61850 EUROPE 2017 CONFERENCE "MULTI-VENDOR MULTI-EDITION IEC 61850 IMPLEMENTATION & OPERATION"

28 -28 Sep 2017

BRUSSELS, BELGIUM

RETHINKING THE URBAN ENVIRONMENT: THE EU TRANSITION TOWARDS SMART CITIES

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

This quiz is about time synchronization, an issue with an increasing importance in protection and substation PAC (protection, automation and control system).

1) WHAT IS THE POWER CAPACITY OF NEW RENEWABLE POWER PLANTS PROJECTS FORESEEN TO BE INSTALLED IN PORTUGAL DURING 2017?

- a) 600 MW
- b) 750 MW
- c) 1200 MW
- d) There are no new projects

2) IN 31ST DECEMBER 2016 THE INSTALLED CAPACITY OF WIND POWER WAS WHICH PERCENTAGE OF THE TOTAL INSTALLED CAPACITY IN PORTUGAL?

- a) 25 %
- b) 10 %
- c) 57 %
- d) 40 %

3) IN THE YEAR 2016, WHAT WAS THE PERCENTAGE OF THE PORTUGUESE POWER DEMAND THAT WAS FULFILLED USING RENEWABLE ENERGY SOURCES?

- a) 40 %
- b) 57 %
- c) 10 %
- d) 80 %

4) WHATS IS THE SECTOR RESPONSIBLE FOR THE HIGHEST GREENHOUSE EMISSIONS IN PORTUGAL?

- a) Transports
- b) Heavy industry
- c) Services
- d) Agriculture

5) HOW MANY INTERCONNECTIONS DOES THE PORTUGUESE TRANSMISSION NETWORK HAVE WITH SPAIN?

- a) 7
- b) 8
- c) 9
- d) 12

6) WHAT WAS THE AVERAGE INTERRUPTION TIME (PER YEAR) IN THE PORTUGUESE TRANSMISSION SYSTEM IN THE LAST 5 YEARS?

- a) Less than 30 seconds
- b) Between 30 seconds and 1 minute
- c) Between 1 and 5 minutes
- d) More than 5 minutes

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 9th edition Quiz

1) In which German city there is a radio station, emitting a long wave time synchronization signal?

Answer: b) Mainflingen

2) Which of these is a valid reason for the presence of time synchronization function in substations?

Answer: c) Because the substation events must be time-tagged.

3) IRIG is a series of time synchronization signals. Which of the following variants is the used for the synchronizations of IEDs?

Answer: IRIG-B

4) Which of the following is a time synchronization protocol?

Answer: a) SNTP

5) PTP is a time synchronization protocol. What does 'PTP' means?

Answer: d) Precision time protocol

6) In a substation communication network, usually a communication switch acts as a:

Answer: c) Transparent clock

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