
DER – leveraging IEC 61850 for the seamless and cost-effective integration of DER into the power system

IEC 61850 Europe 2017



ENGIE
Green



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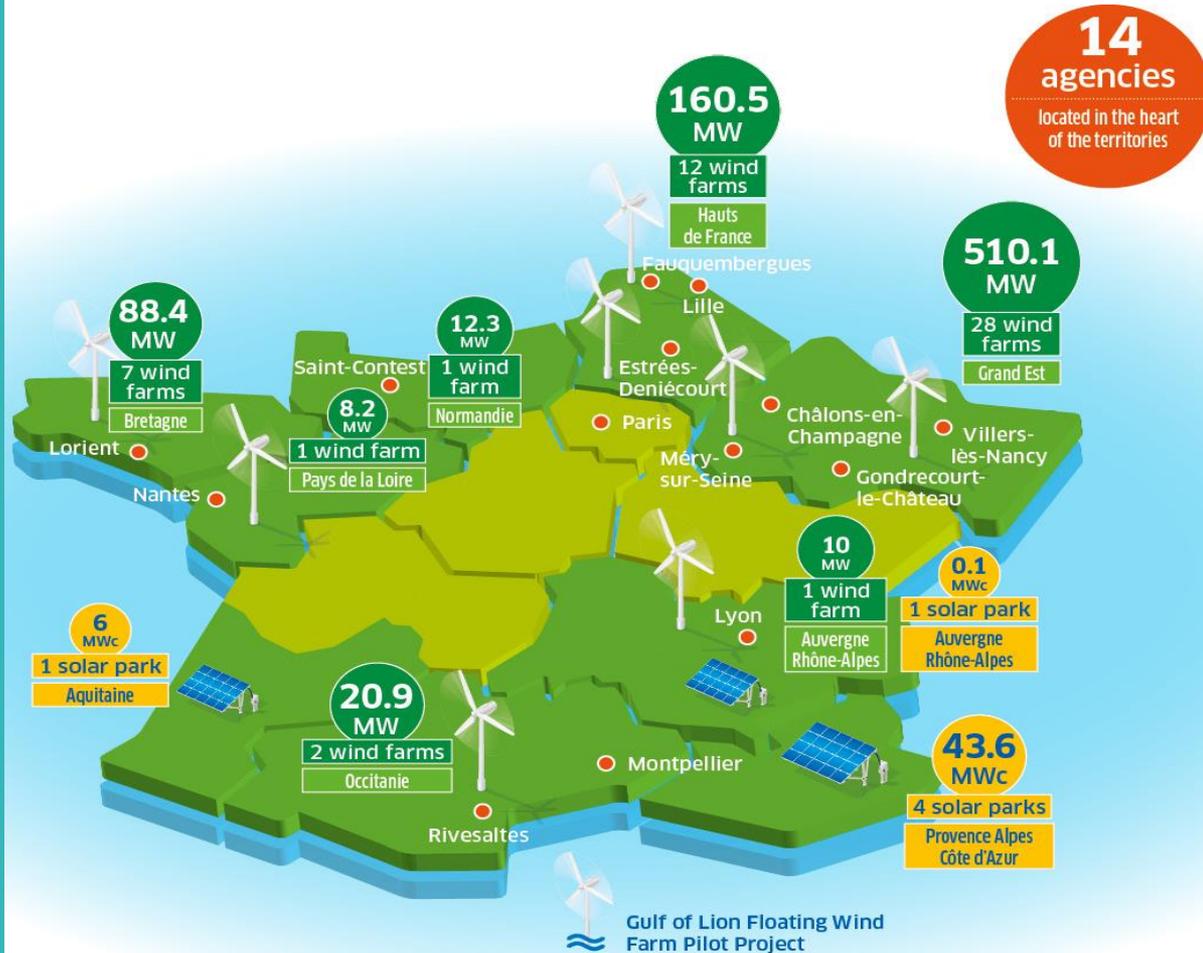
Introduction, context



ENGIE GREEN, DER Operator, is at the very heart of the French regions

Key data*

- **810 MW** of installed operated wind power (58 farms – 396 wind turbines)
- **56.9 MW** of wind power operated on behalf of third parties
- **50 MW** of installed and operated solar power (over 160,000 panels)
- **2,000 MW** under development
- Over **800,000 people** supplied with renewable energy every year



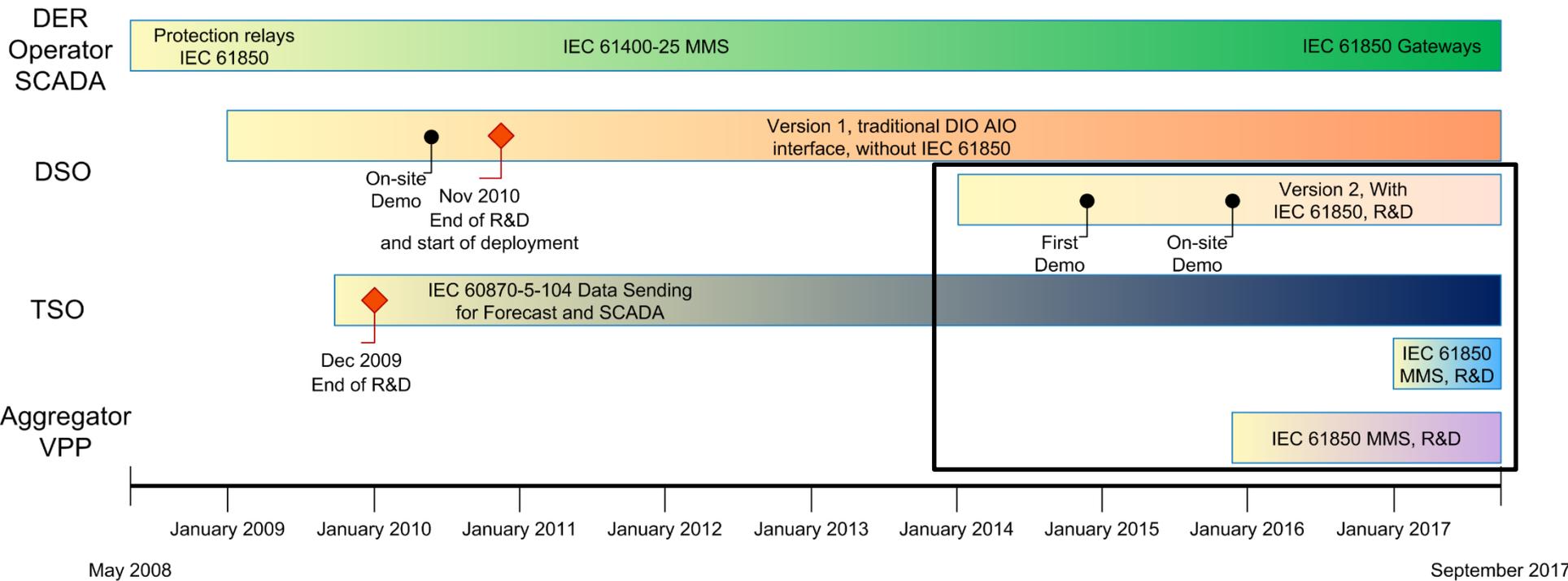
(data at 12/31/2016)

ENGIE GREEN

Our way of IEC 61850 as a DER operator

- In 2008 a national SCADA center was needed, with the possibility to control the protection relay distantly via VPN connections as the most important requirement.
- Preference of standardized protocol, instead of proprietary protocol.
- IEC 61850 is one of the RT communication options that the relay provider had.
- After some bibliography study, we were convinced that IEC 61850 should be the best choice.
- A SCADA third party editor with IEC 61850 Client driver in Beta version had been acquired.
- This project was achieved in 2009 after tremendous works and the help of relay providers.
- In 2012, IEC 61400-25 MMS interface was provided by our turbine provider.
- Since 2012, we have done several on-site Data Gateway configuration projects by using IEC 61131 language. Principally IEC 61850 Server upstream for national SCADA, and IEC 61850 Client and some other protocols downstream for on-site devices.

Summary of RT Communication projects in Engie Green for Grid Connection applications



02

Case-study of three grid connection R&D projects using IEC 61850



Protocol choice for grid connection R&D projects

Why our partners are convinced by IEC 61850?

- First thing first, because we are well convinced ourselves that this protocol is the future, especially for Smart Grid dynamic fast-time communication applications. So we insist it.
- DSO didn't use any very modern protocol for DER on-site telecontrol application. Once they were interested in a R&D project by using IEC 61850, we were very happy to be their partner.
- TSO is largely using IEC 60850-5-104 for remote communications. IEC 61850 is another option agreed and finally chosen together for our R&D project.
- The operator of VPP for aggregator gave us several protocol options, such as MMS based IEC 61850/IEC 61400-25, because this is one of their turbine interfaces already in use.

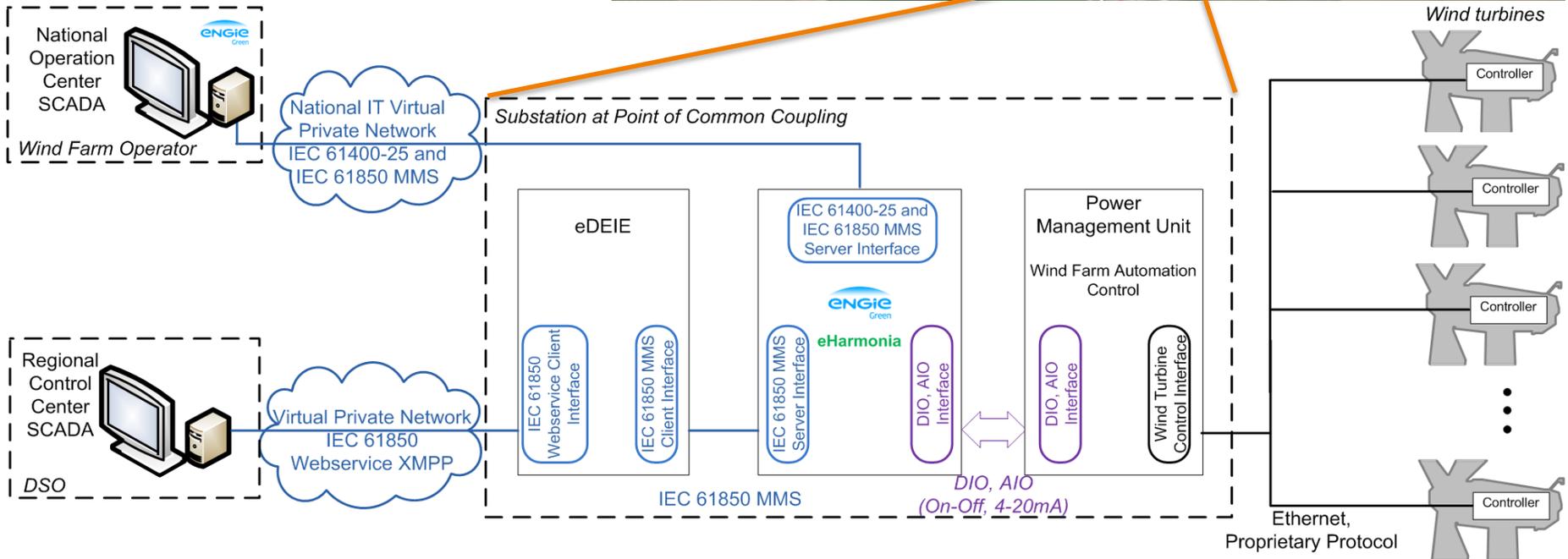
GRID CONNECTION WITH ENGIE Green

IEC 61850 for the communication with DSO

- **DSO = fast dynamic telecontrol**

- **1 second frequency communication**

- Decoupling/re-coupling of DER
- P limitation
- Q regulation
- Telecontrol of on-site devices



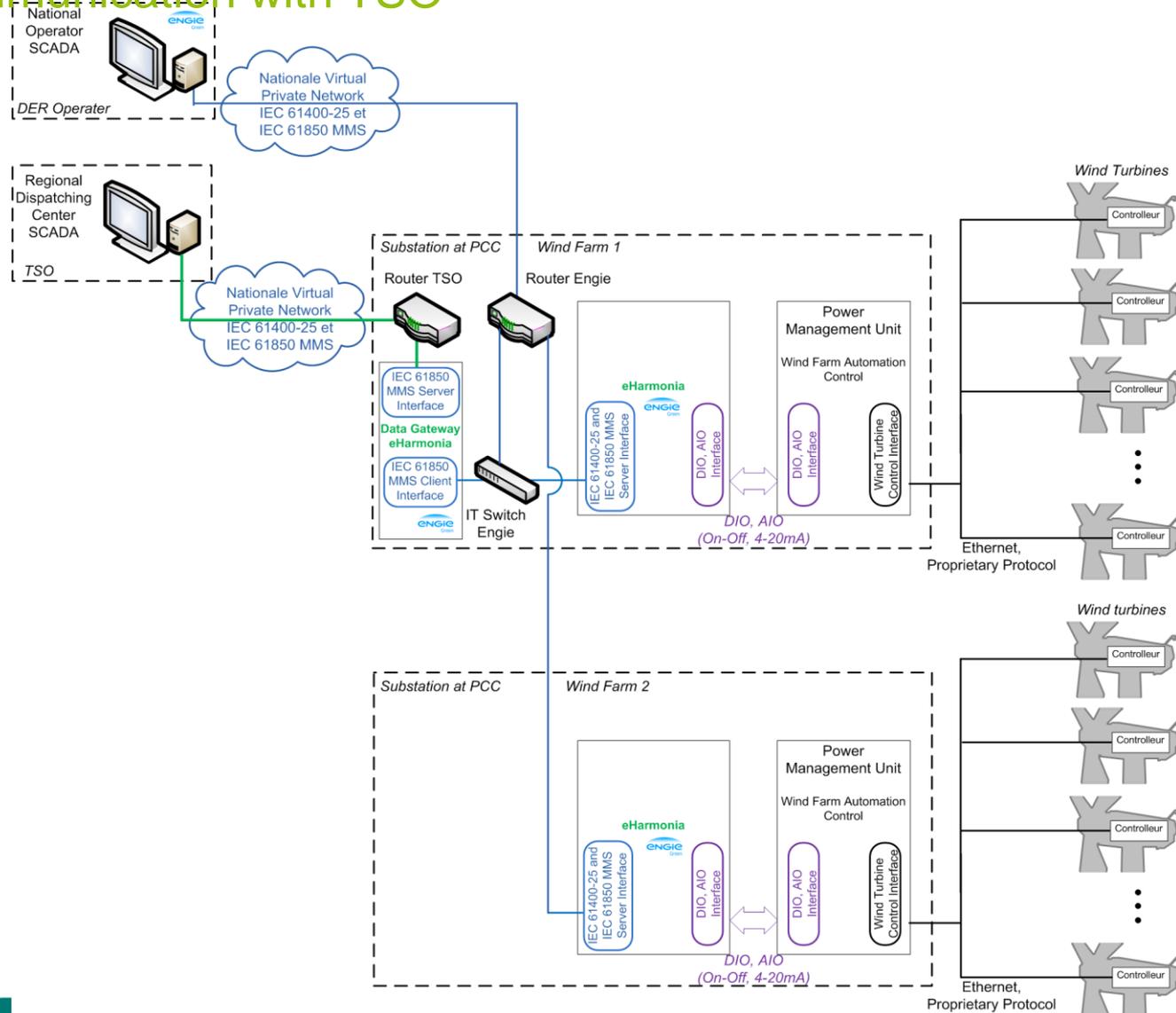
GRID CONNECTION WITH ENGIE Green

IEC 61850 for the communication with TSO

● TSO, 1 minute exchange slow dynamic regulation by the first step of the project

- P limitation for line and transformer saturation problem

- Q/power factor telecontrol for voltage regulation



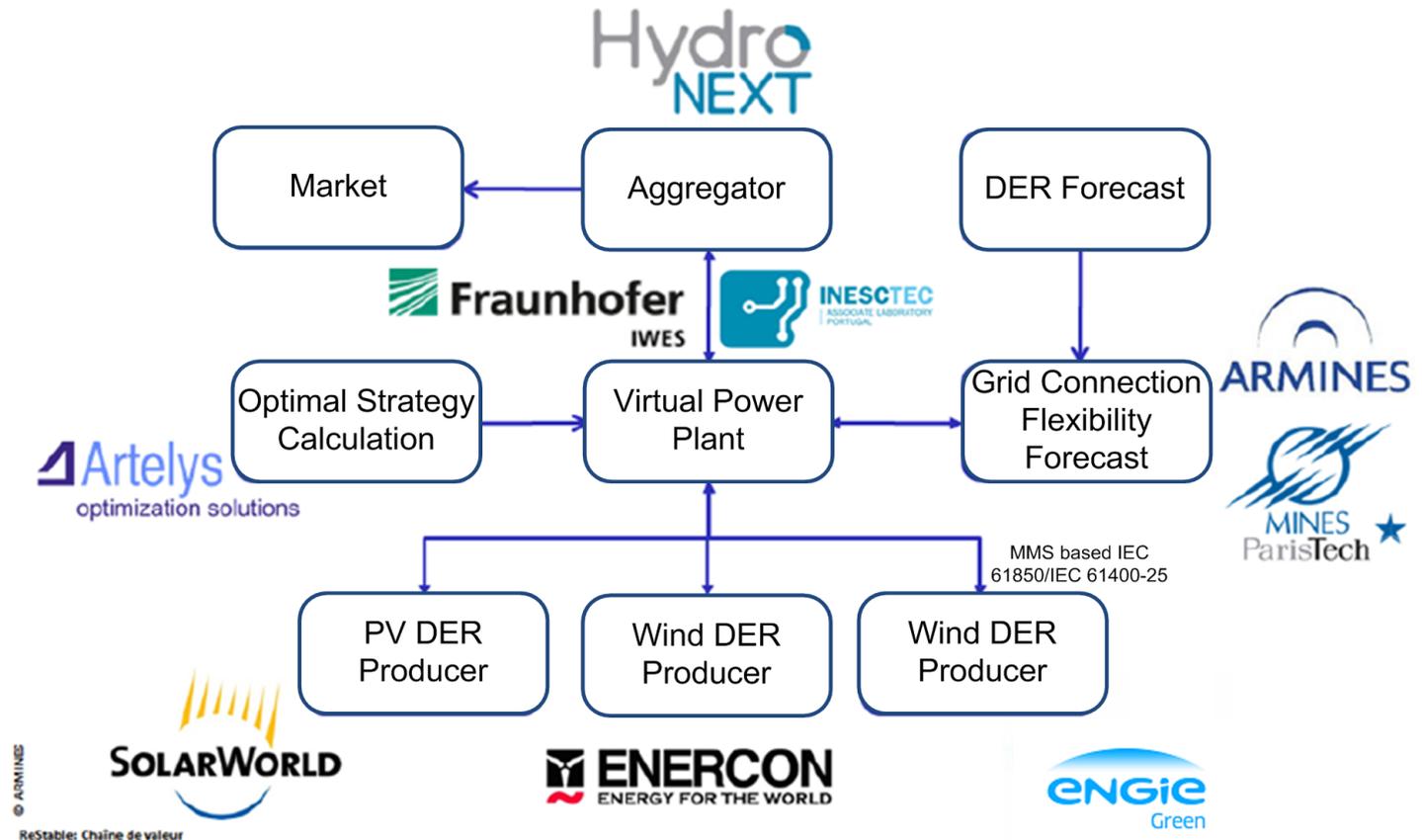
GRID CONNECTION WITH ENGIE Green

IEC 61850/IEC 61400-25 MMS for the communication with aggregator

- **European level VPP for Aggregator (3 seconds level)**

Restable project <http://www.ademe.fr/restable>

Frequency regulation for FCR, aFRR and mFRR according to the Grid Code.



03

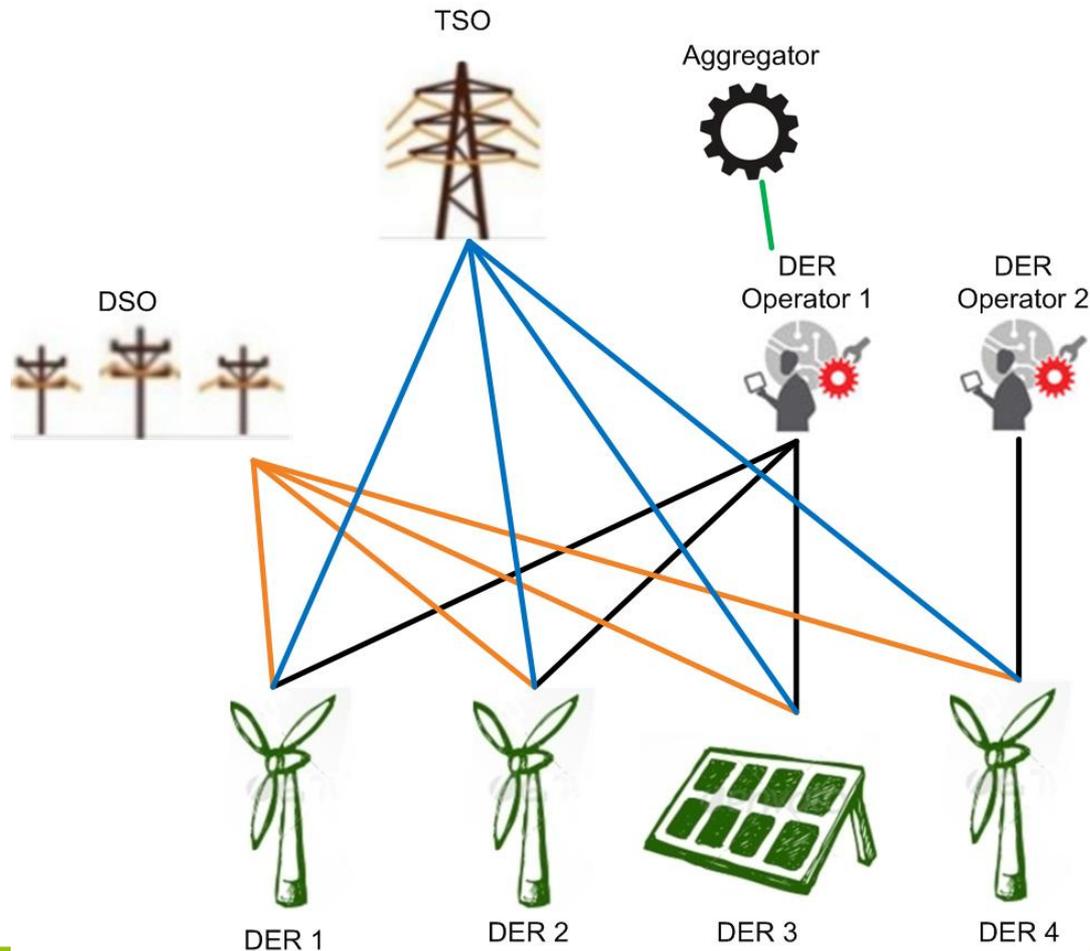
Conclusion and discussions



Overview of the current projects

Complicated IT architecture and data gateway developments

- Everyone wants to connect to DER, for the P and Q regulation!

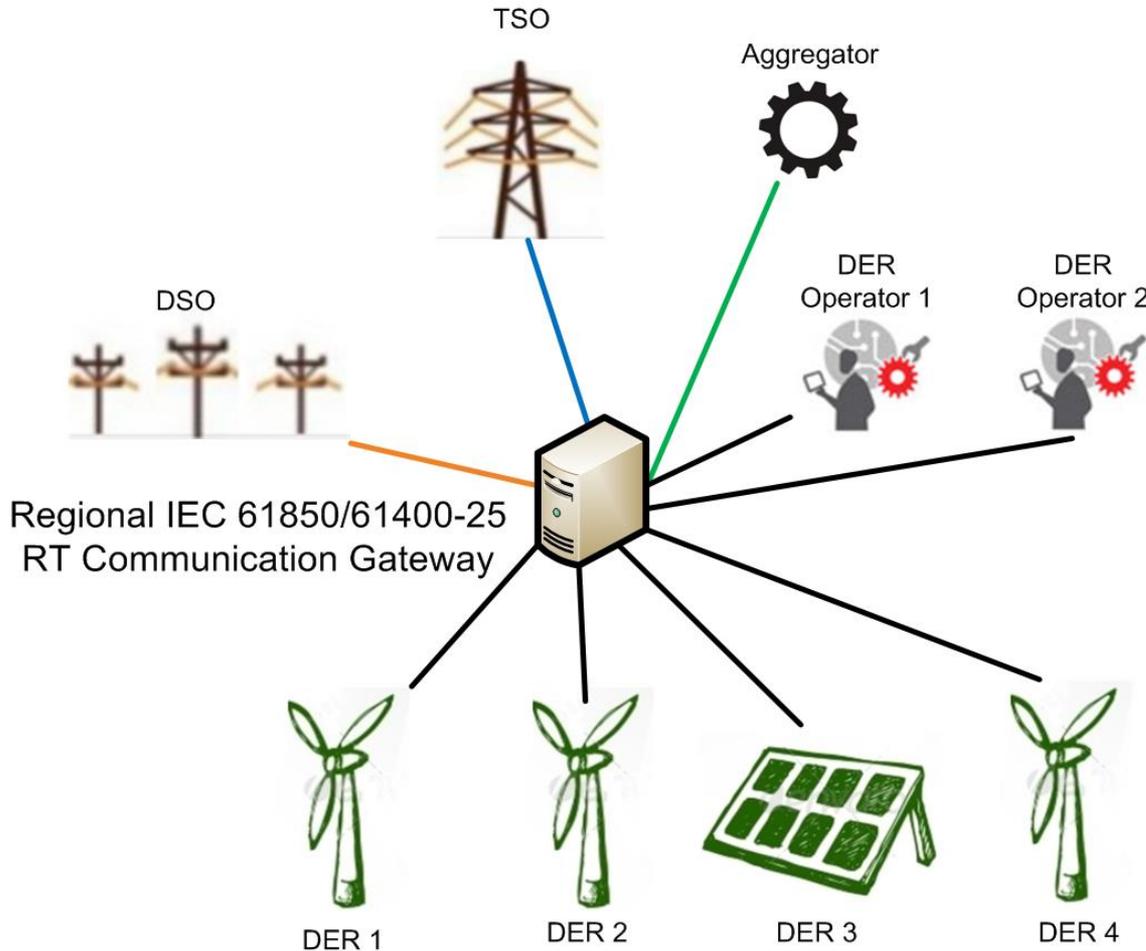


Multiple control sources for a single destination: A heavy R&D technical realization

Perfect future structure?

A regional unique RT data gateway for all parties?

- Idea of a unique RT data gateway



- Everyone shares the same data thanks to the unique IEC 61850/IEC 61400-25 structure
- Single IT link for users, easy cybersecurity management
- Local GOOSE message exchanges for dynamic automation between substations
- ...

Benefits from IEC 61850

- Well-designed self-description data structure.
- Handful testing possibilities, for example, xml file for server-client behaviors tests.
- More and more engineering tools available in the market.
- RT fast communication for Smart Grid applications.
- Development time for IEC 61850 interface:
 - 50% Definition of the technical specifications with our partners
 - 20% Understanding how does it works the interface provided by a new IEC 61850 gateway provider.
 - 15% Definition of LN and DA beyond the standard.
 - 10% Construction of xml file.
 - 5% All the rest of programming and the configuration of the project.



Challenges and discussions by using IEC 61850

- Very huge the first learning step for this comprehensive and abstract standard.
- Computing and bandwidth consumption by IEC 61850 industrial products is more important than other protocols.
- IEC 61850 industrial development tools are often expensive, without complete functionalities, and even with bugs...
- Different decision about the application level functionality integrations to the IEC 61850 driver level (for example interlocking, DPS etc.)
- Always a challenge to define the DA for variables beyond the existing proposition of the standard
- Difficult to develop this driver by a small scale company, event by buying a Stack.
- Open Source driver available but still time needed to learn and make adaptation to our applications.



Challenges and discussions by using IEC 61850

How to make IEC 61850 more friendly to small and medium scale companies?

How to “standardize” the IEC 61850 test tools?

How to synchronize the evolution of IEC 61850 and IEC 61400-25?

How to boost the IEC 61850 local equipment integration? For example, electric meter and converter interface?

How to boost the time critical applications by using IEC 61850? For example, relay coordination between different partners, dynamic power control.

Confidence on IT links?

Cybersecurity?



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Thank you for your attention!
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