# STUDY COMMITTEE D2

## INFORMATION SYSTEMS AND TELECOMMUNICATION

cigre

For power system expertise

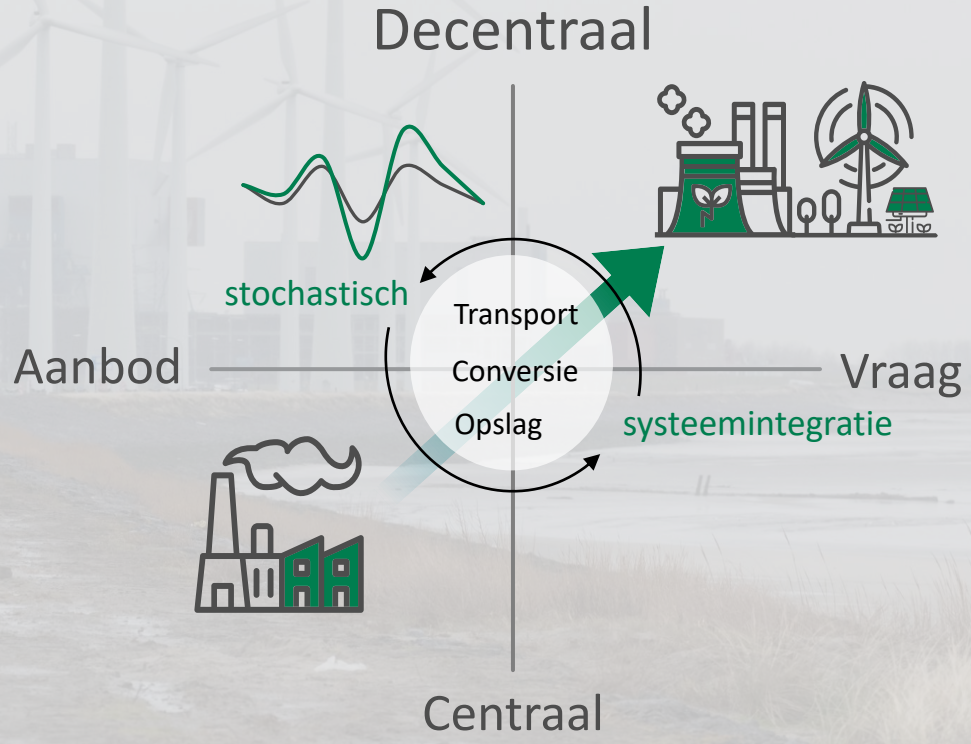
# Inhoudsopgave

# In general

# ‘The Power system of systems’

## Het elektriciteitsnetwerk is de ruggengraat van de energietransitie

- Net Zero; Gedecentraliseerd & gedecarboniseerd;
  E.g.: Geen SF6
- Flexibiliteit; ; Systeemintegratie; DC/AC integratie;
- Urgentie om te versnellen!
- Cyber physical power system
- Convergentie van digitaal en fysiek



# Digitale revolutie

## In het opereren van en werken aan de energienetten

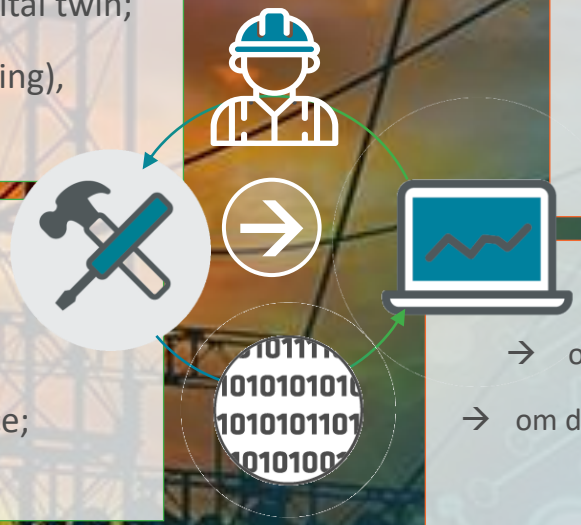
### Oorzaak – **Feiten, Trends & Ontwikkelingen**

- Digitale revolutie in het **opereren** van de energienetten (**bedrijfsvoering**);
- 'Digitale bedrijsvoerder'; bedrifsvoerder 'co-pilot'; Digital twin;
- Meer automatisering, sturing op afstand (verrebediening), opweksturing (DER);

Digitale revolutie in het **werken** aan de energienetten (**instandhouding**);

- (Toestandsafhankelijk) onderhoud,
- 'cross-generation' kennisconsolidatie; cross-experience;
- Personeel met computersystemen & programmeervaardigheden

- Exponentiële datagroei; Asset gegevens; Modellen; Sensoren;
- Primaire componenten, IED's, PMU's, MU's, …
- PD, trapstanden trafo's, temp., luchtvocht., druk, …



### Gevolg - **Implicaties , Impact op Telecom**

→ **Connectiviteit randvoorwaardelijk voor het opereren en instandhouden van de energienetten**

→ Informatie moet waar nodig **tijdig**, **integer**, **nauwkeurig** en **secuur** worden verstrekt

→ Deze informatieoverdracht wordt leidend en bepalend voor vermogensoverdracht (e.g.: laadpaal transactie) omwille van **Net-stabiliteit** en **Net-veiligheid**

→ **Telecom wordt een strategische asset:**

→ om de correcte werking van deze energienetten te kunnen garanderen

→ om de veiligheid voor het werken aan de netten en voor de aangeslotenen te waarborgen

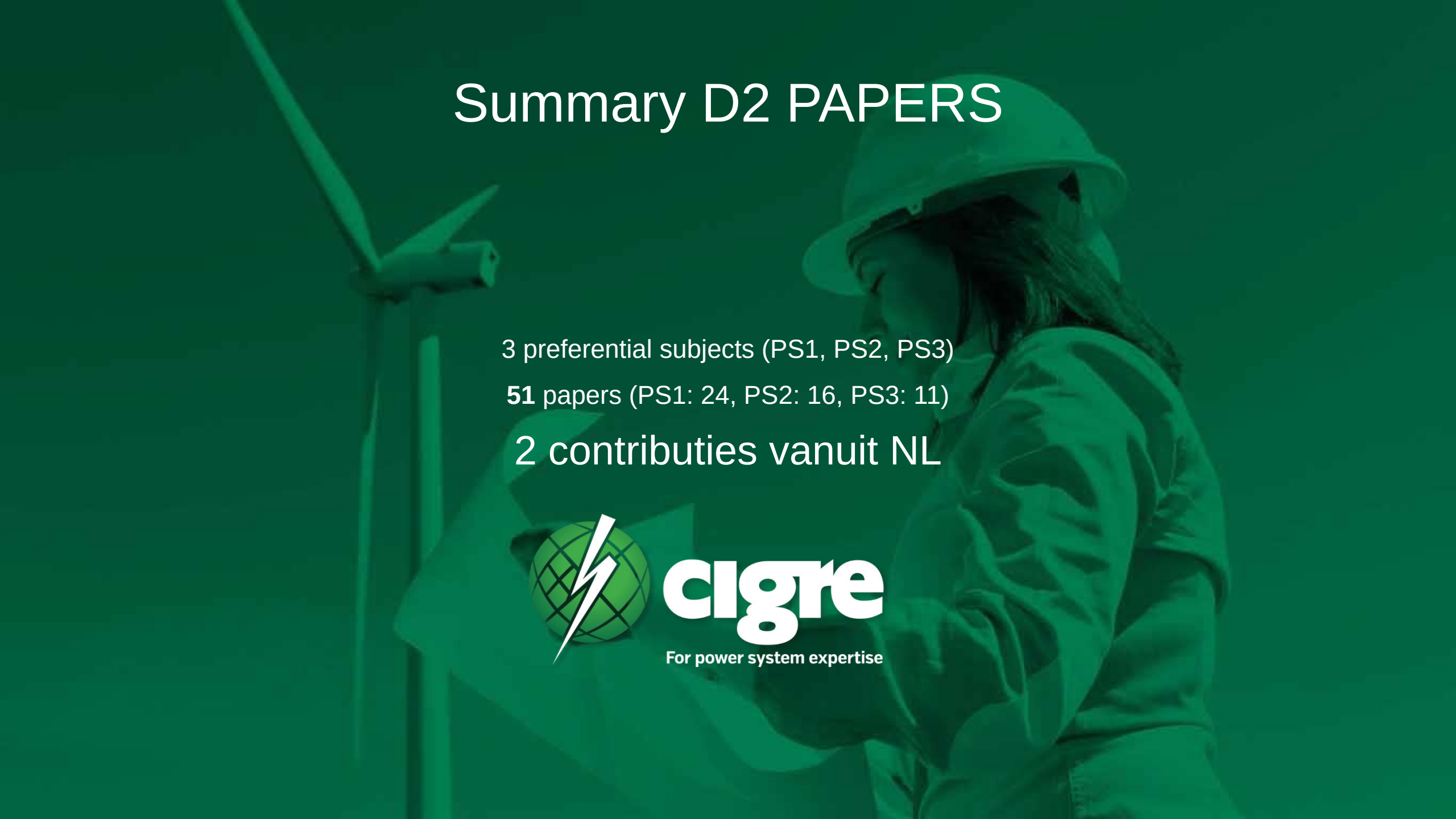
→ **Durven tijdig investeren in digitalisering en i.h.b. Telecom**

→ Toekomstbestendig en flexibele connectiviteit in en rondom de stations

→ Duidelijke demarcatielijnen; Modulariteit

→ Meer samenwerking (sector, andere disciplines, expertise, …)

# Summary D2 PAPERS



3 preferential subjects (PS1, PS2, PS3)

**51** papers (PS1: 24, PS2: 16, PS3: 11)

2 contributies vanuit NL

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# Preferential subjects

PS1: THE OPPORTUNITIES AND CHALLENGES BROUGHT BY EMERGING INFORMATION AND COMMUNICATION TECHNOLOGIES TO ELECTRIC POWER UTILITIES IN THEIR PATH TO DIGITAL TRANSFORMATION

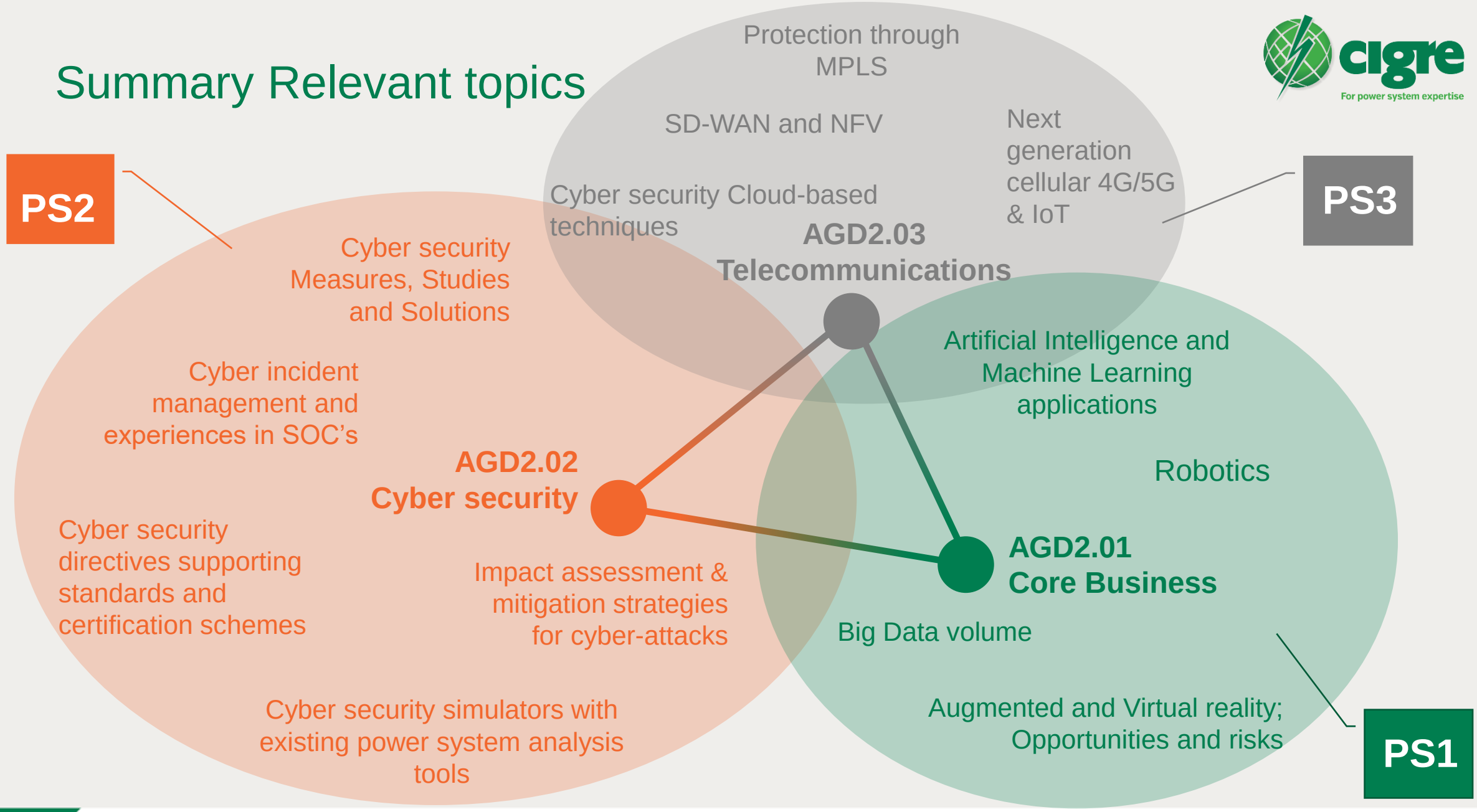
(AI and ML, IoT, AR, VR)

PS2: CYBERSECURITY TECHNIQUES, TECHNOLOGIES AND APPLICATIONS FOR SECURING CRITICAL UTILITY ASSETS

(Cybersecurity directives, incident management, impact assessment and mitigation strategies for cyber attacks)

PS3: MEATING THE DEMANDS OF THE MODERN UTILITY AND DER WITH AN AGILE AND RESILIENT TELECOMMUNICATION NETWORK (4G/5G for OT, SD-WAN and NFV, Migration to packet switched networks)

# Summary Relevant topics



# PS1 D2-11053

## DAS Technology: an opportunity to use fibre optics for asset monitoring and security applications in Electric Power Utilities

Background

Proposed solution

- Diagnostic method and system for partial-discharge (PD) of underground cables using deep learning.
- The training data required for the development of the diagnostic model were collected from test cells that can generate partial-discharge (PD) defect signals.

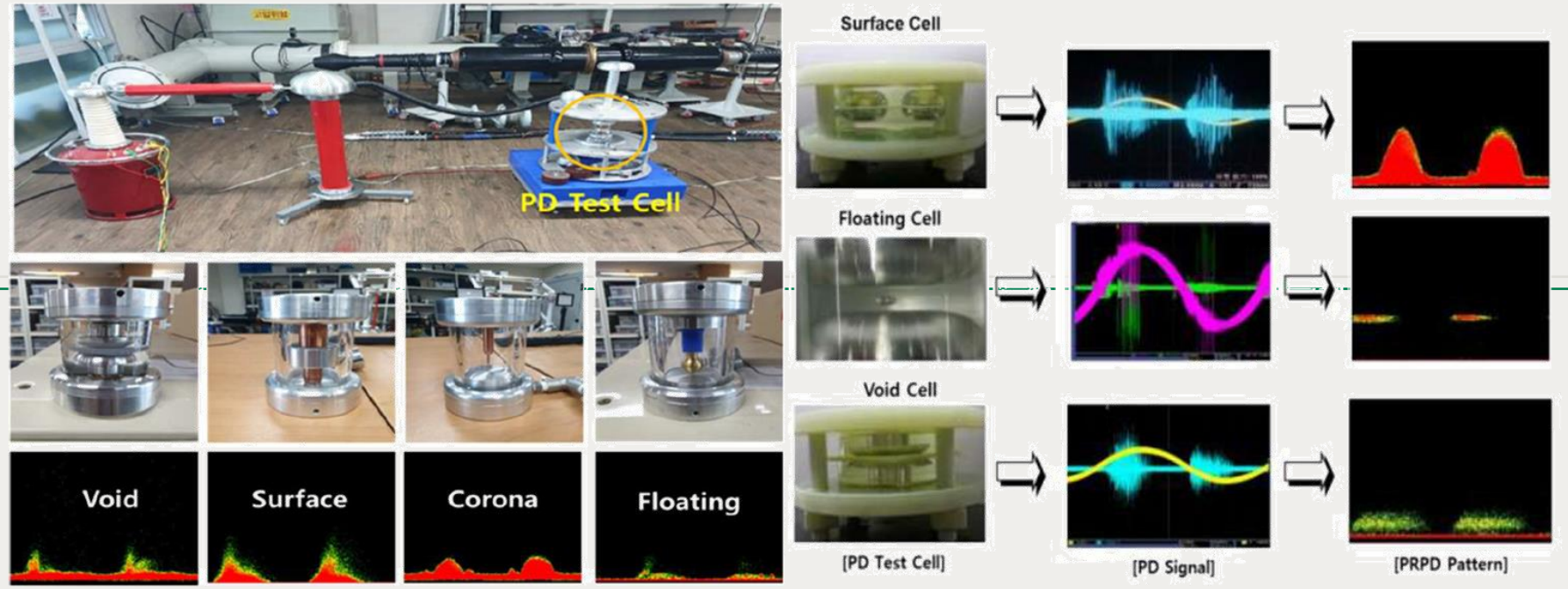



Figure 3. The PD Test Cells with Representative Defect Types

Bevindingen

- The results proved that the proposed diagnostic deep learning model can diagnose the partial discharge occurrence and the defect type with very high accuracy, close to 99.3%.

# PS1 D2-11053

## DAS Technology: an opportunity to use fibre optics for asset monitoring and security applications in Electric Power Utilities

Background

Proposed solution

- Reuse of fibre optic infrastructure by turning the fibres into distributed acoustic sensors.
- Testing @ Red Eléctrica de España facilities in collaboration with the University of Zaragoza and Aragon Photonics.

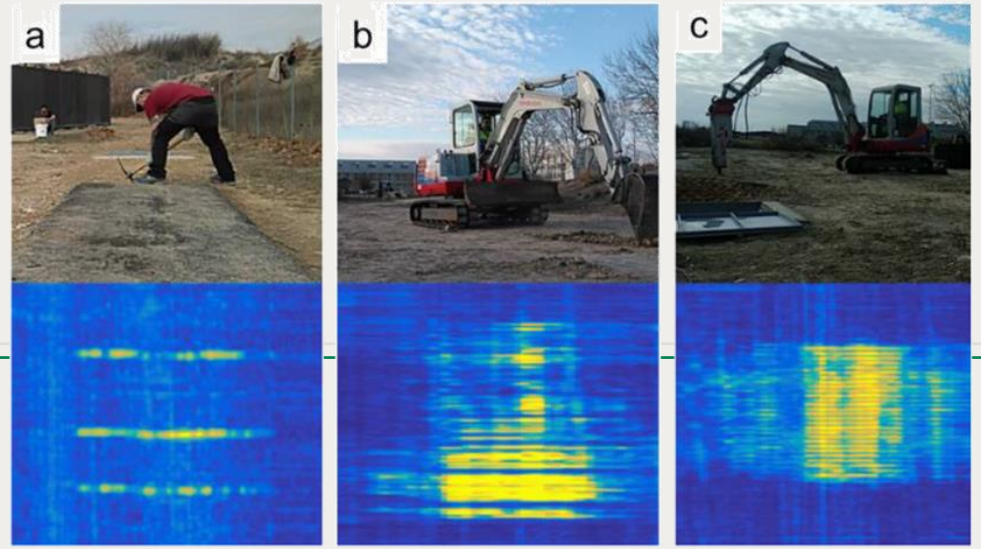



*Figure 6. Application DAS techonology as TPI (Third Party Intrusion). a) is a manual digging threat; b) column is a digging machine; and c) is a heavy hammer machine*

Bevindingen

- DAS (Distributed Acoustic Sensing) is a technology based on C-OTDR (Coherent Optical Time Domain Reflectometry). It is based on the use of Rayleigh backscattering of coherent pulses traveling along the optical fibre.
- This technology turns the fibre into a distributed sensor that, thanks to its high sensitivity, is capable of measuring mechanical and thermal stimuli originated from events happening in the vicinity of the fibre.

# PS2 D2-10348 (NL)

## A Blueprint for Cyber Security of Brownfield Substations in Power Systems using IEC 62443

Background

Proposed solution

- The transition to cyber-physical power systems raises questions, especially regarding vulnerabilities, cyber threats, and secure operation of the power system.
- Existing substation infrastructures comprise of a combination of heterogeneous, co-existing smart and legacy technologies. When these are upgraded with newer technologies such as Internet of Things (IoT) sensors, this gives rise to significant cyber security challenges that must be addressed.

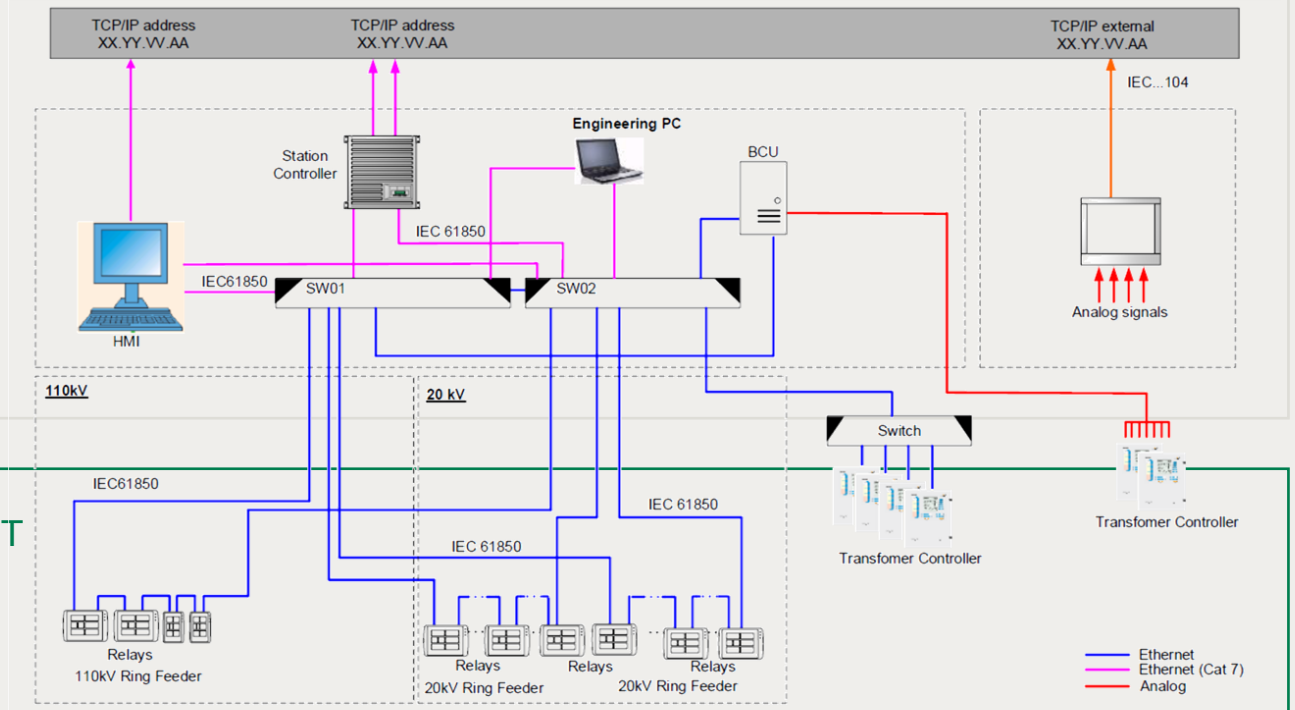



Figure 2: Substation reference architecture

Bevindingen

- Quantify the security levels of substation OT
- The reference model based on the **ISA IEC 62443-1-1/2007** standard is used
- A method is proposed to calculate the target security level, i.e., SL-T, as defined by IEC 62443/3-3 for the substation reference architecture.

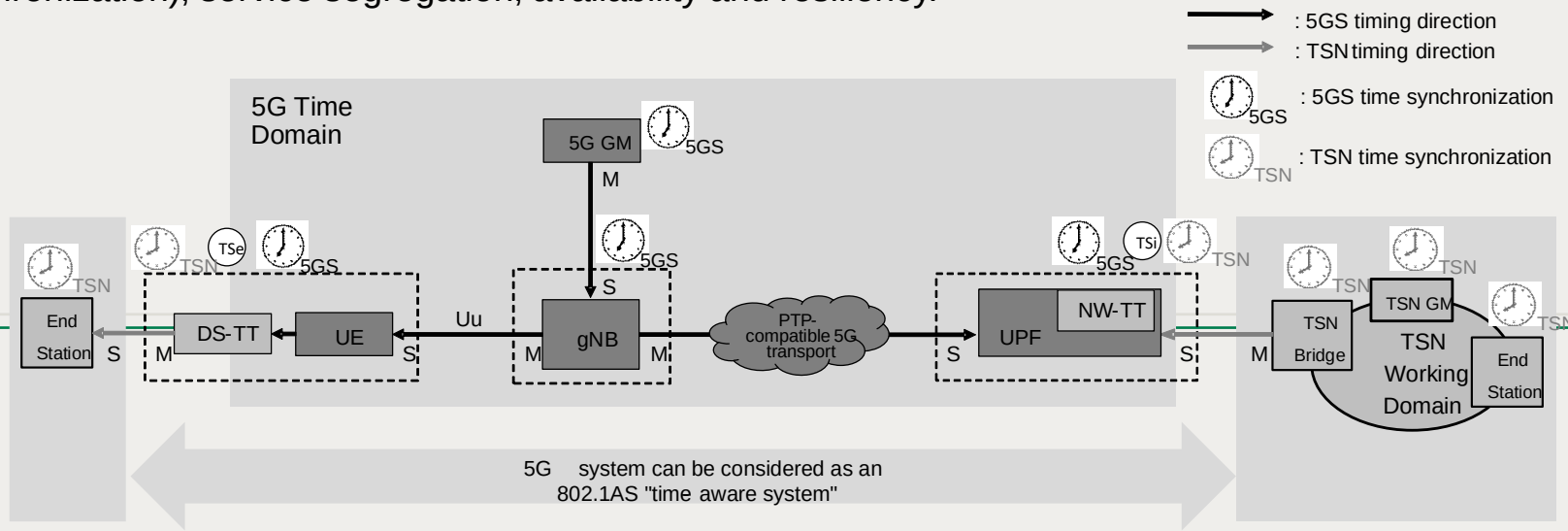
# PS3 D2-10547 (NL)

## Seamless extension of fibre optical IP/MPLS network with 5G technology Releases allowing Business service segregation, Precision time synchronization and Critical teleprotection services in Utility distribution networks

Background

Proposed solution

- How recent 5G technology Releases supports stringent requirements of business critical utility application services
- 5 important features are addressed to support best-effort and critical services: latency, precision timing (synchronization), service segregation, availability and resiliency.




Bevindingen

- 5G_LAN-type service offers private communication using IP and/or non-IP type communications as a service over the 5G system.
- FS_5GSEI, a 3GPP Release 18 WG SA1 Technical Report addressing critical services in smart grids is recommended, the normative requirements are captured in TS 22.104.
- Regarding timing, The 5G network can be considered as a PTP boundary or transparent clock, according to 3GPP Rel.17 TS 23.501, 5.27.1.1. In particular, PTP with definitions according to the IEC/IEEE 61850-9-3 PTP Power Utility Profile or IEEE C37.238:2017 PTP Power Profile can be used here, please see 3GPP Rel.18 TS 22.104, 5.6.1.

# Achievements & Future works

# SC D2 2021/2022 ACHIEVEMENTS

## 1. Successful D2 participation in the 49th CIGRE Session

- **Tutorial "Artificial Intelligence Application and Technology in Power Industry"** by Qixin Chen, John Ging, Luiz. V. Cheim, Javier Mantilla
- **Workshop "Standardization of cybersecurity in power utilities digital infrastructures – a joint vision from IEC, IEEE and CIGRE - Study Committee D2"**
- **D2 GDM:**
  - **51 contributions** presented for PS1-PS3
  - **1 NGN Showcase** presentation
  - **1 Keynote speech** by Mr Iony Patriota de Siqueira, DSc., CIGRE Honorary Member and Former Chair of SC B5
- **D2 Poster Session:**
  - **49 papers** accepted, **34 posters** presented

# SC D2 2021/2022 ACHIEVEMENTS (CONT)

3. **Participation in the SEERC conference (May 31- June 2, 2022, Vienna, Austria) with the Tutorial "**Cyber Security Management – a key player in the EPU resilience strategy" by **Giovanna Dondossola** (IT) and **Roberta Terruggia** (IT)
4. **1 TB published**:
   - **TB 866** "Enabling software defined networking for electric power utilities"
5. **3 new WGs launched**:
   - **D2.56** "Interdependence and Security of Cyber-Physical Power System (CPPS)"
   - **JWG A2/D2.65** "Transformer Digital Twin – concept and future perspectives"
   - **JWG B3/D2.62** "Life-long Supervision and Management of Substations by use of Sensors, Mobile Devices, Information and Communication Technologies"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