Research and Innovation projects with a focus on the development of the Romanian High Voltage Grid

DigitALL

Technical, Energy Efficiency and New Technologies Division
CNTEE Transelectrica SA
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3. Romanian Transmission Electricity Grid - Key numbers

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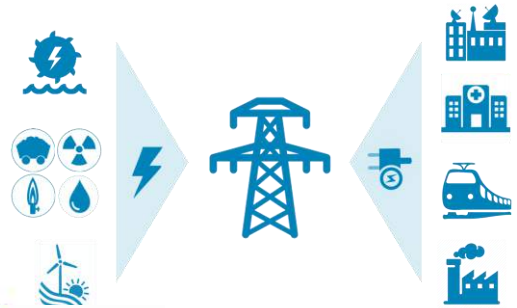


≈9,000 km
Network length

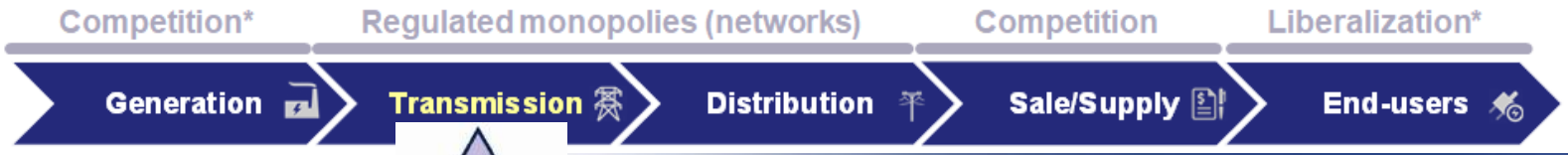
≈450 €m
Market value of equity

400/220/110 kV
Voltages operated

≈ 1,000 €m
Capex plan next 10 years

25 years
License lifespan

Ba1
Moody's (positive outlook)



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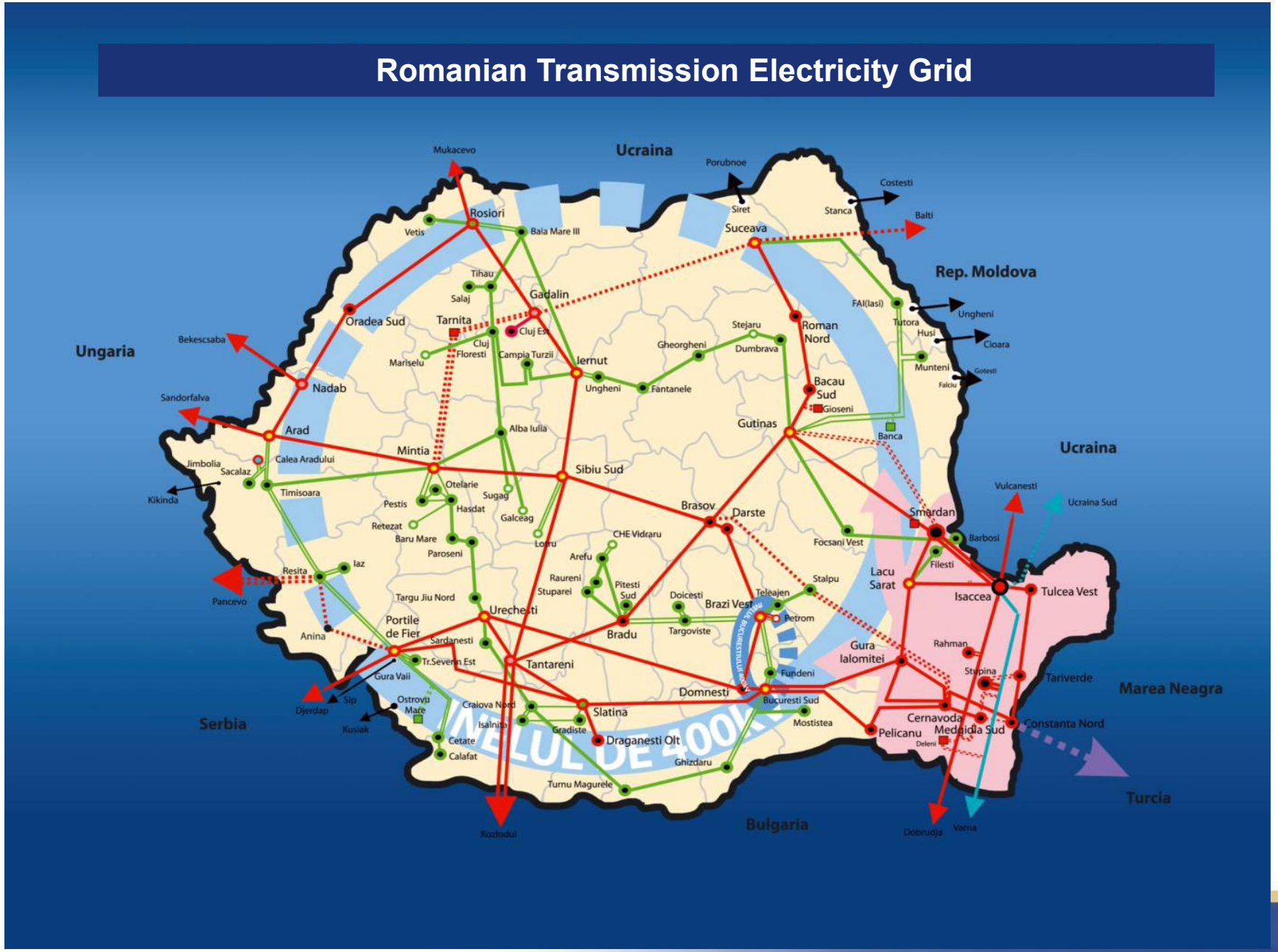
Romanian Transmission Electricity Grid



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1. Transelectrica's vision on Research and Innovation, Digitalization and Smart Grid

- In order to ensure the convergence of European and national objectives, Transelectrica has defined and validated a set of strategic documents to support the vision and ambitions as a high-performing network operator.
- The Implementation Plan of the ENTSO-E vision related to research and innovation serves as a guidance tool for each TSO in order to prepare and activate research and innovation projects.
- The digital transition is prepared to be implemented within research and innovation projects and digital transformation programs, establishing ambitious objectives that will have a substantial impact on the services provided.
- The projects defined within the **DigiTEL** portfolio will optimize and digitize many operational processes that support decisions specific to: operation, maintenance, network planning, network observability, decarbonization and safety.

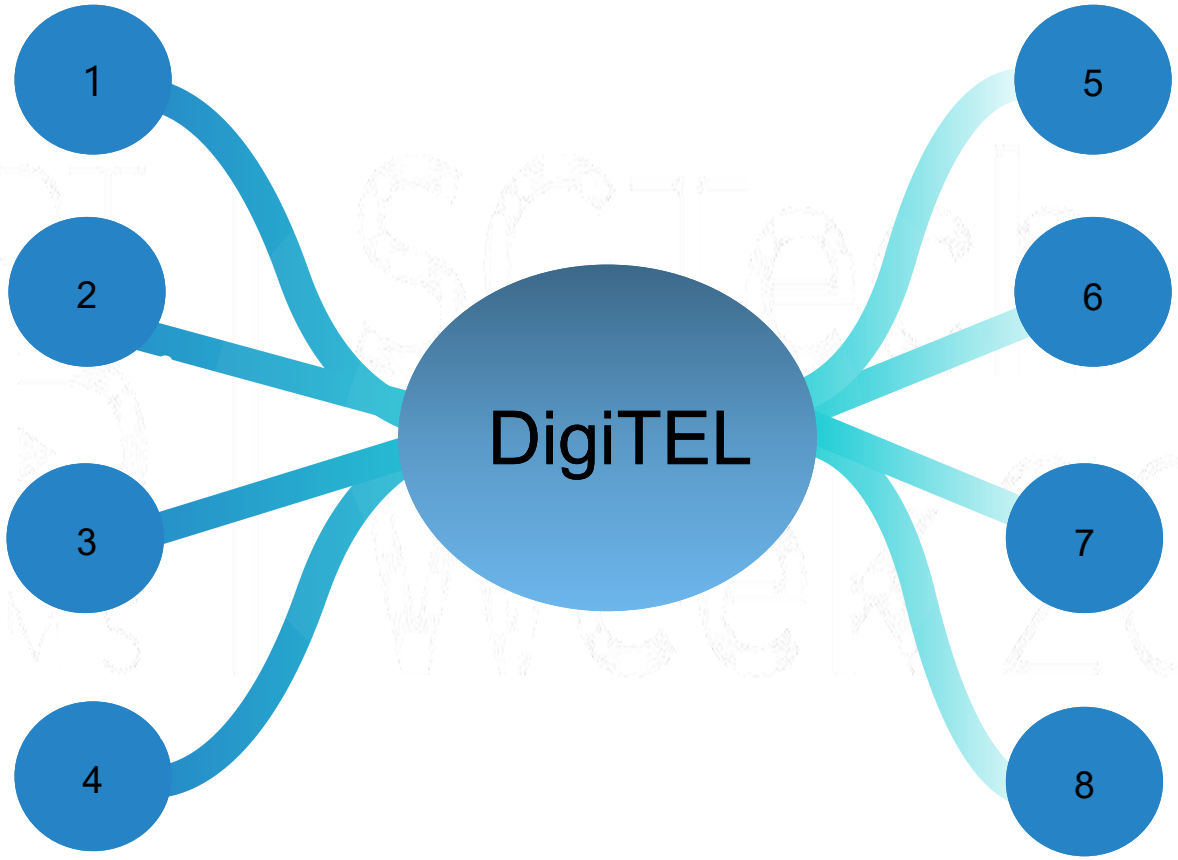
2. Transelectrica's innovation and digitalization pilot projects portfolio – DigiTEL

DigiTEL Alba Iulia
(Digital Substation – Alba Iulia)

DigiTEL Green
(Digital and Sustainable Substation – Mostistea)

DigiTEL Trafo Expert
(Condition Monitoring Systems for 21 Power Transformers)

DigiTEL Smart Vision
(AR/VR and Digital Twin for safer operation and maintenance – Domnesti Substation)



DigiTEL Smart Lines
(Condition Monitoring Systems and DLR for 23 OHL)

DigiTEL 3D Line Vision
(LiDAR scanning, RGB and IR for grid inspection)

DigiTEL Power Lines of the Future
(Tubular towers for one 400 kV OHL)

DigiTEL Next-Gen Power Grid
(Digital Twin and Drones for better operation and inspection)

**DigiTEL pilot projects have an estimated total value of 200.000.000 Euro*

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DigiTEL Alba Iulia
(Digital Substation)

"Pilot Project - Refurbishment of the 220/110/20 kV Alba Iulia substation as a digital substation"

Main objectives

- Asset Management on substation level using Smart Grids architecture and standards;
- Condition Monitoring Systems;
- Asset Health Centre on regional level;
- Passive and Smart Building design;
- Digital Laboratory for personnel / students training with focus on new technologies;
- Virtual Reality, Augmented Reality and Digital Twin.

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DigiTEL Alba Iulia
(Digital Substation)

"Pilot Project - Refurbishment of the 220/110/20 kV Alba Iulia substation as a digital substation"

Benefits

- Increasing the operational safety (for equipment and staff) ensuring the Remote Control of the substation;
- Better substation performance, improving grid services;
- Improved Risk management and cost reduction for operation and maintenance;
- Reducing the environmental impact by using modern equipment and technologies;
- Improving capabilities for Asset Management and Smart Grids implementation.

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DigiTEL Green
(*Digital and Sustainable Substation)*

"Pilot Project - Refurbishment of the 220/110/20 kV Mostiștea substation as a digital and sustainable substation“

Main objectives

- Expanding / scaling the digital technologies and infrastructure created with the Alba Iulia digital substations project;
- Non-SF6 technology for primary equipment and natural oil for power transformer units;
- Energy efficiency (nearly zero energy, independent building) and sustainability for substation refurbishment, following the circular economy concept;
- Automatic technical assistance and surveillance using robots and drones with AI.

DigiTEL Green
(Digital and Sustainable Substation)

"Pilot Project - Refurbishment of the 220/110/20 kV Mostiștea substation as a digital and sustainable substation“

Benefits

It will have the same **benefits** as Alba Iulia Digital Substation project but adding the reduced environmental impact by using sustainable equipment and technologies.

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DigiTEL Trafo Expert
(Condition Monitoring System for Power Transformers)

“Installing Integrated Monitoring Systems for 21 Power Transformers from the Transmission System”

Benefits

- Increasing time interval between preventive maintenance tasks and costs reduction based on the type of intervention;
- Fewer incidents by anticipating the vulnerabilities in the grid diagram;
- Continue to operate the units that has exceeded the standard operation time;
- Cost reduction for undelivered energy caused by the unavailability of power transformers;
- Valuable data base creation about the most important assets from the power grid.

DigiTEL Smart Vision

(Augmented Reality, Virtual Reality and Digital Twin)

„Increasing safety in operation and maintenance activities for Domneşti substation by using digital technologies”

Benefits

- Reducing the risk of human errors in substation operation;
- Improving workflow efficiency of the operational staff;
- Easy accessibility from a smartphone, tablet, laptop or smart glasses to the documentation necessary for the work activities (procedures/ technical instructions);
- On-site training for the staff involved in operation activities;
- Reports and records made directly in the AR system on site;
- Improving the learning process of specific activities in the substation.

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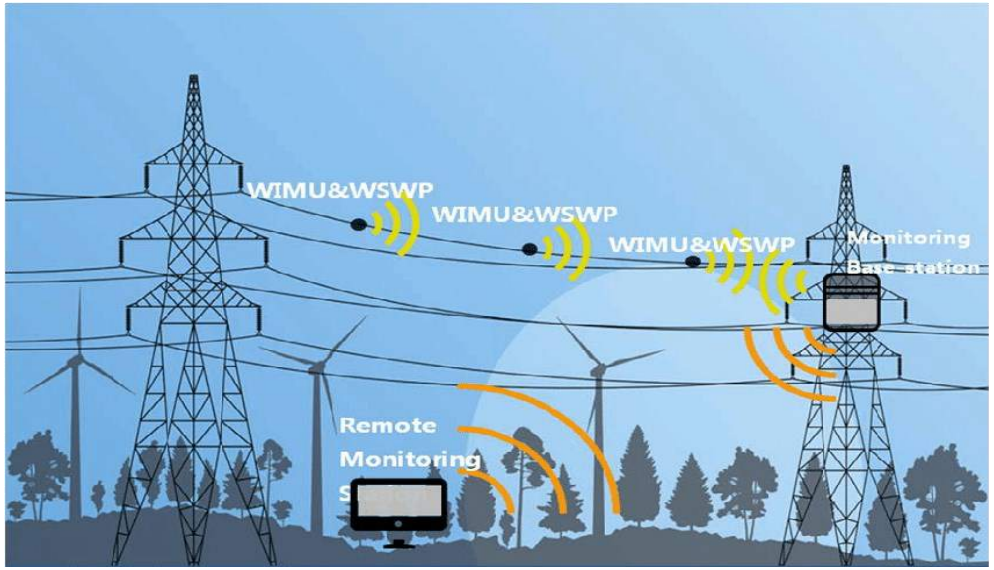
DigiTEL Smart Lines
(Condition Monitoring Systems and DLR for 23 OHL)

"Increasing capacity of interconnections and 400 kV overhead lines for more RES and nuclear generation using Smart Grid on-line monitoring systems"



Benefits

- Increasing the operational safety of the overhead lines by remote diagnosis and assessment of the technical condition based on real time data;
- Implementing the Dynamic Line Rating (DLR) concept for better use of the power transmission capacity of OHLs and to increase it depending on the real-time weather conditions;
- Providing advance warning in case of exceeding the operational limits;
- Avoiding or delaying the costs related to OHL reinforcements and modernization.

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DigiTEL Power Lines of the Future

(Tubular Towers for one 400 kV OHL)

“Pilot project - Converting the 400 kV OHL Isaccea – Tulcea Vest from single circuit to double circuit”

The benefits obtained by implementing tubular towers for the ~32 km are:

- longer lifespan;
- reduced maintenance;
- faster installation;
- reduced footprint;
- reduction in acts of vandalism.

The project will validate in the Power Transmission Grid the best-in-class technologies for:

- Digitalisation - OHL scanning by using drones;
- Asset management - OHL online monitoring systems;
- Digital competencies & design capabilities - Equipping Transelectrica’s staff with advanced equipment and devices for determining the OHL technical condition.

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DigiTEL 3D Line Vision

(LiDAR scanning, RGB and IR for grid inspection)

- The project aims to test LiDAR (Light Detection and Ranging), RGB (Red, Green, Blue) and IR (infrared) technologies as well as to evaluate the benefits of these technologies for large-scale application in the Transmission Grid;
- The objectives scanned using Drones and UAVs are 3 overhead lines 220 kV, 1 substation 220/110 kV and one 400 kV overhead line crossing the Danube river.

Benefits

- Reducing aerial inspection time and costs by up to 90%;
- Increasing safety by minimal human intervention;
- Increasing the efficiency of aerial inspections by covering a larger area, compared to classic land methods;
- Staff training on spatial data administration and operation;
- Technical support for applying standards, methodologies and good practice guides to aerial inspections.

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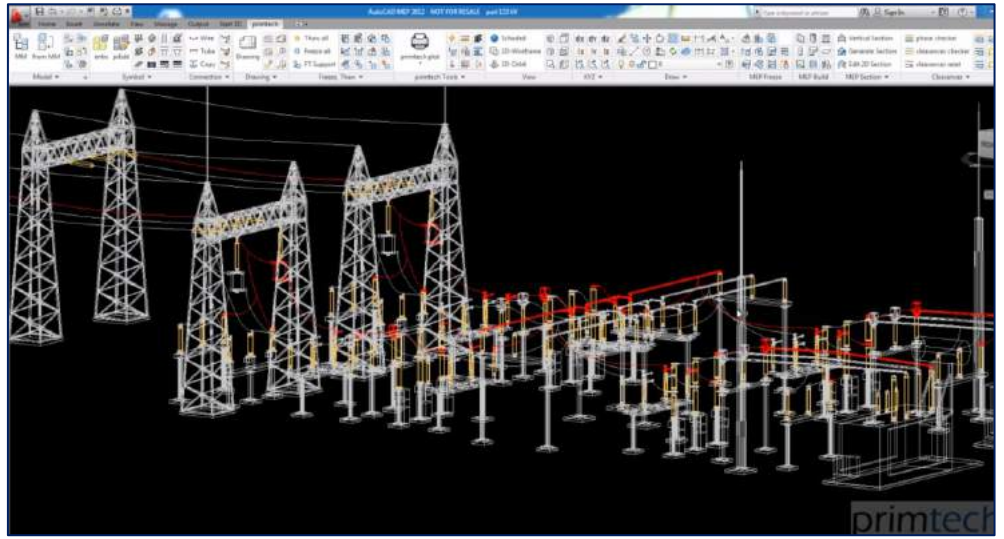
DigiTEL Next-Gen Power Grid

(Digital Twin and Drones for better operation and inspection)

“Pilot project – Substation operation optimization using Digital Twin and autonomous Drones”

- The project aims in the first phase to transform unstructured information into an intelligent digital twin asset. The system operator will be able to visualize, build and manage complex electrical systems, ensuring safe and efficient operation throughout the life cycle.
- Autonomous robotic systems will be used for the aerial inspections of the equipment from the power substations to identify potential problems.



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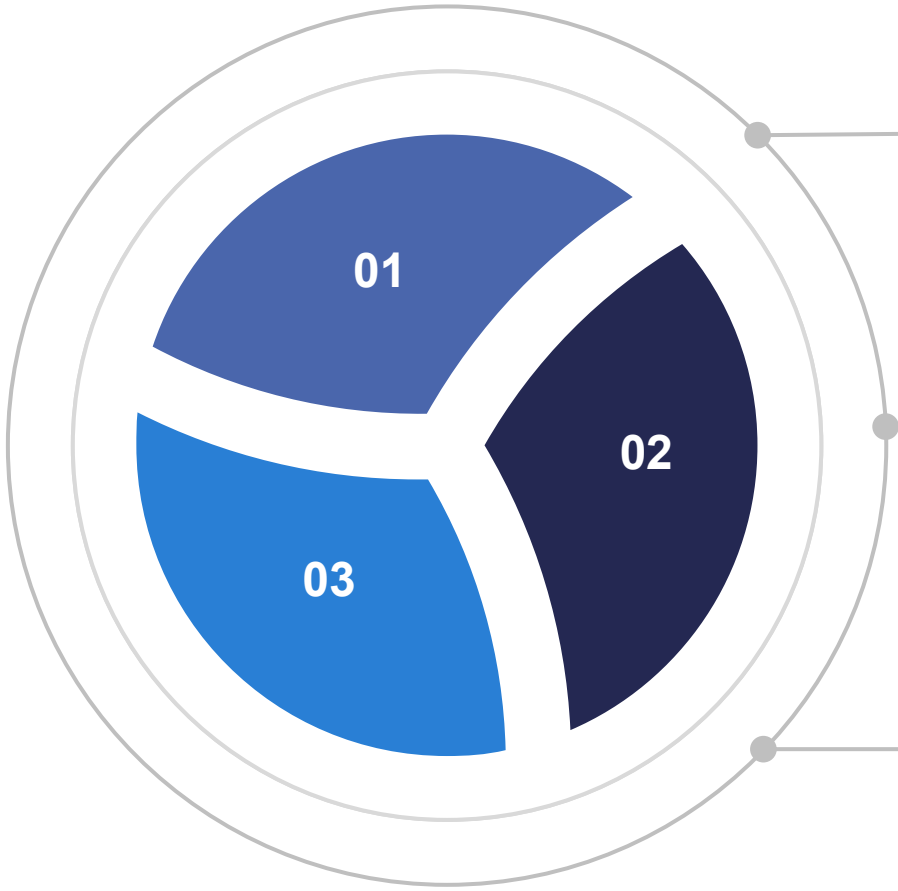
3. Conclusions



During the last years, Transelectrica has become a partner in various financed projects, through which it can make important contributions, as well as other TSOs, in this geographical area of Europe having target horizon for 2030.

Transelectrica, will also continue to focus on what is relevant in the basic activities necessary to ensure a safe energy transition, promoting innovative ideas, concepts and methodologies that allow their adoption in network operation and asset management.

The research and innovation project portfolio (DigiTEL) will positively influence the Company's long-term performance, leading to solid and sustainable growth in response to direct and indirect opportunities that could arise from national and European programs.

Thank you!

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