CESI
Shaping a Better Energy Future

Green Deal & Digitalization: A Great Opportunity

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Energy transition targets have been set all around the world, aiming at "Net-zero emissions" in the next decades…

BBC

Climate change: EU leaders set 55% target for CO2 emissions cut

EU leaders have agreed on a more ambitious goal for cutting greenhouse gases - reducing them by 55% by 2030, rather than 40%.

REUTERS

Italy says it plans to cut carbon emissions by 60% by 2030

FINANCIAL TIMES

EU unveils plan to be carbon neutral by 2050

Green deal is Europe's 'man on the moon moment', says Von der Leyen

REUTERS

Biden says U.S., Canada to work toward achieving net zero emissions by 2050

The Washington Post

Biden calls for 100 percent clean electricity by 2035.

CNN

China will become carbon neutral by 2060, Xi Jinping says

The Guardian

Theresa May commits to net zero UK carbon emissions by 2050

Accelerating EU decarbonization in light of the updated Green Deal targets: by 2030 -55% Greenhouse Gas Emissions vs 1990

The EU roadmap is targeting a 100% carbon free of human activities by 2050

2020 climate and energy package

23 April 2009

2020-2030 Energy Union Package

25 February 2015

2030 Framework for climate and energy policies

23 October 2014

Nov. 2019 Clean Energy for all Europeans package

Dec 2019

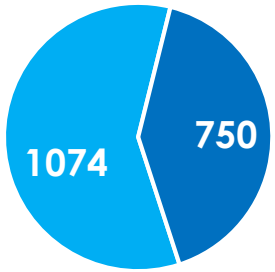
2050 Roadmap for moving to a **zero-carbon** economy

EC, Sept. 2020

2030 Targets	Old objective	Green Deal
GHG reduction vs 1990	-40%	-55%
%RES on energy consumption	32%	40%
Energy saving on consumpt.[1]	-33%	-36%

European Commission

EU Budget 2021-27



Figures in bn €

Next Generation EU

30% Climate Change

[1]Energy Savings evaluated against the 2007 Baseline projections for 2030

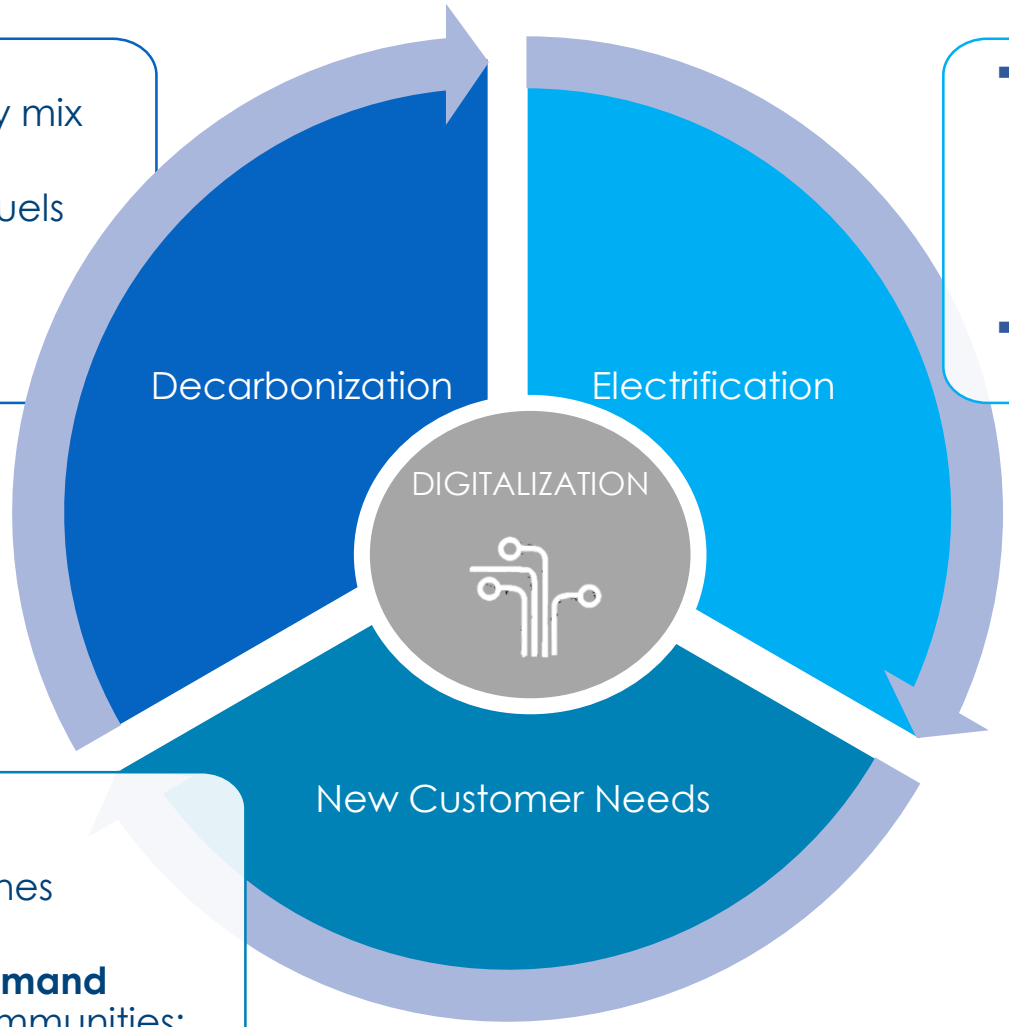
Current situation and targets for energy transition: A focus on Italy

	2020 Preliminary[1]	2030 Target PNIEC 2019	2030 Potential new target[1]
GHG reduction vs 1990	**-25%**	**-40%**	**-55%**
%RES on electric consumption	**38%**	**55%**	**70%**
%RES on energy consumption	**19%**	**30%**	**40%**

[1]Elettricità Futura estimates, Audizione parlamentare PNRR

The 3 drivers of Energy Transition, with Digitalization as a core enabler

- Increase the amount of **renewables** in the energy mix
- Substitute high emission fuels with cleaner alternatives
  → **Green Hydrogen**



- Electrify consumption to leverage the increasing amount of clean energy: sector coupling
  → **E-mobility**, Power-to-X
- Increase of **energy security** due to fuel dependence reduction

- Customized services development with sustainable approaches
- **Energy efficiency**; **Demand Response**; Energy communities; DERs; Blockchain

Energy Transition boosted by Innovation

Innovation could be categorized within 4 main dimensions

Technologies

- Storage
- EV Smart charging
- RES power-to-heat
- RES power-to-hydrogen
- IoT
- Big Data
- Blockchain
- Microgrids
- Supergrids
- Flexibility in conventional power plants

Business Models

- Aggregators
- Peer-to-peer trading
- Energy-as-a-service
- Energy Communities
- Pay-as-you-go models
- Regulated / Merchant model

Market Design

- Higher time and space granularity in energy markets
- New ancillary services
- Capacity markets
- Regional markets
- Time-of-use tariffs
- Market integration of DERs
- Net billing schemes

Operations

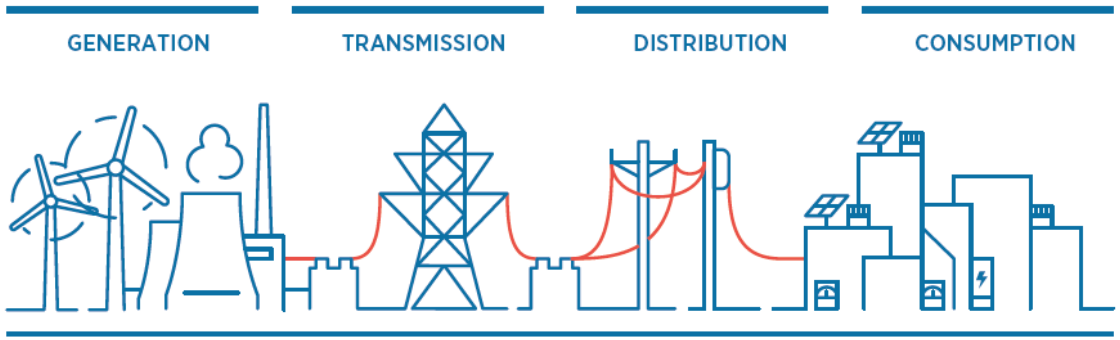
- New role of DSOs
- Cooperation TSOs-DSOs
- Advanced forecasting of variable RES
- Innovative operation of pumped hydropower
- Virtual power lines
- Dynamic line rating

IoT: 75 bn
connected electrical devices worldwide by 2025

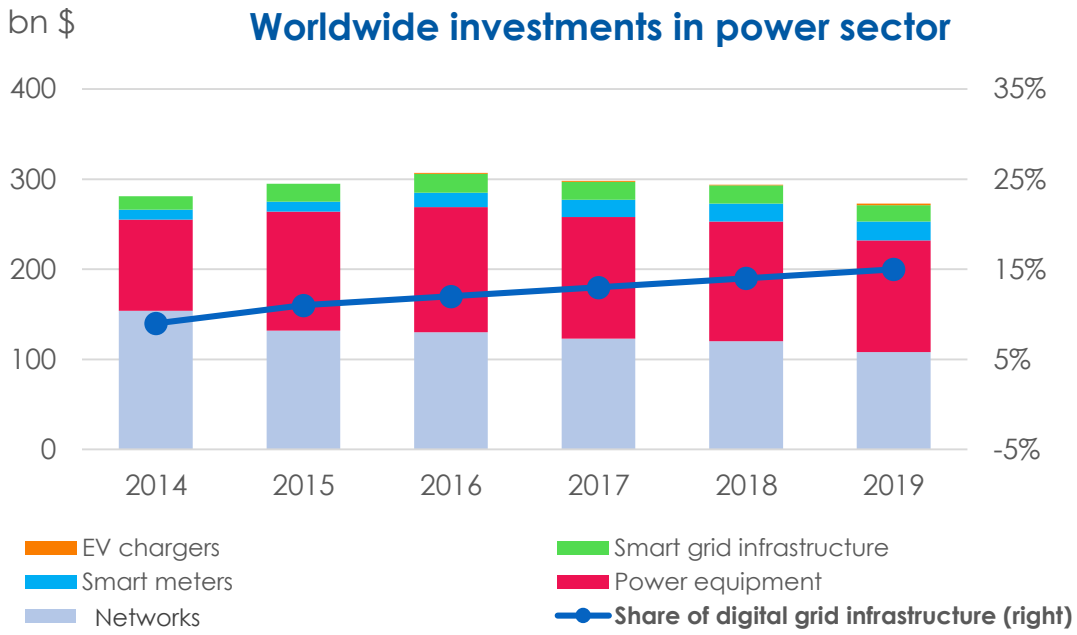
DIGITALIZATION is the cross enabler along the electric value chain to accelerate the Energy Transition

Source: IRENA

Digitalization is the cross enabler along the electric value chain to accelerate the Energy Transition

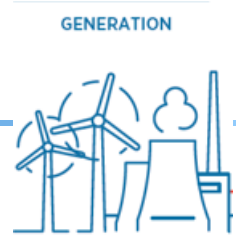


	GENERATION	TRANSMISSION	DISTRIBUTION	CONSUMPTION
CURRENT STAGE OF DIGITALISATION	Moderate	Advanced	Moderate	Early stage
NEXT STEPS	Modernising power plants, automatic grid controls	Advanced algorithms for optimised operations	Full automation for grid stability, optimisation	Fast-acting aggregated demand response, virtual power plants
DIGITAL APPLICATIONS	Predictive maintenance			Operate microgrids, enable peer-to-peer transactions
	Renewable energy forecasting and trading	Maintain grid stability and reliability		
			Managing distributed energy resources assets for balancing the grid and defer grid investments	Automated energy demand management
	Enhanced flexibility through automation control			Energy efficiency



Source: IRENA; IEA; CESI

Digitalization to make V-RES generation more flexible

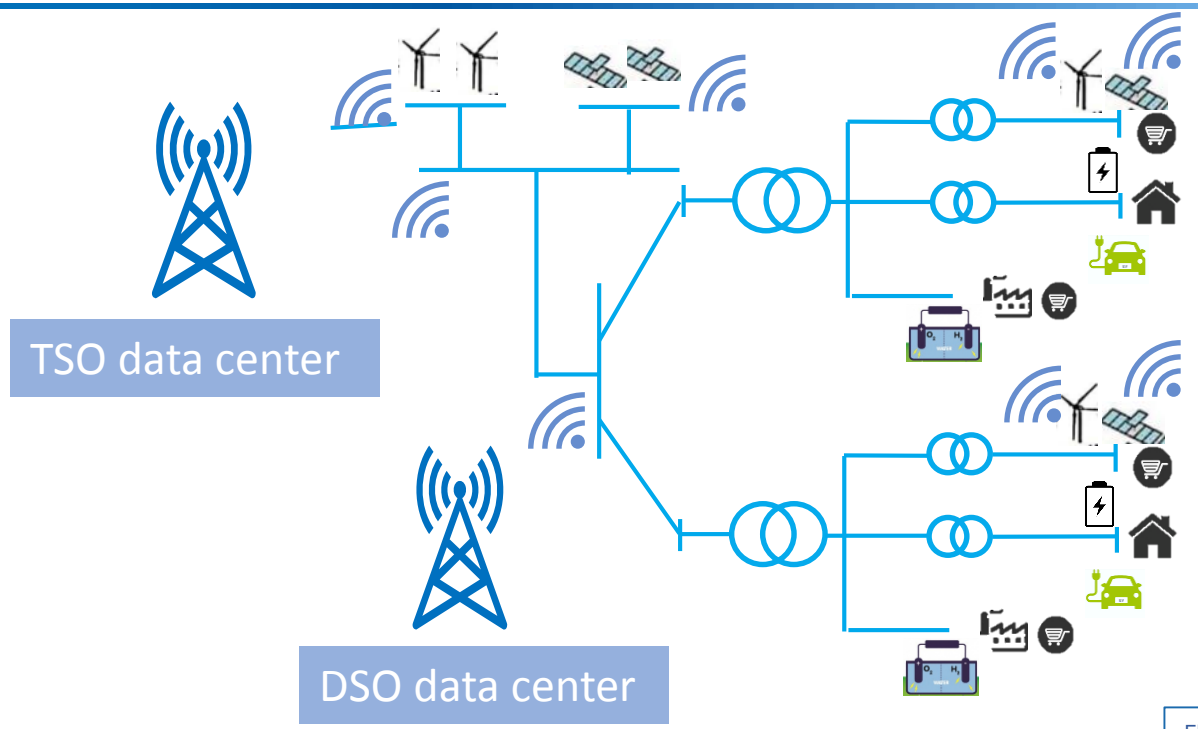


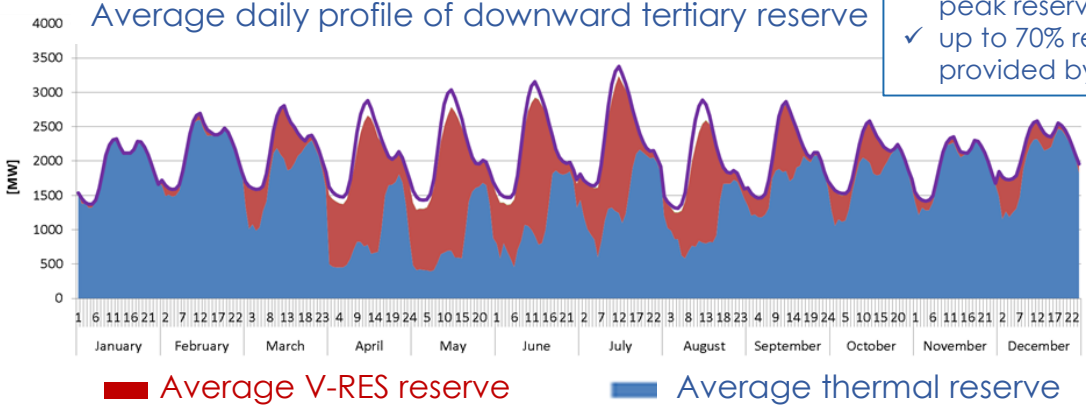
- **Real time data exchange** of V-RES generation at all voltage levels
- **TSO/DSOs data interactions**

- **Enhanced flexibility of V-RES generation** allowing to:
  - ✓ Cope with intermittency of primary RES and demand
  - ✓ Supply ancillary services

V-RES seen a **flexibility system resource** thanks to advanced Telco and Data Exchange architecture *(e.g.: tertiary reserve and balancing provided by V-RES units)*

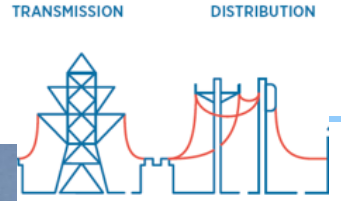
Outstanding benefits from flexible V-RES, but need for an appropriate market design





Flexible V-RES:
- ✓ up to10% reduced peak reserve
- ✓ up to 70% reserve provided by V-RES

Digitalization to improve performances of infrastructures

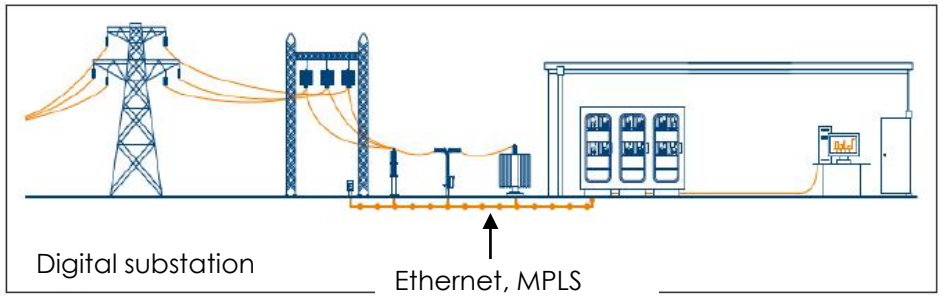


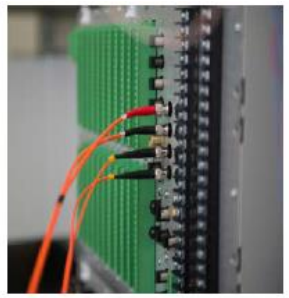
➢ Transmission: Wide Area Monitoring & Control

- ✓ Enhance grid monitoring and control by leveraging on data availability and data-driven decision making
- ✓ Enhance asset monitoring by leveraging on predictive maintenance algorithms

➢ Digital Substation

Enabler to increase safety & reliability while reducing costs and environment footprint

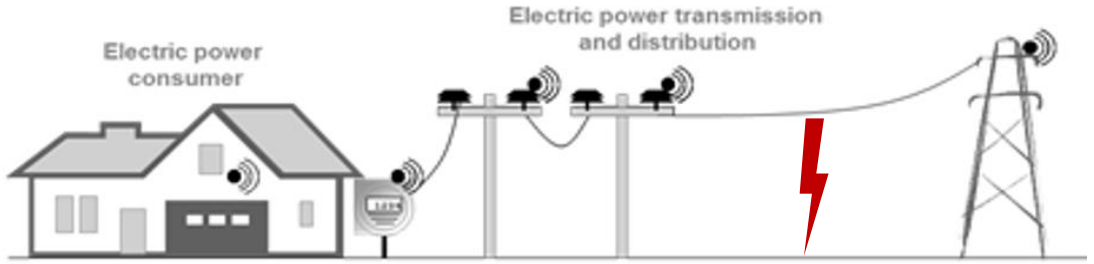




Source: ABB

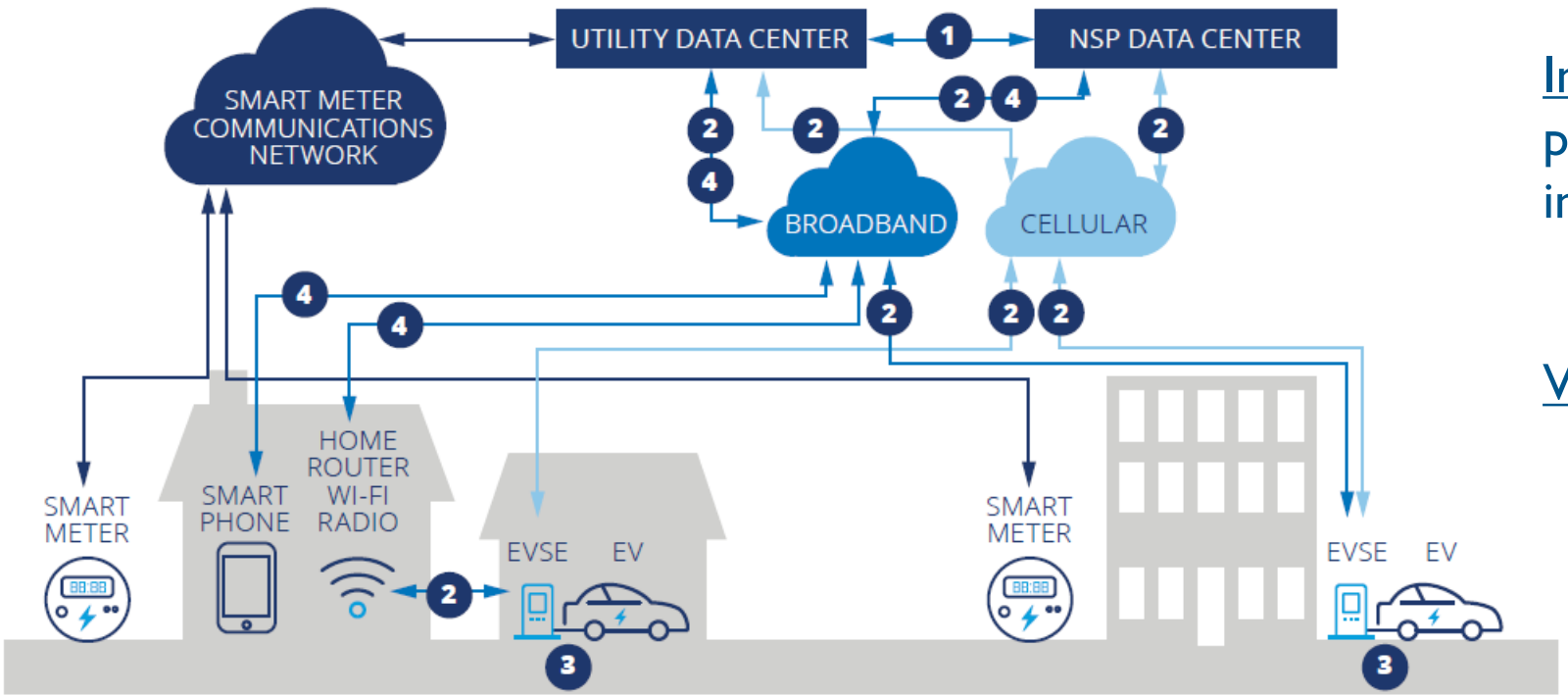
➢ Distribution: Monitoring, Fault Detection and Self – Healing

- ✓ Enhancing operating security
- ✓ Fast supply restoration after faults → improvement of main key performance indicators (SAIDI, SAIFI, CAIDI)
- ✓ Implementing protection algorithms previously verified through simulations



Implementation of a monitoring system through distributed devices paving way to a **fully digitalization of the LV grid** and the implementation of automation procedures based on "*information exchange among fault detectors*"

Digitalization as cross-sectorial enabler: smart meters & e-mobility



Source: Siemens, EV Technical Workshop, NY Public Service Commission, July 2018.

Italy: 6 million EV by 2030 → 24 TWh* of yearly energy consumption (i.e. ≈ 7% of total demand)
→ 4 GW** power peak absorption

Need for an intelligent VGI since the beginning of EVSE deployment

Intelligent EV integration will turn a potential threat to the power system into an opportunity.

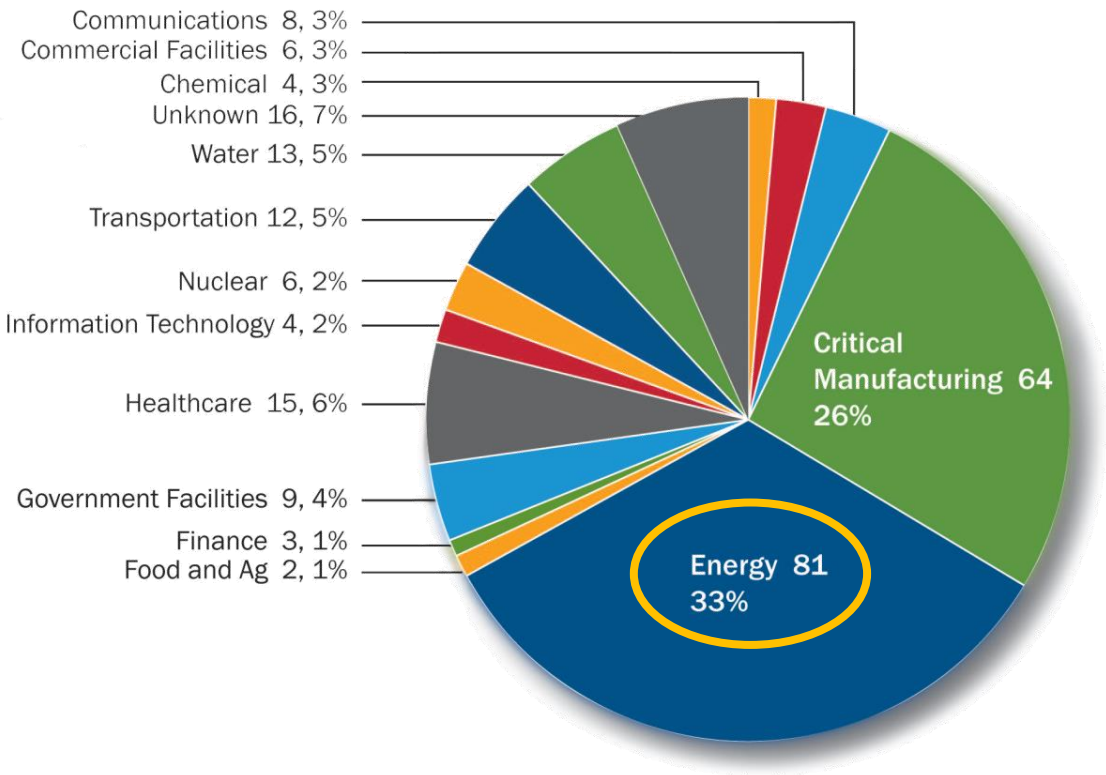
Vehicle Grid Integration providing:

- **Balancing Services**
- **Demand Response**
- **Capacity**

*Assumption: 20000 km/year with consumption of 0.2 kWh/km
** Assumption: power of charging boot equal to 7.4 kW and contemporaneity factor 10%

Pervasive digitalisation: handle with care – Cyber security challenges

- **US**: the **Industrial Control Systems Cyber Emergency Response Team** (ICS-CERT) received and responded to 240+ incidents reported by its associates who own industries and critical infrastructures.



Source: https://ics-cert.us-cert.gov/sites/default/files/Monitors/ICS-CERT_Monitor_Sep2014-Feb2015.pdf

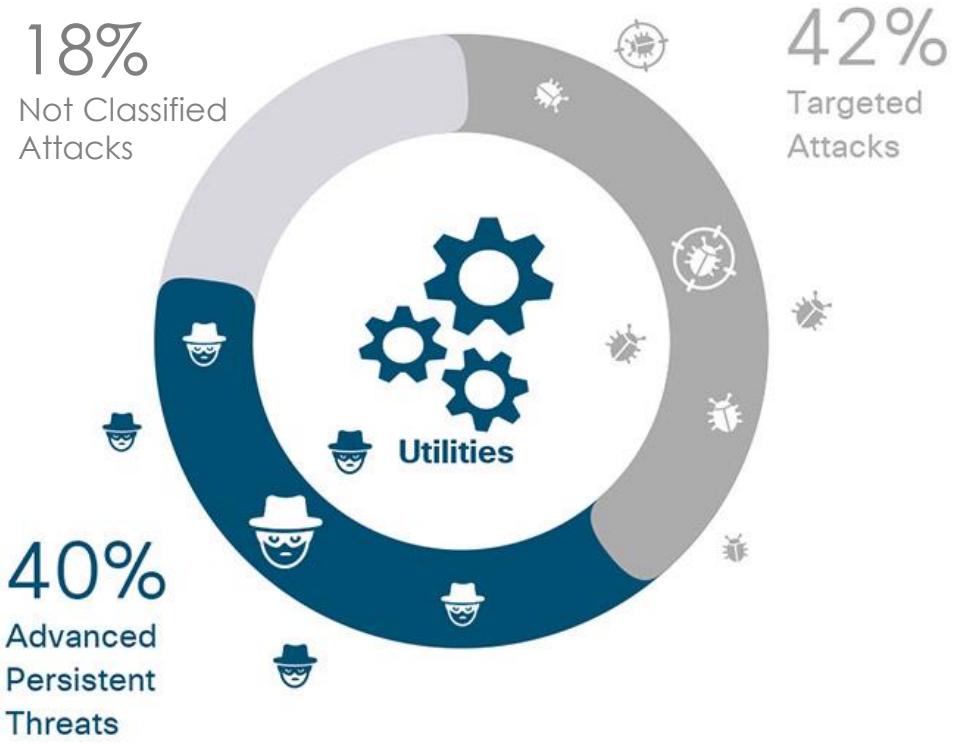
- **EU**: the **EU Energy Expert Cyber Security Platform** (EECSP) identified the main cybersecurity challenges for the Energy sector

No.	Challenge	Electricity	Oil	Gas	Nuclear
1	Grid stability in a cross-border interconnected energy network.	x		x	x
2	Protection concepts reflecting current threats and risks.	x	x	x	x
3	Handling of cyber attacks within the EU.	x	x	x	x
4	Effects by cyber attacks not fully considered in the design rules of an existing power grid or nuclear facility	x			x
5	Introduction of new highly interconnected technologies and services.	x		x	
6	Outsourcing of infrastructures and services.	x		x	x
7	Integrity of components used in energy systems.	x		x	x
8	Increased interdependency among market players.	x			
9	Availability of human resources and their competences.	x	x	x	x
10	Constraints imposed by cyber security measures in contrast to real-time/availability requirements.	x		x	x

Reasons for Cyber Attacks Detected in the Electrical Sector

Electric utilities and related **critical infrastructures** have been the subject of many and varied cyber attacks

- The data stolen from companies seems to some extent aimed at **mapping critical infrastructures** and collecting detailed information about them to create databases
- If not adequately detected and contained, the cyber threats go on for a long time (**APT - Advanced Persistent Threats**) and involve components, networks, plants, monitoring systems and information relating to employees
- The stolen data make it possible to **reconstruct the operating criteria** of companies, exposing them to ever greater risks
- Most of the time, the attacks are aimed **at finding information rather than causing blackouts** on the network



Source: CISCO 2017 – Security Capabilities Benchmark Study

Concluding remarks and key messages

- **Digitalization as the key enabler for the Energy Transition**
- **Energy Transition boosted by four dimensions of Innovation**
- **Highly digitalized power sector at all levels to exploit the full potential of RES**
- **Full digitalization of power sector and newly electrified sectors shall be pursued adopting the best practices to minimize vulnerability against cyber attacks**

Thank you for your attention!