R2D2

Reliability, Resilience and Defense technology for the grid

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etra I+D

elpros

SCC

Cyber Noesis

GRUPO Anticipating a cyber secure world

guardtime

ICCS

ems services

HEDNO

Elektro Ljubljana Obnovljivi viri energije

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Fortifying the Future: How EU R&D Projects can Shape Standards and Policies in Critical Infrastructure Protection

10.12.2024

Regulation and legislation outlook in power systems as critical infrastructure: findings from R²D² project

UKIM / Aleksandra Krkoleva Mateska

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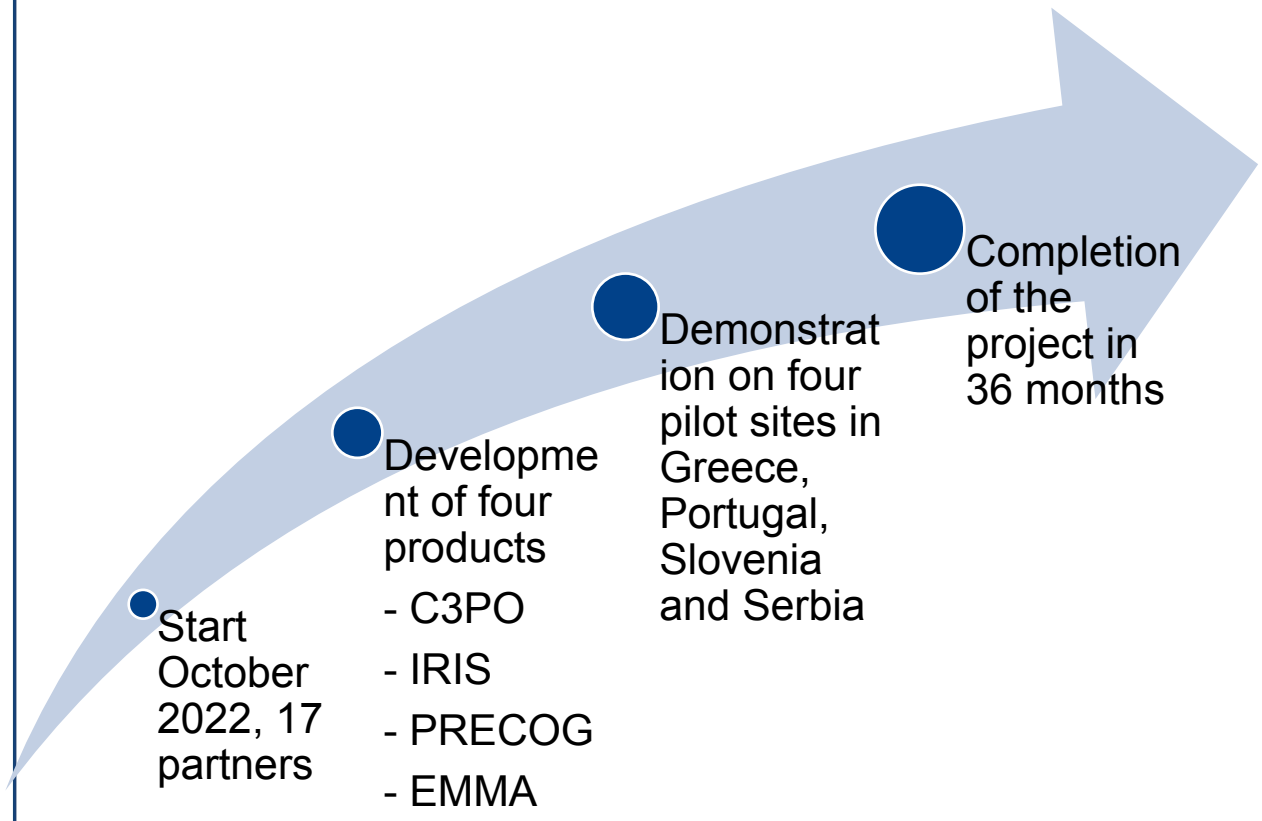
Reliability, Resilience and Defense technology for the grid

R²D² Project overview

- R²D² is an Innovation Action project, funded by the Horizon Europe programme



C3PO

Multi-risk assessment framework for power system contributes to a systematic approach for evaluating energy system security strategy

IRIS

Resilience suite for TSO & DSO is used to improve coordination between system operators for security reasons

PRECOG

Prevention Systems For Energy Infrastructures Security provides a cybersecurity framework to Operational Technology (OT) and Information Technology (IT)

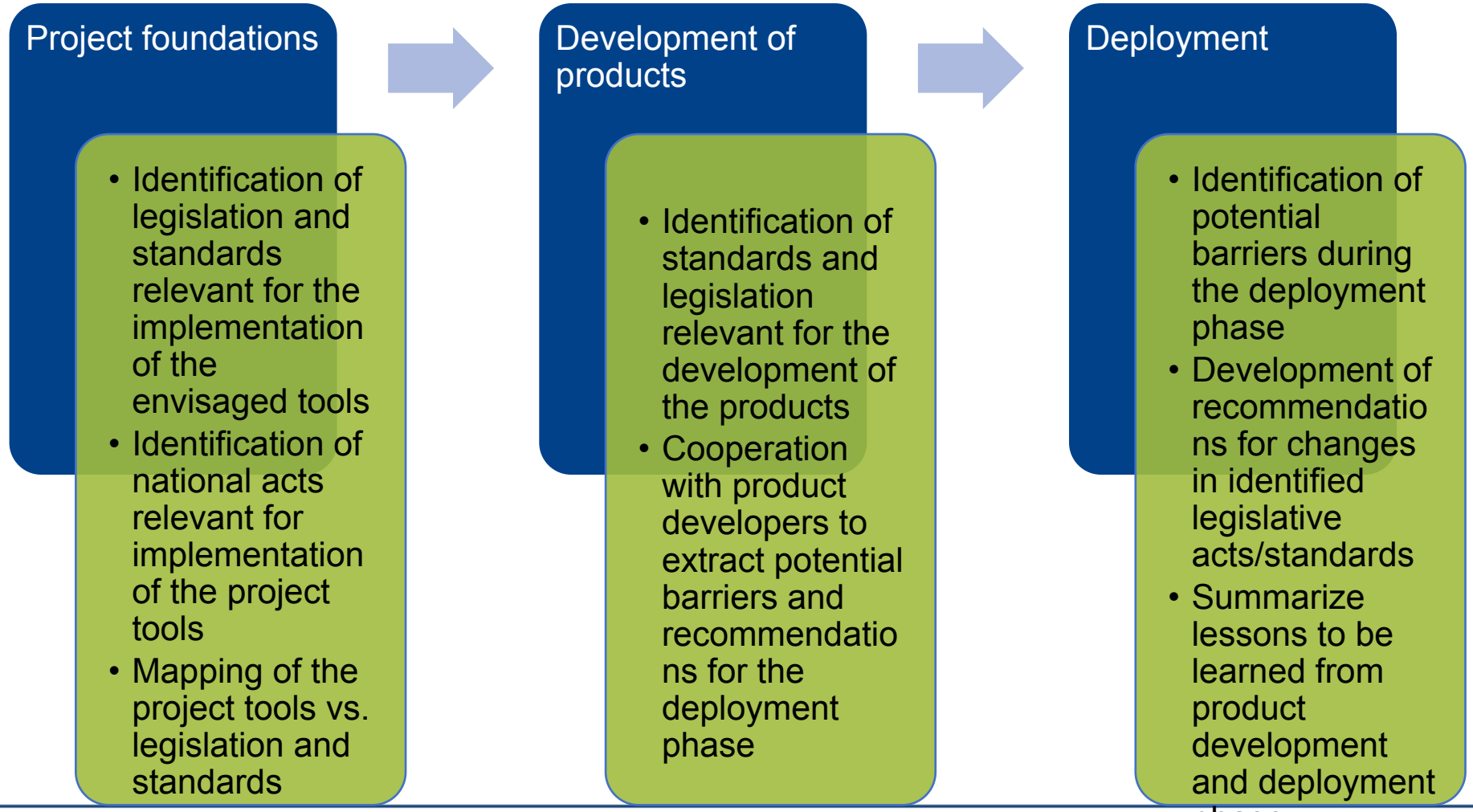
EMMA

Enhanced Assets Maintenance And Management Toolkit contributes to the reliability of the physical assets and to expedite a faster grid recovery

R²D² Project overview

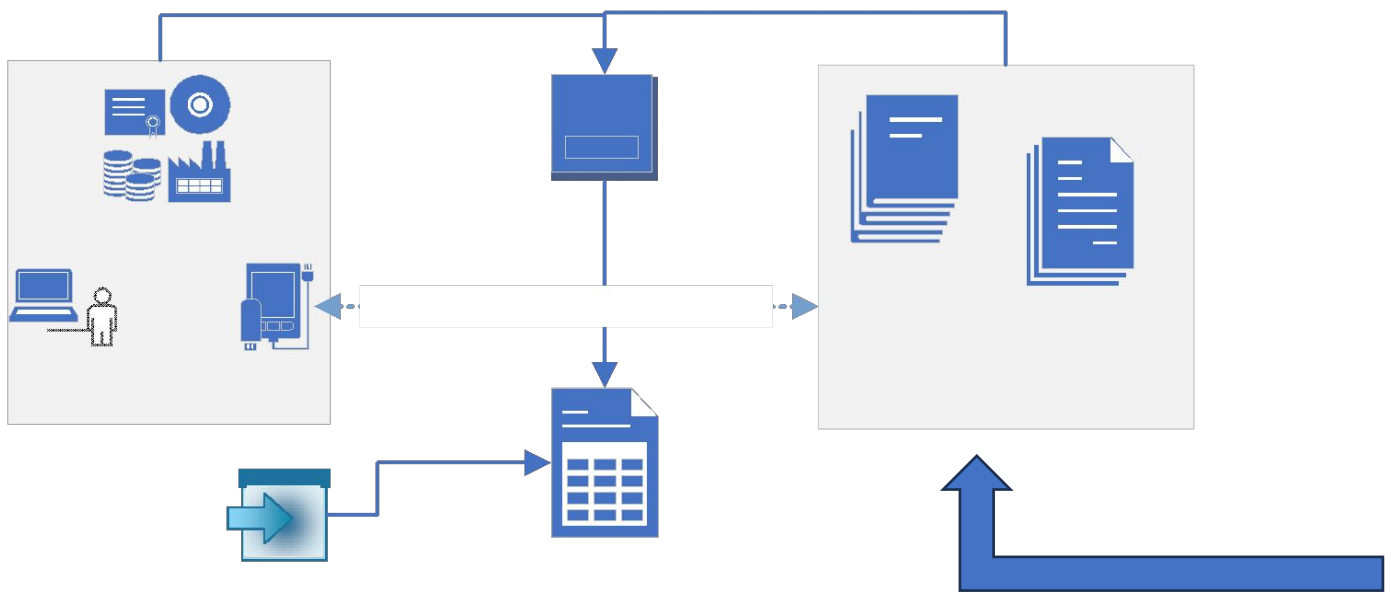
- Project aims
  - Improve the resilience and reliability of current Electrical Power and Energy Systems (EPES) against a growing number of threats and vulnerabilities that may affect such critical infrastructure.
  - Prevent and mitigate technical, cyber and physical risks that may expose weaknesses in the electric infrastructures with harmful and damaging effects on different stakeholders and final customers
  - Deploy four tools dedicated to the prevention, protection and restoration of EPES in two different and independent, but complementary scenarios in the energy value-chain – from regional coordination between TSOs, to privacy of LV customers.

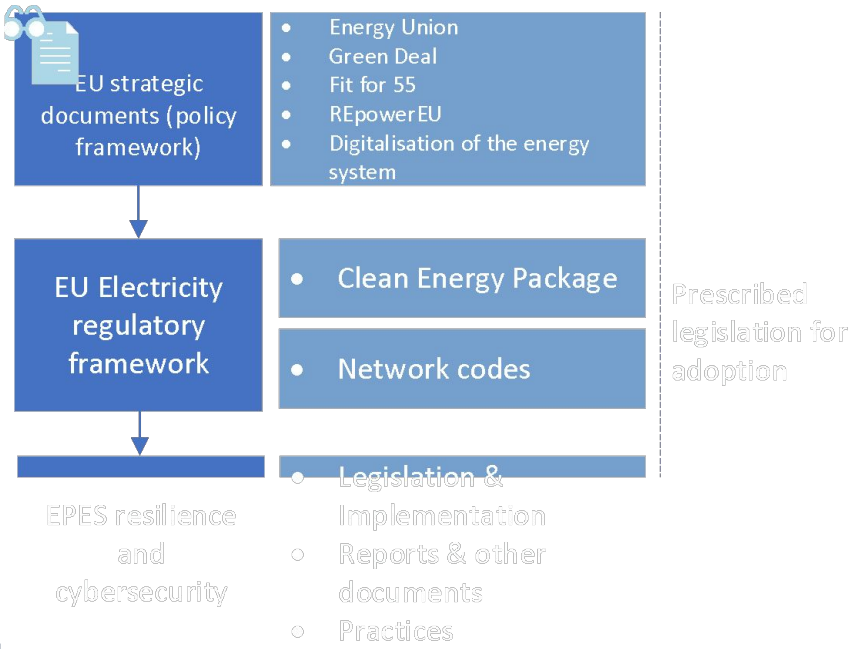
Legislation and standardisation activities



Methodology

- Cooperative approach to describe Project pilot sites, including legislative and normative documents



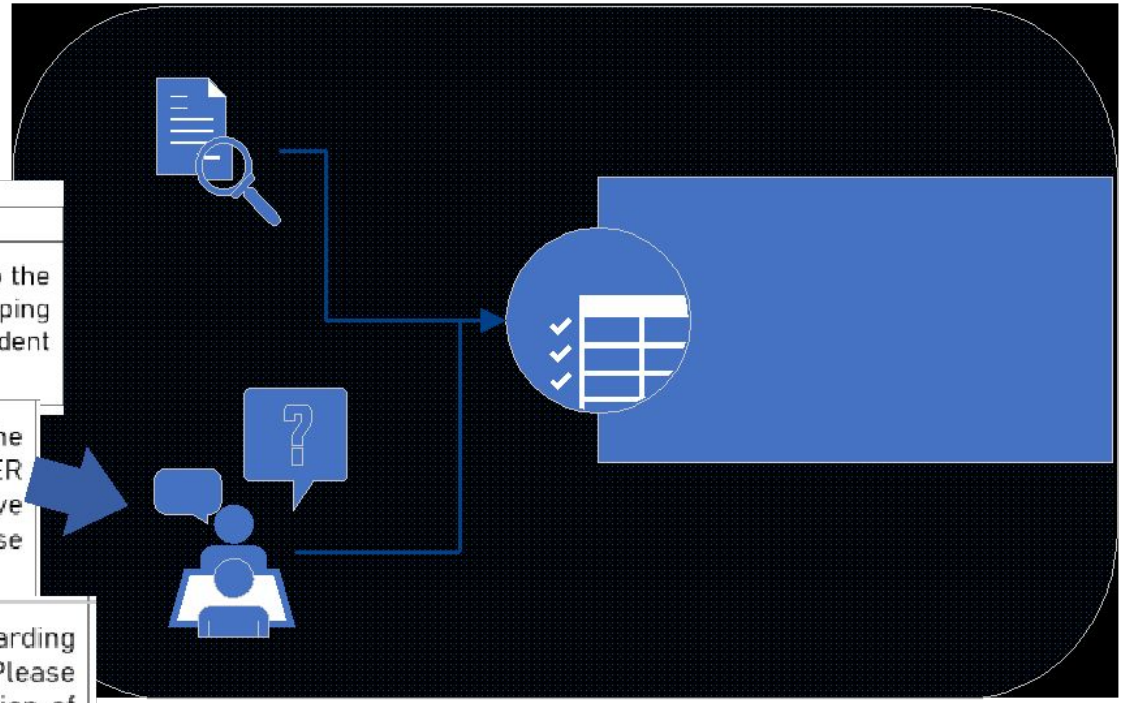


Smart Grid security set of standards	Other relevant security standards (ISA/IEC, IEEE.)
Supply chain cybersecurity frameworks	Cybersecurity frameworks, guidelines and recommendations

Outcome

- Mapping of R^2D^2 Use Cases and products to legislation and normative documents which serve as reference for the next phase of the project
- Detailed pilot site description with relevant legislation and normative frameworks in place

No.	Question
1	Have the requirements for critical entities according to the CER Directive (2022/2557) been considered when developing UCs 20, 22 and 23? Please describe the current incident notification procedure.
2	Performing regular risk assessment is among the obligations for critical entities emerging from the CER Directive. Are there any risk assessment studies that have been considered in the development of UC22 and 23? Please provide a brief description and reference.
3	Are there any national rules (including DSO NC) regarding cascading effects in case of extreme weather events. Please describe briefly. Will they influence the implementation of UC 22, 23 and 29.



Methodology

- Cooperative approach to uncover potential barriers during product development phase

Development of products phase

Outcomes

C3PO tools

General Questions for the Product		Contr. to Digitalizing the Energy System – EU Action Plan		Questions	Cyber risk assessment	OPDE	Dyn. cyber risk assessment	Spatial and temp. modelling	Resilience driven investment	O & P of advanced ME microgrid	Cyber threat intelligence	Knowledge sharing – casc. events
Cybersecurity certification?	1	Digitalized, green and resilient Energy System	1	Is the legislation relevant?	1	1	1	1	1	1	1	1
Update of security capability.?	2	EU framework for sharing data – inn. services	2	Point out specific parts of leg.!	2	2	2	2	2	2	2	2
Guide for vuln. management?	3	Promoting investments in digital electricity infrastructure	3	Were there challenges to comply with legislation?	3	3	3	3	3	3	3	3
Contribution to incident reporting (NIS2)?	4	Strengthening cybersecurity and resilience in the energy system	4	Have the regulations helped?	4	4	4	4	4	4	4	4
Cybersecurity risk-management measures	5			Security by design been considered?	5	5	5	5	5	5	5	5
				Identified gaps in reg. framework?	6	6	6	6	6	6	6	6
				Proposals for identified gaps:	7	7	7	7	7	7	7	7
					1	1	1	1	1	1	1	1
					2	2	2	2	2	2	2	2
					3	3	3	3	3	3	3	3
					4	4	4	4	4	4	4	4
					5	5		5		5	5	5

General questions

Specific questions

Identified challenges and recommendations

Outcomes

- C3PO – example of general recommendations

  Further cooperation with product developers is required to develop condensed recommendations related to **power system planning to increase its resilience**

C3PO tools	Challenges & recommendations
Spatial and temporal modelling of cascading events & quantification of cascading physical events	• Existing regulatory frameworks do not explicitly describe how **resilience should be clearly integrated as an operational/ planning criterion** in power systems. • More coordination between regulatory authorities and industrial/academic communities to showcase how this can be done.
Resilience-driven investment and operational planning to mitigate or prevent cascading effects	
Operation and Planning of Advanced Multi-Energy Microgrids for Enhancement of Resilience	• Legislation and standards on **microgrids** are required to allow for wider application (beyond pilot and specific deployments)

Development of products phase

Outcomes

IRIS tools

General Questions for the Product		Contr. to Digitalizing the Energy System – EU Action Plan		Questions	TSO/DSO - cong. PQ coor. sys. services	TSO/DSO coop. crisis	LV network observability	DER control - flex. procurement	Overfreq. Protection Module	Ph. angles monitoring - instability	Opt. of PMU installation	ER -system split mod. upgrade	Remedeial action automation	TSO/DSO coop IGM	TSO/DSO planning coor. suite
Cybersecurity certification?	1	Digitalized, green and resilient Energy System	1	Is the legislation relevant?	1	1	1	1	1	1	1	1	1	1	1
Interoperability of modules?	2	EU framework for sharing data – inn. services	2	Point out specific parts of legislation!	2	2	2	2	2	2	2	2	2	2	2
Tech., security and org. measures (CER)?	3	Promoting investments in digital electricity infrastructure	3	Were there challenges to comply with legislation?	3	3	3	3	3	3	3	3	3	3	3
Contribution to incident notofocation (CER)?	4	Strengthening cybersecurity and resilience in the energy system	4	Have the regulations helped?	4	4	4	4	4	4	4	4	4	4	4
Relevant standards	5			Security by design been considered?	5	5	5	5	5	5	5	5	5	5	5
				Identified gaps in reg. framework?	6	6	6	6	6	6	6	6	6	6	6
				Proposals for identified gaps.	7	7	7	7	7	7	7	7	7	7	7
					1	1	1	1	1	1		1	1	1	1
					2	2	2	2	2	2		2	2	2	2
					3	3	3	3	3	3		3	3	3	3
					4	4	4	4		4		4	4	4	4
					5	5	5	5				5	5		5
							6	6				6	6		6

General questions

Specific questions

Identified challenges and recommendations

Outcomes

- IRIS – example of recommendations

  The recommendations point to the needs to **reconsider planning processes at distribution level** to optimize the use of distributed energy resources (DERs) and use them adequately to **increase resilience of essential entities (DSOs and TSOs)**

IRIS tools	Challenges & recommendations
TSO-DSO planning coordination suites	• Take into account aspects that have not been recognized in the existing standards such as the separation between essential and non-essential loads. • Limited visibility, data and control access to DERs is still a planning and operational challenge - **DERs are not yet adequately considered in distribution and transmission planning** • The flexibility from DERs should be considered in grid codes and security standards and supported by appropriate market frameworks to enable the system value of those services to be remunerated

Outcomes

- IRIS – example of recommendations

  Specific recommendations to improve relations and context of existing network codes (NCs), in this case the Emergency and Restoration NC and System Operation Guidelines

IRIS tools	Challenges & recommendations
Emergency & Restoration – Over-Frequency Protection	• NC ER(Art. 16.3): 'The TSO shall establish the maximum size of the steps for disconnection of power generating modules and/or of HVDC systems in consultation with the other TSOs of its synchronous area.' It is assumed that this should be done through Synchronous Area Operation Agreement. However, SO GL defines the contents of the Synchronous Area Operational Agreement (Art. 118) without reference to NC ER Art. 16. • In Art. 118 of the SOGL, **add a reference to Art. 16 NC ER regarding** the maximum size of the steps for disconnection of power generating modules and/or of HVDC systems to be agreed among TSOs of a synchronous area

Outcomes

- IRIS – example of recommendations

  A gap has been observed as absence of obligation to introduce real-time monitoring when problems with stability are observed. Actual recommendations for updates of SOGL are introduced.

IRIS tools	Challenges & recommendations
Phasor angles monitoring and prevention of instability	• The tool is one step ahead of the regulatory requirements, as it introduces stability monitoring in real time, and not only through off-line simulations. The gap is the **absence of obligation to introduce real-time monitoring when off-line studies detect possible problems with stability.** • In Art. 39 of the SOGL (Dynamic stability management), a provision can be added that the TSO should introduce real-time monitoring when off-line studies indicate a certain problem with stability. In Article 25 SO GL (Operational security limits) optional limits resulting from stability calculations (e.g. angular difference) can be added.

Methodology

Follow the same approach as in Product development phase

- Develop questionnaires to follow the implementation of each product to the designated site and capture:
  - Product developers' challenges
  - **End-users (TSO/DSO) challenges**
- **Focus on the implementational challenges of the CER Directive and the NIS 2 Directive**
  - Identify the challenges of end-users and how these challenges are overcome by the deployment of R^2D^2 products.

Outcome – recommendations and lessons learned from deployment phase

Conclusions

- The R^2D^2 project continuously takes into account the legislative and normative frameworks developments and uses consistent methodology to identify challenges and provide recommendations
- The following observations have been made during the product development phase:
  - Resilience should be integrated as planning/operating criteria in power systems
  - Improved methodologies for distribution networks planning are required to allow for improved observability and control of distributed energy resources and consequently improve the resilience of these networks
  - Lack of legislation and standards related to Microgrids integration
  - Proposals for existing regulations related to transmission systems operation (concrete proposals to align NC ER and SOGL in relation to over frequency protection, to expand/amend SOGL with regards to dynamic stability, cost sharing of remedial actions with cross-border impact)
- The lessons learned throughout the process will be introduced in the R^2D^2 project Handbook

THANK YOU!

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