Incentive on connection with Flexible access – 1st Workshop

Workshop 1 – 23/02/2024

23.02.2024 | Elia

Part I

1. Context and Encountered Challenges
2. CREG Incentive and Feedback of Public Consultation on Flexible Access
3. Ongoing and Already Launched Actions

Part II

4. Main Principles of Proposed Vision (Target Model)
5. Integration of Grid User Flexibility in Long Term Grid Planning
6. Temporary Period for Earlier Grid User connection
7. Questions ?
8. Next steps

Appendix: Grid Operation & Grid Planning Concepts

1. Context and encountered challenges

Why are Flexible Access becoming more relevant to facilitate the energy transition ?

Clear ambitions…

2021

FIT FOR 55

Increased decarbonization

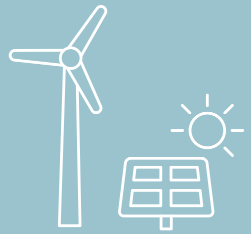
-55%

in 2030 (compared with 1990)

2022

REPowerEU

More renewables



Accelerated expansion of renewable energy resources & infrastructure

2023

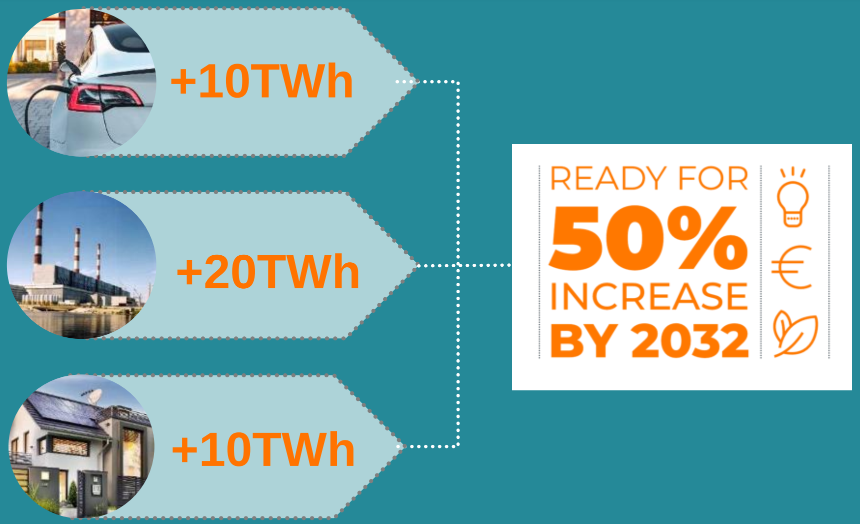
Green Deal Industrial Plan

More investments

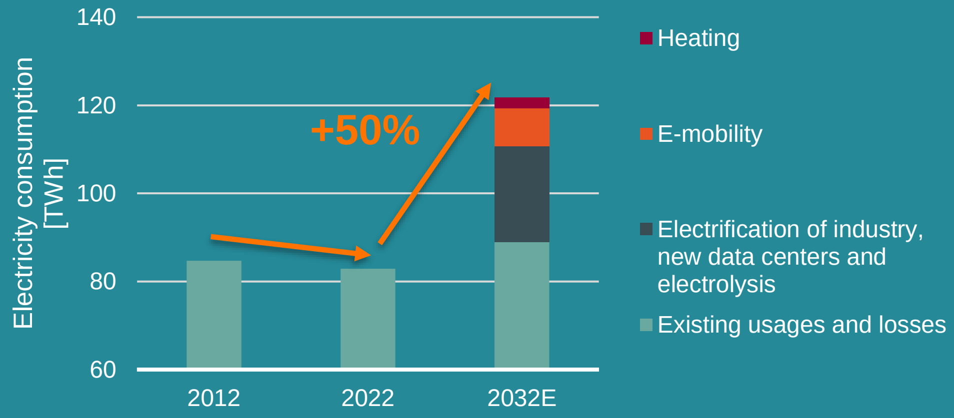
Anchoring Europe's net zero industry

The energy transition implies an important electrification of demand and integration of renewables

Consumption



Expected electricity consumption in Belgium



Production

Solar PV

x2.2

In 2032

Onshore Wind

x2.1

In 2032

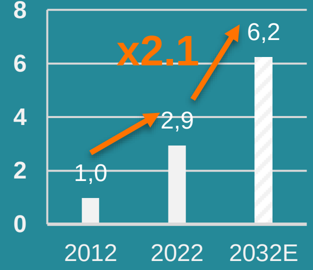
Offshore Wind

x2.5

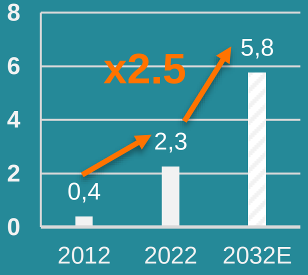
In 2032

Solar PV capacity in GW

Onshore wind capacity in GW



Offshore wind capacity in GW



Source: Central scenario Adequacy & flexibility study

In this Energy Transition context, Elia must provide a robust and fit-for-purpose power grid to Belgian society, striving for a techno-economical optimum for the whole society

- The **Grid** must be **developed** in order to meet the **Belgian** and **European** objectives of **renewables integration**, **electrification of demand** and **market integration** while being
  - Robust and reliable
  - Affordable (techno-economical optimum for society)
  - Sustainable

- To reach this purpose, the TSO proposes appropriate **grid reinforcement projects** striving for a **techno-economic optimum for the society**
  - The costs of these projects are translated into the grid tariffs – and are therefore socialized

Significant Grid investments are planned in order to enable market coupling, RES integration and electrification of demand – zoom on Backbone

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Green Substations

On the road to a net zero society

Expansion and integration of the offshore grid

- A Prinses Elisabeth eiland MOG 2 — 27-29
- B Nautilus — 2030
- C Triton Link — 31-32
- Q Offshore Energy Hub — 2035
- D Lange termijn projecten — >2035
  - 3e Hybride interconnector
  - Naar 8 GW HEB North sea

Further development of onshore interconnection

- E Versterking van de as Lonny-Achène-Gramme — 30-32
- F Versterking van de as Van Eyck - Maasbracht — 32-34
- G 2e HVDC link met Duitsland — 37-38
- Lange termijn projecten — >2035
  - Onderzoek alle grenzen
  - P België-Luxemburg — 2040

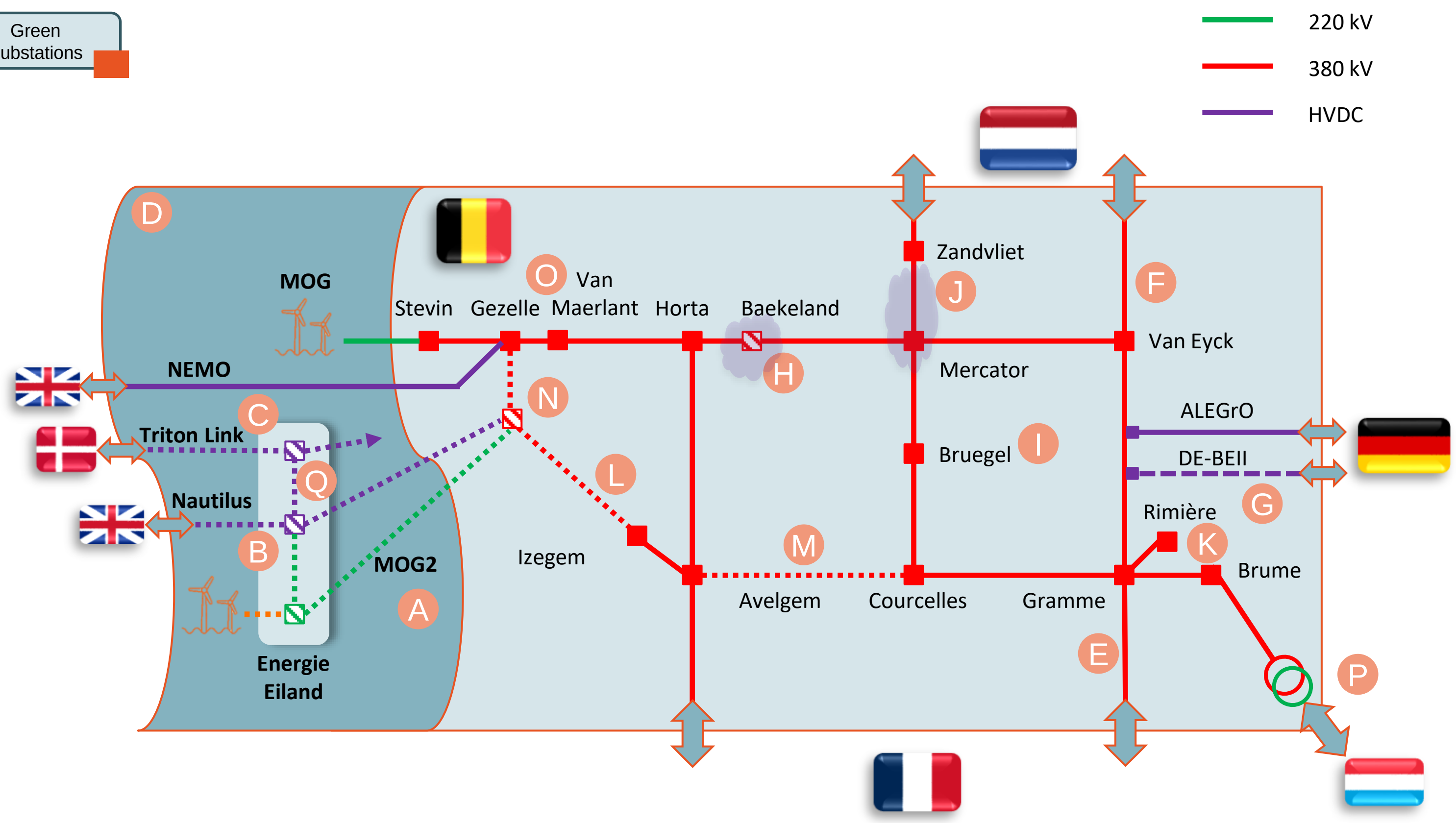
Creation of hosting capacity

- H Nieuwe Posten 380 kV
- Nieuwe transformatiecapaciteit
- Aansluiting netgebruikers

Interne backbone

Optimaliseren bestaand potentieel	Realisatie van ontbrekende schakels	Verzekeren van de systeemstabiliteit	Verzekeren van de systeemflexibiliteit
I Interne backbone versterking centrum-Oost	L Ventilus — 28-30	Spanningsregelende middelen	CCMD
J Interne backbone versterking Antwerpen	M Boucle Du Hainaut — 29-30	N Synchrone Compensatoren — 28-30	Flex in Market
K Interne backbone versterking Zuid-Oost	O Verdere uitbouw Gezelle – Van Maerlant — ~2035		Fiber Everywhere
Plaatsing Dynamic Line rating	Bijkomende Corridors — TBD		Artificial Intelligence

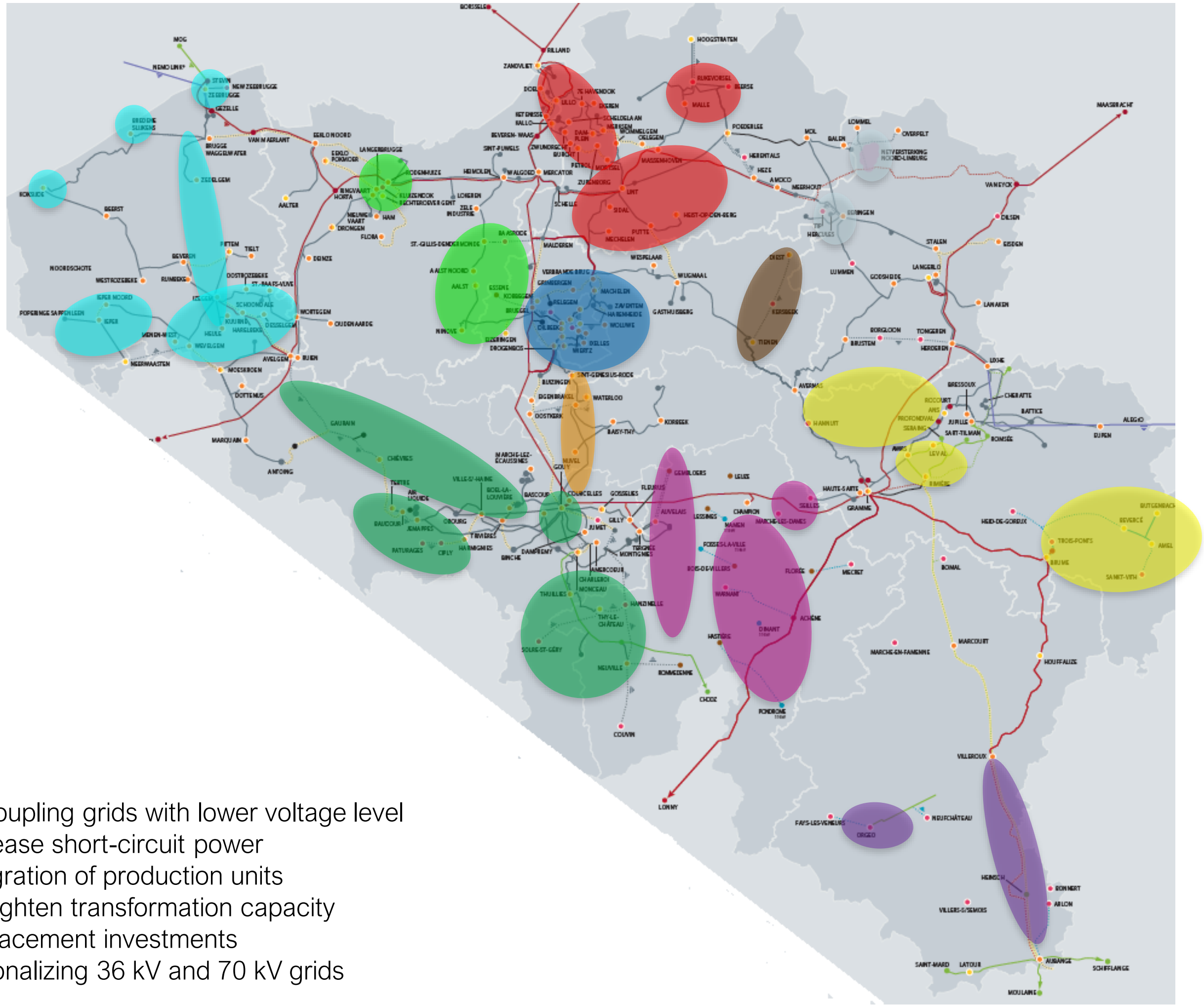
20XX Planned — 20XX Conditional — 20XX For Approval — 20XX Indicative



Whereas in the past only the Centre-East backbone formed a loop, in the future, provided critical connections such as Stevin and Horta-Mercator are looped in with the realization of Ventilus and Boucle Du Hainaut, the Belgian grid will evolve from one loop on 380 kV to three loops. This network architecture offers a significant increase in transmission capacity as well as the robustness and flexibility needed to anchor our central position in the European system and organize the next steps towards 2050 in an orderly fashion.

Significant Grid investments are planned in order to enable market coupling, RES integration and electrification of demand – zoom on Vertical Grid

Region	Project	1	2	3	4	5	6
Antwerpen	Versterking Kempen	✓		✓		✓	
	Evolutie Antwerpen stad en haven	✓	✓		✓	✓	
	Herstructurering 70kV					✓	✓
Brussel / Bruxelles					✓	✓	✓
Hainaut	Projets liés au backbone 380kV	✓			✓	✓	
	Evolution vers 150kV				✓	✓	✓
	Région du Borinage			✓		✓	✓
	Entre Sambre et Meuse			✓		✓	✓
	Scission 150kV Brabant – Hainaut (Gouy)	✓					
	Renforcement Basse-Sambre (Tergnée)				✓		
Limburg	Versterken 150kV	✓			✓	✓	
	Herstructureren 70kV (Tessenderlo – Beringen)				✓	✓	✓
Liège	Boucle de l'Est			✓	✓	✓	✓
	Restructuration Hesbaye			✓	✓	✓	✓
	Integration des nouvelles centrales			✓			
Luxembourg	Evolution vers 110kV (Orgeo)			✓		✓	✓
	Restructuration 220kV					✓	
Namur	Découplage du Hainaut	✓		✓		✓	✓
	Découplage de la province de Liège	✓				✓	✓
	Développement du réseau de Namur			✓	✓	✓	✓
Oost-Vlaanderen	Projecten gelinkt aan backbone 380kV / Haven Gent	✓	✓		✓		
	Aalst – Dendermonde – Malderen				✓	✓	✓
Vlaams-Brabant	Tienen – Kersbeek -Diest	✓			✓	✓	✓
Brabant Wallon	Restructuration 150kV Gouy - Drogenbos				✓	✓	
West-Vlaanderen	Projecten gelinkt aan backbone 380kV	✓		✓	✓		
	Regio Kortrijk				✓	✓	✓
	Westhoek				✓	✓	✓
	Versterkingen Koksijde, Zedelgem, Slijkens en Zeebrugge			✓	✓	✓	



1. Decoupling grids with lower voltage level
2. Increase short-circuit power
3. Integration of production units
4. Stenghten transformation capacity
5. Replacement investments
6. Rationalizing 36 kV and 70 kV grids

➔ FOP 2024-2034 includes a total of 252 projects

In the meantime, the energy transition continues to accelerate, leading to an increasing number of Grid Users' connection requests

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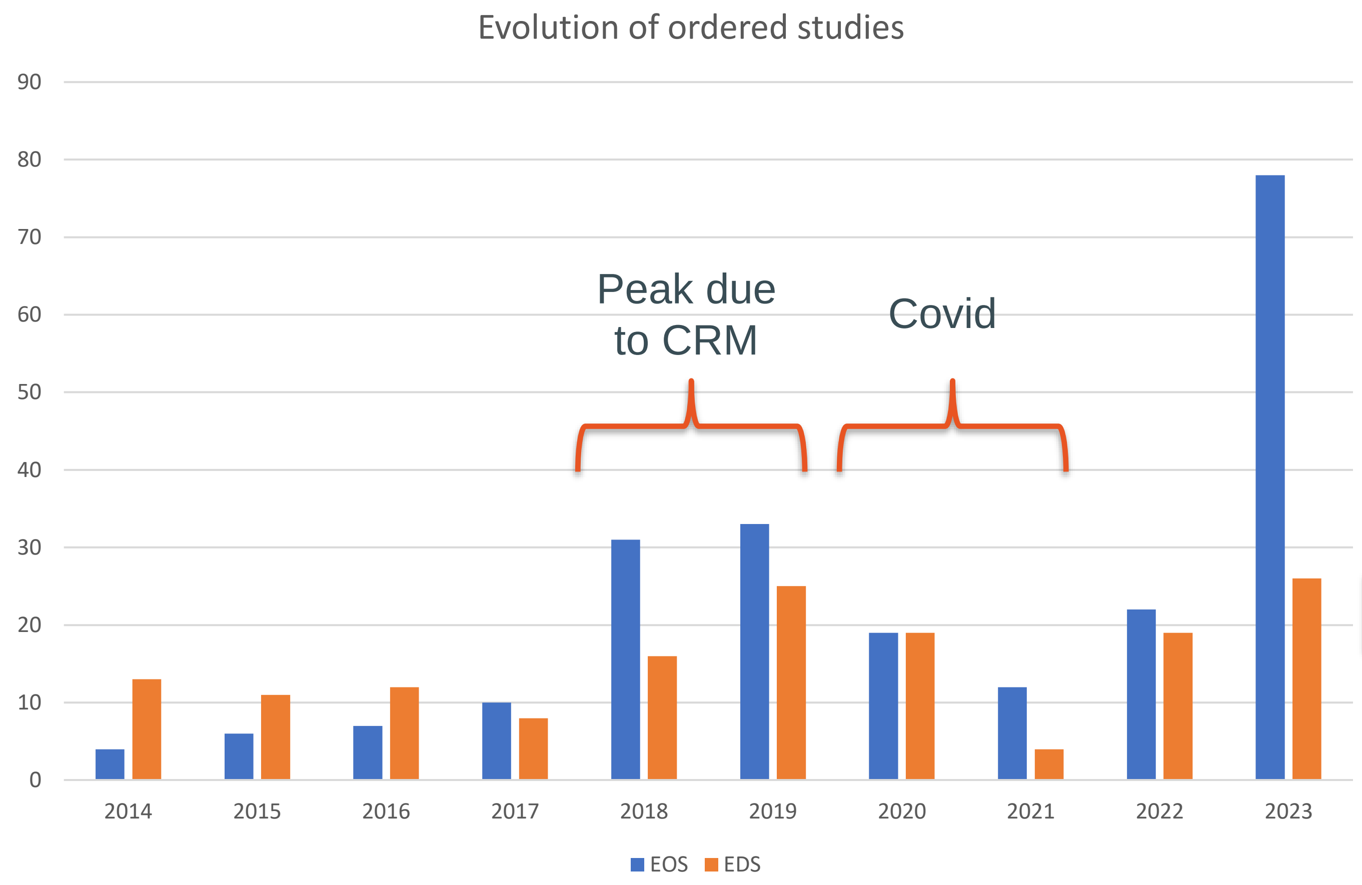
The **yearly number** of **ordered connection studies (orientation/detail)** has **significantly increased** over the last years



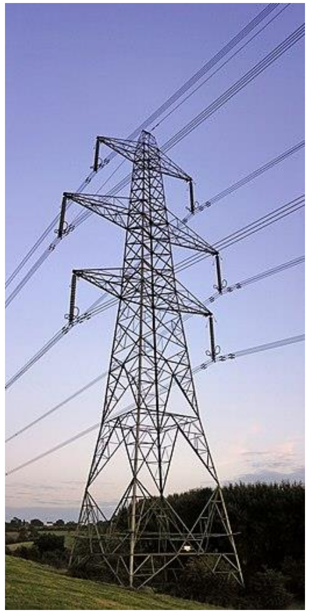
Due to the **high number** of **EOS in 2023**, we expect an **important number** of **EDS in 2024**

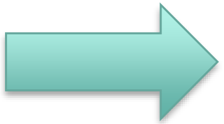
The number of ordered EDS is an **indicator** of the **coming Grid Users**

The difference in time required to develop new grid infrastructure and to develop new renewable or demand electrification projects constitutes an important challenge

- **Electrification of demand** or **renewables projects** : total **lead time** from **1 to 3 years**

- Building **new Grid Infrastructure** : **lead time depending** on the **type of project**
  - **Substation** projects **:** **5 years**
  - **Cable** projects **5 years**
  - **Overhead line** projects **: 5 to 10 years** for **regional grid, 10 to 15 years** for **backbone**





In case of a **Grid User connection request** in a **congested area**, Elia can propose **an earlier connection with flexible access** to the Grid Users – as **an alternative** compared to **a later firm connection after realization** of the needed **grid reinforcement projects**

Given these challenges, flexibility has an important role to play

Given the rapid increase in EOS/EDS (for RES, storage and demand), the importance of flexible connections – allowing Grid Users to connect before the realization of required grid reinforcements – will increase

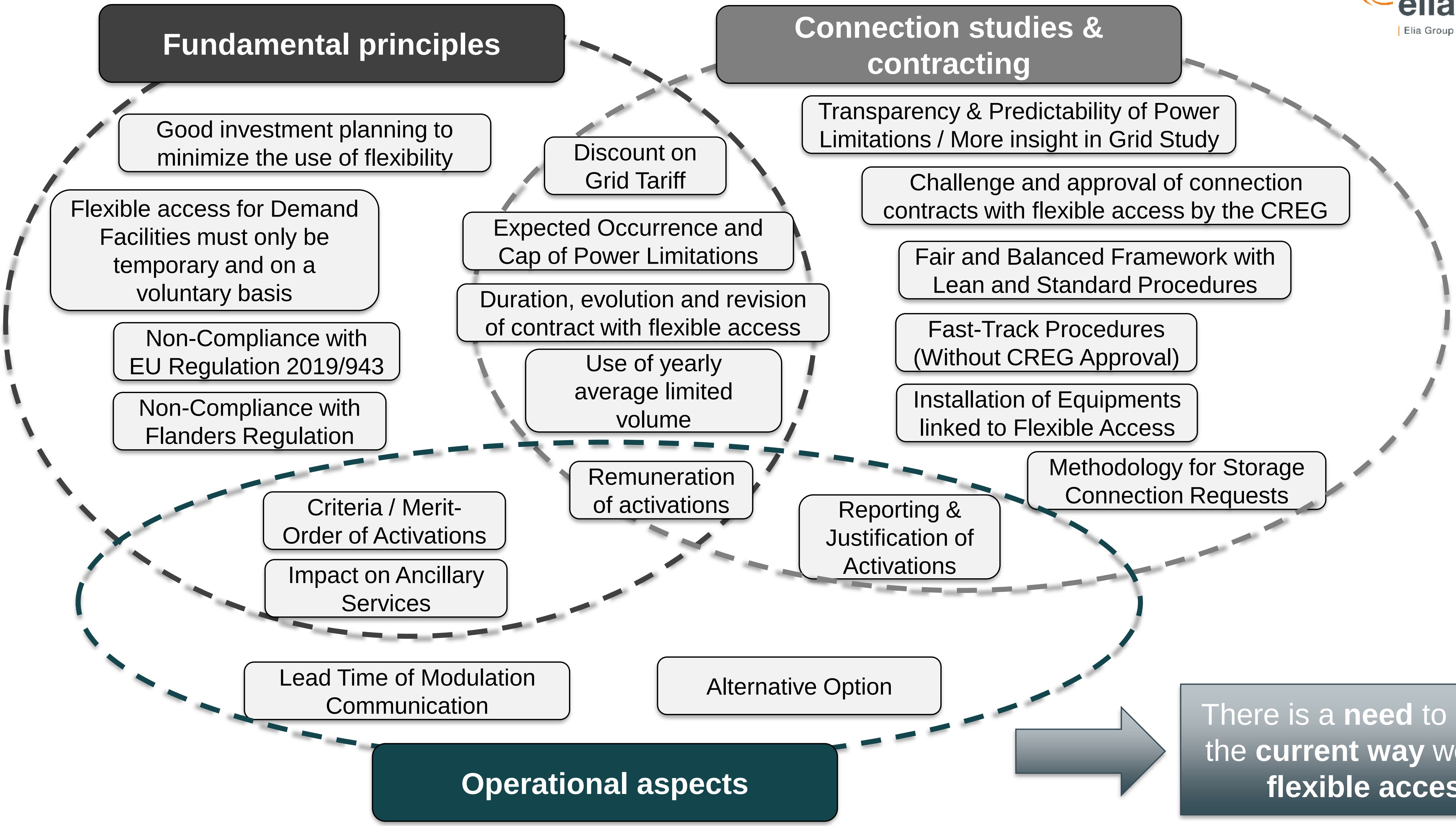
Considering the flexibility of Grid Users – when capable and when willing – is key as a new design factor for the future power system to strive for a techno-economic optimum for society, as anchored in EU legislation

2. CREG Incentive and Feedback of Public Consultation on Flexible Access

CREG incentive on connection with flexible access

- Ongoing discussions with CREG on refining the scope and revised planning
- The incentive is composed of 3 main parts
  - Reporting of Flexibility Activations
  - Methodology for Client Connection Studies
  - Vision of the role of Grid User Flexibility in Long Term Grid Planning
- Objective is to focus on the clarification of the current flexibility framework
- Already planned / foreseen stakeholder interaction:
  - ✓ 23/02/2024 Workshop : Vision on the role of GU flexibility in LT Grid Planning
  - ✓ 26/03/2024 Workshop : Methodology for client connection studies
  - ✓ 16/04/2024 Workshop : Possible guarantees to be given to GU
  - ✓ Info session to be planned in May / June on operational aspects related to flexibility activations
- A design note will be drafted based on workshop takeaways and informally consulted in Q2 2024
- Elia will present a detailed planning during next workshop

Public Consultation on flexible access : Market Parties feedback



There is a **need** to **clarify** the **current way** we treat **flexible access**

There are both long-term and short-term needs

This evolving context implies a need to review the approach and design related to flexible access

- **Ambition** for a **long-term** and **future-proof Vision** on **Grid User Flexibility** for Congestion Management (**Target Model**)
- Alignment on **fundamental principles** and **design** of new **congestion flexibility products**

In the meantime, the current way to treat flexible access needs to be clarified

- **Feedback** from **Market Parties** captured through the public consultation highlighted that the **current way** to **treat flexible access needs to be clarified**. There is a need for **more transparency** and **guarantees** so that Grid Users can calculate the viability of their Business case.
- There is a **willingness from the regulator** to adapt the **regulatory framework** by end of 2024

Proposed approach

- **Focus** on **short term** needs and a **clarification** of the **current flexibility framework**…
- … **in line** with the proposed **fundamental principles** of the Long-Term Vision (first step of this journey)

3. Ongoing and already launched actions

To address these challenges, Elia has launched several initiatives

What is ongoing

- GUFlex4CM project
- Ambitious CAPEX Plan
- Revision of EOS/EDS and Capacity Reservation processes

What has already been done

- Public consultation on flexible access with current modalities*
- Hosting Capacity Map
- Existing Gflex Solution

* Useful inputs from Grid Users and Market Parties

Revision of EOS/EDS and Capacity reservation process

Review of EOS/EDS and Capacity Reservation processes

Topic introduced during WG BG 07/12/23 and 26/01/24

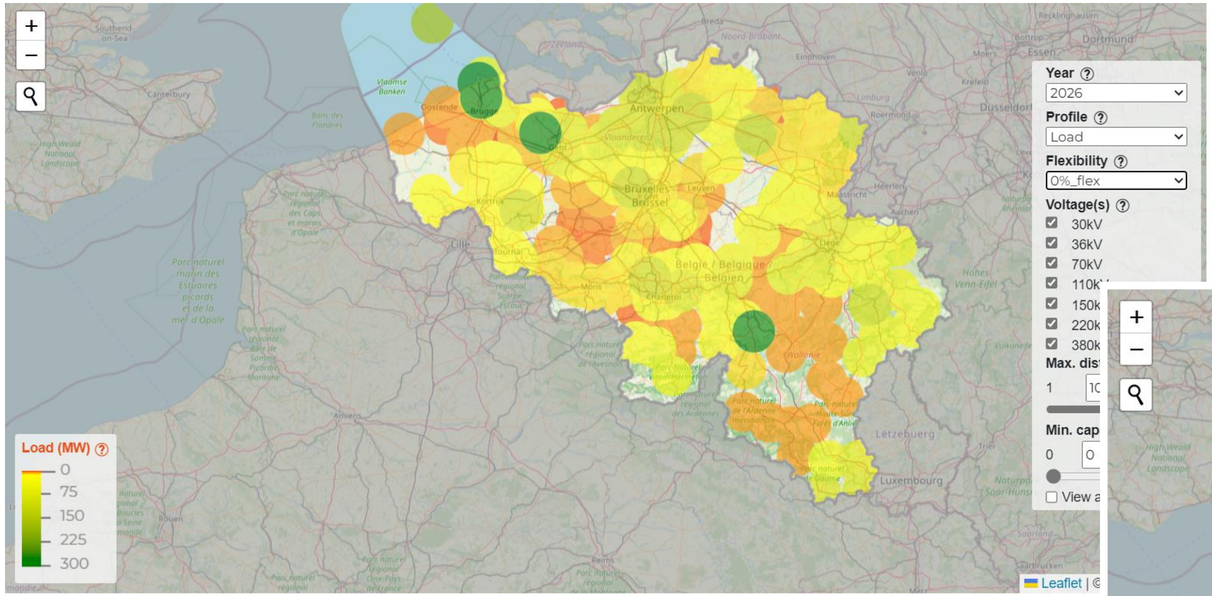
A lot of synergies with discussions on flexible access: initiatives will be linked

- **Following same planning (see slide below) and approach:**
  1. **Description of process in design note**
  2. **Public consultation on design note**
  3. **Proposal changes Code of Conduct**
  4. **Public consultation on Code of Conduct**
- **Further discussion on proposal in WG BG and/or planned workshops**
  - **WG BG 22/3: high level view on proposed changes based on collected feedback (internal, market parties and CREG)**

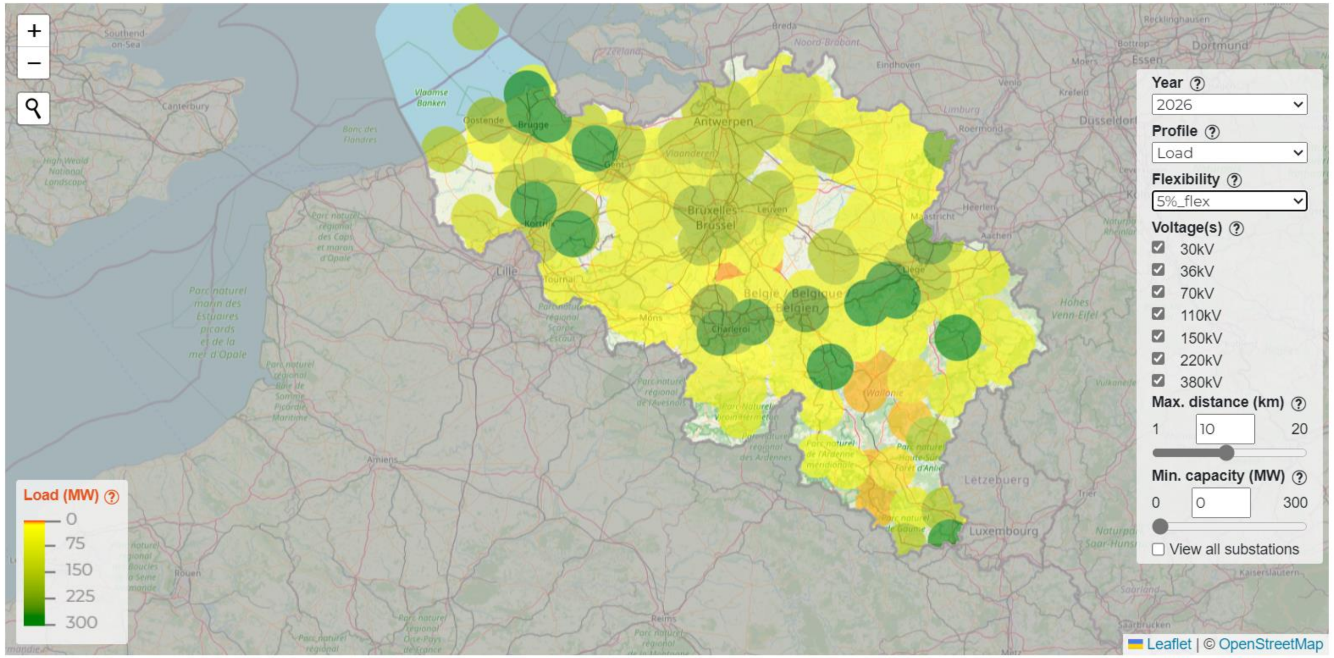
Hosting Capacity Map

The Hosting Capacity Map aims at incentivizing the Grid Users to target their connection request where hosting capacity is available

Hosting Capacity for **load** without **flexibility** - 2026



Hosting Capacity for **load** with **5% flexibility*** - 2026



Hosting **Capacity significantly increases** with a **limited amount of flexibility,** allowing **more/better** grid **connection options**

* Curtailment of 5% of the yearly consumption (MWh)

Existing Gflex solution

The existing Gflex solution enables to connect Grid Users in a zone where there is not enough hosting capacity

- **Gflex** solution was historically developed to manage **congestion on the transmission grid** (HV/MV transformers, upstream grid) due to **local production** (onshore wind and solar) connected in the **distribution grid**
  - Marginal solution at first, win-win

- Due to the **acceleration of the energy transition**, this solution is now also being applied to **TSO-connected units**
  - Production units (mainly onshore wind) : **Gflex**
  - Batteries : **Bflex**
  - Could also be applied for Load : **Lflex**

How Gflex works

- A **Grid User** connects in a **congested area**
- The **SCADA monitors the flows** in the **congested lines** and sends **modulation signal** (setpoints) in **RT** to the Grid User
- In case of congestions, the **Grid User must reduce its production**. He is **not remunerated** and the **BRP perimeter is not corrected**

→ This enables to **quickly connect** new **Grid Users without additional costs borne by society**

→ The **absence of remuneration** aims at incentivizing Grid Users to **ask for a connection** in a **timely way** and at the **appropriate location**

→ The **flexible access** can be **temporary** (to allow a faster connection prior to a planned reinforcement project) or **permanent** (if no reinforcement is foreseen)

The current Gflex product: feedback from Grid Users (Public Consultation)

Grid User perspective

Grid User feedback indicates that :

- **Insufficient view** on the **flexible volumes** for the **Grid Users** – which makes it **difficult to assess** the **viability of their Business Case**:
  - The **absence of remuneration** and the fact that the **estimated flexible volumes are not binding** in the contract
  - The **estimation** of **yearly flexible volume** mentioned in the contract is **an average**, where the **effective flexible volume** may highly **fluctuate over years**
  - There is **no guarantee** on the **duration** and **evolution** of flexible access over time
- How do the **flexibility activations interact** with **redispatching activations** (iCAROS)?
- Such a **flexible access** is **only possible** for **Grid Users** who effectively have **technical flexibility capabilities**
- The **current Gflex** modalities are **not fit for purpose** for **all technologies**
- The **higher the flexible volume** – combined with a **RT activation mechanism** – the more challenging it becomes to address **impact on balancing**

The current Gflex product: feedback from Grid Users (Public Consultation)

Grid User feedback indicates that:

- **This complexifies the operational processes.** In an area where there is a **GU with flexible access** and **GU** with **usual redispatching obligations**, operators must **make a distinction** between those GUs while performing the **security analysis**
- What is the **merit-order of activations? Purely technical** or also **economical?**
- How to ensure that the **TSO remains** sufficiently **incentivized to reinforce the grid?**

System Operation perspective

4. Main principles of proposed Vision (Target Model)

Goal of coming discussion

Present and discuss some design aspects of the proposed Target Model…

… to ensure that the short-term actions will go in the right direction

Overall objective

A power system that is fit-for-purpose today, tomorrow and in the future for hosting generation and storage units and feeding demand facilities with reliability, affordability and sustainability as key drivers

Long term grid planning

Grid User connection process

Striving for the societal optimum

Anticipate future needs

Keep stranded asset risk under control

Goal

Complying with grid user's needs

Robust connection

Quick connection

through

Grid reinforcements

"non-wires alternatives"

Enduring solution

Combined with potentially a

Temporary period

Electrical infrastructure

Remunerated Grid User Flexibility

Electrical infrastructure
Remunerated GU Flexibility

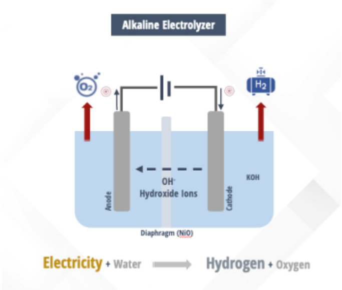
Early connection through flexibility with costs borne by the GU

5.Integration of Grid User Flexibility in Long Term Grid Planning

Why to integrate Grid Users flexibility in Long Term Grid Planning ?

- **Currently**, the **grid is developed** in order to **enable firm access** to **all Grid Users** at all times (except non-structural congestions e.g. linked to maintenance/project works etc)

- **New technologies** and **newly electrified appliances** have **intrinsic flexibility**
  - **Electric Vehicles** and **eMobility** have **flexibility** for charging
  - **Electrolysers** can flexibly operate given storage potential at the molecule side
  - **Battery storage systems** are technically flexible by essence



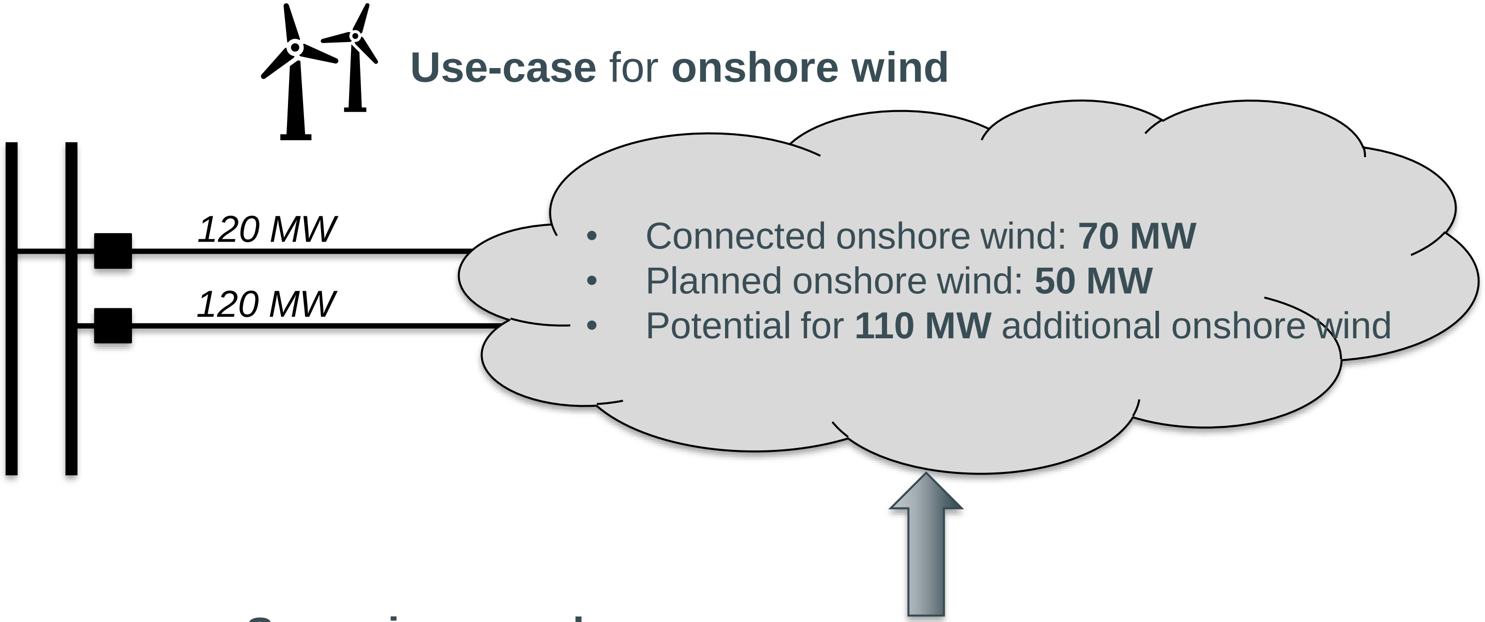
In addition to "**traditional" infrastructure solutions** (i.e. building power lines, transformers…), **Grid Users' flexibility** – as anchored in **European and Belgian legislation** – should be **considered** in order to **optimize the needed grid investments** and therefore **strive for a techno-economic optimum for society as a whole**

As **investments in grid infrastructure** – translated into **grid tariffs** – **are socialized,** the **cost of using flexibility** – when applied as an alternative to grid investments – should **also be socialized** in order to allow a **trade-off to** take place. Some kind of **remuneration** (tariff discount, activation payment, reservation payment…) **to the flexibility providers** should therefore be foreseen

The Grid Development Plans aim at hosting the expected Grid Users and facilitating their required power flows

- **Grid Development Plans** are based on future power system **scenarios** taking into account **the already known future Grid Users projects** as well as **additional volumes of renewables and electrification** based on **national and European ambitions** and based on the **identified potential** in the concerned areas

Use-case for **onshore wind**



Scenario example

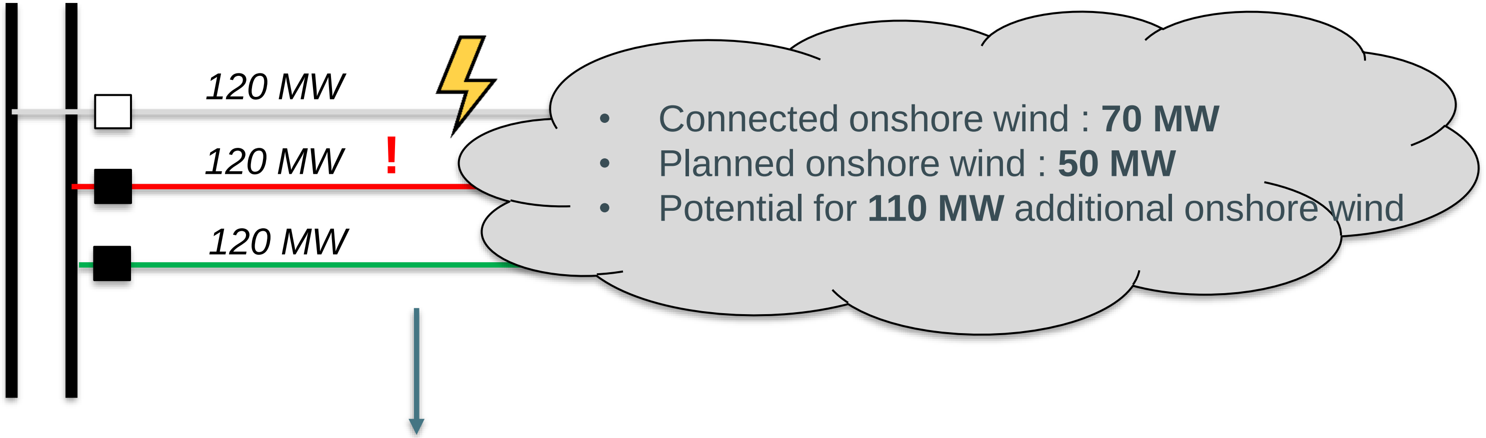
- Certainty for 120 MW onshore wind (installed + reserved)
- Potential for 110 MW additional onshore wind not yet materialized by projects or client connection reservations

The Grid Development Plans aim at hosting the expected Grid Users and facilitating their required power flows

- **Grid Development Plans** are based on future power system **scenarios** taking into account **the already known future Grid Users projects** as well as **additional volumes of renewables and electrification** based on **national and European ambitions** and based on the **identified potential** in the concerned areas
- **Reinforcement projects** are **proposed in** order to **alleviate the identified grid congestions** inherent to the **power flows** required to facilitate the expected Grid Users

Congestion arises and the grid needs to be reinforced

Scenario: **230 MW** onshore wind

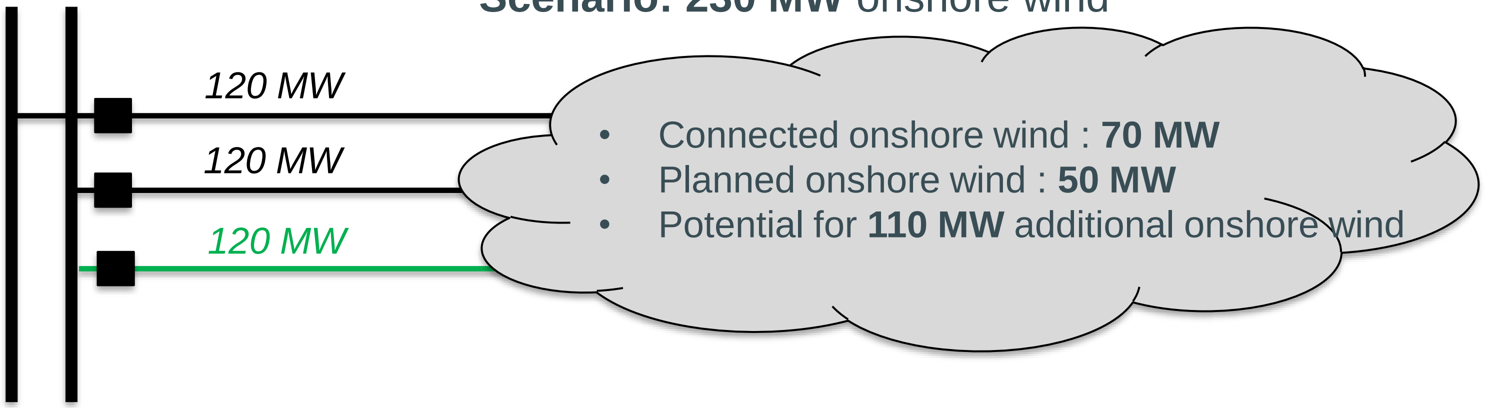


- A new cable is planned in **anticipation** of additional offshore wind potential
- Cost of additional infrastructure is socialized (included in tariff)

The Grid Development Plans aim at hosting the expected Grid Users and facilitating their required power flows

- **Grid Development Plans** are based on future power system **scenarios** taking into account **the already known future Grid Users projects** as well as **additional volumes of renewables and electrification** based on **national and European ambitions** and based on the **identified potential** in the concerned areas
- **Reinforcement projects** are **proposed in** order to **alleviate the identified grid congestions** inherent to the **power flows** needed to feed the expected Grid Users
- Given the intrinsic **uncertainties** related to **the realization of the potential (including the timing)**, the quantification of a certain potential implies a certain **stranded asset risk*** – born by society – which is to be **weighted against** the risk of **insufficient grid hosting capacity** – impacting the country's economic development

Scenario: 230 MW onshore wind

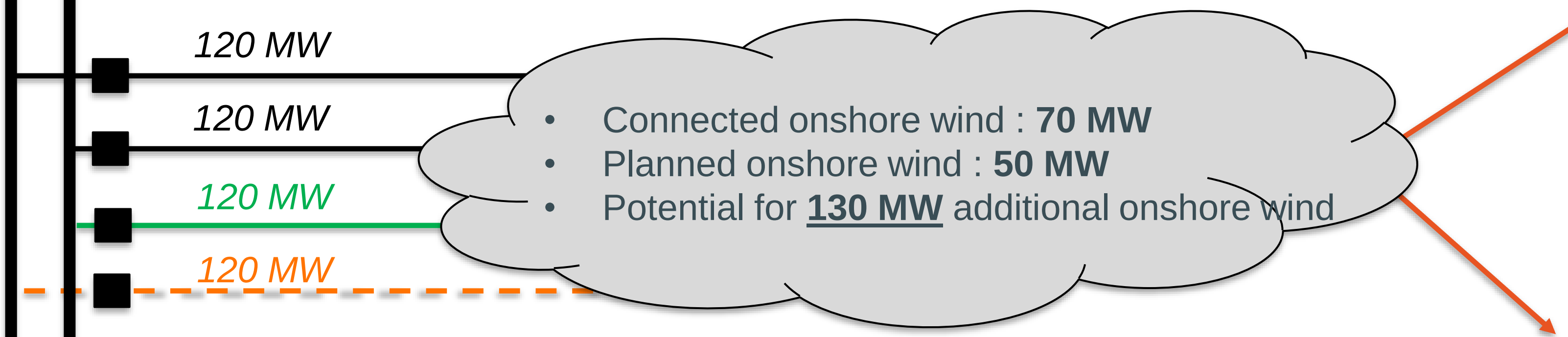


*We may invest too soon or not at the most appropriate location

GU Flexibility can contribute to optimizing the needed investments as well as the total cost and risks borne by society

- Considering **remunerated Grid User flexibility** in addition to grid reinforcements may – in some situations – enable to **cut the tail of investments** and therefore **reduce the total costs borne by society** (and keep the stranded asset risk under control)

Scenario: 250 MW onshore wind



Cost of new cable : ≈ 10 M€
(economic lifetime: 50 years)

Cost of wind curtailment
- Maximum curtailment: 10 MW
- Avg yearly **curtailed volume ≈ 300 MWh** (**0,05%** of yearly production)
- Yearly cost : **≈ 35 k€**

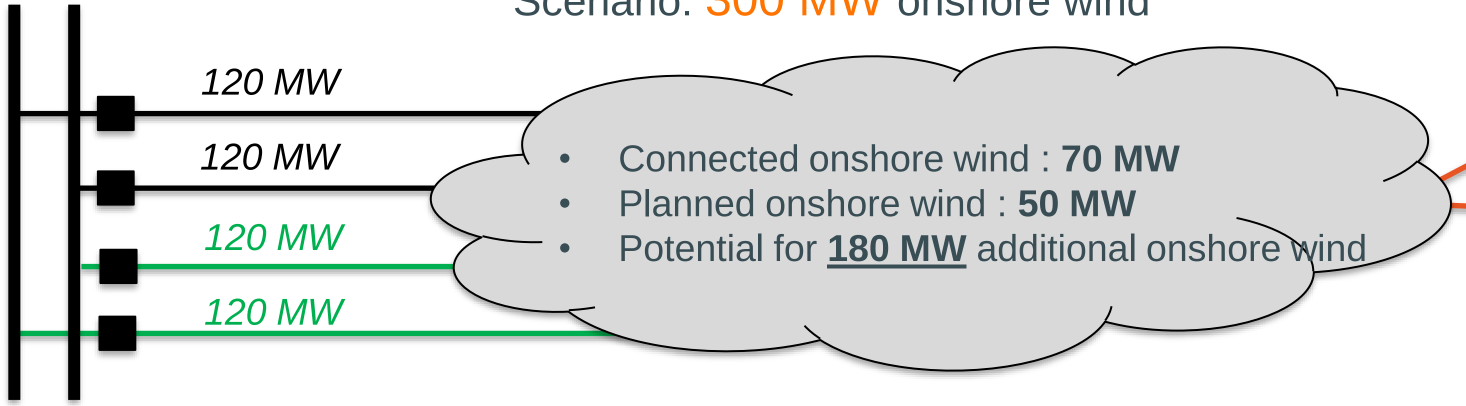
→ **1,8 M€ over 50 years**

For covering the last 10 MW of the 130 MW potential, calling upon GU flexibility would be more optimal: it is in the societal interest to not anticipate investment yet in a second new cable and remunerate the flexibility

GU Flexibility can contribute to optimizing the needed investments as well as the total cost and risks borne by society

- Considering **remunerated Grid User flexibility** in addition to grid reinforcements may – in some situations – enable to **cut the tail of investments** and therefore **reduce the total costs borne by society** (and keep the stranded asset risk under control)
- As of **300 MW onshore wind**, the **investment in a 4th cable becomes economically justified:**
  - **Yearly curtailed energy** : **≈ 1.800 MWh → 216 k€/year**
  - **10,8 M€** over **50 years > 10 M€ cost of a new cable**

Scenario: 300 MW onshore wind



Flexibility cost **< Investment** cost until **300 MW** onshore wind

Flexibility cost **> Investment** cost above **300 MW** onshore wind

Grid investments are **triggered/anticipated** when the **expected (societal) costs** of Grid User **Flexibility** excess the **expected costs** of **reinforcing the Grid**

This **approach** will lead to **structural congestions** where such **flexibility is counted on** at the grid planning stage

In order to ensure a harmonious development of the power system, limitations on the usage of flexibility can be defined

Grid investments are by default triggered when the **expected usage of Grid User Flexibility** is above **predefined bounds**

How do you see those bounds ?

- **What type** of **limitation** ? (% time ? Energy ? Power ?)
- **Predefined set of bounds** ? Or **proposed by concerned Grid User** and discussed on a **case-by-case basis** ?
- Bounds depending on **technology** / type of **Grid Users** ?
- Bounds at **national/regional/Grid User** level ?

Conclusion
Long Term Grid Planning: Cost-Benefits Analysis for Flexibility

In **Long Term Grid Planning**, **Cost-Benefits Analysis** will be realized to **compare Grid Reinforcements** and **Remuneration of Grid Users' flexibility** – within a **limited range** - as a **complementary solution.**

To ensure a **harmonious development of the Grid**, **bounds** should be put on the **expected usage of flexibility**

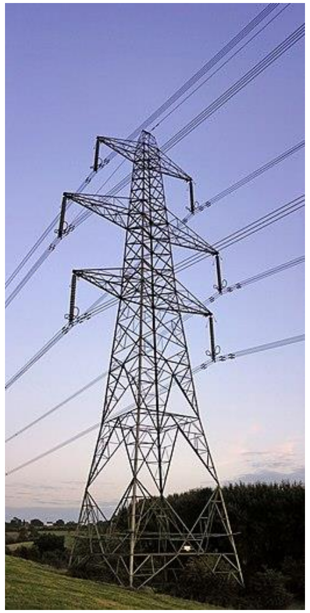
- **Investments** are **triggered** when the **expected** (societal) **costs** of **using Grid Users' flexibility** are **higher** than the **expected costs of reinforcing the grid**
- **Investments** are **triggered** when the **expected usage of flexibility** is **above predefined bounds**

6. Temporary period for earlier Grid User connection

Temporary Period
Introduction

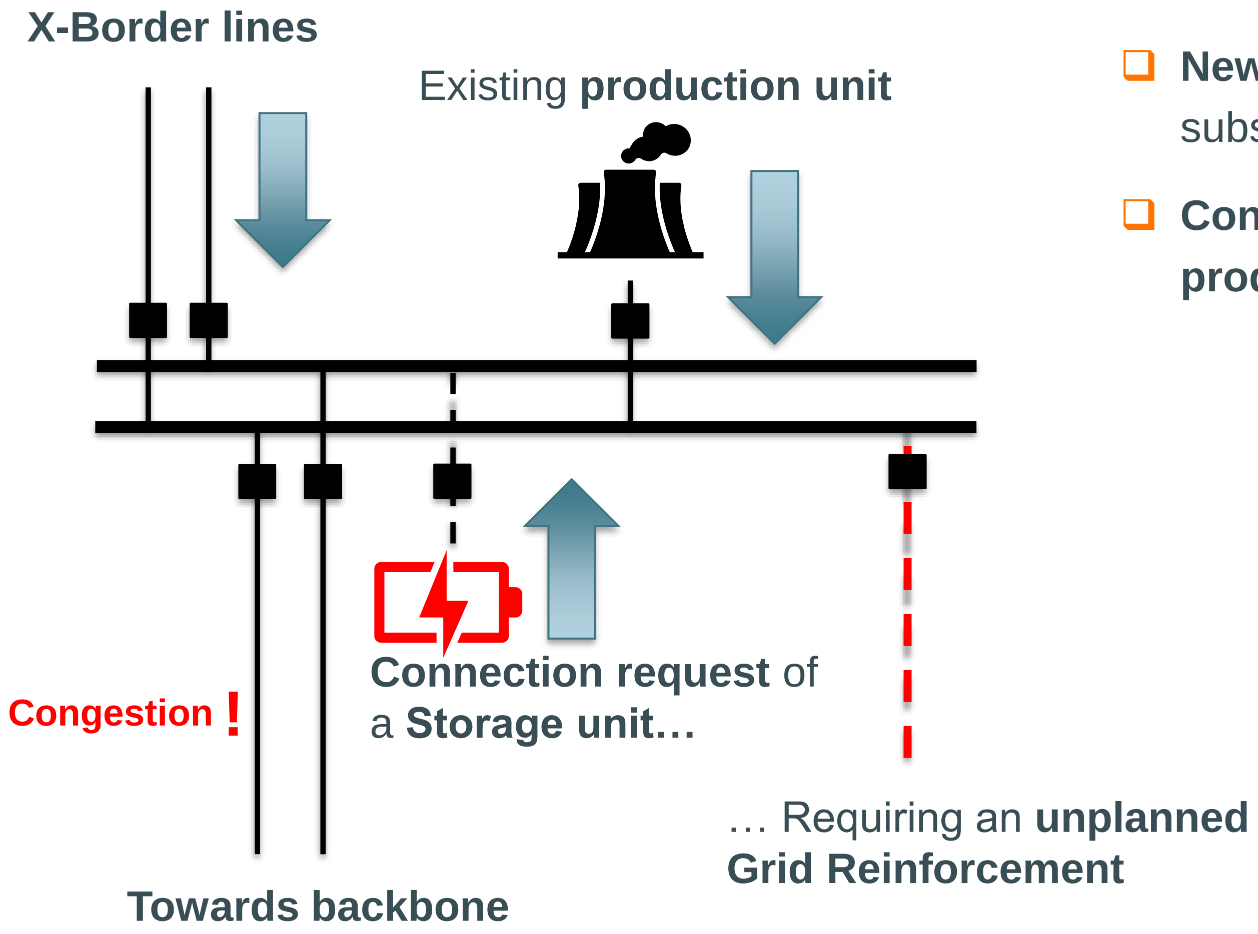
The **connection request** of a **Grid User**…

… may **require** a (planned or not identified nor planned) **grid reinforcement project**



- If **agreed** by the **Grid User**, the Grid Operator can **propose** a **connection before the realization of the grid infrastructure** identified in the **context of the development plans**
- In **those conditions**, **flexibility** will be **applied**. As it is the **Grid User's choice to connect earlier**, those inherent **flexibility costs shall not be socialized** but **shall be borne by the Grid User until the end of the temporary period**

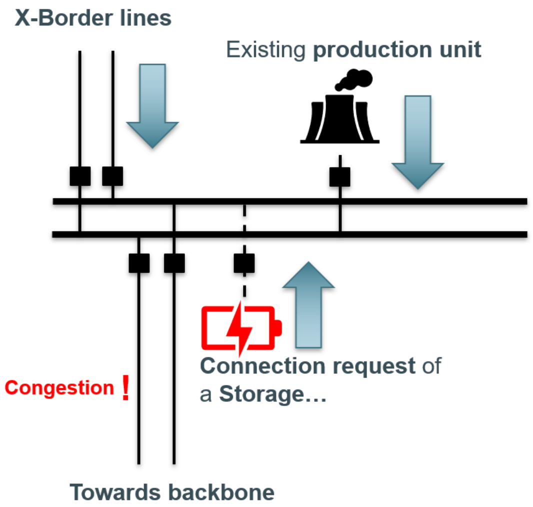
Temporary Period
Use case



- **New connection request** of a **storage unit** near a 380kV substation with an **existing production unit** and a **X-border line**
- **Congestions** occur in case of **import** when the **existing unit produces** and the **storage injects**
  - Grid reinforcements are needed
  - Those reinforcements are not planned yet as this Grid User connection request was not anticipated in the assumptions of the latest approved development plan
  - The storage system can either
    - → connect after identification and realization of the grid reinforcement
    - → connect earlier if a certain level of flexibility is applied

Temporary Period

Use case – what if the battery system is connected without temporary period?



- ❑ System Operator must **take action** in **case of congestion**. E.g :
  - ➢ **D-Bid** on the **storage**; and/or
  - ➢ **D-Bid** on the **production unit**; and/or
  - ➢ **Countertrading** to reduce X-border imports; and
  - ➢ **Compensation bid to restore system balance**

Those are **Costly Actions**, which will impact the grid tariffs and are therefore socialized

→ All Grid Users are impacted by the earlier connection of the storage unit

→ There is no incentive for the storage unit to anticipate its connection request or connect to a (more) appropriate substation

⇒ This is not in the interest of society

➔ The cost of Flexibility should therefore be borne by the storage facility during a Temporary Period

After temporary period

- ❑ No more redispatching needed after realization of the necessary grid reinforcements…
- ❑ …or remuneration of Grid User's flexibility in case (part of) the flexibility is evaluated as a more efficient solution compared to grid reinforcements

Temporary Period
How to bring clarity to the Grid Users?

Grid users need **as much clarity as possible** in order to assess their business case, and this on 2 levels

1. Clarity on the **use of flexibility** during the temporary period
   - ❑ Currently, a GU with a flexible contract receives a non-binding estimation of the % of time where he will be “flexibilized”
   - ❑ Elia is currently investigating whether additional guarantees could be provided (maximum bounds in terms of MWh, time,…)
   - ❑ Attention point: gaming risk needs to be avoided
2. Clarity on the **definition of the temporary period**
   - ❑ There is currently no notion of temporary period ➔ GUs with a flexible contract can be activated for an unlimited duration
   - ❑ Elia has investigated the possibility to define a temporary period, providing proposals of answers to 2 questions
     - ✓ When does the temporary period start?
     - ✓ When does the temporary period end?

Temporary Period

Definition of the temporary period - When does the temporary period start?

Proposal

- At the date of signature of the connection contract

Alternative

- At the commissioning of the client's connection

Justification

- The end of the temporary period depends on how much time is needed for Elia to develop the grid, not on how much time is needed for the client to connect
- The end of the temporary period should not depend on possible delays from the GU

Temporary Period

Definition of the temporary period - When does the temporary period end?

- 3 cases can be distinguished

  1. There is no project in the development plan allowing to remove the structural congestion
  2. There is a project in the development plan allowing to remove the structural congestion, but the project is not yet initiated and hence the exact scope and timing is not yet defined
  3. There is a project ongoing, possibly to be commissioned soon after the client's connection

- Need to define rules which cover those different cases, for example:

  - The end of the temporary period can't be linked to the planned or effective commissioning of an infrastructure project if there is no project identified to solve the congestion
  - Defining a standard fixed period will not be appropriate to situations where the infrastructure project is already ongoing and close to be commissioned. Example: a fixed period is set to 10 years but the project is about to be commissioned 1 year later

Temporary Period

Definition of the temporary period – When does the temporary period end?

<u>**Possibility 1**</u>

- **The temporary period ends** when the **infrastructure project** expected to **solve the identified congestions** is **commissioned**. An indicative, non-binding timing is provided to the client.
- In addition, there is a **maximum duration** of **15 years** for **380-220kV**, **10 years** for **150-70-36kV** and **5 years** for **MV**
  - Note: The **maximum duration** is defined by the **voltage level of the congested grid elements**, not by the voltage level where the GU is connecting

<u>**Justification**</u>

- The maximum duration leads to a risk of socialization of costs, but provides guarantees to the Grid User and an incentive for Elia to develop the grid
- The voltage level of the congestion grid elements is the best approximation we have of the time needed to develop the grid in order to solve the congestion issue
- The maximum durations are in line with the time needed to develop the grid at the given voltage level
- The duration for DSO’s requests is aligned with the duration from CWAPE

Temporary Period

Definition of the temporary period – When does the temporary period end?

<u>Possibility 2</u>

- The end of the temporary period is **linked to the commissioning of the project**. If **not yet in the development plan**, the temporary period is defined for an **undetermined duration**

<u>Justification</u>

- The temporary period is proposed to the GU as an option. The GU has the possibility either to connect at another place in the grid, either to wait for the infrastructure project to be realized. Therefore, no risk of socialization of costs should be taken

Temporary Period : Summary

The **Temporary period** can **apply** on the request of **Grid Users** in **areas** where **not enough firm hosting capacity** is **available**

During the **Temporary Period**, **the flexibility costs** are **borne by** the **concerned Grid Users**

Clarity should be given to **the Grid Users** related to the **definition** of the **Temporary Period**

Guarantees should ideally be given to **the Grid Users** related to **maximal bounds** to the **flexible volume** during the temporary period – under the condition that **gaming risk** is **avoided**

→ Will be discussed in the next workshops

7. Questions ?

8. Next steps

Next steps

- You can send your **questions** or **feedback** to guflex@elia.be by 08/03/2024
- **MoM** will be sent by 15/03/2024 and a **follow-up** will be done during **22/03/2024 WG Belgian Grid**
- **Next workshop** planned on the **26/03/2024** on **Methodologies and Criteria for client connection studies**

Thank you.

Appendix

Grid Operation & Grid Planning concepts

Limit of Grid Elements

Pre-read

Permanent and temporary limits of Grid Elements

- **Permanent** admissible **limits** : **loading** (in A or MVA) that can be **accepted by a Grid Element** for an **unlimited duration without any risk for the material**
  - For some **types of Grid Elements** (e.g. overhead lines), the **permanent limits depend on the temperature** (we therefore have **seasonal limits**)

- **Temporary** admissible **limit : loading** (in A or MVA) that can be **accepted by a Grid Element** for a **certain limited duration** (e.g. **115 %** of **permanent limit** during **15 min**). This loading depends on the **initial operating conditions** of the considered Grid Elements (e.g. linked to thermal inertia)
  - The temporary limits also depend on the temperature
  - Some **types of Grid Elements** don’t have temporary admissible limits

Grid Studies : analyzed situation and criteria

Pre-read

Grid Connection Studies – analyzed situations

The following **grid situations** are **analyzed within the Grid Connection studies :**

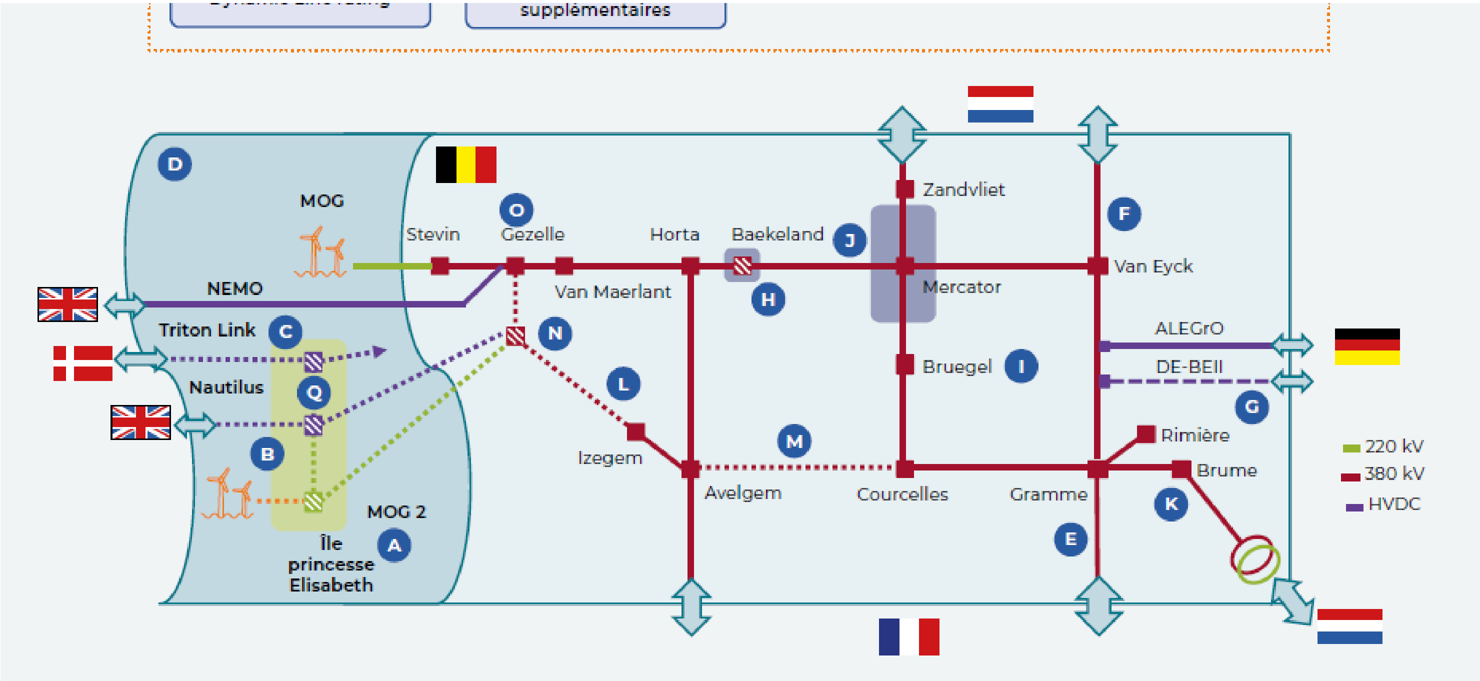
- **N** state : **all the grid elements** are **available**
  - For **each planned step of grid evolution**, a **new N state is studied**

- **N-1** state : **with respect to N** state, **one grid element** **or** **one Grid User** is **disconnected** (in a **planned** **or** **unplanned way**)

- **N-1-1** state: **with respect to N** state, **one grid element** is **preventively** taken **out of service** (for *maintenance*, *work* or *repair*) and then an **unplanned outage** takes place
  - This state must be “respected” during sufficient time period so that the Grid Operator can plan the needed work, outages …

Pre-read

Practical case : study in North sea area



Considered steps of the **planned Grid evolution**

1) Asis
2) With Ventilus (2028)
3) With Boucle du Hainaut (2030)
4) With MOG 2 (as of Boucle du Hainaut)

Pre-read

Operation limits for the analyzed states

The following **technical planning criteria** are respected for the different analyzed states if :

- Contingency list (N-1) defined in line with SOGL principles
- The **voltage** on each node remains between the operational limits
- The **short-circuit currents** don’t excess the maximal admissible values
- The **dynamic** and **transitory limits** of the production units is ensured
- The **power quality** requirements are satisfied
- The **current** in the **grid elements don’t excess** the **maximal admissible values**

Actions for solving congestion

How to solve congestions ?

Pre-read

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General philosophy :

- **Preventive actions** : in **N state** – to **avoid unacceptable situations**
  - **All Grid Elements** are **below their permanent limits**
  - **All Grid Elements** are **below their temporary limits** for **each simulated N-1 situation**
    - **Preventive action** is needed if the **temporary limits** of **Grid Elements** are **excessed in N-1**
- **Curative actions in N-1 : actions** taken when **problematic situation appears** in order to **get back to safe state**
  - All **Grid Elements** should be **put back below their permanent limits**

In practice

- **Curative** action if overload is **above permanent limit** and **below temporary limits** (15')
  - **1 topology action** (Tap TFO or PST adjustment + close or open breaker)
  - **Gflex***
- If the **temporary limits** are **exceeded in case of N-1 situations**, Elia performs **preventive actions**
  - **1 topology action**
  - **Redispatching** (iCAROS/CIPU) **and Gflex**

* Gflex : modulation signal sent in RT

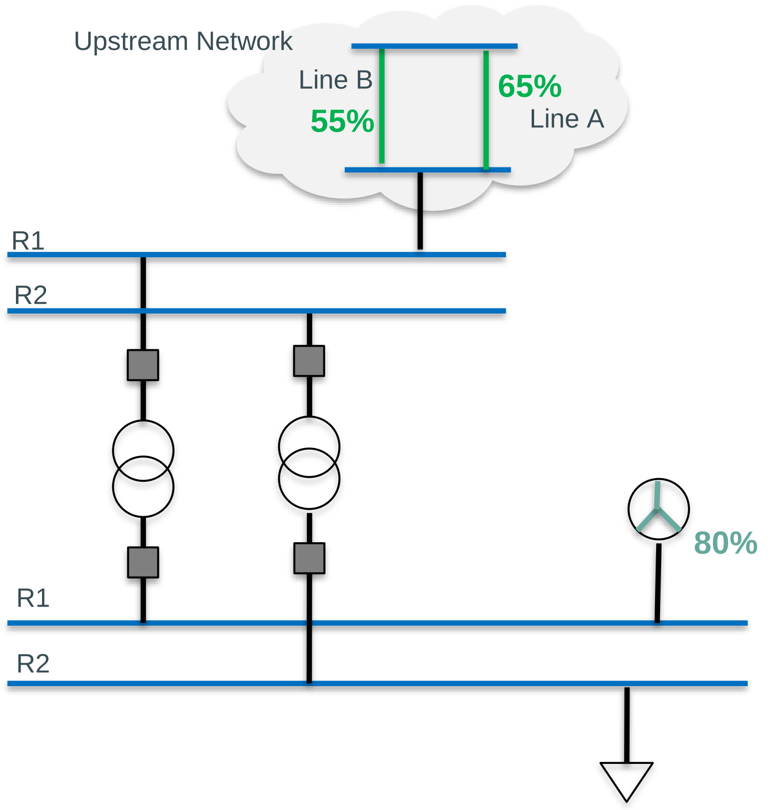
Use Case

Keep the grid N-1 safe

Pre-read

If outage,
- All grid elements stay under 15min limits
- N-1 safe again within 15 min.

N situation



Keep the grid N-1 safe

Pre-read

If outage,
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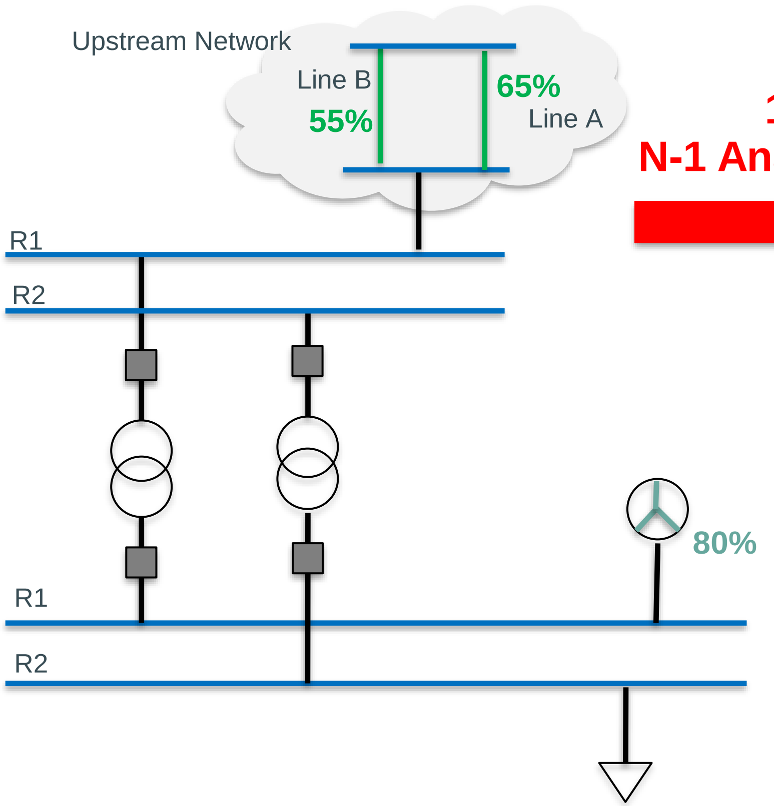
- N-1 safe again within 15 min.

N situation is safe



1
N-1 Analysis

1 – Security Analysis
N-1 safe if outage?

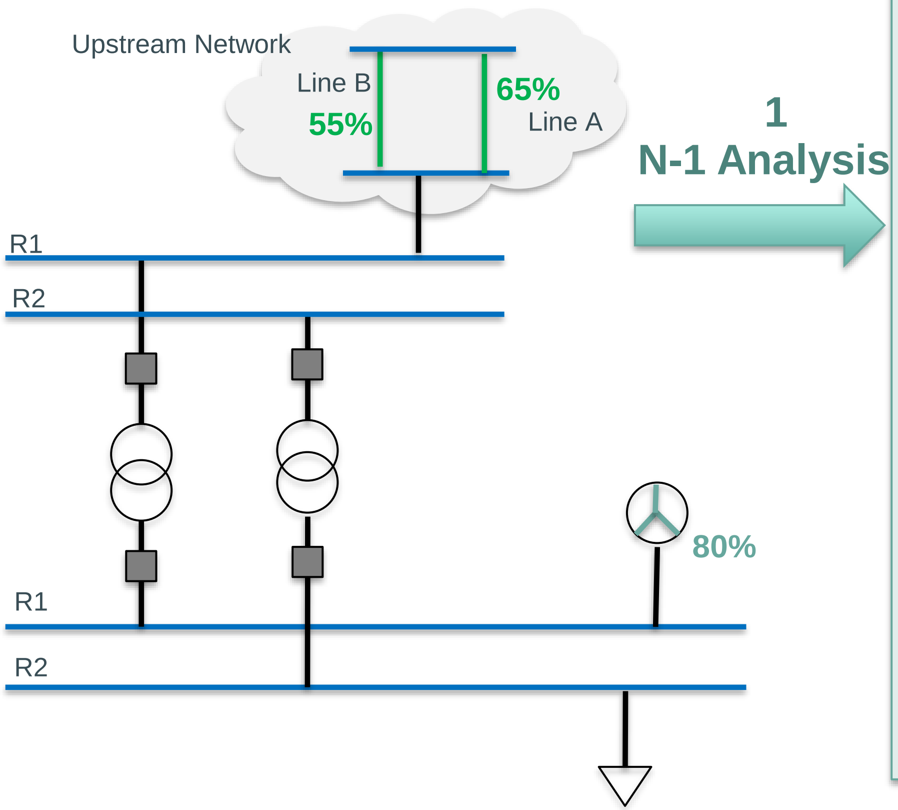
Keep the grid N-1 safe

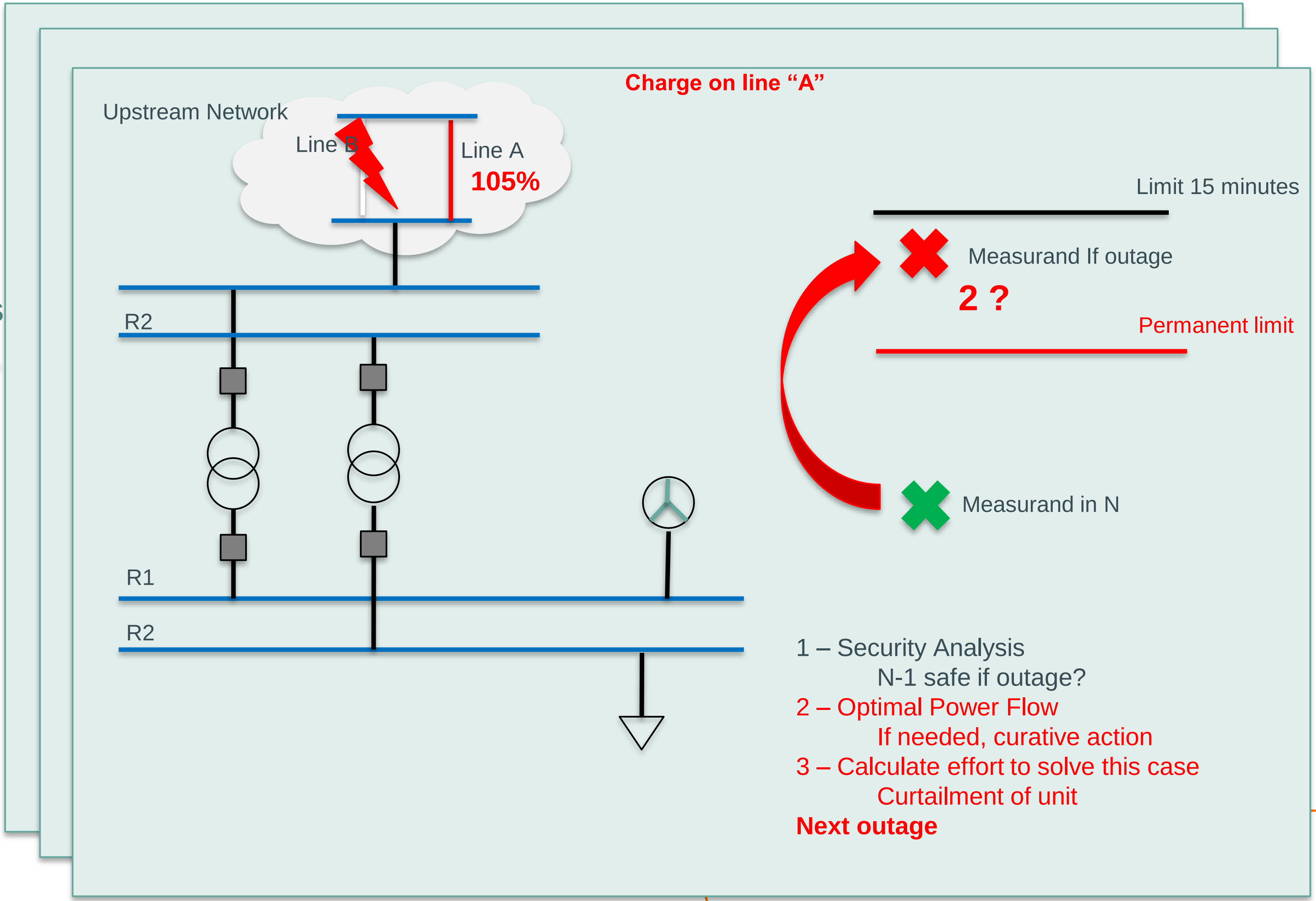
Pre-read

If outage,

- All grid elements stay under 15min limits
- N-1 safe again within 15 min.

N situation





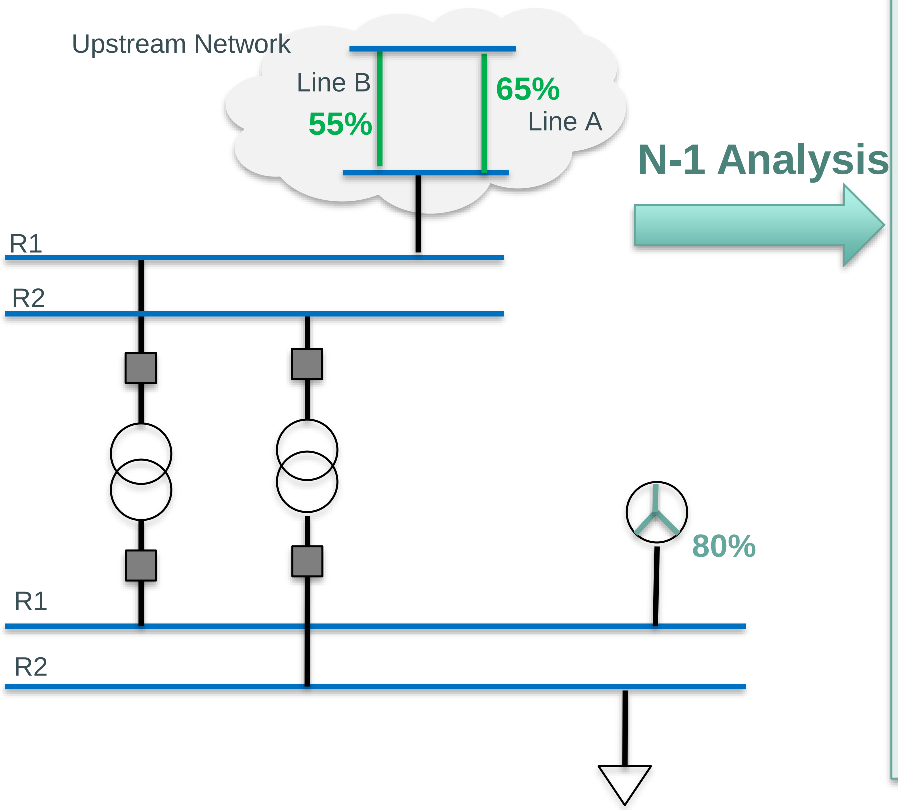
Keep the grid N-1 safe

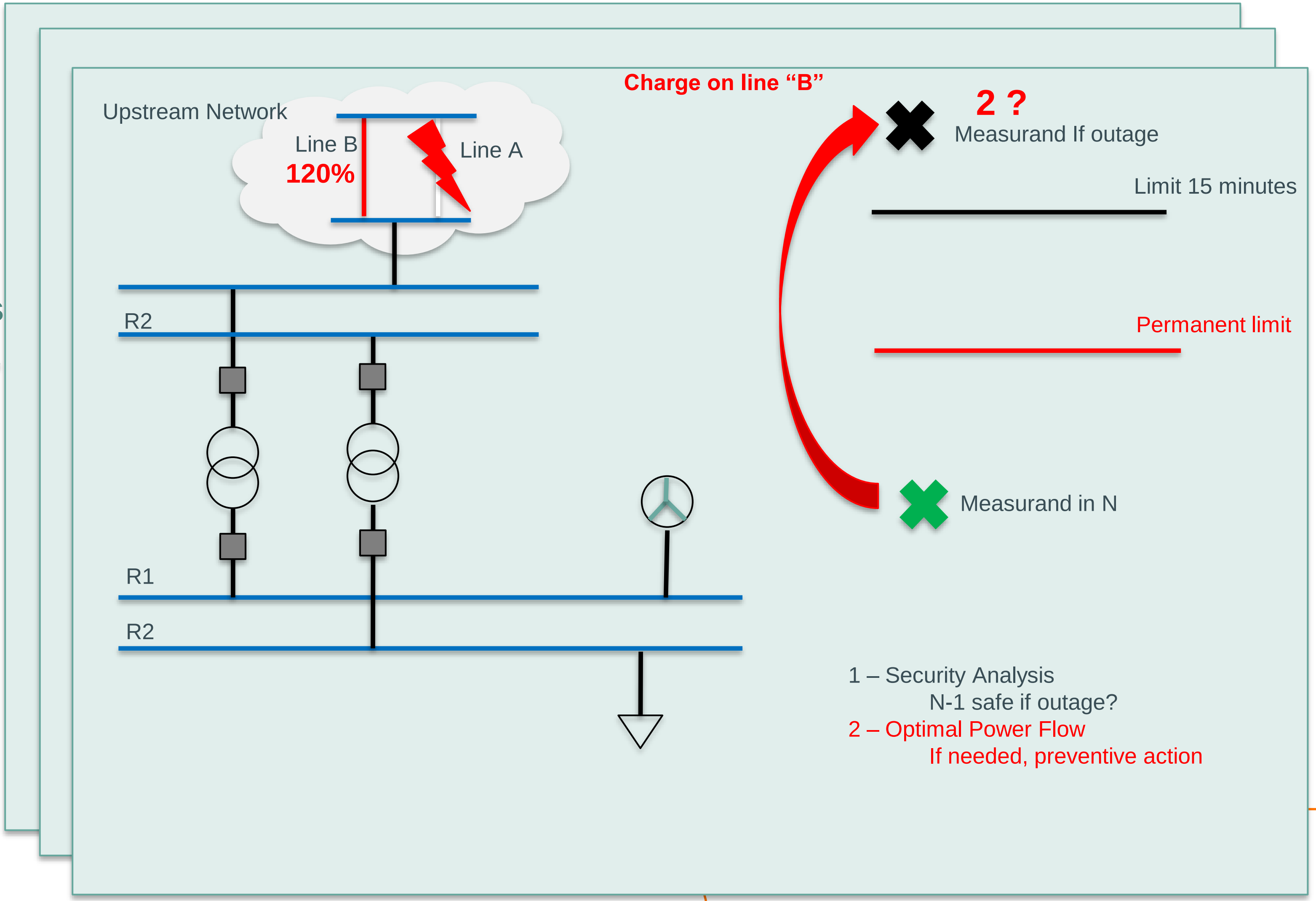
Pre-read

If outage,

- All grid elements stay under 15min limits
- N-1 safe again within 15 min.

N situation



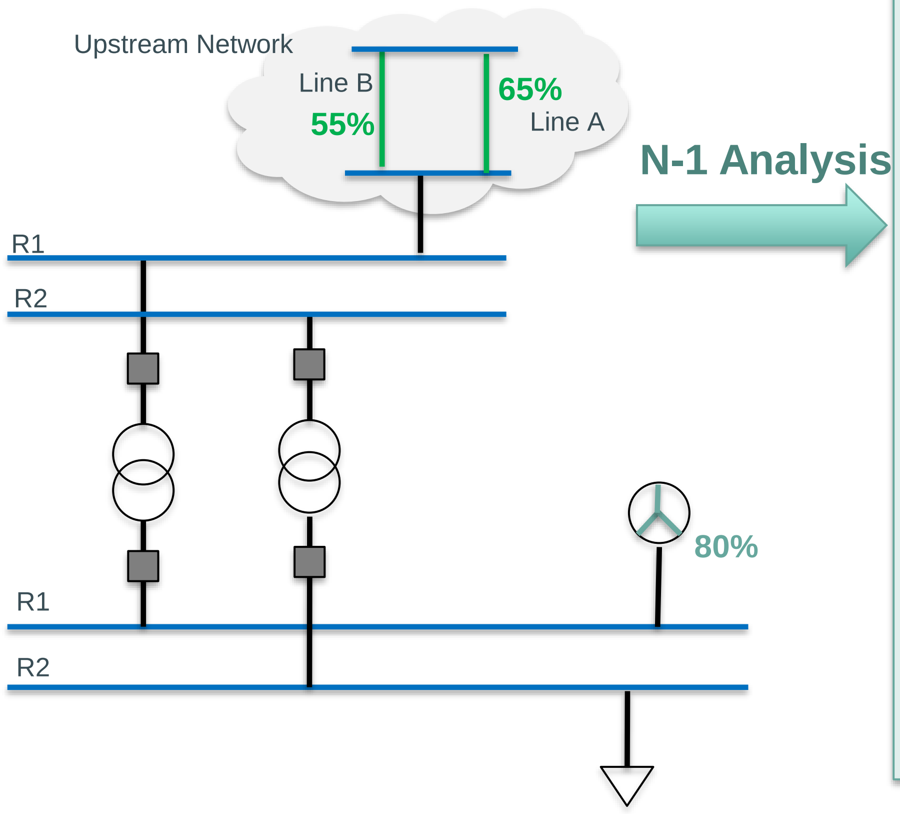


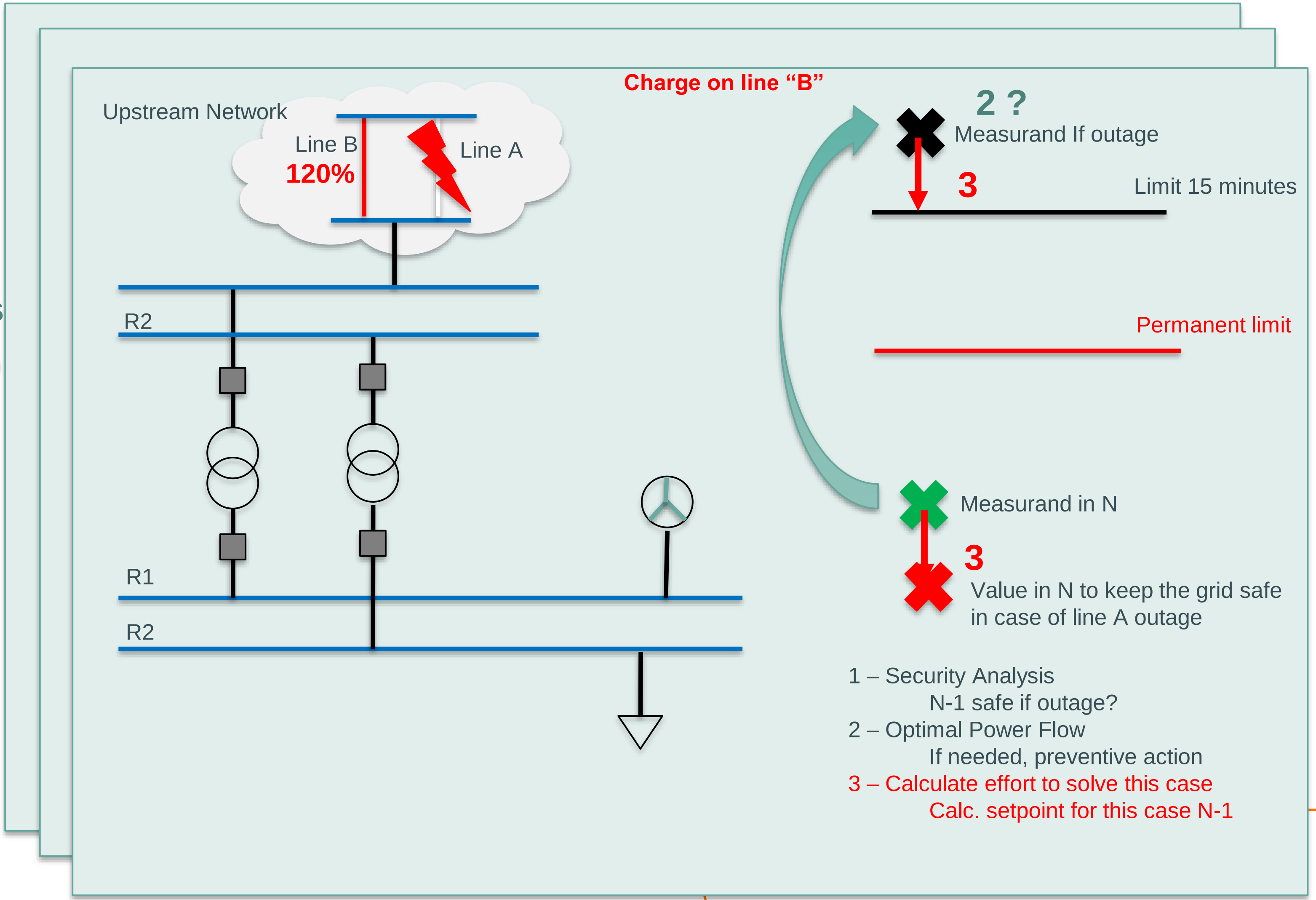
Keep the grid N-1 safe

Pre-read

If outage,
- All grid elements stay under 15min limits
- N-1 safe again within 15 min.

N situation





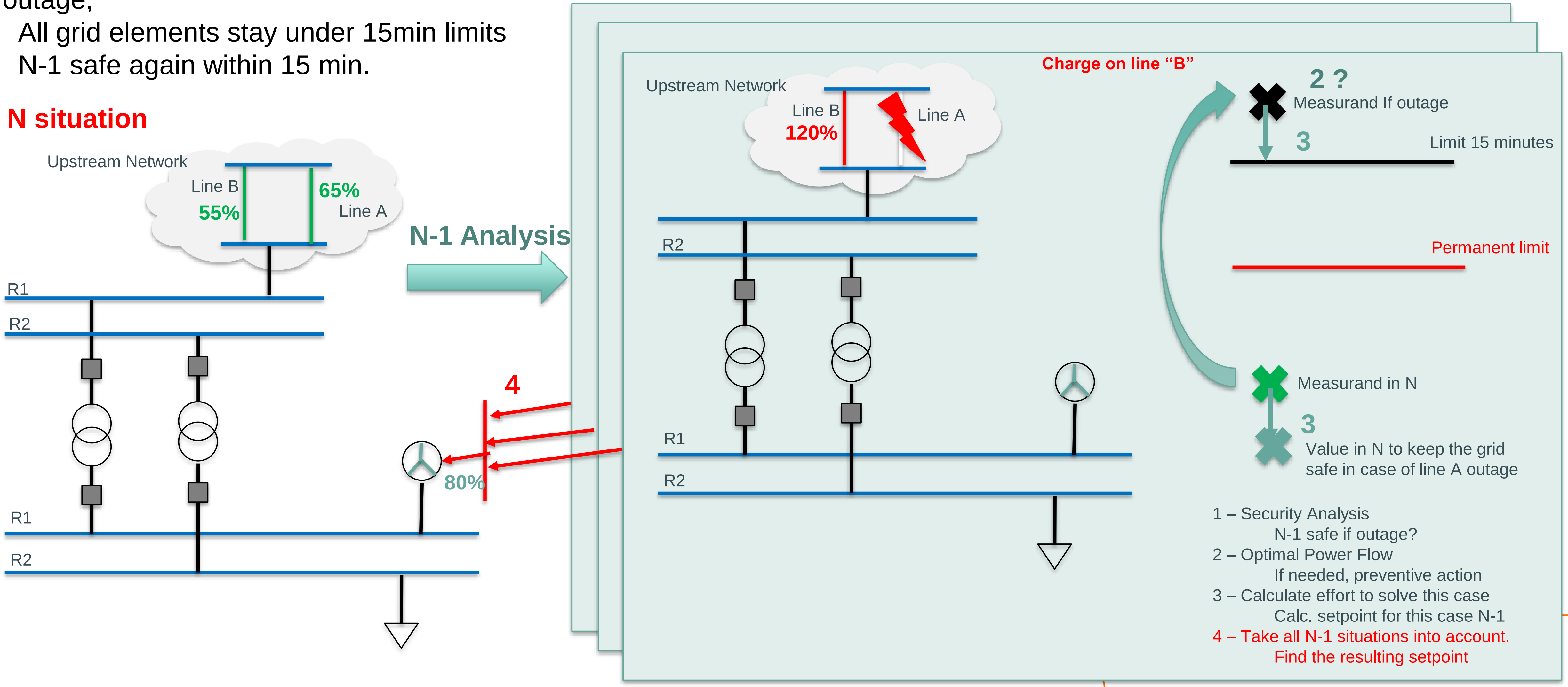
Keep the grid N-1 safe

Pre-read

If outage,

- All grid elements stay under 15min limits
- N-1 safe again within 15 min.

N situation



Keep the grid N-1 safe

Pre-read

If outage,

- All grid elements stay under 15min limits
- N-1 safe again within 15 min.

New N situation