Please note that these slides are a snapshot of the current status of the TERRE work streams.

The information provided is still under discussion and does not reflect the final status of the project.
Topics and Agenda

1. **Scope, Context and Project description**
2. **Design:**
   - TERRE product
   - TERRE TSOs need
   - TERRE CMO
   - TERRE Settlement procedure
   - CBA analysis
   - Timing and Scheduling
   - ATC management
3. **TERRE Implementation Group**
4. **Stakeholder inputs**
5. **Timelines**
Scope, Context and Project description
TERRE = Pilot Project validated by ENTSO-E for RR exchanges

The Design of TERRE solution will be compliant with the requirements of:

- The FW guidelines on Electricity Balancing
- The implementation of TSO-TSO balancing model
- The NC on Electricity Balancing (NCEB)
  - Centralised and automatic management of XB capacity
  - Offer based on “cheapest” internal bids
  - Improved offers selection process…

TERRE aim is to support and provide experience for the entry into force of the NC EB.
TSOs involved = more than 80% of TSOs using RR

- REN
- NG ET & IC
- TERNA
- RTE
- ADMIE
- Swissgrid
TERRE in the NCEB context

- EIF of NCEB
- Definition of Standard products
- Multilateral CMO - RR
- Harmonization Imbalance Settlement Features
- Proposal for the implementation framework to implement the European integration model for the Replacement Reserves

- t0
- t0 ≈ June 2016
- Go live TERRE
- Harmonization Settlement

- 1 Y
- 2 Y
- 3 Y
- 5 Y
Local implementation of TERRE project will be carried by the national market frameworks
Project Work Packages (1/2)

1. Definition of the standard TERRE products
   - RR offer by BSP
   - RR needs by TSO

2. Balancing CMO
   - "Algorithmic optimization" including automatic ATC management

3. Settlement procedure
   - Marginal price as preferred solution for XB exchange
   - Definition of Financial settlement between the TSOs

4. Cost-Benefit analysis
   - Study of the potential socio-economic benefit (social welfare)
Project Work Packages (2/2)

5. Timing and scheduling
   Interaction between the Intra-day market and the TERRE process

6. ATC management
   Centralized ATC management module

7. Governance issues
   Preparation of the NRAs approval process
   Preparation of the Implementation Phase
Definitions

1. **Bids**: Balancing Energy Bids. They will correspond to TERRE Standard Product

2. **Needs**: Volume (and price if applicable) of balancing energy (RR) needed by an electric system

3. **Selected Bids**: Bids selected in the TERRE CMO

4. **Activation Request**: Request from the Connecting TSO to the BSP to activate a Balancing Bid
TERRE Product
TERRE product should:

- be compliant with TSOs requirements
- be coordinated with the RR standard product definition
- be scheduled and manually activated

(a) Preparation Period
(b) Ramping Period
(c) Full Activation Time;
(d) minimum and maximum quantity;
(e) Deactivation Period;
(f) Price of the Bid;
(g) Divisibility;
(h) minimum and maximum duration of Delivery Period;
(i) The Bidding Zone where the bid is located;
(j) Validity Period;
(k) Mode of Activation.
(l) minimal duration between end of Deactivation Period and the beginning of following Full Activation Time
TWG agreed on the definition of FAT parameter  = 30min

FAT = Preparation Period + Ramping Period

This definition will facilitate the participation of a variety of BSPs capable of meeting the range of ramps shown below
Structure of standard balancing product

Basic agreed criteria

0- Activation principle = Scheduled

1- Preparation period = from 0 to 30 min

2- Ramping period = from 0 to 30 min

3- Full Activation Time = 30 min

4- Min quantity = 1 MW

5- Min delivery period = 15 min or multiples of 15 min

6- Max delivery period = 60 min

7- Location = Bidding zone

8- Validity period = defined by BSP but equal or less than 60 min

9- Recovery period = defined by BSP
Bid validation Criteria

10- Deactivation period = Ramping Period

11- Divisibility Volume: Under the responsibility of BSP
• Min volume = 1MW
• Resolution = 0,1MW
• Maximum Bid Size: In case of divisible bid, no max is requested.

12- Price of submitted bids= the Cap & Floor prices will be compliant with the local market rules

For settlement result-Clearing/Marginal definition of cap and floor Price: Still under validation
The links between the bids accepted by the TERRE solution are under discussion.

There is a different level of complexities regarding the implementation of these possibilities.

The aim is to reach a compromise between the complexity of algorithmic implementation and incentivizing flexibility for maximum liquidity purposes (flexibility for BSPs participation).

Once the offer is selected by the matching process and asked for activation, the connecting TSO is responsible for the energy delivery on its border.
- The methodology is under the responsibility of the TSO ➔ we don’t need to have an harmonized methodology.
- As for the TERRE product, the parameters which describe the need submitted to TERRE platform should be defined.
- The XB scheduling impacts the characteristics of the need. This topic is addressed within TERRE project.
TERRE CMO
TERRE process

BSP’s

Offers

TSO’s

Bids & Needs

XB Capacity

TERRE Module

incl. CMO

Selected Bids

Netted needs

XB exchanges

TSO’s

BSP’s

Activations (Activation Request)
Different design options are actually under discussion in the TERRE Working Group.

Evaluation process is actually not finished, different combinations of the design options are still under investigation and are simulated.

A principle question related to the clearing algorithm is under investigation and needs to be clarified in general:

- Is it appropriate to activate positive and negative RR at the same time only because of the financial benefit or should the activation of BSP offers be limited when the TSO need is fulfilled?
Remark:
The expressions “elastic” and “inelastic demand” are established and defined wordings in economics and represent the need of the TSO.
Actually favored solution from TWG:

- **Elasticity → Elastic demand**
  - Simplifies the process
  - Gives flexibility to each system
- **Algorithm → One stage process**
  - Higher efficiency
  - More compliant with the elastic demand principles
  - Simpler settlement
- **Design/objective function → Maximization of social welfare**
  - Best solution regarding economic criteria
  - Simple process
Different possibilities for bid formats are still under evaluation
The calculation time of the CMO algorithm is strongly depending on the complexity
Sustainable statements about the possibilities can be made only after testing with realistic data volume

Different Bid formats:
- Single divisible bid
- Multi-part bid
- Single block bid
- Conditional bid
- Linking bid

<table>
<thead>
<tr>
<th>Bid Format</th>
<th>Complexity</th>
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<tr>
<td>Single divisible bids</td>
<td>Not linear increase</td>
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<td>Multi-part bids</td>
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<td>Single block bids</td>
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<td>Conditional bids</td>
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<td>Linking bids</td>
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TERRE Settlement
Settlement TERRE product

Financial exchanges between TSOs will be based on this energy volume

Energy volume used for the centralized CMO
Marginal Price vs Pay-as-bid TSO-TSO Settlement

- Characteristics of design of TERRE pilot project:
  - Supra-regional scope (not bilateral)
  - Optimization algorithm (not FCFS) for efficient allocation of bids and needs maximizing social welfare and optimizing use of interconnections and balancing resources

- Two analyzed options for settlement of XB schedules
  - Pay as cleared (marginal) – preferred solution by FG EB / NC EB
  - Pay as bid (subject to CBA that demonstrates that it is more efficient)
As presented before, two solutions are discussed for the CMO definition.

This situation obliged the TWG to define the TSO-TSO settlement procedures for this two options:

- **Clearing algorithm** ➔ One stage process for settlement
  - The marginal price should be defined (for upward and downward activation? Pay-as cleared?)
  - The congestion rent should be described...

- **Pre-netting + Clearing algorithm** ➔ Two stages process for the settlement
  - A settlement for the pre-netting phase based on avoided offer activations?
  - A settlement for the clearing phase based on pay-as-cleared price?
  - What is the impact on the congestion rent …
ENTSO-E currently working with Frontier Economics to develop a standard CBA methodology. TERRE’s aim is to use this where possible to structure CBA.

Currently three approaches being considered:

- Pure CBA
- Augmented CBA
- Multi-Criteria Assessment

Monetisation of benefits:

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<td>Degree</td>
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The TERRE project agreed that we should try and use the Augmented CBA approach as it was felt this best captured the quantitative and qualitative aspects of TERRE.
Methodology:

- The simulation tool developed for TERRE project will be used to calculate the historical costs of balancing the system for each TSO using actual data from 2013. This will form the counter factual or 'as is' scenario.

- We will then use this tool to simulate what the costs would have been if all the available bids/offers in that period were in a Common Merit Order List and were activated in a clearing process which took into account ATC.

- Social welfare / benefit will then be calculated based on the comparison.

Results will also be produced on a national level to see the distribution of benefits between TSOs.

Looking at defining sensitivity analysis (e.g. varying ATC could indicate potential benefits of reserving ATC for balancing as per GL EB)

Work has started on detailed CBA document, detailing methodology (e.g. discount factors etc) and highlighting the assumptions made both in the data collection and simulation in order to be transparent about the potential limitations of the CBA.
However while we are making good progress on the assessment of potential benefits, assessing the costs is more difficult..

- Will link to work on IT WG and tender process for delivery of IT platform
- Difficulties taking into account costs incurred by national TSOs for local implementation of TERRE
- Uncertainty around how best to take into account costs incurred by market participants, particularly given the timelines…

CBA will obviously be a key part of the NRA approval process and at previous stakeholder sessions, questions have been asked whether this will be independently audited.

Hence there will be some key interdependencies between tasks in the IT WG, CBA work stream and NRA approval process that will require careful planning
Timing and scheduling
The process is still under discussions

- Warning: ID market GCT not harmonized
- The timings of each phase are not completely defined yet
Interaction between CMO and XB scheduling step

Structure of TSO need (example)

- ID Market
- TERRE processing
- Delivery period

Matched by XB (Swiss and French, and could be extended to other borders s.t. XB ID market and involved TSO’s agreement) or local products

- XB scheduling step = 30min

This is a maximum value. Shorter XB scheduling steps (30 min, 15 min…) will be analysed in TERRE project
An Implementation Group was set up between the TSOs and the NRAs.

The aim is to discuss the progress of the project, the risks and the preparation of the implementation phase.

The frequency of the meeting during the design phase = one each 2/3 months.
Stakeholder events/meetings
Project TERRE has organized the current meeting in order to communicate on the relevant information toward market participants.

The questions and comments from the market participants will be highly considered.

BSPs/BRPs could also contact their connecting TSOs in order to be informed about the local impact related to the implementation of TERRE.

Project TERRE will organize another workshop or meeting before the end of the design phase.
Timelines
## Overview

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<td>Monitoring of economic variables (costs, volumes, social welfare)</td>
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<td>NC EB proposal of modification of target model</td>
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Thank you...