

Balancing pilot projects update

23rd September 2015

Contributions and geographic extension of PP

Increase of social welfare and market liquidity

Pilot projects in operation are demonstrating that XB balancing is increasing social welfare and is giving more flexibility for TSOs (especially needed with increasing RES penetration). Challenge to keep local adequate incentives for BRPs in a cross border balancing market with marginal pricing.

Geographical extension

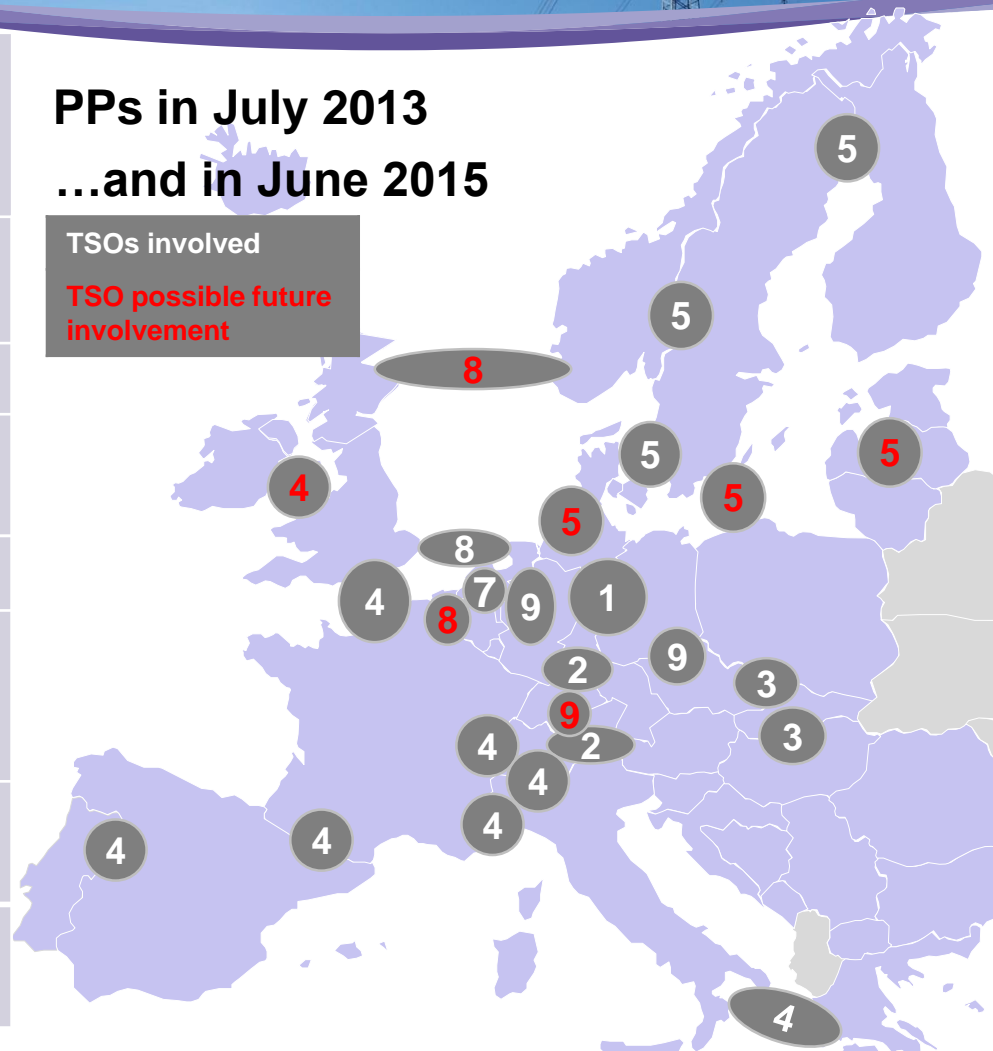
Several pilot projects have increased the number of participating TSOs / geographic scope because TSOs see benefits in wider cooperation:

- Pilot 1: feasibility studies for cooperation with PP 5 and 7 and aFRR cooperation with Austria
- Pilot 2: extension towards German, Austrian, Dutch and Swiss TSOs went live on April 7th;
- Pilot 4: REE, Swissgrid and ADMIE and potential future extension towards Eirgrid.
- Pilot 5: feasibility studies with Baltics, Poland and pilot 1
- Pilot 7: on going feasibility studies with pilot 1 and Austria
- Pilot 9: multilateral agreement will make easier for new TSO's to join

Pilot projects are actively contributing to the early implementation of NC EB and extend in geographical size. Harmonization increases among more TSOs

PPs in July 2013 ...and in June 2015

TSO possible future involvement



entsoe

ENTSO-E Balancing Pilot Project Report

Summary of learnings and barriers

Contributions and geographic extension of pilot projects

Several processes in the same CoBA

A clear example is the case of pilot 1, which delivers a working example for maximum optimization potential and can serve as basis for step-by-step implementation of Imbalance Netting, joint procurement of FCR, aFRR and mFRR as well as the CMOs for aFRR and mFRR.

Flow based approach

The implementation of the flow based approach for activation of aFRR in pilot 1 allows for an overview of the flows created by the CMO activation.

Standardization of balancing products

The design of products and the process to exchange them might affect local ACE quality, local reserve needs, local market liquidity and sourcing price, local ability to cover reserve needs.

Barriers and Regulatory Issues



Differences in the way TSOs are operating the system

- Central dispatch systems versus self dispatch systems
- Reactive systems versus proactive systems
- Some TSO's use scheduled products while others use direct activated products.
- Market time resolutions (Gate Closure Times, Time to restore frequency...)
- Some systems rely more on aFRR product while others on mFRR products.

Regulatory Issues

- Different cap and floors for balancing pricing due to different national legislation. → creates asymmetries for both bidding process and Imbalance settlement
- Some countries settle using pay as bid scheme while others use marginal pricing for XB TSO-TSO balancing energy.

Key learnings from pilot projects: barriers (i)



Experience shows that implementing pilot projects is a long process; examples:

Pilot 7: Tennet-Elia 2 years discussion (different control blocks and bidding zones is an issue)

Pilot 1: GCC (1 country, 1 NRA, 4 TSO's) 2 years (including common procurement and dimensioning)

Pilot 4: design phase not finished yet: long process; among other reasons, increasing number of TSO's participating (different needs, different local products different local regulatory frameworks with different timings/scheduling processes)

Additional barriers derived from:

Current lack of harmonized XB ID market in Europe → this is an important issue for defining common timing and scheduling for balancing: for instance, pilot 4: difficulties for defining common timing for updating bids to be submitted and updating ATC for XB balancing)

Some countries settle using pay as bid scheme due to National legislation while NC Balancing recommends marginal pricing for XB TSO-TSO balancing energy (this is an issue at pilots 1 and 4, for instance)

Key learnings from pilot projects: barriers (ii)

Fundamental difference with DA –ID of a balancing market due to the short distance to real time and security aspects involved

Operational real time market and local TSO responsibilities need to be respected (LFC&R);
TSO's should preserve reserves/ACE quality in a context of different system dynamics;
These TSO's tasks should be preserved independent of balancing markets extension.

Economic impact from balancing markets:

How to manage a reduction of balancing price, derived from a higher balancing market liquidity, while preserving adequate local incentives for BRPs to be balanced or help to restore the imbalance

Pilot projects and current proposal of manual products

	P-DA-15-15/30 (mFRR)	P-DA-10-10/25 (mFRR)	P-DA-5-5/20 (mFRR)	P-Sch-15-0/15 (mFRR)	P-Sch-30-15 (RR)	P-Sch-15-15 (RR)
FAT	15	10	5	15	30	15
Min delivery	15	10	5	0	15	15
Max delivery	30	25	20	15	15 / 60	15
Temporal divisibility	Mandatory yes. between min and max. Minute based resolution	Mandatory yes.	Mandatory yes.	NO	NO	NO
Links (temporal)	No	No	No	No	Yes / No	No
Activation method	Continuous process	Continuous process	Continuous process	Continuous process, or clearing	clearing	clearing
Pilot projects	Pilot 1, Pilot 5				Pilot 4	Pilot 7

A satellite view of Europe at night, showing the continent illuminated by city lights against the dark background of the Earth and the starry night sky. The image is framed by a dark blue border at the top and bottom.

Description of recent achievements, learning points and road map of each pilot project

Pilot 1 – Common Merit Order (CMO) for mFRR and aFRR with real time flow based congestion management

Key Learnings:

- The project delivers a working example for maximum optimization potential between TSOs without constraints of different regulatory frameworks and can serve as basis for step-by-step implementation of Imbalance Netting, aFRR-Assistance, joint procurement of FCR, aFRR and mFRR as well as the CMOs for aFRR and mFRR.
- The main expected contribution is the implementation of the optimization functions, real-time operation and experience with the implementation of the TSO-TSO model.

Achievements:

- Feasibility studies for cooperation with pilot projects 2, 5 and 7.
- Experience implementing a flow based approach at balancing markets
 - The implementation of the flow based approach for activation of aFRR in Germany was successful since it allows an overview of the flows created by the CMO activation.
 - While the feasibility was proven under conditions of real operation, it has to be mentioned, that the flow based approach, as it is currently implemented for the aFRR-CMO between the German TSOs, is an operational tool and has no interactions with the flow-based allocation of transmission capacity for energy markets due to the fact that Germany is one bidding zone and the flow-based approach for intraday is not yet implemented.



Key Learnings

- As the Central Clearing Function considers different market characteristics and rules (e.g. various types of bids: divisible/not divisible, conditional), it is not necessary to harmonize all product characteristics in the first place

Achievements

- Example of a clear TSO-TSO model according to NCEB
- Optimization function implemented in this project in line with NCEB
- The founding TSOs – the Austrian TSO (APG) and the Swiss TSO (Swissgrid) – were joined by the FCR cooperation between the German TSOs (50Hertz, Amprion, TenneT and TransnetBW), the Danish TSO (Energinet.dk) and the Dutch TSO (TenneT).



Some questions and answers

The exchange of reserves is done over the TRM. Is this in line with NC EB? Is this capacity sufficient to create a common balancing market?

- The NC EB does not prescribe exchange of FCR. The TRM is among others generally reserved for the FCR exchange. The capacity is sufficient to create a common balancing capacity market since this is determined by ENTSO-E operational procedures. Furthermore, there are FCR export limits in the FCR cooperation.

What are experiences with geographical extension?

- Pilot project 2 has demonstrated the possibility to integrate inhomogeneous markets into one single FCR platform. This resulted in higher market competition and increase of social welfare.
- As the cooperation between the German, Austrian, Dutch and Swiss TSOs went live on April 7th, 2015, the next step is to monitor the economic variables (social welfare, etc.). The actual cooperation may be extended to other TSOs. Elia (Belgium) and RTE (France) already showed interests in joining.

Why did the German NRA block the participation of Denmark?

- The German NRA (BNetzA) blocked the participation of Denmark because of the unresolved issues linked to the cross-border capacity between Germany and Denmark.

Pilot 2 road map



	2012				2013				2014				2015				2016				2017				2018			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Design phase</i>																												
<i>NRA approval</i>																												
<i>Decision go live/ not to go (under a CBA)</i>																												
<i>IT Implementation</i>																												
<i>Testing</i>																												
<i>Go Live</i>																												
<i>Monitoring of economic variables (costs, volumes, social welfare)</i>																												
<i>NC EB proposal of modification of target model</i>																												



Key Learnings

- experiences gained from TSO-TSO real-time cooperation and settlement.
- multilateral agreement, as this is the basic document for the cooperation. It contains the operational rules, settlement rules, liability rules and define boundaries of the cooperation in general

Achievements

- Important savings of aFRR activation and appropriate good experience running eGCC Imbalance settlement scheme

Some questions and answers:

- *Fixed price vs market based pricing? When will it be changed?*

There is no exact roadmap for changing the pricing methodology. Participating TSOs highly value transparency and simplicity of the fix price.

The other currently used pricing scheme – opportunity price – allows increased consistency with market prices of electricity in regional level (assuming the electricity market price is reflected in balancing energy bid prices). On the other hand, the scheme is highly complex with lower transparency and simplicity in comparison with the fixed price scheme. Until there is a better (more simple and transparent) scheme, e-GCC does not intend to change the fixed pricing scheme.

- *What are the experiences from interfaces between multiple IN initiatives?*

Participation is hierarchical. First e-GCC followed by IGCC.

- *What are the reasons for not merging with pilot 9? Only pricing and IT structures?*

In general, we are open to merge with any imbalance netting cooperation. However, such merge must bring benefit for us. Such benefit should outweigh costs associated with the merger and we do not see such high benefit anywhere at the moment.

- *Has real time Flow Based congestion management been considered as in pilot 1?*

e-GCC is of a size where flow-based congestion management would not bring benefits. We prefer to wait for experiences gained by pilot 1 and 9 (there is a vision to implement flow-based congestion management) before we start thinking about implementation.

- *CEPS joint first to IGCC and latter to eGCC or the opposite?*

CEPS has started e-GCC with SEPS at the end of March 2012 and joined IGCC at the beginning of June 2012.

Pilot 3 road map (currently pilot 3 is on hold although monitoring economic variables evolution)

	2013				2014				2015				2016				2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Design phase</i>																												
<i>NRA approval</i>																												
<i>Decision go live/ not to go (under a CBA)</i>																												
<i>IT Implementation</i>																												
<i>Testing</i>																												
<i>Go Live</i>																												
<i>Monitoring of economic variables (costs, volumes, social welfare)</i>																												
<i>NC EB proposal of modification of target model</i>																												



Key Learnings

- TSOs are willing to cooperate and harmonize knowing the challenges derived from increasing the number of involved TSO's. These can be either technical (e.g. DC link between FR-GB) or market oriented.
- Despite the fact that there are many TSOs involved in TERRE with different local market designs, near to set up a design solution on which these TSOs all agree.
- Interaction of RR process with Intraday market:
 - ☐ Difficulties as European ID market not yet harmonized (local or/and XB markets).
 - ☐ Difficulties for defining common timing for updating bids to be submitted to TERRE and updating ATC for XB balancing.
- Challenging project:
 - ☐ Target of setting up of an implicit XB balancing solution/market
 - ☐ Expected timescales



Achievements

Good advance at design phase despite an increasing number of TSO's collaborating:

- The algorithmic optimization is currently tested
- The optimization mix a netting of need and activation of offer
- The CMO will allow elasticity at TSOs need
- Regarding settlement issues: it is envisaged the application of marginal price and the treatment of congestion rents

Road map pilot 4

	2013	2014				2015				2016				2017			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Design phase</i>																	
<i>NRA approval</i>																	
<i>Decision go live/ not to go (under a CBA)</i>																	
<i>IT Implementation</i>																	
<i>Testing</i>																	
<i>Go Live</i>																	
<i>Monitoring of economic variables (costs, volumes, social welfare)</i>																	
<i>NC EB proposal of modification of target model</i>																	

Pilot 5: Recent actions and learning points

Three feasibility studies for FRRm integration have been finalised by the end of 2014 (Poland, Baltics and pilot 1)

- Baltic TSOs have from January 1st 2015 implemented imbalance netting between Estonian, Latvian and Lithuanian power systems as suggested by the feasibility study on Nordic-Baltic balancing cooperation development.
- ToR for Baltic – Nordic integration has been already developed by Nordic and Baltic TSOs
- Analysis of different exchange models between Nordic and other synchronous areas has been initiated

Implication for the Nordic synchronous system

- Current Nordic RPM is well functioning with +50 mEuro annual socio economic gain and covers two synchronous areas and with minor differences in product definitions
- Exchange of balancing energy on more interconnectors will increase complexity in the Nordic system creating challenges with respect to operations, IT systems and fair treatment of external cooperation
- The Nordic TSOs currently analyze the needed prerequisites for the development of a common framework to meet these challenges.

Nordic – German study

- Desk top study concludes large potential socio economic gain from integration of Nordic and German RPM
- Germany mainly using FRRa and Nordic mainly FRRm – focusing on different products of the FRR process and different market setup
- Need for harmonization of marginal pricing/pay as bid, gate closure time, combined vs. separate capacity/activation market, voluntary bids and ISP (60 vs. 15 minutes)

Nordic – Poland study

- In order to ensure that bids coming from the Polish central dispatch system and bids from the Nordic self dispatch system are comparable, balancing energy bids coming from or to the central dispatch system have to be converted by the TSO.
- Further cooperation awaits Polish intraday market development

Nordic – Baltic study

- The Baltic balancing market is undergoing regional harmonization and therefore alignment with existing and planned Nordic balancing mechanism is possible
- Fast step by step integration and positive socio economic gain and improved operational security

Pilot 5 road map for Polish - Nordic cooperation

Time plan to be updated

	2013				2014				2015				2016				2017				2018				2019			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Design Phase														?														
IT implementation																		?										
Testing																												
Go-Live																												
Monitoring																												

Pilot 5 road map for Nordic - Baltic cooperation



	2014				2015				2016				2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Design Phase 1 (HVDC link)							?																	
Design phase 2 (combined CMO)												?												
IT implementation, phase 1																								
IT impl. phase 2																								
Testing phase 1												?												
Testing phase 2																?								
Go-Live																								
Monitoring																								

Pilot 5 road map: cooperation with pilot 1



Time plan to be updated

	2013				2014				2015				2016				2017				2018				2019			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Design Phase														?														
IT implementation																		?										
Testing																												
Go-Live																												
Monitoring																												



Key Learnings

- Pilot 7 currently discussing market design assumptions with Pilot 1 and Austria.
- Close interaction between LFC&R responsibilities and design for XB exchange
 - Design products & processes might potentially affect the ACE quality, required reserve capacity volumes and corresponding sourcing costs (link local access tariffs)
- Imbalance settlement is an important LOCAL tool to incentivize market parties to keep their balance or help to restore the system imbalance
 - For doing this an imbalance settlement period of 15 min and an appropriate design of settlement price of balancing energy is key.
 - Single marginal imbalance pricing is recommended
 - Change of imbalance settlement system in BE is demonstrating a significant improvement of the balance position of BRPs
- To enable the XB exchange of aFRR harmonisation is required:
 - a merit order activation with potential impact on aFRR capacity volumes, price and procurement costs for TSOs with a pro rata activation
 - an harmonisation of the ramp rate with potential impact on market liquidity and aFRR capacity prices for TSOs with a different ramp rate
 - Exchange of aFRR on the border should be done via the exchange of aFRR control request
 - Exchange of aFRR demand (GCC) is difficult to replicate between different control blocks
 - TSO can activate more bids on CMO – prior access for connecting TSOs
- To enable the XB exchange of mFRR harmonisation is required:
 - scheduled mFRR product activated locally
 - Schedule activated, firm power profile exchanged over the border
- Settlement of balancing energy:
 - Pricing can be done in several ways; cross zonal pricing or not / cross product pricing or not
 - 1 single marginal imbalance price of uncongested region = BRPs have no incentive to stay balanced per control block (LFC&R responsibility TSO)
 - Local pricing ensures that BRPs are incentivised to balance per LFC Block
 - Cross-product pricing of balancing energy requires local pricing to ensure ex-ante firmness of CMOL
- Use of remaining commercial capacity after ID markets – interdependencies; netting affected by aFRR & mFRR, aFRR affected by mFRR

Pilot 7 road map

	2013				2014				2015				2016				2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Design phase</i>									CBA	CBA	CBA																	
<i>NRA approval</i>																												
<i>Decision go live/ not to go (under a CBA)</i>																												
<i>IT Implementation</i>														?	?	?	?	?	?	?								
<i>Testing</i>																		?	?	?								
<i>Go Live</i>																												
<i>Monitoring of economic variables (costs, volumes, social welfare)</i>																												
<i>NC EB proposal of modification of target model</i>	Question not clear				?	?	?	?	?																			

Pilot 8 – RR on BritNed (currently on hold)



Key Learnings

- potentially combining Pilot 8 with Pilot 4, however, due to the differences in market design, it was decided that it would be useful to concentrate on how the GB and NL market could potentially develop an RR service.
- The current different market models used in GB and the Netherlands makes the exchange of cross border energy very difficult i.e. proactive balancing regime in GB vs reactive in the Netherlands
- The main barrier therefore is that GB is more likely to use an RR service as it provides the system operator with greater balancing tools.
- it may not be possible to fully develop replacement reserves between the two countries.

Pilot 8: some questions and answers (i)



- Why would further clarification from NCEB be decisive for pilot project 8?
 - Certain requirements in NCEB restrict the number of CoBAs that a TSO can join. If GB is prevented from joining different CoBAs for different products, then it is severely limited in its ability to develop other services with different TSOs, which is not truly in the spirit of cooperation and coordination. (e.g. by joining TERRE, why should GB be prevented from joining a FRR pilot project if it is technically and commercially possible to do so?)
- Why not consider mFRR? Possibility to merge pilot 8 with pilot 7 regarding mFRR?
 - NGET and TenneT have met to discuss the possibility of establishing a mFRR service over BritNed, both sides agree it would be beneficial for NGET to meet with TenneT and Elia to establish if it might be possible for NGET to join BPP7.

Pilot 8: some questions and answers (ii)

- What incompatibilities need to be harmonized to enable cooperation between proactive and reactive systems?
 - NGET manages its system proactively, and so uses RR products in timescales further ahead than 15 minutes to balance its system according to forecasts. TenneT does not do this, and so does not need/use RR services. TenneT's approach is to enable BRPs to maintain the balance of its portfolio in real time: TenneT reacts only to any residual imbalance in its control area.
 - In separate discussions it has been established that there are similarities in the FRR products that both TSOs use. There is also a desire to make the current frequency response services under trial in GB over BritNed available to Continental Europe as well.
 - The differences between proactive and reactive system management techniques by the TSOs are the most significant barrier to developing a RR service. However, the similarities in the use of FRR products by the TSOs could offer an opportunity for the development of SO-SO services. NGET and TenneT are in discussion to establish if it is commercially and technically possible to do so, firstly on a bilateral basis, but with a long term view to integrating with other TSOs if possible.



Key Learnings:

- Imbalance netting can be easily implemented even if the participating TSOs do not have same national legal and balancing frameworks (7 countries = 7 different legal and balancing frameworks).
- There is no need for a standard product (no need to harmonize technical preconditions for BSPs) and for any kind of a contract with BSPs.
- To combine multiple legal frameworks, to set a common framework for cooperation, to agree on a governance structure and on a decision making process takes some time (almost 2Y now) even if it is only TSO-TSO cooperation.
- Establishing well-functioning governance bodies with the right experts is essential for the cooperation. All participants must be highly involved and want to cooperate, otherwise, further development is impossible (bottom-up approach).
- Opportunity pricing scheme is quite flexible solution. However, without harmonization of national market designs (pay-as-bid, regulated price or other schemes) some TSOs can have different monetary benefits than the others. Even though, the cooperation still brings significant benefits to all.

Questions:

- What are the learnings connected to IT systems?

Everything is about thorough testing and well designed real-time and especially ex-post processes.

On-going development:

Participants are strongly focusing on finalization of the MLA. Further development is planned in flow-based congestion management; aFRR-assistance and in settlement in order to ensure more robust benefit distribution.

Increased social welfare and market liquidity: Pilot 9

