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PV4Balancing Workstream Report Findings from the Pilot Project

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1	Introduction / management summary	3
2	Product design	3
2.1	Product characteristics: control power and control energy	4
2.2	Provision and requested amounts	4
2.3	Remuneration	5
2.3.1	Remuneration for power provision	5
2.3.2	Remuneration for the supply of energy	5
3	Findings from the pilot project	6
3.1	Prequalification	6
3.2	Power provision	6
3.3	Energy tenders	7
3.4	Activation	9
3.5	Ex-post schedule coordination	10
3.6	Monitoring	10
4	Foreseeable developments	11
5	Recommendations for market integration	11
5.1	Summary of recommendations from the pilot project	11

1 Introduction / management summary

The installed PV capacity in Switzerland had reached 8.2 GW by the end of 2024. It is estimated that the installed PV capacity could rise to as much as 30 GW by 2040. By comparison, the average grid load in Switzerland is approximately 7 GW.

However, the integration of rapidly growing PV generation into the Swiss electricity grid is still inadequate in terms of forecast accuracy, plant controllability and the quality of the information available. Even today, there are an increasing number of situations in which the Swiss control area experiences significant imbalances due to inaccurate PV forecasts. Since 2023, for example, there have already been several occasions when more than 1 GW of control energy has been required.

This expansion poses two major challenges for grid control. Firstly, due to the limited accuracy of forecasts for solar power generation, there is a risk of imbalances and a corresponding need for TRL reserves. Secondly, procuring negative control reserves is especially difficult on days with low consumption and high PV generation, as many conventional flexibility providers do not generate power on these days and therefore do not have any available ramp-down capacity.

The most obvious yet still largely untapped solution for covering this shortfall is to integrate photovoltaic plants more extensively into the AS market. If a contract is awarded on the tertiary control reserve market (TRL), a bidder is currently obliged to submit corresponding tenders on the tertiary control energy market (TRE) for a fixed amount and for the entire four-hour period. Remuneration is paid both for the binding power provision and for the actual supply of energy. Photovoltaic plants can already participate in the TRL/TRE market today via pooling. However, because they must guarantee power provision for several hours, this is rarely the case or only occurs in combination with other sources of energy.

To facilitate the participation of photovoltaic plants in the TRL/TRE market, in 2024/25 Swissgrid developed an initial outline concept for a product with tailored requirements («PV4Balancing»). In order to assess both the practical suitability of this product itself and its integration into the AS market, a pilot project involving several ASPs has been carried out between June 2025 and June 2026, during which the PV product has been in use in regular system operation. The findings of the pilot project have been recorded in a structured manner in this document.

The pilot project clearly shows that integrating PV is possible, but challenging. Processes, forecasts, data bases and control mechanisms must be further improved in order to ensure that photovoltaic plants can be reliably integrated into system operation. Major challenges exist, particularly with regard to forecast quality, control/communication, consistent balancing, a lack of standardisation and economic scalability. Nevertheless, PV is already a relevant resource for system control at times when there is little conventional tertiary control energy available. This effect will become even more pronounced in the future given that the share of PV generation is rising rapidly. This means that integrating PV into the control market is not only essential, but should also be prioritised in the interests of efficient market design.

If PV is to make a real contribution to the control market in the future, this will inevitably involve a certain degree of uncertainty. Without a willingness to take these risks in a controlled manner, it will be virtually impossible to achieve efficient and timely integration. Failing to integrate PV also entails risks: the challenges for system control associated with the growing share of PV will not simply disappear – if anything, they will intensify.

2 Product design

As described in the introduction, a new product with tailored requirements for the participation of PV in the TRL and TRE markets was developed for the pilot project in order to take account of the specific characteristics of

PV generation. The differences between the «PV_TRL» and «PV_TRE» products in relation to the standard TRL and TRE products are explained below.

2.1 Product characteristics: control power and control energy

PV_TRL-: adjusted reserve obligation

Unlike conventional TRL, PV_TRL- does not require a fixed amount to be held in reserve. Instead, if a bidder is awarded a PV_TRL- contract, they undertake to submit PV_TRE- tenders that accurately reflect their actual production at all times. For the purposes of the pilot project, this «provision» by the plant is remunerated by means of a lump sum.

PV_TRE: minimum bid size of 1 MW

Whereas there is a standard minimum bid size of 5 MW for TRE, PV_TRE- bids can be submitted from as little as 1 MW.

PV_TRE: 96 gate closures

Unlike the standard hourly gate closures at H-25, PV_TRE- bid amounts can be adjusted at quarter-hourly intervals up until T-25. The usual gate closure times of H-25 apply to prices.

PV_TRE: only in a negative direction

Due to the production characteristics of photovoltaic plants, the power curve can mainly be adjusted downwards. Consequently, the product is calculated only in the negative power direction (PV_TRE-).

The following table provides a detailed comparison of the product characteristics of PV_TRE- with those of standard tertiary control energy products.

PRODUCT TYPE	TRE_MFRR (MARI/IM)	PV_TRE-
Product name	TRE_mFRR_sa+ TRE_mFRR_da+ TRE_mFRR_sa- TRE_mFRR_da-	PV_TRE_sa- -
Delivery period	15 mins. (+15 mins. for DA)	15 mins.
Gate closure	25 mins. before the start of the hour (1 GCT for all 4 quarters of the hour)	Amounts: 25 mins. before the start of the quarter-hour (1 GCT per QH) Prices: 25 mins. before the start of the hour (1 GCT for all 4 quarters of the hour)
Lead time until full service provision (FAT)	TRE/MARI: 12.5 mins.	TRE/MARI: 12.5 mins.
Volumes	Indivisible: 5 MW – 100 MW Divisible: 5 MW – 9,999 MW (in 1 MW increments)	1 MW – 100 MW (in 1 MW increments)
Price/MWh	-15,000 EUR/MWh – 15,000 EUR/MWh	-15,000 EUR/MWh – 15,000 EUR/MWh
Divisibility	Indivisible, divisible with/without a minimum amount	Indivisible
Linking of tenders	Conditional (limited, backwards between QHs)	N/A

2.2 Provision and requested amounts

Plants with a total nominal capacity of around 50 MWp were connected for the pilot project.

When a request is received, production at the plant must be reduced in line with the requested amount. This may apply to plant production or feed-in, although both options were deliberately permitted for the pilot project¹.

The probable generation (feed-in or plant production) is reflected in the tender amount of PV_TRE- bids and can be adjusted up to 25 minutes before the delivery period. Requests for PV_TRE- are based on the tender amounts and are taken into account accordingly in control and balancing processes.

2.3 Remuneration

2.3.1 Remuneration for power provision

During the pilot phase, a fixed price is paid for the promised capacity (connected nominal capacity of the PV pool). This is based on historical TRL prices, taking into account the ratio of actual capacity to nominal capacity (just under 10%²). Remuneration of 3 CHF/MW_ph was defined for the pilot phase; this corresponds to the connection of 1 MW_p per calendar year

$$3 \text{ CHF/MW}_p\text{h} \times 1 \text{ MW}_p \times 8,760 \text{ h} = \text{CHF } 26,280$$

Based on the TRL prices for 2025, a price of 1.3 CHF/MW_ph³ would currently be appropriate, assuming the methodology remains unchanged.

2.3.2 Remuneration for the supply of energy

Remuneration for the supply of energy is based on the bids received. Contracts are awarded in the regular tertiary control energy auction in accordance with a combined TRE- and PV_TRE- MOL.

During the pilot project, a specific pricing incentive was established to guarantee PV requests, thereby both improving the informative value of the pilot project and justifying the fixed remuneration for the connected capacity. To this end, a target figure was set for the number of requests. The aim was to encourage tenders in the price range of –200 to –300 CHF/MW:

*«The aim of project phase 1 is to request **60%** of the tendered PV capacity during the quarter-hourly intervals when TRE- tenders are activated and the market price is below **–200 EUR/MWh**. The ASPs endeavour to help meet this objective by submitting tenders.»*

¹ Reducing the **feed-in** makes more sense and is more understandable from the perspective of the energy strategy and end customers. Less energy is wasted, and there remains an incentive to shift own consumption to coincide with production times. Reducing **plant production**, on the other hand, has a greater impact, as it allows a larger amount of TRE- to be supplied. The amount requested depends on fewer factors and is therefore easier to determine.

² Based on data from the overall energy statistics (SFOE) [11796-GES-Stat_2023_Web.pdf](#)

³ Data from January to August 2025 was taken into account.

3 Findings from the pilot project

The pilot project was designed to test the practical viability of the new PV control product. The processes implemented and tested were therefore very closely aligned with the existing standard processes for the TRL market. The individual process steps are shown schematically in the diagram below.



The individual sub-processes from the pilot project are described below and key findings are given.

3.1 Prequalification

At present, there are no clear prequalification conditions for PV participation in the ancillary service market, which is one of the biggest obstacles to PV participation in the control market. In particular, there are only implicit prequalification conditions with very limited options for baselining; these involve high costs (sensors) or high complexity (plant splitting) and are therefore not feasible for the majority of plants. A simplified prequalification process with specific requirements was therefore introduced for the pilot project. A much wider range of baselining methods was permitted in order to gain experience with different approaches. Furthermore, the participating ASPs were required to set up a PV-only pool to ensure that the PV_TRE- requested during the pilot project was actually supplied by the photovoltaic plants.

Findings and challenges

Master data is difficult to access. It is difficult to find information about plant metering points. Information about the balance group and the suppliers of plants is often not systematically available (no data base). The flow of information is insufficient between ASPs, BGMs and DSOs regarding the participation of plants in the AS market, even though this requirement is actually specified as part of the prequalification process. All of this complicates the prequalification process and makes it relatively time-consuming, particularly for small-scale plants, which therefore limits the participation of new players and distributed resources on the AS market. This issue is expected to be resolved in the future thanks to the Datahub and associated processes (in around 2028).

There is currently no standardised baselining process. Various approaches were adopted in the pilot project, each with its own strengths and weaknesses. To facilitate market integration, the range of baselining methods should be expanded and clear recommendations provided. To this end, the chosen baselining method should then be calibrated during operation or in a test phase and evaluated according to a quality criterion. The recommendation would be for the n_RMSE (normalised root mean square error) of the entire pool to be used as a quality criterion for baselining and capped at 10%. A quality criterion based on the individual production unit should also be evaluated. In addition, the supplier's baselining should be compared with Swissgrid's baselining on a case-by-case basis, and a difference of less than 10% should be ensured.

Offline data on plant production is essential for verifying energy supply. Offline data was requested during the pilot project. This data was supplied and analysed via Databricks by means of a straightforward process. This requires regular data monitoring and, as the process is scaled up, will necessitate clearly defined responsibilities and resource allocation.

3.2 Power provision

The current framework conditions in the control power market allow only very limited participation by PV due to the compulsory power provision for time horizons of four hours or longer. For the purposes of the pilot project, the PV_TRL- reserve component was instead remunerated by means of a lump sum for the connected

nominal capacity of the PV pool. This was subject to the obligation to make the plant's full capacity available in the form of tenders on the TRE market. Players with a total nominal capacity of 51 MWp participated in the pilot project.

Findings and challenges

Nominal capacity (MWp) is an arbitrary reference for the reserve volume. During the pilot project, payments were made for nominal capacity as remuneration for the reserve capacity. However, it has become clear that this simplification falls short and that the disadvantages of this lump-sum remuneration outweigh its advantages (i.e. its simplicity). Depending on the plant configuration, location, operating mode, etc., the actual maximum capacity may deviate so significantly (or not at all) from the nominal capacity that the figure simply ceases to be meaningful. Of the 51 MWp connected during the pilot project, no more than 24 MW of PV_TRE- was ever tendered. Furthermore, the associated obligation to offer the plant's full production as PV_TRE- resulted in poor energy tenders. The requirements set out in the pilot project do not stipulate that energy tenders must include safety margins, nor do they require the PV_TRE- tender to be backed by a larger pool capable of mitigating any production risks. This effect increases the risk of discrepancies between what is tendered and what is supplied. The reserve component should therefore be based on a tender by the bidder that gives a more realistic picture of plant production, taking into account margins and competing processes (own consumption, price signals, etc.).

The available capacity fluctuates significantly over time and by season, and correlates with TRL- prices. During the pilot project, the highest tender volumes were observed between 11 a.m. and 4 p.m., while the highest request volumes occurred between 12 noon and 3 p.m. Supply was also found to be significantly higher in the summer than in the winter – the highest tender volumes were observed in June, July and August following a ramp-up phase, while the highest request volumes occurred in September. The average value of PV_TRL- in 2025 (Jan–Aug) was just under 1.3 CHF/MWh or 5.4 CHF/MWh⁴. However, it is much higher at midday, in the summer and at weekends⁵, as there is less flexible hydroelectric power available for negative control power at these times. TRL- prices therefore correlate with the available PV capacity. This shows that PV represents an important resource for system operation, and this effect is expected to become more pronounced as PV penetration rises and PV plays a greater role in the control market. The strong temporal and seasonal patterns suggest that PV_TRL- should (only) be procured at times when there is sufficient PV availability.

There are several options for market integration which differ in particular with regard to the binding nature of power provision. There is, however, a trade-off between the binding nature of the agreed capacity volumes and the need to facilitate broader market participation, particularly for new bidders.

3.3 Energy tenders

For the purposes of the pilot project, PV_TRE- was introduced as a new product in AS B&E. PV_TRE- tenders from the ASPs are placed on the regular TRE market and requested in accordance with the merit order list (MOL) as part of the standard control process.

Findings and challenges

The supply of the requested control energy is still insufficient. There are significant discrepancies between the requested control energy and the actual control energy supplied. During the pilot project, particularly in the

⁴ Average or marginal price for TRL-, taking into account a PV capacity factor (average energy production per MWp per year) of 11%. The capacity factor of 1,000/8,760 ≈ 11% is, of course, a simplification.

⁵ A further distinction must also be made: When there is a constant long position in the control area, the value of PV_TRL- is very high. In changeable weather, prices may be high and PV_TRE- tenders available, but energy supply is often lower due to forecasting errors.

early stages, excessively high amounts of PV_TRE- were frequently tendered, which could not then be supplied. As the pilot project progressed, the volumes became more realistic, but supply remains challenging. In particular, tenders based on day-ahead forecasts and without margins lead to poor supply. Part of the difficulty during the pilot project is also directly linked to the product design, which implies that the plant's full capacity must be placed on the market as PV_TRE-. This restriction should be put into perspective in order to allow for safety margins in the bidding process. With tenders based on short-term forecast figures, this should significantly improve the quality of tenders. Quarter-hourly gates make particular sense for PV to enable bidding based on short-term forecasts and as close to real time as possible.

Various baselining methods are used in the pilot project. They include taking the previous day's weather forecast, plant production 15 minutes prior to the delivery interval, backcasting, a reference measurement of global radiation or a combination of different methods as a baseline for plant production. However, producing an accurate production forecast remains challenging, and even at times when there are no PV_TRE- requests, it is not always possible to calculate a theoretical production figure that comes close to actual production.

Short-term forecasting is difficult and requires automated bidding processes. Although short-term forecasts are highly relevant to tender quality and supply, they are not yet a matter of course. The 96 gates introduced for PV_TRE in the pilot project have so far been used by only a few ASPs. Some ASPs withdrew from the pilot project altogether for the same reason.

The 1 MW bid granularity has proven its worth. Given the current level of accuracy in bidding, a granularity higher than 1 MW makes no sense. The minimum amount and bidding increment of 1 MW defined for PV_TRE will be rolled out across the entire market from May 2026.

PV_TRE- is primarily competitive in the summer and at midday, leading to significant savings in tertiary control. As shown in Table 1, the participation of PV in the control energy market within the framework of and under the conditions of the pilot project resulted in significant savings in negative tertiary control energy. If the range of PV products were to be scaled up, this effect could be even more pronounced. However, PV remains a comparatively expensive resource for the control market due to fixed costs for control systems, feed-in tariffs, own consumption, the distribution of profits amongst various stakeholders (plant owners, aggregators, ASPs), the subjective opportunity costs associated with the loss of «clean» energy, and the risk premium for potential non-supply and the corresponding imbalance energy. Prices generally range between –400 and –500 EUR/MWh. A price incentive mechanism was defined for the pilot project (see section 2.3.2), which is why the prices from the pilot project are not directly representative. A tool for calculating the business case would be a useful incentive for PV.

Table 1: Costs for the activation of negative tertiary control energy in June–November 2026. Comparison of scenarios with varying levels of PV participation in the control energy market.

	June	July	August	September	October	November
Scenario 1: without PV	EUR 7,278,255	EUR – 220,281	EUR 1,127,250	EUR 8,135,465	EUR 1,245,011	EUR – 694,486
Actual costs	EUR 7,112,399 (– 2.3%)	EUR – 301,961 (–37.1%)	EUR 1,002,988 (– 11%)	EUR 7,704,335 (– 5.3%)	EUR 1,121,590 (– 9.9%)	EUR – 720,819 (+3.8%)

3.4 Activation

PV_TRE- was activated during the pilot project as part of the operational process for tertiary control. However, it was analysed in much greater detail and compared with offline data on plant production in order to obtain the best possible understanding of the behaviour of the PV control pools.

Findings and challenges

Controlling photovoltaic plants is generally a challenging task. Supply fails to reach the desired level (see also section 3.3) for various reasons. These include forecasting errors, a lack of feedback loops, communication issues, plant outages, hardware problems, etc. Furthermore, the typically high level of technological diversity within a pool of plants makes it difficult to establish stable processes and, since every problem is different, leads to time-consuming troubleshooting. The pilot project should be continued beyond the summer of 2026 in order to build on the findings and resolve the main outstanding issues, thereby laying the foundations for sound market integration.

A deviation in supply does not necessarily lead to problems. If the ASP's balance group uses the same forecast for its grid balance as it does for submitting PV_TRE tenders, the fact that plant production and the corresponding supply fall short of the tender amount is not a problem, in that the balance group position would be just as short, which in turn would reduce the need for tertiary control energy. As it is impossible to measure either of these factors directly and they are not reflected in the schedules, a lower supply of PV_TRE- goes hand in hand with an unrecorded short position of the BG, and ultimately the figures are balanced. This effect requires further investigation, but could prove to be a key factor in the debate surrounding the supply of PV_TRE. In this context, the definition of the energy supplied must also be clarified. Is *supply* the difference between the *forecast*, *tender* or *backcast* (or, in the pilot project, the «*theoretical production*» transmitted as offline data)⁶ and actual *plant production*?

Larger pools reduce the risk of non-supply. Similarly, backup plants can also help to improve the supply of the requested control energy. This not only tends to reduce forecasting errors but also helps to mitigate the impact of outages and communication issues affecting individual plants. However, this is primarily a challenge for smaller and new market players.

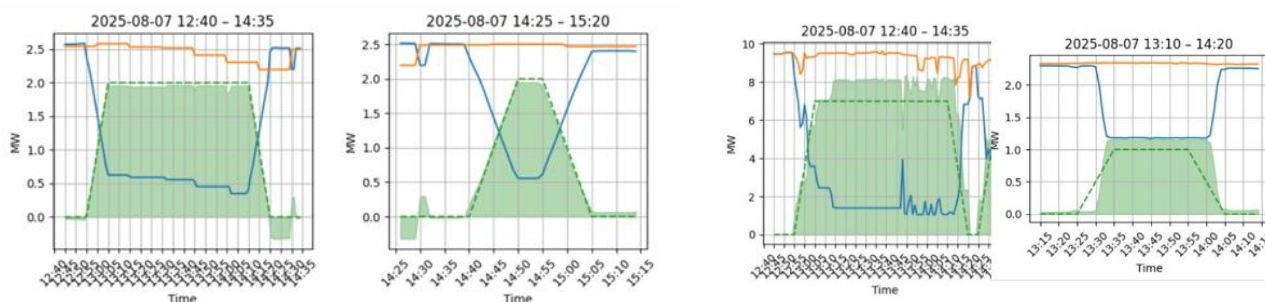


Figure 1: Monitoring the supply of control energy in the pilot project (examples of requests)

A wide variety of technical approaches can be used to implement PV control – ranging from various Home-Energy-Management-Systems (HEMS) to the direct control of the inverter via API or linking the park controller to the control system. These solutions differ in terms of cost, response time and reliability. However, many of the

⁶ The following definitions are used:

Forecast: The forecast at time $t - x$ (e.g. $t - 25$ mins.) of a plant's feed-in at time t

Backcast: The estimate at time $t + x$ of a plant's feed-in at time t (based on machine learning, actual weather data, etc.)

Theoretical production: The data transmitted during the pilot project on the feed-in from a plant at time t , adjusted for the request (based on the methodology accepted for the pilot project depending on the ASP)

approaches currently available are only suitable for secondary control energy to a limited extent and can generally only be used economically in larger plants.

Ramps are a challenge. The ramp-up following the activation of PV_TRE- is particularly difficult, as the target value – i.e. the plant’s production without curtailment – is unknown. Continuous ramping is also technically challenging and often requires a multi-stage approach. Requests made in quick succession create even more control problems.

3.5 Ex-post schedule coordination

Ex-post schedule coordination refers to the process of coordinating schedules that takes place after control energy has been activated. The correct allocation of control pooling to the relevant balance groups is particularly important with regard to PV.

Findings and challenges

The information flow in the schedule coordination process is insufficient. At present, the balance groups do not receive any information regarding plant or technology-specific activations. Consequently, the integration of PV into the control market makes production forecasts even more difficult for the balance group. Furthermore, suppliers do not receive any information about the INS, and there may be incorrect allocations in the DPS. Introducing a separate BusinessType in the INS would solve at least part of this problem.

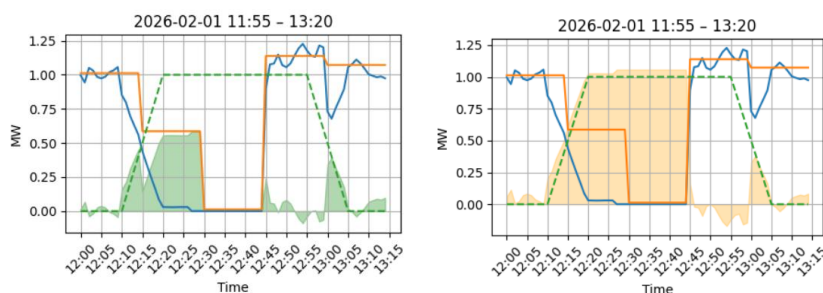
3.6 Monitoring

At present, the Swiss balancing market mainly monitors power provision. For the purposes of the pilot project, energy supply was also systematically reviewed and analysed on a monthly basis using offline data⁷. This provided important insights into the challenges posed by the new product.

Findings and challenges

Monitoring energy supply is important, but there is not yet an established process for doing so. The monitoring process applied in the pilot project is simple and effective, but requires appropriate resources and responsibilities in order to be scaled up (see also section 3.1).

⁷ Supply is evaluated based on offline data from the ASPs regarding *actual production* and *«theoretical production»*, *in-house baselining* according to production data before and after activation and *activation volumes* from AS B&E.



Blue: actual (real-time) production, orange: theoretical production, green dotted line: activation volume.
 The green area (on the left) represents the difference between actual and theoretical production, while the orange area (on the right) compares actual production with the in-house baselining method.

4 Foreseeable developments

Better integration of PV into market and system processes is currently a priority for the industry. In this context, a number of parallel market and process developments are under way that will have a significant impact on the future integration of PV into the control energy market.

Introduction of a single-price system: a single-price system for imbalance energy was introduced at the beginning of 2026. The specific implications are yet to become clear in detail, but this system will certainly strengthen the incentive for balance groups to apply their own controls. On the one hand, this should reduce the demand for control energy; on the other hand, it is also a competitive process that ultimately draws on the same sources of flexibility.

Introduction of market prices for photovoltaic plants: photovoltaic plants with a capacity of more than 150 kW will be subject to market prices from mid-2026. This limits the potential for large-scale plants to participate in the TRE market, especially at times when demand for PV_TRE- is particularly high. When there is a surplus of energy in the control area (long position), negative prices tend to cause large photovoltaic plants to disconnect from the grid due to the prices, meaning they are unable to supply negative tertiary control energy. In the pilot project, only around 3–4% of all participating plants had a rated power of less than 150 kW. This makes it all the more important to continue to develop the conditions of participation in the control market so that small-scale plants in particular can participate in a way that makes economic sense.

5 Recommendations for market integration

The pilot project clearly shows that PV can, in principle, be integrated from a technical perspective, but that processes, forecasts, data sources and control mechanisms still need to be significantly improved. Major challenges exist, particularly with regard to forecast quality, control/communication, consistent balancing, a lack of standardisation and economic scalability. At the same time, PV can already contribute to system security and help to reduce costs – particularly during periods when there is little conventional tertiary control energy available.

5.1 Summary of recommendations from the pilot project

Essentially, the pilot project has shown that if PV is to make a real contribution to the control market in the future, this will inevitably involve a certain degree of uncertainty. Without a willingness to take these risks in a controlled manner, it will be virtually impossible to achieve efficient and timely integration. Failing to integrate PV also entails risks: the challenges for system control associated with the growing share of PV will not simply disappear – if anything, they will intensify.

The recommendations from the pilot project are summarised again below (see section 3 for detailed explanations):

Prequalification (3.1)

- Improving access to master data: establish better, systematic data flows between ASPs, BGMs and DSOs via the Datahub in the future
- Standardising baselining: expand baselining methods, define clear guidelines and ensure quality using a uniform quality criterion (e.g. nRMSE \leq 10%)
- Calibrating baselining: test methods in operations and compare them with in-house baselining; the deviation should also be \leq 10%
- Professionalising offline data processing: clearly define responsibilities and resources to ensure regular data checks

PV_TRL- power provision (3.2)

- Rethinking the benchmark for power provision: instead of using nominal output, use an ASP tender that represents a more accurate reflection of the plant's actual production, including margins
- Envisaging time-specific procurement: give preference to time slots with relevant PV- availability for procuring PV_TRL-
- Further developing market design options: examine various options to strike a balance between binding obligations and market access for new bidders. Five different options are explained and compared in section **Fehler! Verweisquelle konnte nicht gefunden werden..**

PV_TRE- energy tenders (3.3)

- Allowing safety margins in bidding: relax the requirement to offer the plant's full production and allow margins in order to avoid overbidding
- Encouraging short-term forecasting: having 96 gates is important and should be widely used
- Promoting automation: encourage the use of automated processes to improve supply
- Maintaining granularity: the minimum tender of 1 MW has proven its worth and should remain the standard in the future

Activation (3.4)

- Extending the pilot project: continue the pilot project beyond summer 2026 to gain a better understanding of control, forecasting and system behaviour
- Clarifying the definition of energy supply: establish a uniform evaluation of supply and determine whether it should be assessed in relation to the forecast, tender or backcast
- Strengthening pooling: promote larger pools or backup plants to mitigate outages and forecasting errors more effectively
- Improving communication: define clear requirements for the communication quality of control systems
- Exploring ramping in more detail: further investigate the process and technical requirements, particularly for ramp-up and sequential requests

Ex-post schedule coordination (**Fehler! Verweisquelle konnte nicht gefunden werden.**)

- Improving information flows: BGs and suppliers should actively receive information on technology-specific activations
- Adding a BusinessType in the INS: introduce a new BusinessType for PV activation to facilitate correct allocation and simplify the forecasting processes of the BGs

Monitoring (3.6)

- Systematically monitoring energy supply: introduce a monitoring process for energy supply (similar to the pilot solution)
- Defining responsibilities: clearly defined roles, resources and a standardised process are required for scaling
- Integrating product delivery validation: establish a monitoring process