TRANSNET BW

Discussion paper “Security of supply”

REDISPATCH PAYMENT GUARANTEE: INCENTIVES FOR INVESTING IN THE CONSTRUCTION OF RELIABLE CAPACITY AT SYSTEM-RELEVANT SITES

22 May 2023

1.0 EXECUTIVE SUMMARY

The German target of becoming climate-neutral by 2045 requires a swift transition of the energy system. At the same time it is crucial to ensure a secure supply of electricity at all times going forward.

In order to succeed on both fronts and decommission coal-fired power plants that are harmful to the climate by 2030 as planned, a considerable amount of climate-friendly, reliable generation capacity needs to be built[1], among other things. This includes hydrogen-ready gas-fired power plants that cover the demand for electricity during times of less electricity from renewables being fed into the grid and can be used as system security tools for alleviating grid congestion (redispatch measures).

However, building new gas-fired power plants is not economically feasible within the current electricity market design. Without new incentive mechanisms, the required new capacity will not be built. And time is of the essence. When planning, approval and construction phases are included, it takes five to seven years until a plant is operational.

In this context, the concept presented here, **"redispatch payment guarantee"** will ensure fast, efficient and effective incentives for building new reliable capacity at locations where the new plants can cover several system requirements at the same time.[2] The key incentive instrument will be an annual remuneration for the expected benefit of the plants to the grid that will be guaranteed at the time of investment.

The use of plants for stabilising the grid as part of redispatch measures called upon by the transmission operator is already remunerated via proportional value consumption in retrospect. With the redispatch payment guarantee concept, the expected redispatch deployment is to be calculated in advance and the payment of the respective sum guaranteed at the time of investment in the future.

In this way, this part of refinancing can be planned in advance by the investors. Considerable operating hours for redispatch measures and thus a significant refinancing share are expected for new power plants in southern and western Germany in particular. In these regions the revenue streams secured via the redispatch payment guarantee for new generation are a decisive factor for a positive business case as a prerequisite for the necessary investment decisions.

Calculations carried out by consulting firm Enervis prove the incentivising effect of the redispatch payment guarantee concept. With this proposal, an investment in a CCGT power plant[3] (H_2-ready) that would not be viable in the current market environment will cross the threshold to profitability if the payment is approved for the first ten years after commissioning for 650 redispatch operating hours annually. A comparison to actual redispatch calls in 2022 and the results of a grid analysis for 2030 carried out by TransnetBW show that a guaranteed redispatch remuneration on this scale is realistic. The redispatch payment guarantee can also be the decisive factor for the economic viability of a H_2-ready gas turbine.

It is not expected that the redispatch payment guarantee will lead to additional costs being incurred in the energy system – the incentivising effect is created by increasing the security of future revenue streams. Implementing the mechanism in the energy-only market and linking it to the existing redispatch remuneration system make the redispatch payment guarantee relatively easy to put into action. The system would become effective

[1] In addition, it is required, in particular, to expand renewable energy capacities, rapidly expand the grid, integrate storage systems and create more flexibility on the demand side.
[2] Particularly the coverage of residual loads and measures to remedy grid congestion.
[3] Combined-cycle gas turbine power plant

much faster than other incentive mechanisms that are being discussed in Germany (e.g. capacity markets), whose implementation would take too much time to incentivise new construction in time. In the long term, the redispatch payment guarantee concept can be integrated into the electricity market design as it continues to develop.

2.0 CHALLENGE: CONSTRUCTION OF RELIABLE CAPACITY FOR SYSTEM SECURITY AND SECURITY OF SUPPLY

LACK OF INVESTMENT IN H_2-READY GAS-FIRED POWER PLANTS

The latest report on security of supply by the Federal Network Agency states that 17-21 gigawatts of new H_2-ready gas-fired power plant capacity must be built by 2031 to ensure security of electricity supply.[4]

There are no signs that the construction of additional capacity will take place in time within the current market design. Without additional funding, for example via the German Act on Combined Heat and Power Generation (Kraft-Wärme-Kopplungsgesetz, KWKG), investments in new gas-fired power plants are currently not economically viable.[5] With the increasing expansion of renewables, the plants will only be used for a few hours a year to cover electricity demand at peak load times in the electricity market in the future. In addition, the framework for enabling long-term planning of capital-intensive investments is currently insufficient, e.g. in terms of availability of green hydrogen for the conversion to H_2 operation that is planned for the medium-term.

RELIABLE CAPACITY MUST BE INCENTIVISED WHERE IT IS NEEDED FOR THE POWER SYSTEM

In view of security of electricity supply, it is not just important that reliable capacities will be built on time, but also where the plants will be built. The plants are most urgently needed in the south and west of Germany. There, the plants will not only be contributing to cover demand at times of low feed-in of wind and solar power (ensuring security of electricity supply) but can also counteract grid congestion as part of redispatch measures and thus stabilise the grid (ensuring system security).

It is already necessary to prohibit old coal-fired power plants in the south and west of Germany that are prone to failures from being shut down because they need to be available to the transmission grid operators as reserve power plants to supply additional "ramp-up power" for redispatch measures. Currently, redispatch measures make up a significant proportion of operating hours not only for these reserve power plants but also for many conventional market power plants in this region – some power plant units were utilised for more than 2,000 operating hours for redispatch measures in 2022 alone (Fig. 1).

REDISPATCH: RAMP-UP POTENTIAL WILL STILL BE REQUIRED IN THE SOUTH AND WEST IN 2030

With the exit from coal, 36 gigawatts of reliable capacity will be taken off the grid in Germany by 2030 – a large proportion of this in the south and west of Germany.[6] At the same time, it is to be expected that as part of the transformation of the energy system there will be a continued need for redispatch measures at a considerable scale in the medium term.

[4] See Federal Network Agency (2023).
[5] See analysis by Enervis energy advisors, commissioned by TransnetBW (2023).
[6] See power plant list by the Federal Network Agency (November 2022), figures comprise lignite- and hard-coal-fired power plants.

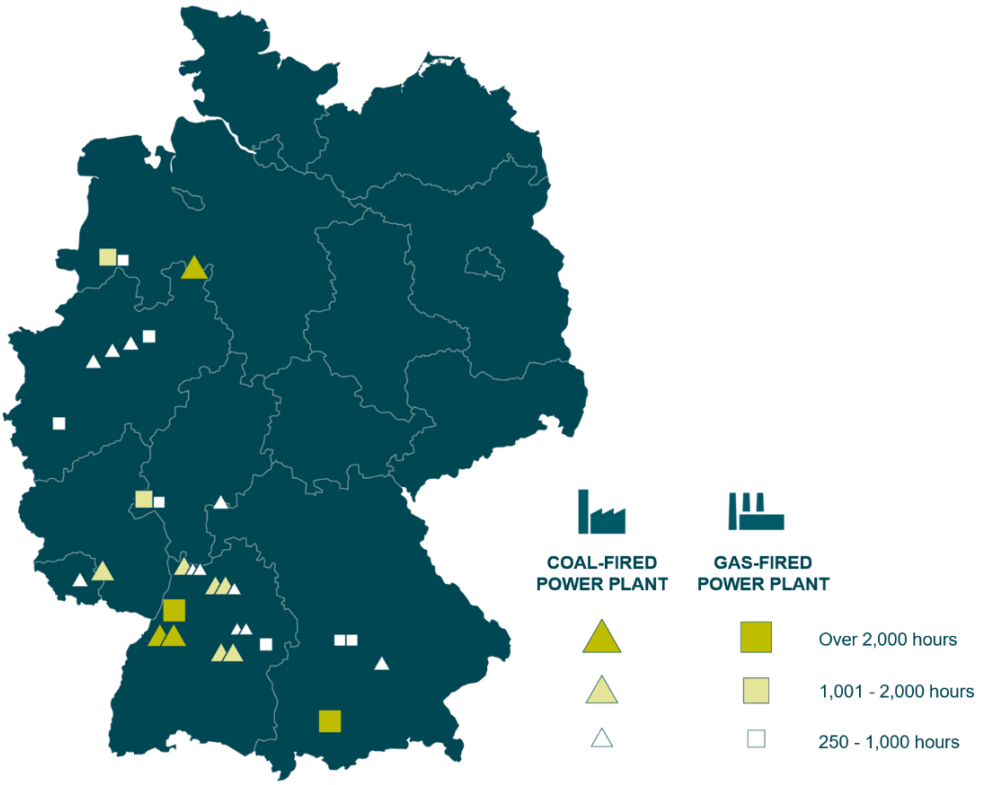

Fig. 1 Power plants with 250 redispatch operating hours or more in 2022[7]

A grid analysis by TransnetBW[8] has shown that with an assumed new construction of hydrogen-ready gas-fired power stations with a total capacity of 20 GW across Germany by 2030 (assumption: 40 CCGT plants with a nominal capacity of 500 megawatts each), these would be needed regularly to a considerable extent for stabilising the power grid in the south and west of Germany in addition to their utilisation on the market.[9] For the newly constructed power plants in southern and western Germany this would thus result on average in approximately 930 redispatch operating hours per plant for 2030 in addition to the market-driven operating hours.

CLIMATE TARGETS AND COAL PHASEOUT BY 2030 DEMAND QUICK ACTION

In summary, it can be said that the exit from coal by 2030 can only succeed if new reliable capacity is being built rapidly, in particular in southern and western Germany. In view of the usual times needed for planning, approval and construction of gas-fired power plants, it is thus necessary to put in place the necessary legal framework quickly, so that investments will be made as soon as possible and the plants can be built at locations where they are most beneficial for the power system.

[7] Based on data from www.netztransparenz.de. Current- and voltage-related redispatch (without test starts of grid reserve power plants). Gas-fired power plants including oil-fired systems.
[8] Internal grid analysis based on long-term analyses by the transmission system operators for 2030.
[9] For the grid analysis it was assumed that Germany is divided into five grid regions (50Hertz, Amprion, Tennet North, Tennet South and TransnetBW) and that the 40 newly built plants would be distributed equally across these regions. Based on the division according to the grid development plan 2023 (1st draft), the south and the west of Germany comprise the three regions of Amprion, Tennet South and TransnetBW.

3.0 GUARANTEED PAYMENTS FOR NEW RELIABLE CAPACITY

IT IS NEARLY IMPOSSIBLE FOR INVESTORS TO PLAN AHEAD BASED ON REDISPATCH REMUNERATION

In order to incentivise the construction of new electricity market power plants swiftly and with a detailed local focus, the redispatch payment guarantee concept tackles the key problem for investors, i.e. the high degree of uncertainty about future revenues from the plants.

Starting point is a component of redispatch remuneration known as proportional value consumption. Proportional value consumption is already part of redispatch remuneration pursuant to section 13a paragraph 2 (2) German Energy Industry Act (EnWG). This is based on the linear depreciation of the investment's residual value due to redispatch operating hours.[10] The more frequently a plant is used for redispatch, the higher the proportional value consumption, and the higher the proportion of the investment costs refinanced through redispatch remuneration.

When the redispatch operating hours are high, as is currently the case at many power plant sites and which is expected to be the case in the future, the remuneration for the proportional value consumption significantly contributes towards covering the fixed costs.

However, redispatch remuneration is practically impossible to plan for in the long term by investors within the current market design. As it stands, proportional value consumption is paid ex post based on actual redispatch requests by the transmission system operator. The frequency of calls for redispatch and thus the size of the payments cannot be influenced by the power plant operators. Future revenue streams from redispatch payments are therefore either not being taken into account at all in their investment calculations or with high markdowns for the risks involved.

INCENTIVES FOR MARKET POWER PLANTS THROUGH GUARANTEED REMUNERATION OF PROPORTIONAL VALUE CONSUMPTION

The proposed concept eliminates these uncertainties about future revenue streams. The transmission system operator guarantees to compensate the investor for a fixed number of annual redispatch operating hours at the time of investment via payments for proportional value consumption. In this way, the investors are relieved of the risk for a portion of future revenues for a fixed period of time, e.g. ten years. This portion can make a key difference with regard to covering fixed costs, in particular at locations where the number of redispatch operating hours is expected to be high (Fig. 2).

The aim is not to free the investors completely of all risks involved in their investment, but to limit the risk to a reasonable market risk level. The share of the fixed costs that remains after the guaranteed remuneration has been deducted must still be covered by market revenues.

[10] See German Association of Energy and Water Industries (BDEW, 2018).

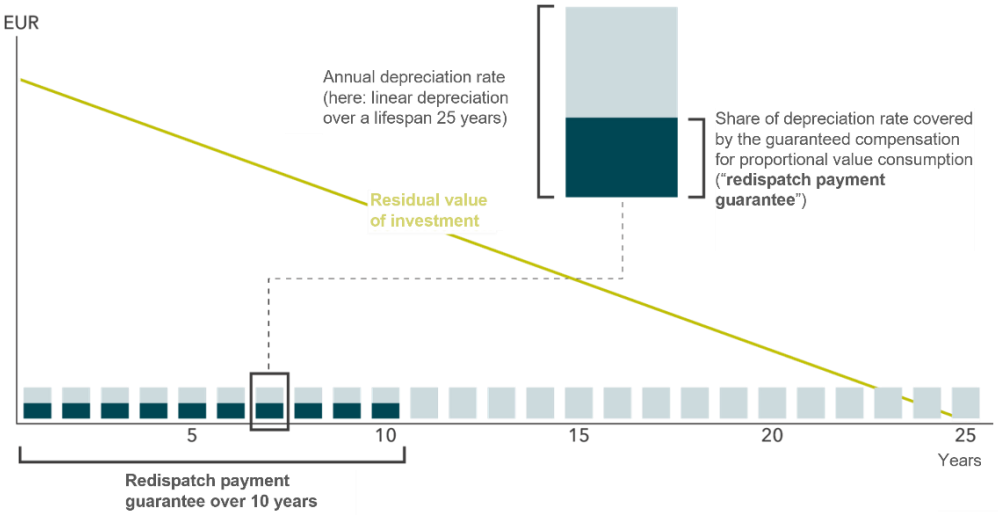

Fig. 2 Redispatch payment guarantee reduces uncertainty of investment (example)

THE PRINCIPLE OF GUARANTEED PAYMENTS DOES NOT REQUIRE NEW REMUNERATION COMPONENTS

The proposed concept eliminates the need for introducing additional funding instruments and will turn insecure future revenue streams into plannable revenue streams by guaranteeing the remuneration component of proportional value consumption, which is already in place.

Ideally, the instrument will not incur any additional system costs despite the considerable impact it is likely to have. Once the guaranteed number of redispatch operating hours is reached, the proposed concept does not exceed the size of payments made under current rules. Should the redispatch payment guarantee concept be put out for tender, it is even possible to save costs compared to the current redispatch remuneration rules because of competition.

In any case, the guaranteed remuneration comes with a reward for the guarantor. As market power plants, the power plants are obliged to provide redispatch services pursuant to section 13a paragraph 1 EnWG and thus increase system security. At the same time, they contribute to demand fulfilment in situations with little wind and photovoltaic feed-in and can provide additional grid services such as reactive power or black start capability.

In order to avoid paying twice for operating hours that are already covered by the guaranteed payments, proportional value consumption payments for redispatch calls will be ceased until the quota of operating hours paid for in advance is reached. However, if more redispatch operating hours are requested than have been paid for in advance, the proportional value consumption for the additional hours is remunerated based on the actual operating hours as has been the case previously.

4.0 INVESTMENT CALCULATION SHOWS INCENTIVISING EFFECT

DESCRIPTION OF THE INCENTIVISING EFFECT

An investment calculation carried out by consultancy firm Enervis shows the incentivising effect of the redispatch payment guarantee concept. To this end, an exemplary net present value calculation for a 400-megawatt CCGT plant as well as a 300-megawatt gas turbine (both H_2-ready) was carried out. With the guarantee for future payments for proportional value consumption under the proposed scheme, uncertain future payments

from redispatch remuneration can be included in the net present value calculation as secure future revenues. Depending on the guaranteed term (e.g. ten years) and the number of redispatch operating hours paid for annually, this effect can ensure that the investment will be profitable.

ASSUMPTIONS AND SCENARIOS FOR THE INVESTMENT CALCULATION

The CCGT plant as well as the gas turbine were assumed to be commissioned in 2028. In view of the usual planning and construction times for new gas-fired power plants this appears to be the earliest possible date. It was also assumed that that the plants will initially be run with conventional natural gas. As a result of the German government's target for the electricity sector to become almost climate neutral by 2035, it will be necessary to convert to 100% green hydrogen by that year.[11]

Modelling of the electricity market revenues was carried out based on current market assumptions.[12] Power plant dispatch from 2028 to 2050 was modelled using the Enervis dispatch model. Potential revenues for heat were not included.

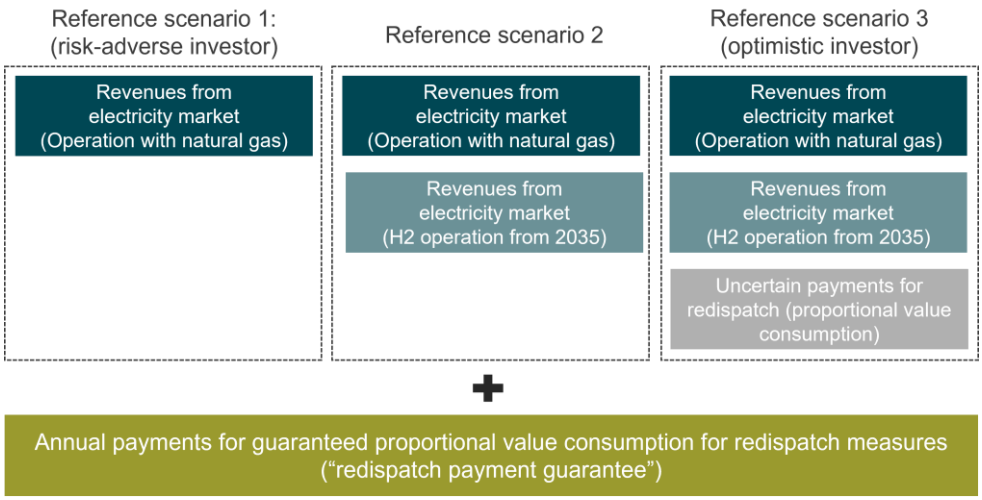

Fig. 3: Reference scenarios: Revenues taken into account for investing in gas-fired power plants

The investment calculation looks at three scenarios (Fig. 3) reflecting a realistic range of possible assumptions by investors in the current market environment.

- **Reference scenario 1**: A particularly risk-adverse investor assumes that the investment must be refinanced exclusively via revenues from natural gas operation before 2035 due to the insecurities associated with the conversion to hydrogen (e.g. H_2 availability).
- **Reference scenario 2:** For the "middle" scenario the investor assumes electricity market revenues from hydrogen operation for the time after 2035 in addition to those from the initial natural gas operation. These will initially be low due to the high costs for the scarce fuel and increase slightly over time.

[11] See Federal Ministry for Economic Affairs and Climate Action (BMWK, 2023).
[12] Assumption: Enervis "High Ambition" scenario, incl. conversion of electricity generation by gas-fired power stations to H_2 operation. As at March 2023.

- **Reference scenario 3:** Based on the existing remuneration rules, an optimistic investor assumes insecure redispatch remuneration payments in addition to the electricity market revenues. However, they are entered into the net present value calculation with high markdowns for the risks involved.

In a first step, the net present value was calculated without additional funding. In the second step, it was determined how the redispatch payment guarantee would affect the investment calculation and what the prerequisites are for the redispatch payment guarantee to achieve profitability of the investment.

CONSTRUCTION OF NEW PLANTS NOT FEASIBLE WITHOUT INCENTIVE

The model calculations initially confirm what is also evident in reality. Without additional incentives the construction of H_2-ready gas-fired power plants is currently not economically feasible. This is true regardless of whether the electricity market revenues from hydrogen operation from 2035 onwards are taken into account or not.

For the power plants, the dispatch model shows low market-driven operating hours with an average of 2,250 hours/year for the CCGT plant and 260 hours/year for the gas turbine, as expected for backup capacities to cover the residual load. The net present value (NPV) of the investment remains clearly in the red for the various scenarios (see Fig. 4).

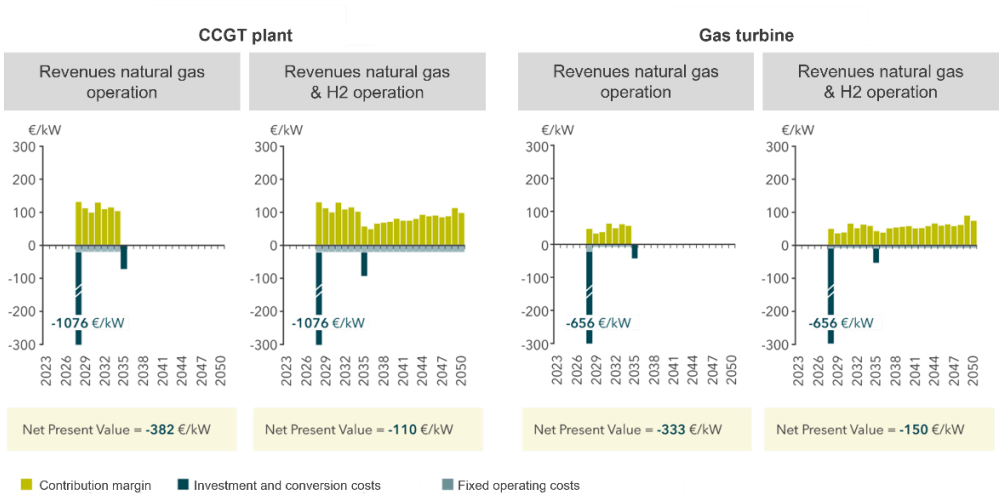

Fig. 4: Reference value: Without incentive, neither the CCGT plant nor the gas turbine are economically viable[13]

RESULTS OF THE FEASIBILITY CALCULATION

The size of the feasibility gap that needs to be bridged by the redispatch payment guarantee concept depends on the assumptions about future revenues for the investor and thus the choice of reference scenario used.

Fig. 5 shows the results for the CCGT plant and the gas turbine in the “middle” reference scenario 2. The net present value and thus the feasibility of the investment increase depending on the duration and size of the guaranteed future redispatch payments.

For the H_2-ready CCGT plant the calculation shows that the feasibility threshold is reached with redispatch remuneration guaranteed for ten years for 650 redispatch operating hours annually (net present value = 0).

For the H_2-ready gas turbine the investment already reaches the threshold of feasibility

[13] Source: Investment calculation by Enervis, commissioned by TransnetBW (2023).

with a redispatch payment guarantee over ten years and at least 175 redispatch operating hours annually. The lower number of operating hours needed results from the fact that, due to the low market-driven operating hours, the proportional value consumption already covers a high proportion of the fixed costs with only a few redispatch operating hours. Due to higher operating costs, gas turbines are also usually used less frequently for redispatch measures so that only a smaller number of hours can be guaranteed for them in advance.

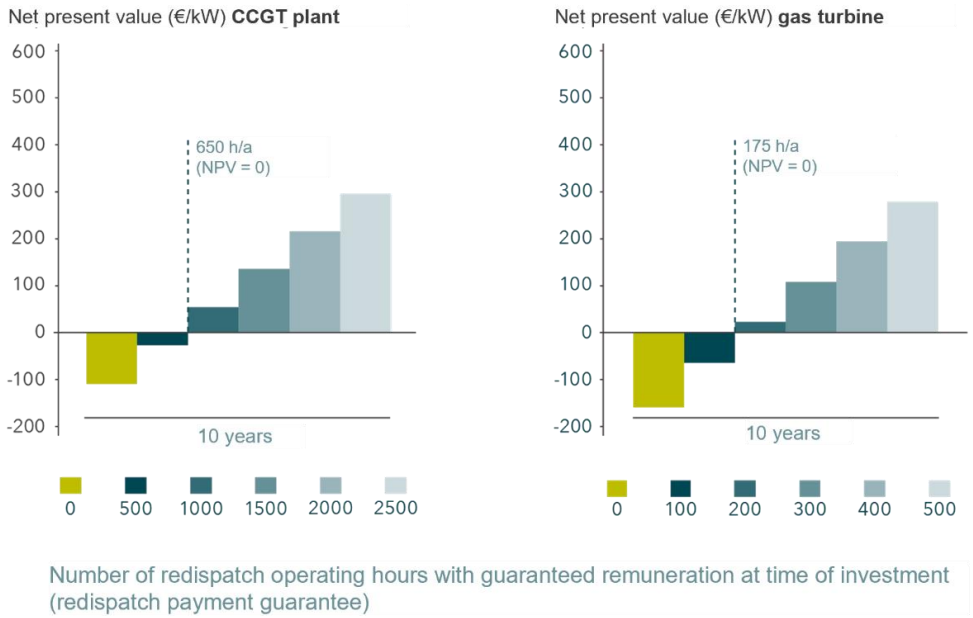

Fig. 5: Feasibility threshold of a H_2-ready CCGT plant and a H_2-ready gas turbine taking into account the redispatch payment guarantee (reference scenario 2)[14]

In order for the investment calculation of a very risk adverse investor (reference scenario 1) to cross the feasibility threshold, the new-build advance must be higher. In that case, the investment will only become profitable with a guaranteed value consumption over ten years and 2,350 hours annually (CCGT) or 390 hours annually (gas turbine).

For an optimistic investor willing to take risks (reference scenario 3) a ten-year redispatch payment guarantee for 600 hours (GuD) or 160 hours (gas turbine) is sufficient to achieve a net present value of at least zero.

THE REDISPATCH PAYMENT GUARANTEE IS EFFECTIVE

The results demonstrate that the redispatch payment guarantee concept can have the decisive incentivising effect for the construction of new hydrogen-ready gas-fired power plants. The comparison with the redispatch operating hours in 2022 from Fig. 1 shows that the redispatch hours that need to be guaranteed in order to ensure the feasibility of the investment for the middle scenario are within a range that is already being reached or even clearly exceeded by many power plant.

The market simulation by TransnetBW assuming the construction of 40 power plants across Germany for 2030 shows that the expected redispatch hours for plants in southern and western Germany are sufficient to make the investment feasible – if they are guaranteed in advance.

[14] Source: Investment calculation by Enervis, commissioned by TransnetBW.

5.0 IMPLEMENTING THE REDISPATCH PAYMENT GUARANTEE

COMPETITIVE MECHANISMS ENSURE COST EFFICIENCY AND INCENTIVISE NEW CONSTRUCTION AT GRID-SERVING LOCATIONS

The plants constructed as part of the redispatch payment guarantee scheme participate in the electricity market. In order to ensure that the process is cost efficient, the remuneration guaranteed by this concept should be subject to a tendering process. In this context, a direct call for tenders for the proposed scheme seems to make sense, but implementing the instrument within the framework of other funding mechanisms is also possible. Both options are explained below.

DIRECT TENDERING

In order to ensure that regional requirements for secured capacity are covered in a targeted manner, a steering mechanism should be included when implementing the proposed scheme. In view of the requirement for hydrogen-ready gas-fired power plants across all of Germany by 2030, it is thus advisable to cover part of this demand as part of local tenders, e.g. via a separate segment for “New construction of grid-serving reliable capacity”. The power plants incentivised via this segment contribute towards resolving bottlenecks on the grid and, at the same time, covering the overall demand for reliable capacity across Germany.

The following sequence is being proposed: The TSOs forecast regional requirements for the construction of new power plants and the number of redispatch operating hours for which guaranteed remuneration can be granted in this grid area via extended system analyses.

Based on these analyses, a tendering process is carried out. The tendering body defines the requirement for newly built capacity (in MW), the technology-specific, funded redispatch operating hours (in h/a) as well as the maximum tender value (in €/MW).[15] The number of operating hours being put out to tender should be differentiated by technology, since the number of redispatch operating hours is likely to vary depending on the technology used (e.g. CCGT plant and gas turbine).

The bidders submit their bid for the guaranteed remuneration of proportional value consumption required for the investment (in €/MW) for the defined number of redispatch hours and state the capacity of the power plant.

The contract will be awarded to the bidders who ask for the lowest guaranteed remuneration for the set number of redispatch operating hours.

The bids are ranked in ascending order of the guaranteed remuneration they ask for, until demand in the respective region is covered.

When being awarded the contract, the bidders commit to making the additional secure capacity available as per their bid.

[15] The maximum tender value could be set, for example, based on the proportional value consumption of a reference plant.

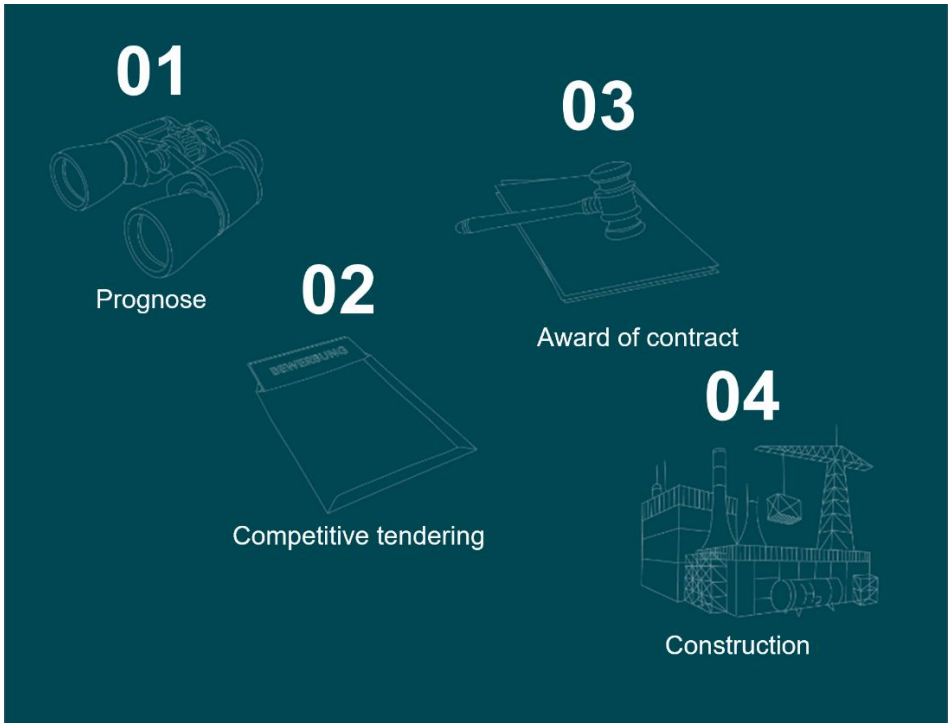

Fig. 6: Tendering the redispatch payment guarantee concept

ALTERNATIVELY: REDISPATCH PAYMENT GUARANTEE AS INSTRUMENT FOR REGIONALISATION AS PART OF OTHER FUNDING MECHANISMS

The mechanism of the redispatch payment guarantee is not necessarily linked to a regional tender for the proportional value consumption. Alternatively, the guaranteed remuneration of redispatch value consumption can form an efficient instrument for local differentiation in connection with other funding instruments, e.g. with Germany-wide tenders for surcharge payments.

For plants at system-serving locations, remuneration for a significantly higher number of redispatch hours will be guaranteed in advance than at locations that are less relevant to the grid. The investors take that into account for calculating their bids and can thus submit more favourable bids for the funding instrument at those locations. In this way, Germany-wide tenders for the redispatch payment guarantee will create a strong incentive for constructing plants at locations that are particularly beneficial to the grid.

BENEFIT OF REDISPATCH PAYMENT GUARANTEE: A SIMPLE MEASURE THAT BECOMES EFFECTIVE QUICKLY

Regardless of whether the proposed concept is put out for tender directly or combined with other tenders as an element for regional steering, implementation requires only very little intervention into the design of the electricity market. The energy-only market remains in place. There also will be no completely new remuneration components, since proportional value consumption is already used and laid down in the Energy Industry Act. This means the concept can be implemented quickly and cost-efficiently. In view of the urgency for building new plants in southern and western Germany, where additional reliable capacity is needed by 2030 at the latest, this is a decisive advantage.

The redispatch payment guarantee concept thus does not stand in the way of the

electricity market design being developed further in a more fundamental way, as is currently being discussed. A transition to a more comprehensive instrument, e.g. a centralised capacity market, at a later time is possible. This makes the proposed concept a quick and effective no-regret measure and ensures security of supply on the path towards a climate-neutral electricity system.

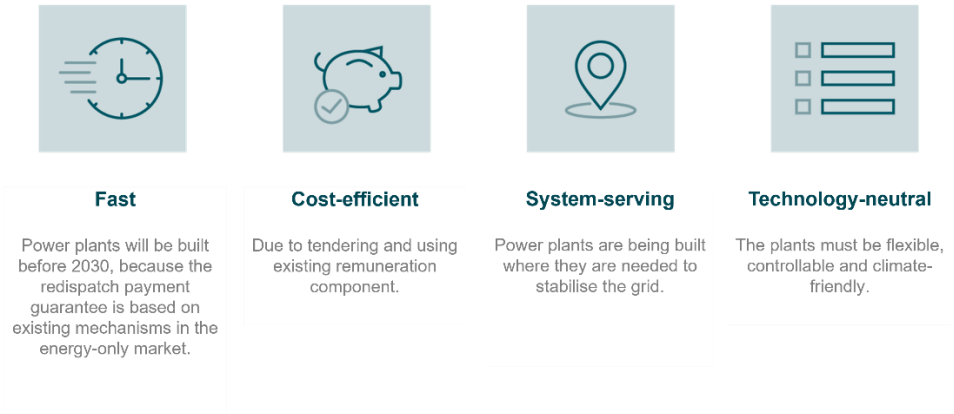

Fig. 7: Benefits of the redispatch payment guarantee concept

IMPLICATIONS IN TERMS OF STATE AID LAW AND NATIONAL IMPLEMENTATION

Not least because of the use of state funds from an EU Commission point of view (here: grid fees, which are also to be directly subsidised by the government from 2023), the model of a redispatch payment guarantee is likely to constitute state aid (cf. art. 107 paragraph 1 TFEU). This must be justified in order to be permitted. The present design of the proposed concept takes the key aspects for such a justification into account.

Helpful in this context is that participation in the proposed scheme is basically non-discriminatory, (technologically) open and, as far as possible, designed to promote environmentally friendly technologies. In addition, the redispatch payment guarantee can be designed in such a way that potential plants at particularly system-relevant locations will have only indirect advantages in terms of their location. Furthermore, it will be taken into account that the funding measure will be received for a maximum of ten years.

Moreover, it is to be expected that in case of direct tendering the redispatch payment guarantee will be covered by the “Aid for the security of electricity supply” in accordance with section 4.8 of the new Climate, Energy and Environmental State Aid Guidelines 2022 (CEEAG). Alternatively, if the instrument is implemented as a component of another funding mechanism under Section 4.1 CEEAG to provide regional incentives, such funding mechanism remains approvable even with an embedded redispatch payment guarantee. A corresponding notification procedure by the Federal Republic of Germany therefore appears promising.

The proposed concept requires a legislative and regulatory act at the national level. It makes sense to implement the redispatch payment guarantee in the form of a separate authorisation to issue statutory instruments based on the existing instruments of the grid reserve and the capacity reserve pursuant to section 13d EnWG and section 13e EnWG. Further details of the concept could be regulated, for example through an amendment of section 13i EnWG. However, a detailed definition of the approach is subject to the legislative implementation of the stipulations set out by the ECJ in its decision of 2 September 2021, reference C-718/18.

6.0 POLICY OPTIONS

/ Fast implementation of mechanisms to incentivise reliable capacities in the European energy system is key to ensuring system security and security of supply. Relevant market design changes for this issue – such as the implementation of capacity markets – might come too late to address the current challenges in time. Therefore, targeted instruments with rapid implementation based on the existing market design should be allowed to quickly incentivise new capacity.

/ In Germany, the “power plant strategy” announced by the German Federal Ministry of Economics must create the framework for climate-friendly market power plants to be built before 2030 as soon as possible. As a cost-efficient, system-serving instrument that can be quickly implemented to flank the coal phase-out, achieve climate targets and ensure a secure supply of electricity, the redispatch payment guarantee concept needs to be considered in this context.

/ It is essential to introduce a local component. New plants must be built where they can support system security and security of supply most effectively. Thus, instead of the clear distinction in current European legislation between congestion management instruments and capacity mechanisms, a more holistic approach would contribute to ensuring that investments in additional capacities are made at locations where they generate the highest benefit from a system-wide perspective.

/ In the short-term, the European regulation should be adapted to ensure measures to incentivise investment in additional capacity, with the primary objective of serving congestion management. These should be considered as congestion management measures (and not capacity mechanisms), even if they might also contribute towards achieving the required level of resource adequacy.

/ The analysis of future security of supply and system security must be carried out in an integrated manner. To this end, system analyses must be expanded. They are to become the legal basis for the required regional power plant capacity and the number of redispatch hours that are put out to tender by the transmission system operators.

/ To achieve a quick conversion of the new plants to climate-friendly hydrogen, planning of the energy system must take place in an integrated manner and a reliable planning framework for investors must be put in place.

/ In parallel, a system reserve is to be introduced in Germany to bundle the reserve instruments and simplify their dispatch.

/ For the transitional period until the power plants are built, sustainable medium-term planning of the German grid reserve must take place. System relevance assessments of power plants in the grid reserve must cover longer time horizons.

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