Annual Market Update 2020

Electricity market insights

7 April 2021

TenneT

Introduction

Annual Market Update 2020, an electricity market review focused on the Netherlands and Germany, including wider European trends

This Annual Market Update (AMU) is focussed on relevant developments on the Central Western European electricity markets, and the Dutch and German electricity markets in particular. This is the third edition of the TenneT Annual Market Update. Previous editions of the AMU and its predecessor the TenneT Market Review can be found here.

The developments in the Annual Market Update are structured alongside several main topics:

- The chapter Wholesale market prices discusses wholesale day-ahead and identifies price trends.
- As our electricity system is still highly dependent on fossil-fuelled power, the chapter Fuel prices describes developments in hard coal, natural gas and emission allowance prices, as well as the margins for generators.
- The chapter Capacity & generation focuses on the supply side of the electricity system and discusses developments in installed capacity and generation.
- Support for renewables in the Dutch and German system are discussed in the chapter RES support schemes, by looking at budget distribution, awarded capacity and generation in the subsidy schemes.
- In the chapter Wholesale market integration the storyline zooms out and includes the interactions of the Dutch and German electricity system with neighbouring systems. Additionally, the ongoing efforts of coupling EU electricity markets are discussed in this chapter.
- The last two chapters focus on mechanisms in place to ensure the stability and functioning of the electricity system for both the Netherlands and Germany: Balancing measures, to ensure supply and demand is equal at all times; and redispatch measures, to resolve congestion in the grid.

Main Findings (1/3)

Lower wholesale prices across Europe in 2020, significantly impacted by the covid-19 pandemic

Wholesale electricity prices across Europe decreased in 2020. The annual average day-ahead electricity price decreased within the CWE region with 19% to 32 €/MWh. Between March and June all European countries installed restrictive measures in a response to the covid-19 pandemic spread across the globe. In these months day-ahead electricity prices dropped to monthly average prices in the range of 17-25 €/MWh. After this first series of restrictive measures, some degree of relieve in measures were implemented that resulted in increased economic activity and corresponding demand for energy. Since June the day-ahead electricity prices kept rising and surpassing the yearly average level of around 39 €/MWh since September.

Additionally wholesale prices within the CWE region remained at a similar converge of 43% compared to 42% in 2019. For the Netherlands the amount of hours with full price convergence slightly decreased with all neighbours and reached 49% full convergence with Germany, which was 1%pp less than in 2019. For Germany full convergence with most of its neighbours decreased, mainly due to a decrease in convergence with non-CWE neighbours.

Annual average CO2 price remained stable compared to 2019 but 2020 closed at a record high 30,9 €/tCO2. Coal and Gas prices decreased compared to 2019

This decrease in wholesale electricity prices across Europe is mainly explained by a significant decrease in annual average natural gas (35%) and coal prices (22%). The annual average carbon emission allowance (EUA) price remained stable around 25 €/t CO2, a -1% decrease compared to 2019. But in difference to 2019 the spread of the EUA price over the year was much larger. In the first period after the restrictive measures were implemented the EUA price dropped to 15 €/tCO2. Ever since the EUA price increased, closing 2020 at a record high of 30,9 €/tCO2 almost 6 €/tCO2 higher than the annual average. The effect of these changes in fuel and carbon prices resulted from January until October in coal-to-gas switching due to higher generator margins for gas-fired power plants compared to coal-fired power plants in both the Dutch and German markets.

Main Findings (2/3)

The Netherlands became a net exporter in 2020 for the first time since 1981
Germany significantly reduced hard coal, lignite and nuclear in it's power mix

The Netherlands reached a net export position over 2020 for the first time since 1981. This coincided with an increase in total generation. As a consequence of coal-to-gas switching, generation based on natural gas significantly increased and generation based on coal significantly decreased. Generation from wind and solar increased with 40% to 23 TWh. Additionally around 4,2 TWh of biomass co-firing in coal-fired power plants was certified, meaning 4,7 TWh of total generation in coal-fired power plants can be attributed to the biomass co-firing.

Total generation in Germany decreased with 26 TWh (-5%) over 2020. Generation from the most carbon intensive polluters hard coal and lignite decreased most with a combined reduction of 33 TWh compared to 2019. Whereas nuclear decreased 10 TWh (-14%). These reductions were partly offset by the increase of Gas 9 TWh (+17%), Solar and Wind 11 TWh (+6%) and a reduced export position.

26 GW and 55 TWh/yr RES is granted subsidy under the Dutch SDE+
RES in Germany reached almost 250 TWh in 2020 and 33 B€ in EEG costs

In 2020 round I, less funds were made available for SDE+ subsidies compared to previous SDE+ rounds. Solar projects still had the largest share in allocated SDE+ subsidies by 2,2 B€ in 2020 round I. The cumulative development of awarded projects in SDE+ show more than 26 GW of renewable capacity is expected to be installed which accounts for an annual generation of around 55 TWh, of which 11 TWh by unsubsidised offshore wind.

Total generation of renewables in Germany reached almost 250 TWh. The corresponding costs in 2020 are estimated to be around 33 B€. Recent Feed-in-Premium auctions show most tenders in which the available volume remains untendered and prices clear at the installed cap of around 6,2 ct€/kWh. The available tender volume for solar was awarded in all recent auctions, clearing around 5,3 ct€/kWh.

Main Findings (3/3)

Increased prices capacity for Dutch FRR in 2020 compared to 2019 Introduction of 4-hour products for FCR and a decrease of the common price

Capacity prices for Dutch Frequency Restoration Reserves (FRR) increased in 2020. This effect can partly be contributed to the increase in contracted capacity. The increased demand for upwards capacity is the result of the dimensioning of mFRR+aFRR that increased due to the operational return of Claus C 1.340MW in 2020.

Rather stable German aFRR prices throughout 2020 with slightly increased volumes compared to 2019 as an outcome of new dynamic dimensioning approach for both aFRR and mFRR volumes (determined for each 4-h-product timeframe individually).

Capacity prices for Frequency Containment Reserves (FCR) for the common region decreased in 2020 compared to 2019. For the Dutch share of FCR the prices increased. Furthermore, since July 2020, FCR capacity is auctioned daily for 4-hour products instead of for daily products.

Dutch congestion management costs increased 27% in 2020 compared to 2019 whereas German costs remained comparable to 2019

Costs for congestion management in the Netherlands increased to €77,6 million in 2020(+27%). Most costs were related to redispatch, and a smaller share can be attributed to restriction contracts, which are contracts with market parties to withhold a share of production for a certain period. Across the border in Germany, cost for congestion management in the first three quarters (Q4 data unavailable yet) of 2020 were in the order of €1 billion, comparable.

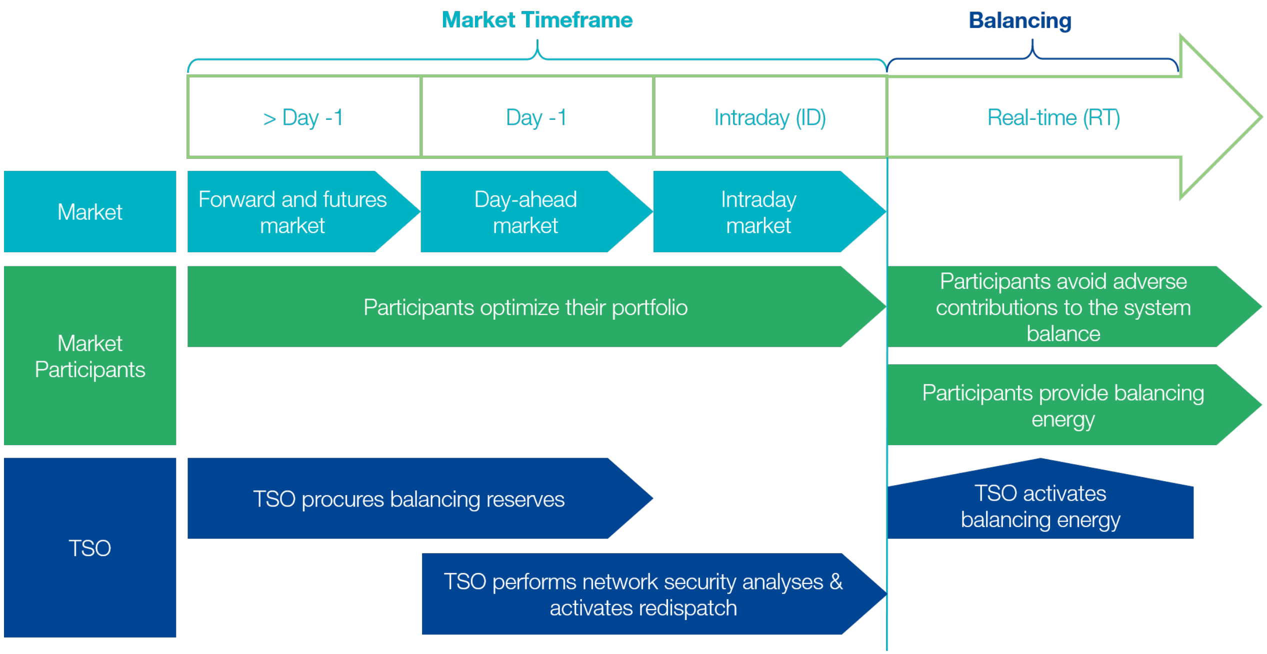
83 GWh of redispatch volume was contracted through the GOPACS platform in 2020. In September 2019 the first Intraday Congestion Spreads (IDCONS) were activated via the Grid Operators Platform for Congestion Solutions (GOPACS). GOPACS is a TSO-DSO coordinated market-based congestion management platform that enables intraday bids with a geo-tag to be used for congestion management as well (see for more info www.gopacs.eu).

Wholesale market prices

Market Timeframes

The wholesale market consists of several sub-markets

Market Timeframe and Balancing



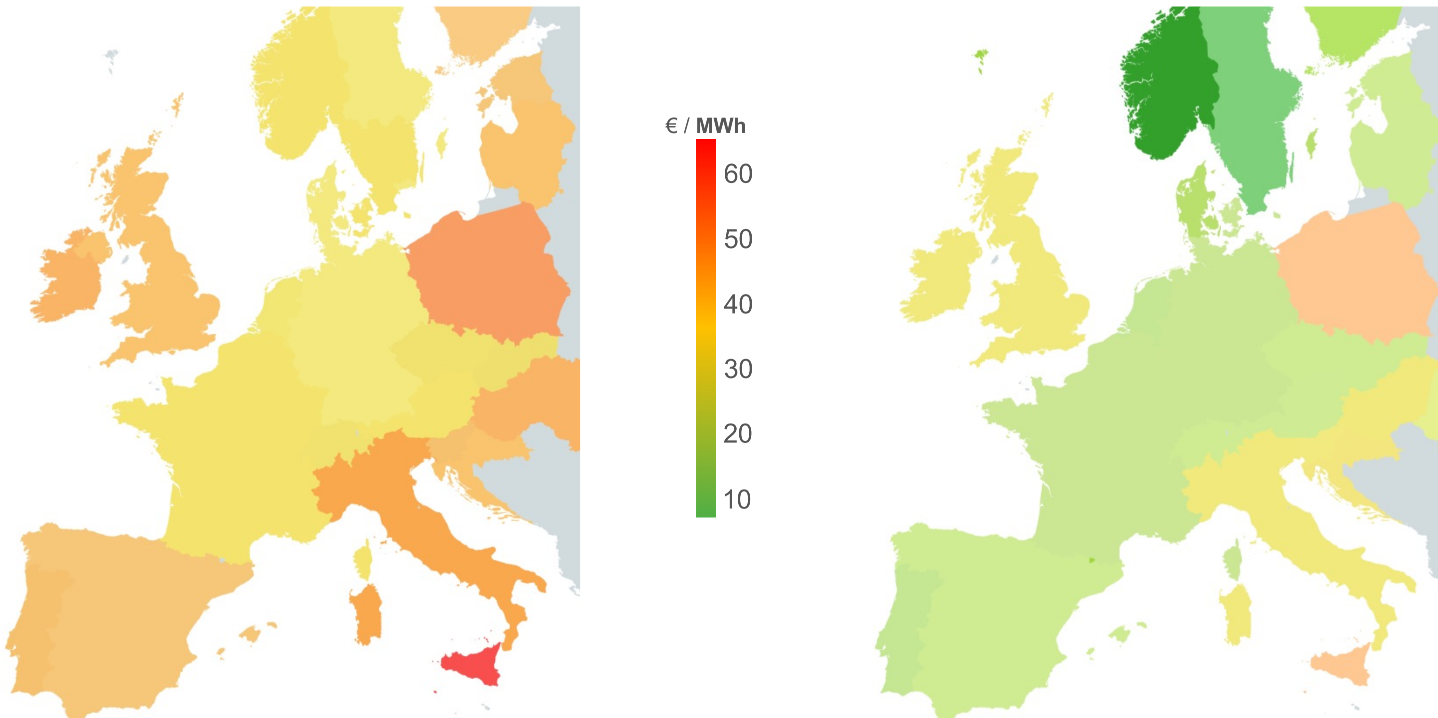
- The figure above shows the relation between the different timeframes of the wholesale market and the balancing market. In wholesale markets, electricity generators sell electricity to large industrial consumers and electricity suppliers. The electricity suppliers sell electricity to the final consumer in retail markets. The scope of this Annual Market Update is on wholesale markets.
- Balancing and redispatch are system services that are important features of the electricity system. TSOs procure balancing reserves that can be activated in real-time to resolve disruptions in system balance. Also, TSOs perform network security analyses to identify congestion, which is resolved by activating redispatch.

Day-ahead prices Europe

2020: significant decrease of day-ahead prices across Europe

Yearly Average DA Prices Europe

2019 **2020**



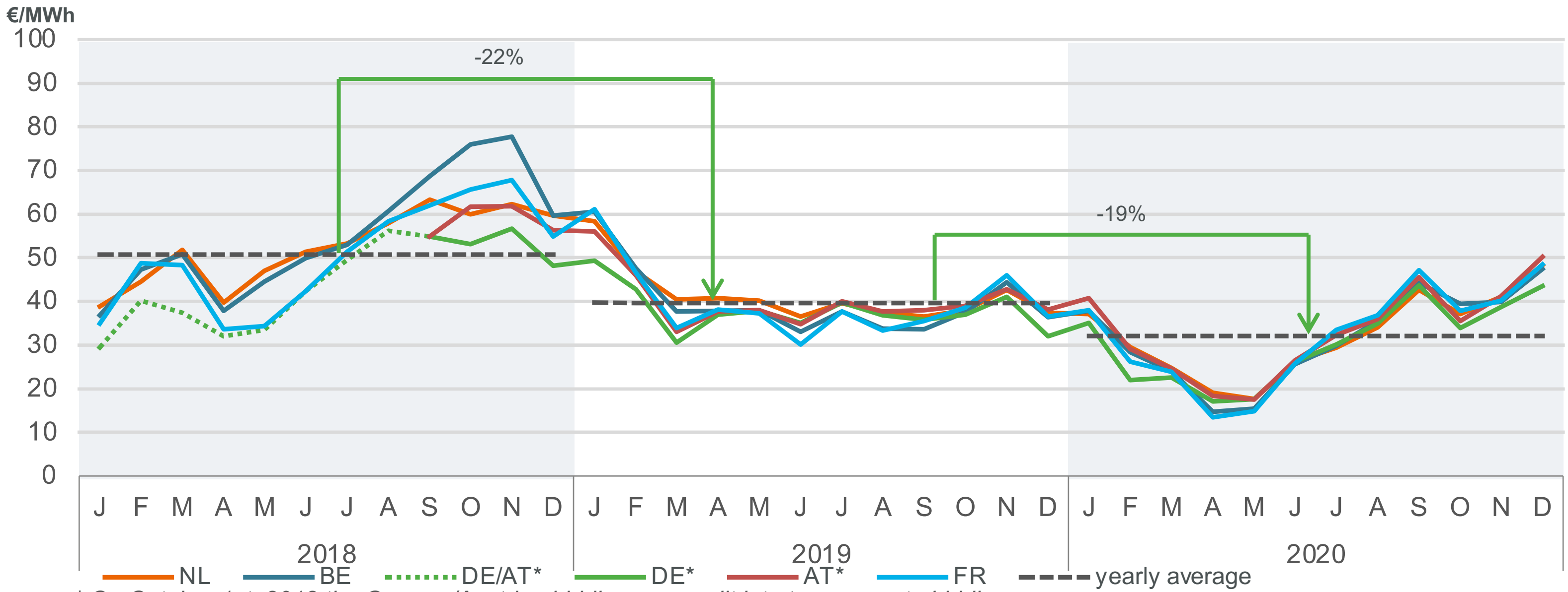
- Annual average day-ahead prices of almost all European countries significantly decreased from 2019 to 2020.
- Norway and Sweden experienced the steepest decline in the range of 60% - 80 %.
- Denmark, Spain and Finland experienced a decrease around 30%.
- In most other countries the decrease as in a range of 20% - 25%.

Source: MRC Market Coupling

Day-ahead prices CWE

Prices significantly decreased in spring in response to Covid-19 related restrictions

Monthly Average Day-ahead Wholesale Prices in the CWE region



** On October 1st, 2018 the German/Austrian bidding zone split into two separate bidding zones*

- The average day-ahead (DA) electricity price decreased within the Central Western European (CWE) region by 19% to 32 €/MWh.
- Overall, DA prices in the CWE region decreased, mainly due to effects of the restrictive measures that most governments took in response to the Covid-19 pandemic. These resulted in a decrease in demand for electricity and gas, which pushed down the marginal cost for generators which in return lead to a significant drop in average DA prices. Also the increase of renewables had a price damping effect. Additionally within the CWE region DA prices had a high level of convergence relative to 2018.
- Demand for gas and electricity increased again after the relieve of measures around May and June. These were price lifting effects, for both gas and electricity, contributing to the increase in DA prices since May. In addition, also typical fall and winter uncertainty regarding nuclear availability in France and Belgium contributed to higher prices because of tight availability.

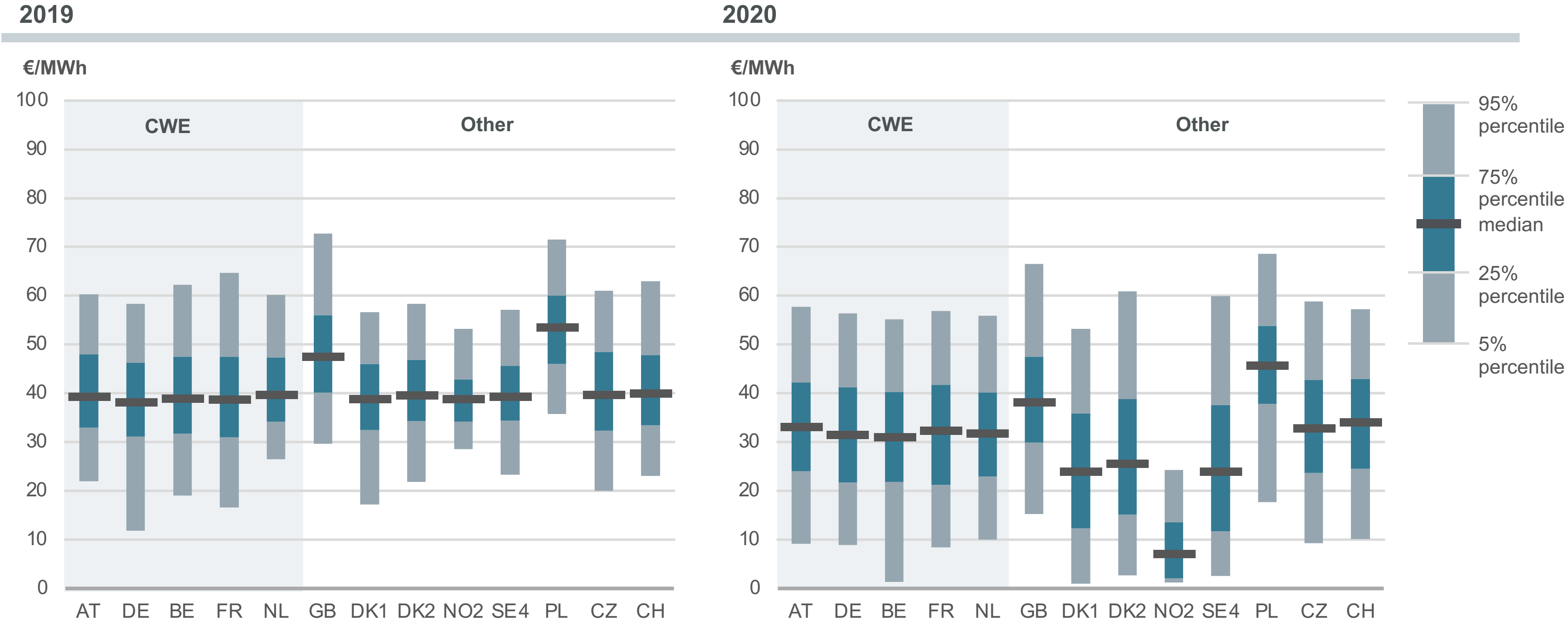
Source: MRC Market Coupling

TenneT

Day-ahead prices – price volatility

Price volatility increased in 2020

Spread of Day-ahead prices in selected European countries



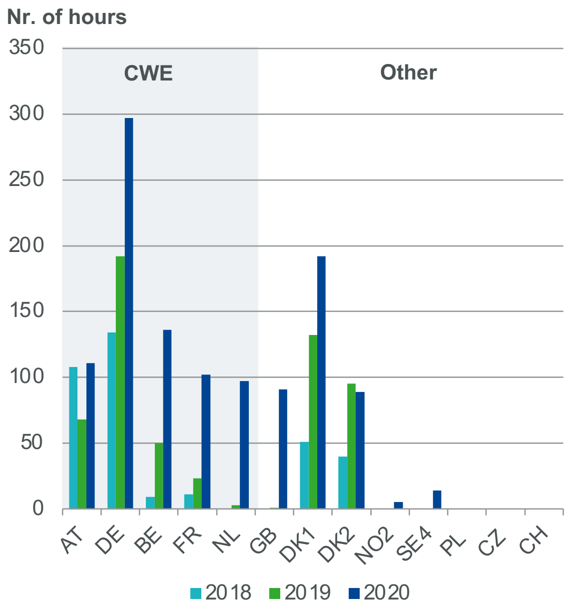
- Higher volatility in general in almost all selected countries and smaller differences in volatility between CWE countries in 2020 compared to 2019. Because prices were lower in Q2 2020 compared to 2019 partly due to the covid-19 related restrictions and higher in Q4 2020 compared to 2019, the volatility over the year increased.
- Norwegian prices mostly set by the marginal opportunity cost of hydro, these costs were low in 2020 due to the high availability of hydro stocks as a result of melting water.

Source: MRC Market Coupling

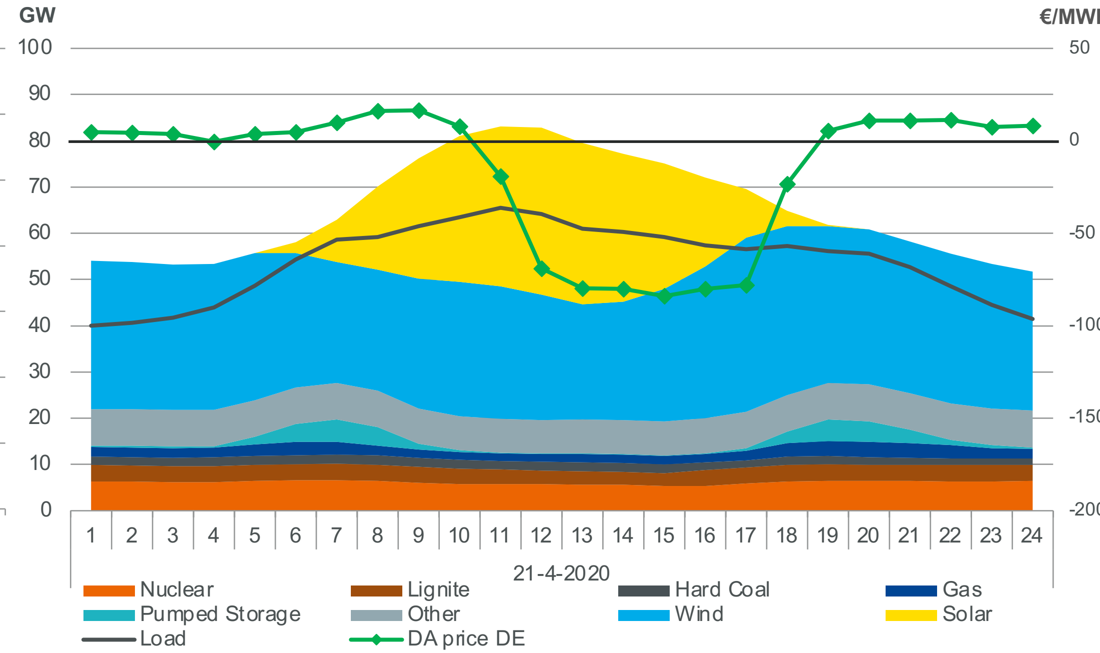
Day-ahead prices CWE – negative prices

Increase of hours per year with negative prices within CWE and neighbours

Negative Day-ahead Wholesale Prices



Example: 21-4-2020 German Day-ahead wholesale prices and electricity mix



- The number of hours per year at which day-ahead markets cleared at negative prices increased in the CWE region, GB, and some Nordic bidding zones. Germany reached 297 hours of negative prices which is 3,5% of all hours in 2020.
- The example shows the day-ahead prices and hourly generation mix in Germany on a day with significant negative prices.
- Negative prices as outcome of the day-ahead auction signal the willingness of producers to pay off takers of their power. This is possible because there are also other remunerations beside the day-ahead market. If those remunerations exceed the costs for negative prices at day-ahead, a positive return is still made. Remunerations can come from a.) other markets, e.g. must-run installations for heat, b) network operators, e.g. support system quality, or c) governments, e.g. regulation / subsidies for renewables. In addition, less-/in-flexible thermal power plants that incur heavy start/stop costs and risks will accept a negative price if these costs are lower than the start/stop costs + risks.

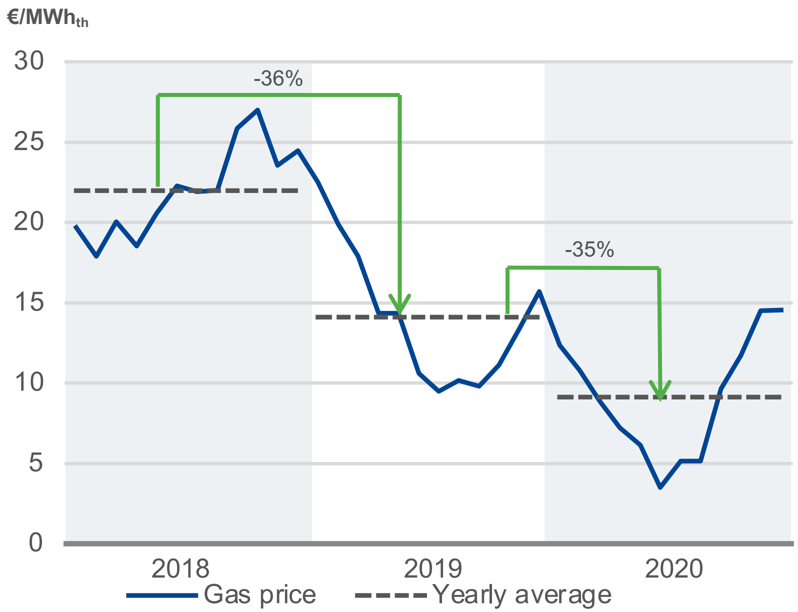
Source: MRC Market Coupling; Fraunhofer Energy Charts www.energy-charts.de

Fuel Prices & Generators

Fuel Prices

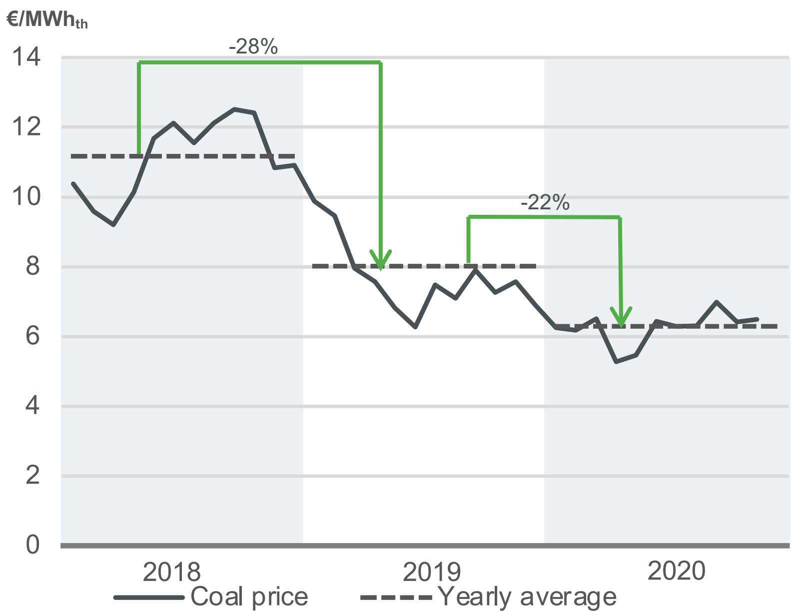
Natural Gas Prices decreased with 35%, Coal prices decreased with 22% on average compared to 2019

Natural Gas Prices



Gas prices are based on OTC natural gas prices at the Dutch virtual exchange Title Transfer Facility (TTF).

Coal Prices



Coal prices are based on the over the counter API#2 price index.

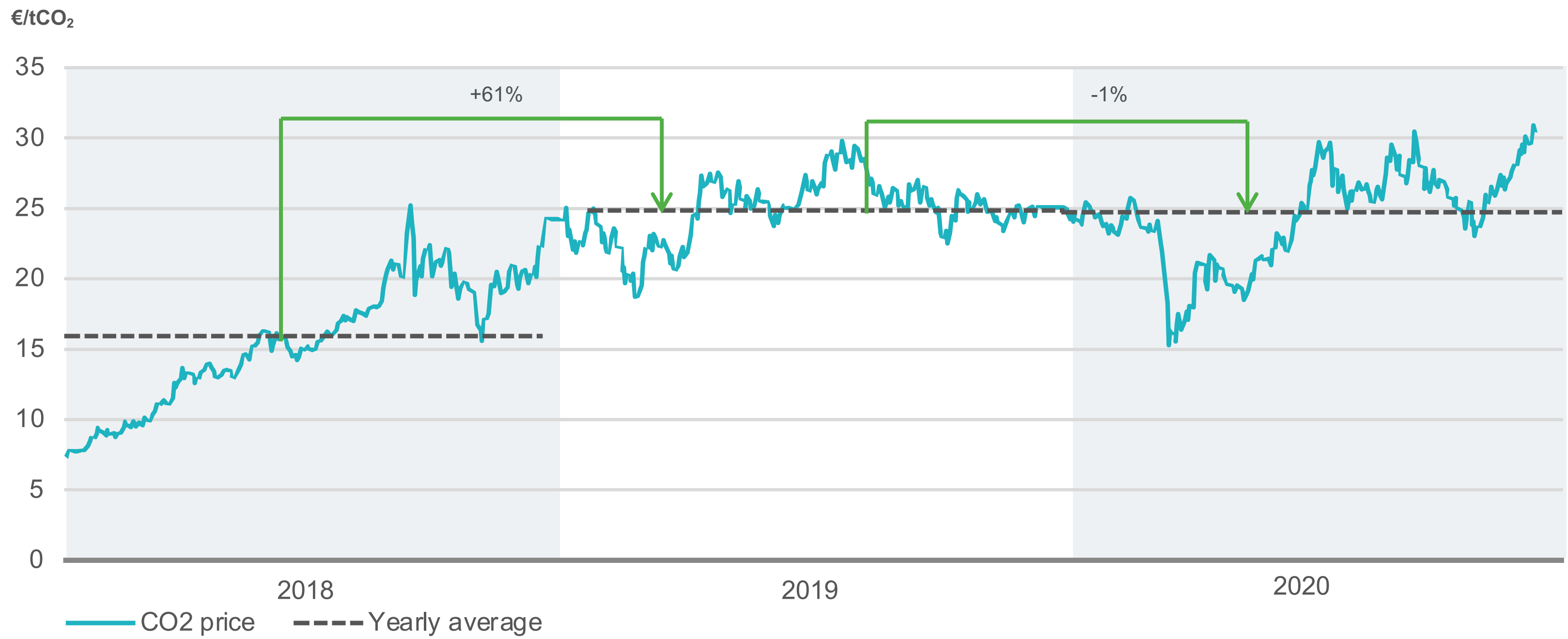
- Fuel prices decreased on decreased demand for fuel induced by tough restriction measures of European governments in response to Covid-19.
- Natural gas demand decreased for both the industrial sector as well as the electricity sector, resulting in a drop in Natural gas prices of 35%.
- Coal prices decreased with 22%. This was affected partly due to a decrease in demand for power as well but more particularly by a reduced demand for power from coal-fired generation due to uncompetitive margins *(see Generator Margins NL and DE).*

 Source: energate

Carbon Prices

Year-on-year carbon prices remained stable around 25 €/tCO_2 in 2019 and 2020
Closing carbon price in 2020 reached a record high of 30,9 €/tCO_2

CO_2 Emissions Allowance (EU ETS) Prices



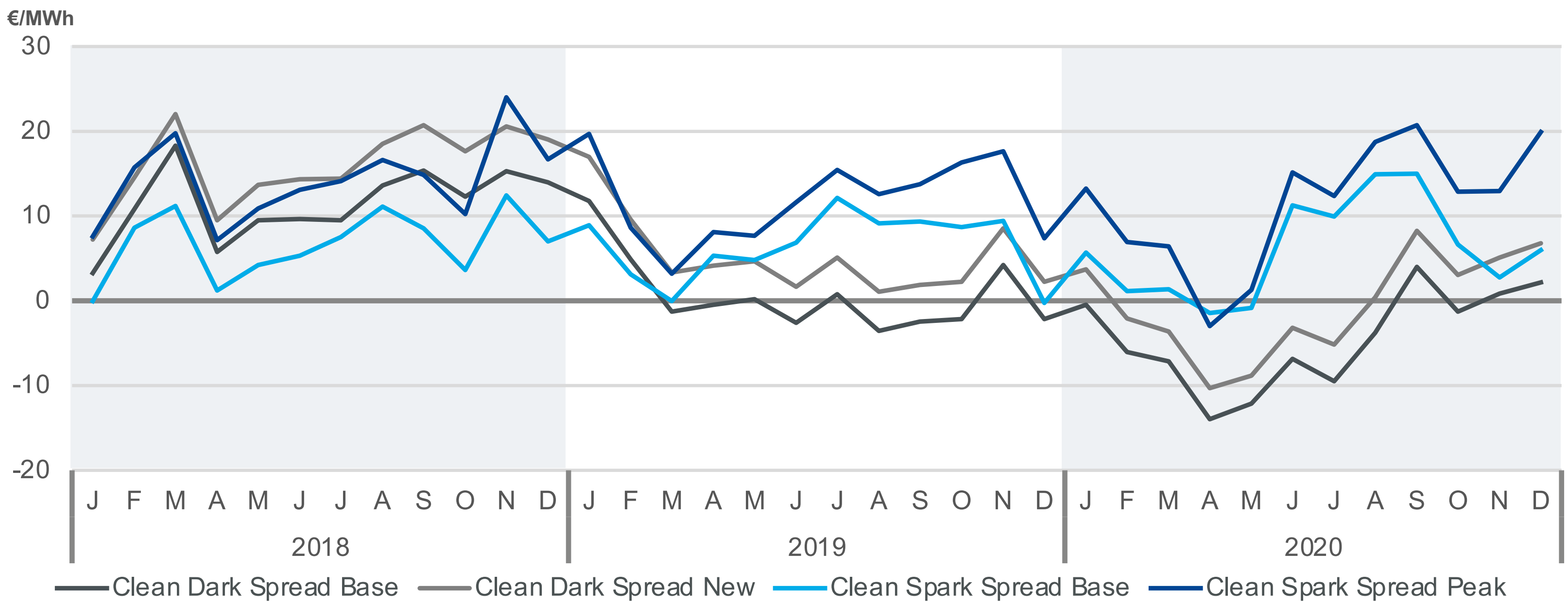
- After the CO_2 Emission Allowances price stabilised around 25 €/tCO_2 during 2019, the yearly average price for 2020 remained rather stable with a year-on-year decrease of 1%.
- Volatility was much higher in 2020 with lower dips and higher peaks. The strong dip occurred when Europe responded to the covid-19 pandemic with heavy restrictions. The peak marked a record high of 30,9 €/tCO_2 by the end of 2020, closing the year almost 6 €/tCO_2 higher than the yearly average.
- The upwards trend of the CO_2 Emission Allowances prices in 2020 is partly the result of the new agreed EU Green Deal. The 40% CO_2 Emission reduction target for 2030 compared to 1990 emissions is lifted towards 55%.

Source: energate

Generator Margins NL

Coal-to-gas switching from January to November
Negative spreads coal- and gas-fired generation in April and May

Dutch Monthly Average Clean Dark Spread and Clean Spark Spread



Assumptions
***Coal**: efficiency Base 40%, New 45%, emission factor 91,7 $tCO_2/TJth$, heating value 25,1 MJ/kg; **Gas**: efficiency Base & Peak 55% emission factor 55,6 $tCO_2/TJth$,.*

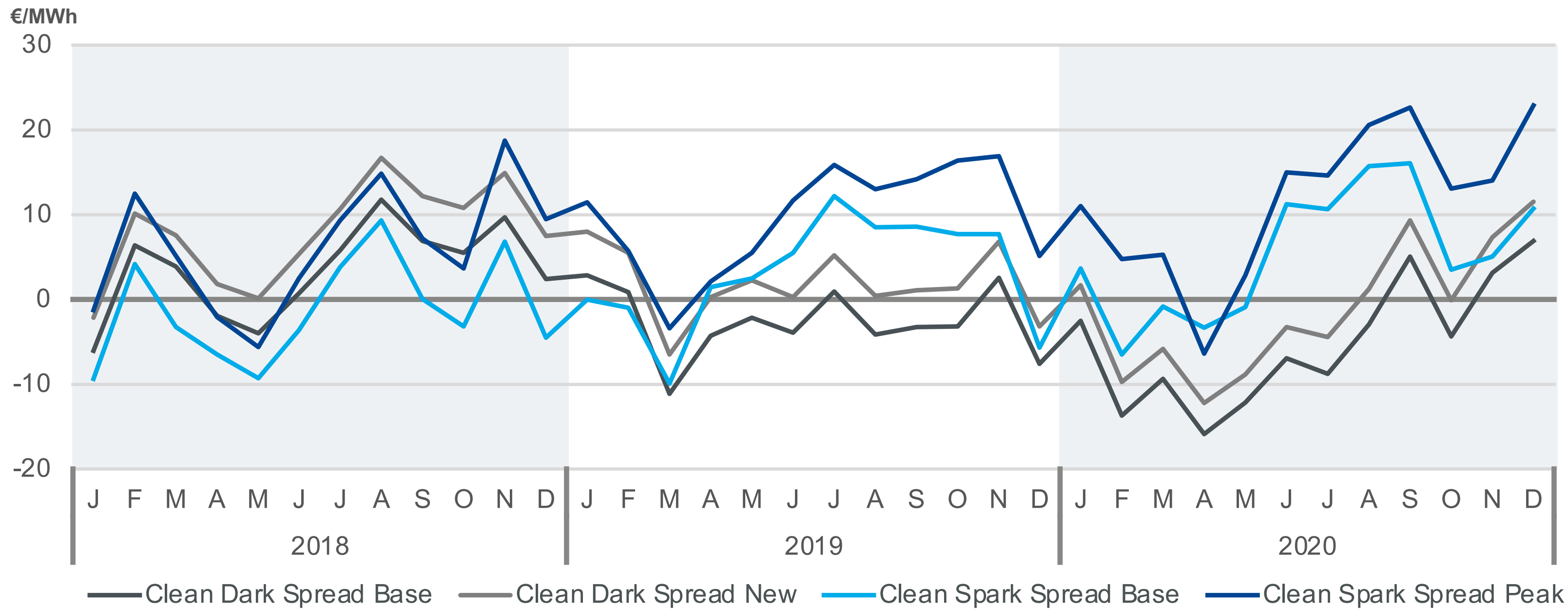
- At the start of 2021, up to November, the Clean Dark Spread Base and new (*for modern high efficient coal-fired power plants)* decreased below the Clean Spark Spread Base suggesting coal-to-gas switching. This indicates the point at which it is more profitable to produce electricity from natural gas than from coal.
- The effects of coal-to-gas switching in the actual monthly generation mix (*Generation in the Netherlands)* shows a significant decrease in generation from coal-fired power plants and an increase in the generation of gas-fired power plants. In June and July the difference between the Clean Spark spread base and the Clean Dark spread base and new was highest, resulting in the lowest contribution of Coal-fired generation in the generation mix.

Source: energate, MRC Market Coupling

Generator Margins DE

Negative spreads for Base gas-fired generation from February till May and for Base coal-fired generation from January till August

German Monthly Average Clean Dark Spread and Clean Spark Spread



Assumptions
***Coal**: efficiency Base 40%, New 45%, emission factor 91,7 tCO_2/TJth, heating value 25,1 MJ/kg; **Gas**: efficiency Base & Peak 55% emission factor 55,6 tCO_2/TJth,.*

- The German Clean Dark and Clean Spark Spreads show a similar pattern. Coal-to-gas switching occurs as well from January till November. Exception to the Dutch pattern is the negative margins in February till May (clean spark spread base) as a result of high renewable in-feed in Germany suppressing monthly average day-ahead prices down below healthy margins of both coal- and gas-fired power plants.
- This effect was amplified by reduced loads all over Europe due to Covid-19 related restrictions. In April the Clean Spark Spread Peak was even lower than the Base (in both NL and DE), signalling that day-ahead prices during the day were lower than the daily average prices.

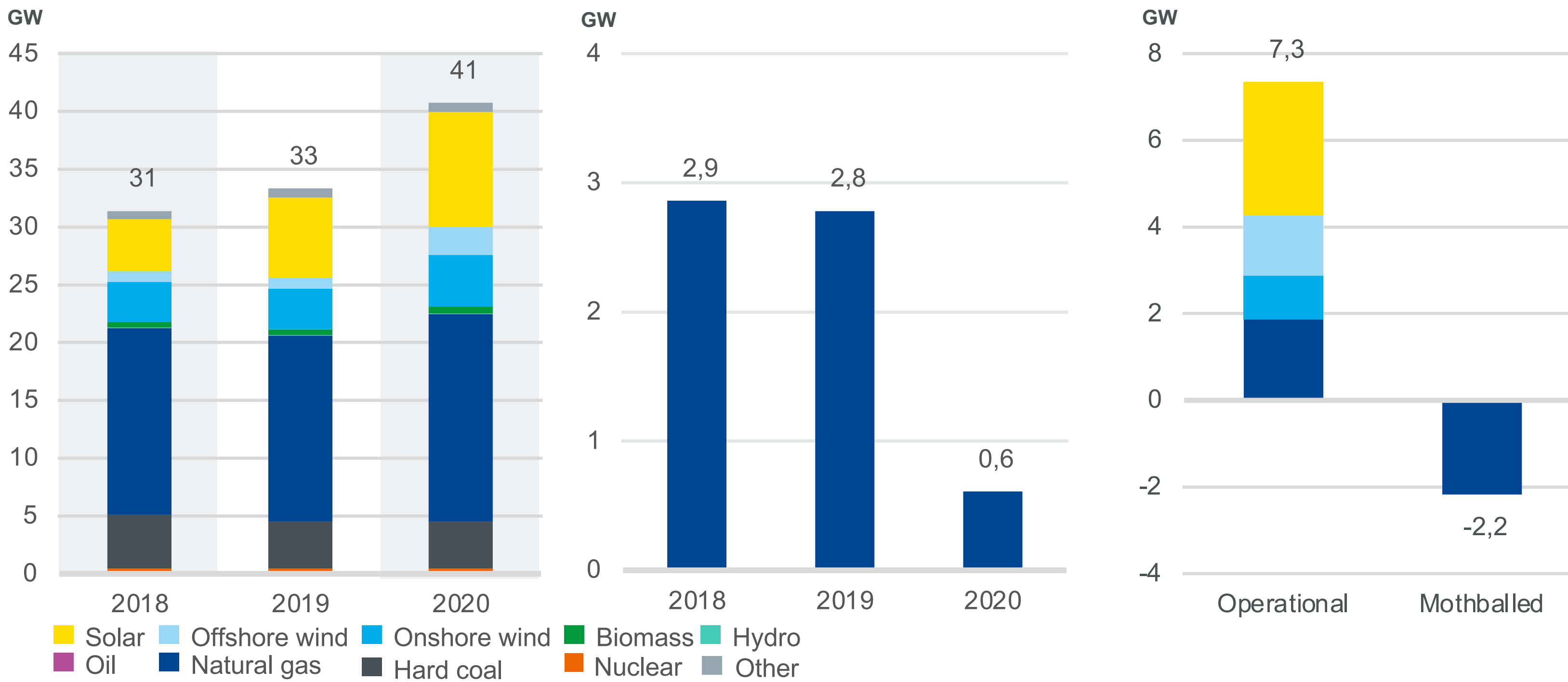
Source: energate, MRC Market Coupling

Capacity & generation

Capacity in the Netherlands

Main capacity increase by Solar PV, which grew by 3,1 GW
1,9 GW of mothballed capacity was made operational again

Dutch Operational Capacity | **Dutch Mothballed Capacity** | **Changes (Δ2020-2019)**



The figures represent the end-of-year installed capacity as observed on December 31st of 2018, 2019 and 2020

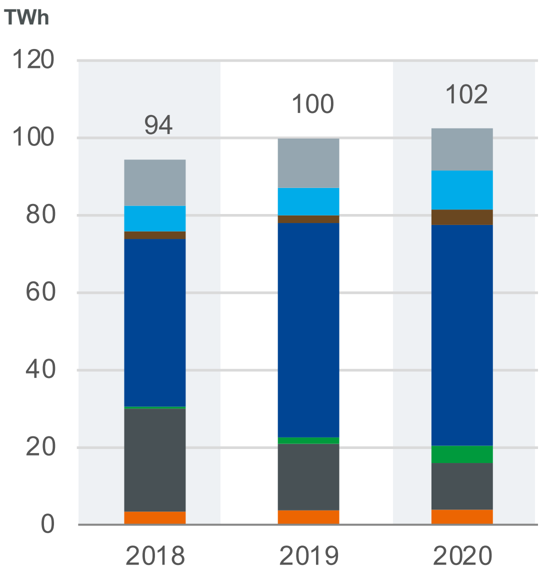
- Operational capacity increased by 7,3 GW, roughly half is the result of solar PV which grew by 3 GW in 2020. Onshore wind accounted for 1 GW. The 1,4 GW additional offshore wind capacity are the first two out of five 700 MW offshore wind sites that were part of the *2013 energy agreement*, Borssele I&II 700MW and III&IV 700MW.
- Due to improved market conditions for gas-fired power plants (*see Fuel Prices & Generators*) almost all mothballed capacity re-entered the market with 1,9 GW, of which the Claus C gas-fired power plant with 1,3 GW is the largest connection. Because this is the largest single connection in the Dutch grid this also had implications for the dimensioning of the FRR capacity *(see Balancing).*

 Source: TenneT NL, CBS

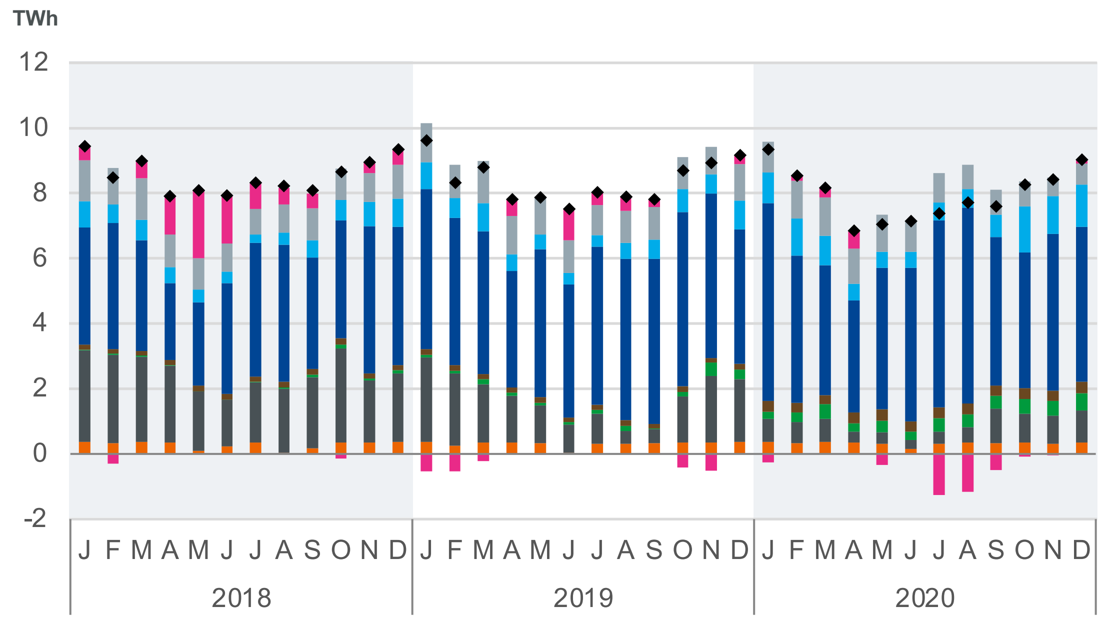
Generation in the Netherlands

Reduced coal-fired and increased gas-fired and biomass co-firing generation
Record high export volumes in July and August

Dutch Yearly Gross Electricity Generation



Dutch Monthly Generation, net Imports and Exports



Nuclear | Hard coal | Certified co-fired biomass | Waste | Natural gas | Wind | Uncategorized | Net import (+) / export (-) | Load + grid losses

**Generation shown is electricity infeed measured on public grids: ~82-85% of total NL generation. Uncategorised: units <10MW. Solar generation and some onshore wind not available in measurements.* .

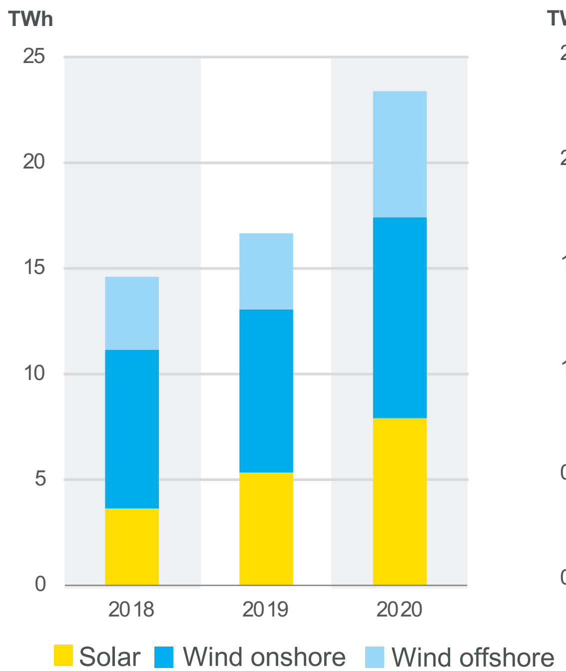
- In June and July the difference between the Clean Spark spread base and the Clean Dark spread base and new was highest, resulting in the lowest contribution of Coal-fired generation in the generation mix (*Generator Margins NL).*
- Biomass co-firing increased in 2020 up to 4,5 TWh, this is still 2,1 TWh short of the expected 6,7 TWh annual generation expected from the SDE+ subsidies when co-firing of biomass will be fully reached (*NL: Cumulative development SDE+)*
- July and August had record high exports due to the high competitiveness of the Dutch gas dominated generation mix. Monthly average day-ahead prices were lowest within the CWE region and the difference between the clean spark spread and clean dark spread was highest in these months.

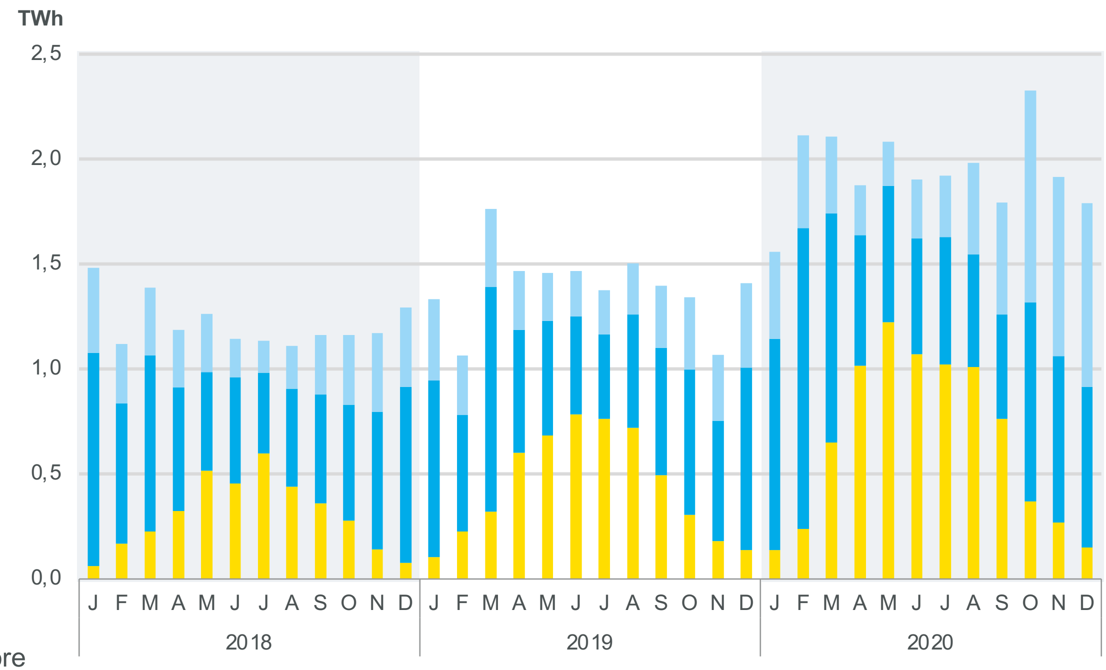
 Source: TenneT NL, CertiQ

Solar and Wind Generation in the Netherlands

Offshore wind generation increased up to 6 TWh in 2020
Solar generation increased up to 8 TWh in 2020

Dutch Solar and Wind Generation annually and monthly





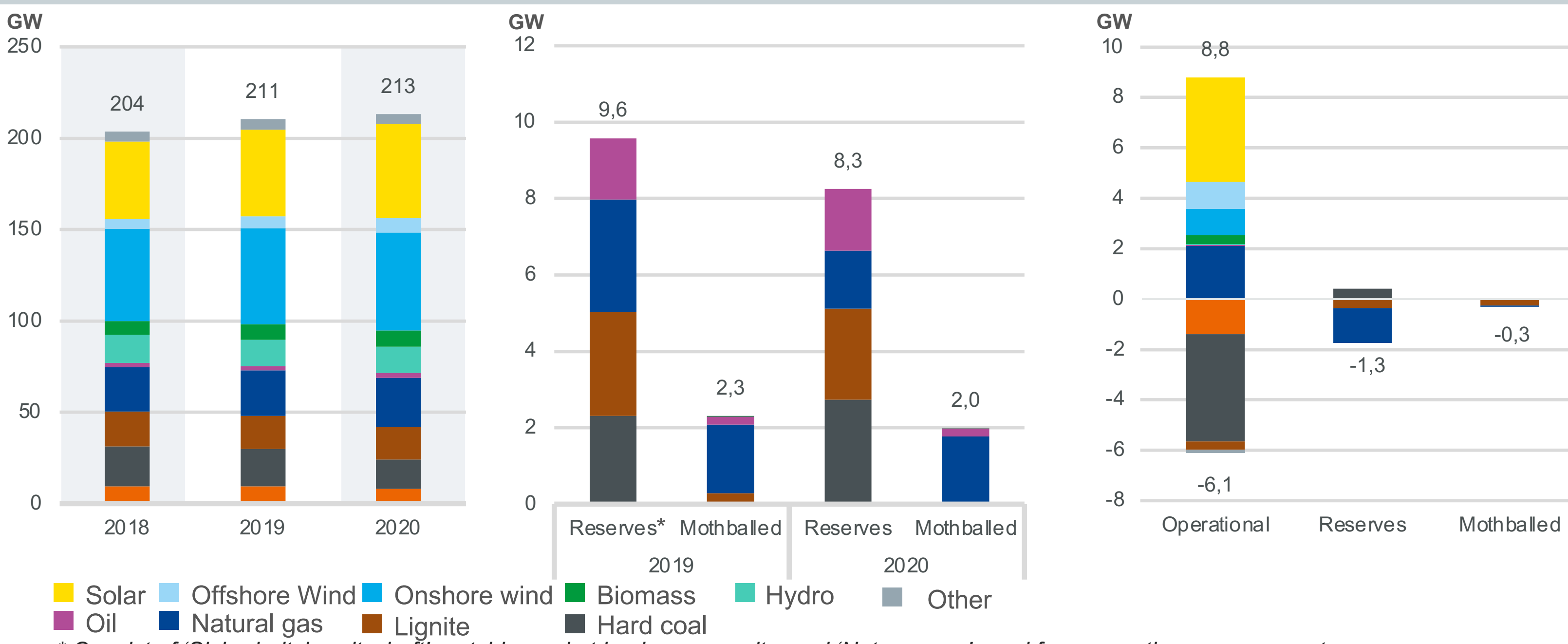
- Solar generation increased most of the weather dependent renewable generation sources in the Netherlands up to 8 TWh (+49%) , a logical consequence of the 3 GW installed capacity increase in 2020.
- Offshore wind generation increased most relatively with an increase of 66% growing towards 6 TWh generation in 2020. This was the result of the first two offshore wind sites from the *2013 energy agreement*, Borssele I&II 700MW and III&IV 700MW, which started generating in 2020.
- The monthly pattern shows that wind and solar were complementary on a monthly aggregated level with typically more solar in the summer and more wind in the winter. Variability on an hourly or daily level is significantly larger.

Source: energieopwek.nl

Capacity in Germany

Increase in RES and Gas-fired Generation, reduction of hard coal-fired generation
Strategic reserve implemented in 2020 for the first time

German Operational Capacity | **German Reserve and Mothballed Capacity** | **Changes (∆2019-2020)**



** Consist of 'Sicherheitsbereitschaft' outside market back-up capacity, and 'Netzreserve' used for congestion management*

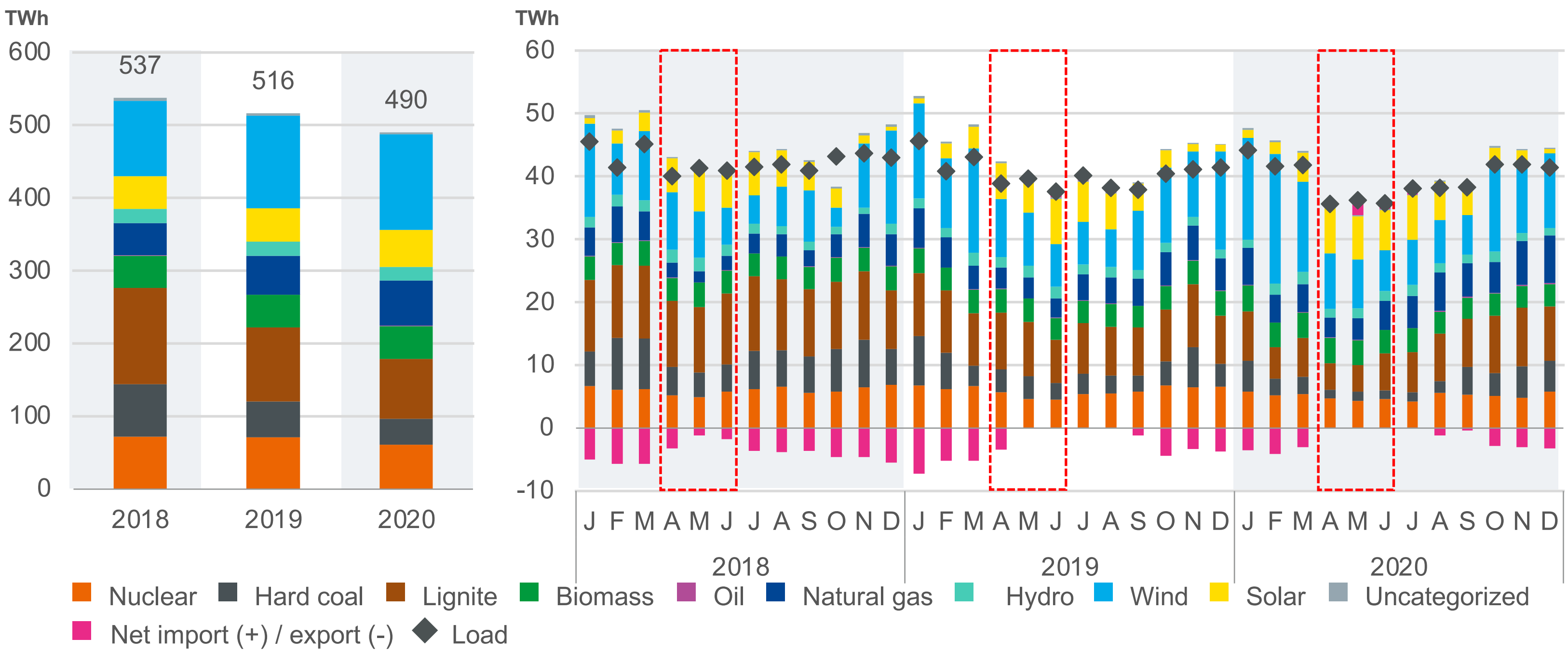
- Operational capacity increased by 2 GW. PV solar grew by roughly 4 GW and wind by 2 GW while coal capacity decreased by almost 4 GW. More than 1 GW of gas-fired capacity from reserves came back into the operational fleet due to improved market conditions (*Generator Margins DE).*
- Strategic reserve scheme introduced in Oct. 2020. For first delivery period a total of ca. 1 GW gas-fired capacity contracted. This capacity is kept outside the market. The strategic reserves are plotted in the operational capacity category in this classification of the Kraftwerklisste from the Bundesnetzagentur.
- According to nuclear phase-out plans, one nuclear power plant was shut down in 2020 (ca. 1 GW).

Source: Kraftwerkliste Bundesnetzagentur, ENTSO-E Transparancy Platform

Generation in Germany

Overall generation in Germany decreased in 2020 compared to 2019
Largest reduction for hard coal, lignite and nuclear generation

German Yearly Gross Electricity Generation



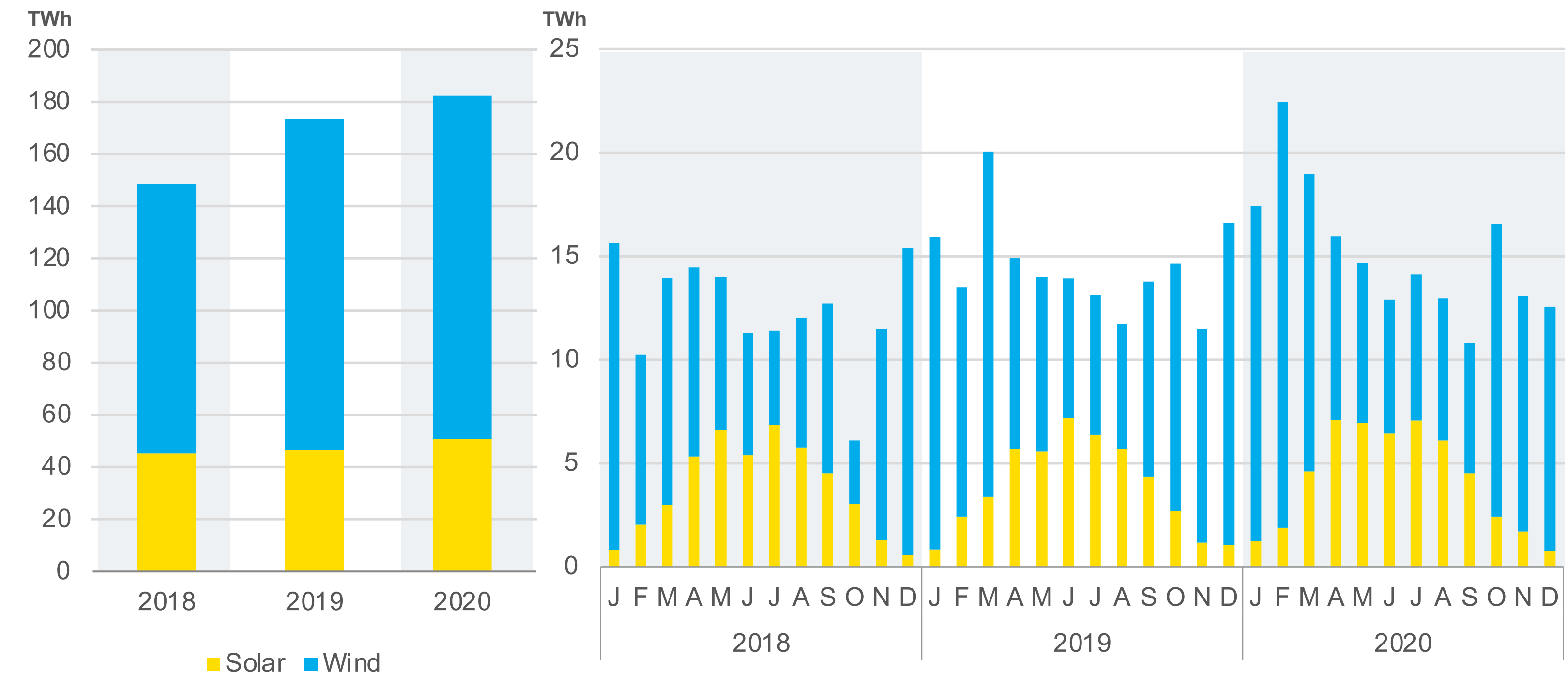
- Total generation in Germany decreased in 2020 compared to 2019 with 26 TWh (-5%). Generation from hard coal decreased with 13 TWh (-27%) lignite with 20 TWh (-20%) and nuclear with 10 TWh (-14%). This reduction was partly offset by the increase in gas 9 TWh (+17%) solar and wind 11 TWh (+6%) and a reduced net export position.
- Biomass and hydro based generation remained a similar generation output over the past three years.
- Total generation and load in Q2 2020 seems to be significantly below the generation and load in the same period in 2018 and 2019 which likely shows some effect of the Covid-19 related restrictions on the total consumption in Germany.

Source: Fraunhofer Energy Charts www.energy-charts.de

Solar and Wind generation in Germany

Solar generation increased 9,5% compared to 2019

Annual and Monthly Solar and Wind Generation Germany



- In 2020 Solar generation was up 9,5% compared to 2019, reaching 51 TWh which was a logical consequence of the 4 GW additions in solar capacity. Wind generation increased only marginally up to 132 TWh (+3,5%)
- The monthly pattern shows that wind and solar were complementary on a monthly aggregated level by typically more solar in the summer and more wind in the winter. Variability on an hourly or daily level are likely to be significantly larger.

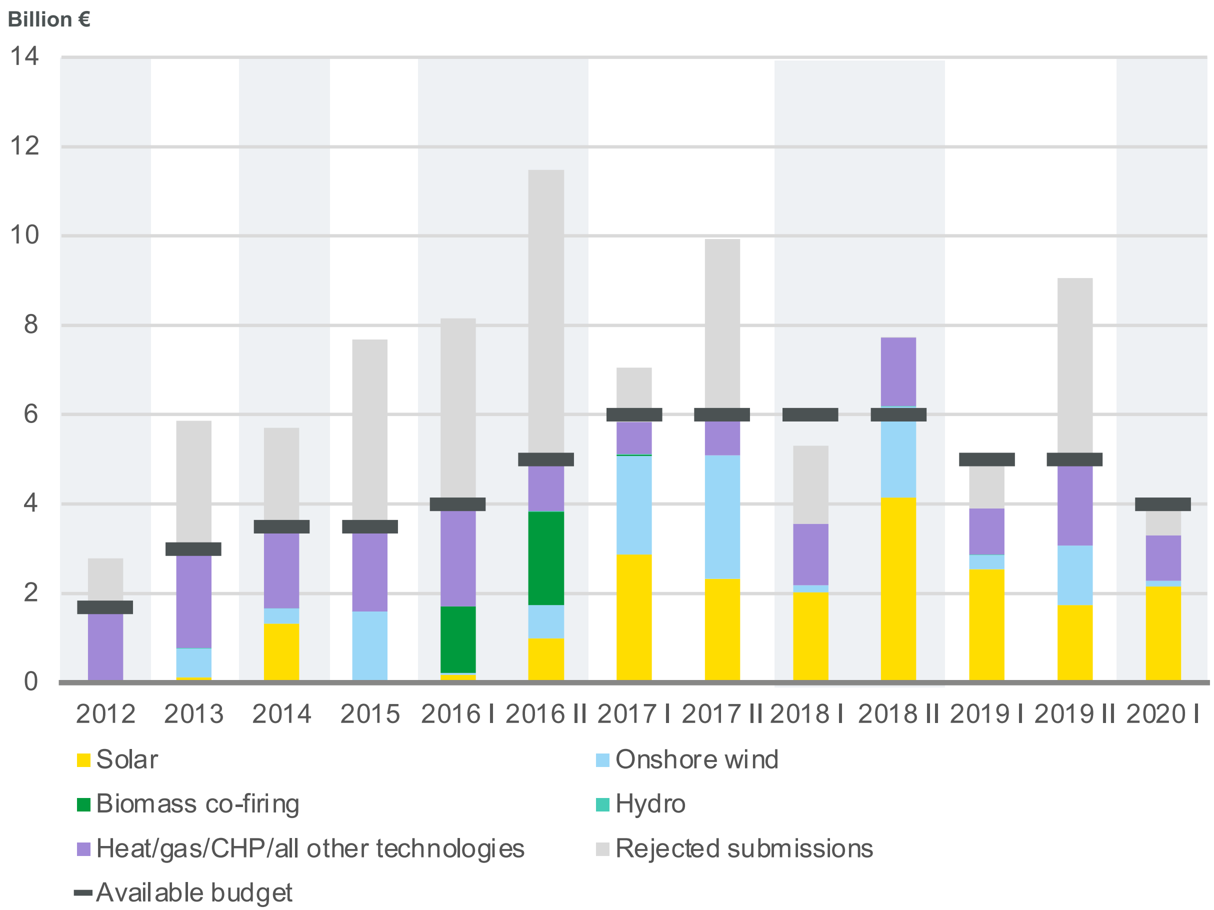
Source: Fraunhofer Energy Charts www.energy-charts.de

RES support schemes

NL: Budget Distribution SDE+

Decreased budget for SDE+ since 2019
Solar taking around half of the 2020 round I available budget

Budget Distribution per SDE+ Round



- The SDE+ is an operating (feed-in-tariff) subsidy. Producers receive a guaranteed payment (subsidy) for the energy they generate from renewable sources.
- In relation to the expected technological improvements and associated cost reductions, the available SDE+ budget is decreasing. This decision was made to ensure sufficient competition in development of renewable energy projects.
- In 2020 round I, several subsidy requests were rejected due to insufficient adherence to requirements set by the Netherlands Enterprise Agency (RVO).
- Available grid capacity became part of the requirements for the project assessments since 2019 round II.
- Solar took slightly more than half of the budget for 2020 I, almost no budget was allocated to wind onshore projects.

 7 April 2021

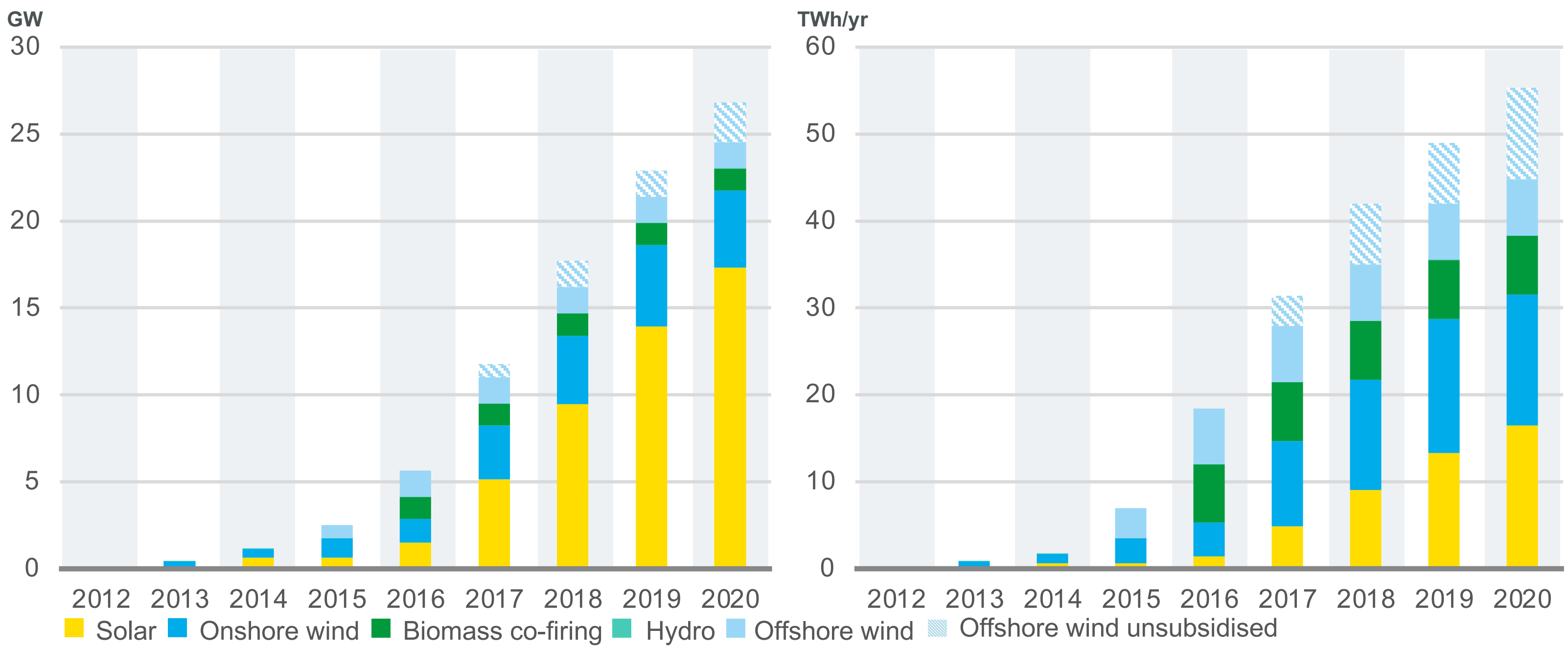
Source: RVO

NL: Cumulative development SDE+

Over 26 GW renewable electricity capacity is projected to be installed under the SDE+ subsidy scheme

End of Year Cumulative Capacity to be installed under SDE+

End of Year Cumulative Electricity Generation to be generated annually under SDE+



**Note that 2020 round II is excluded in 2020 figures*

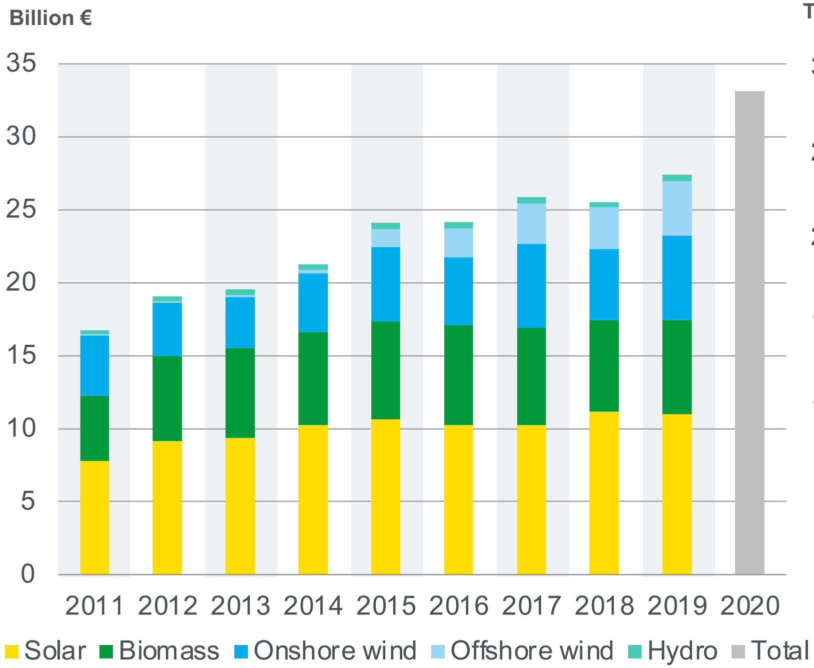
- After 8,5 years of SDE+ subsidy schemes, more than 26 GW of awarded capacity of solar, on- and offshore wind, hydro, biomass co-firing is in operation or is planned to be installed. 2,3 GW of this capacity is unsubsidised offshore wind.
- This cumulative capacity will be good for 55 TWh annual generation of which 11 TWh from unsubsidised offshore wind. With an annual consumption of 117 TWh in 2018 (AMU 2018), renewable generation resulting from SDE+ subsidies (excluding the unsubsidised offshore wind) would correspond to 38% of total annual consumption.
- A clear discrepancy is seen between awarded capacity and awarded electricity generation. Even though the majority of capacity was awarded to solar in recent years, electricity generation from wind is higher. This can be attributed to the higher load factor of these technologies.

Source: RVO

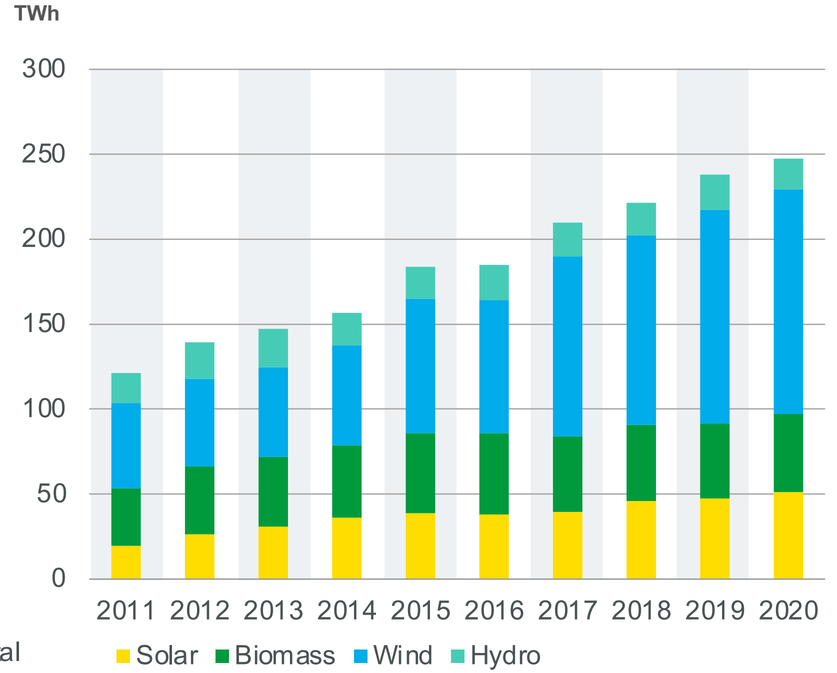
DE: Cumulative development EEG payments

Increased total EEG payments for 2020

End of Year Cumulative Payments to Renewable Support Scheme (EEG)



Renewable Generation



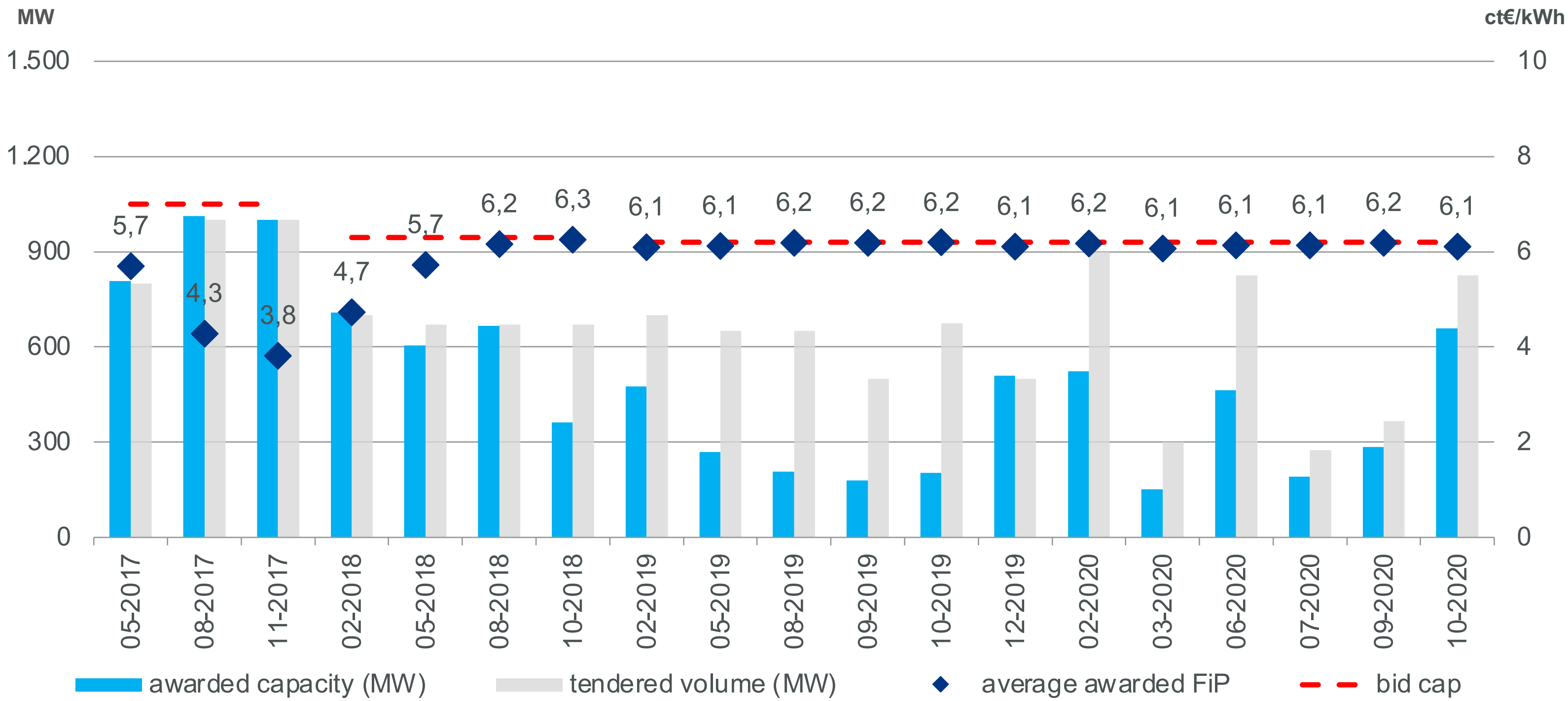
- Overall lower electricity wholesale price level led to a substantial increase in payments to renewable generators under the EEG scheme in 2020 (in total: 33,1 billion €; numbers preliminary)
- As a result, for the first time in the history of the Renewable Energy Sources Act, the EEG surcharge was subsidized by federal funds. The surcharge was fixed at 6,5 ct/kWh for 2021. It would otherwise have risen to 9,7 ct/kWh

Source: Bundesnetzagentur

DE: Development of feed-in premiums

Level of feed-in premiums (FiP) for new onshore wind installations remains constant in 2020 with awarded FiP close to bid cap of 6,2 ct€/kWh

EEG Auction results for the onshore wind Feed-in Premiums (FIP)



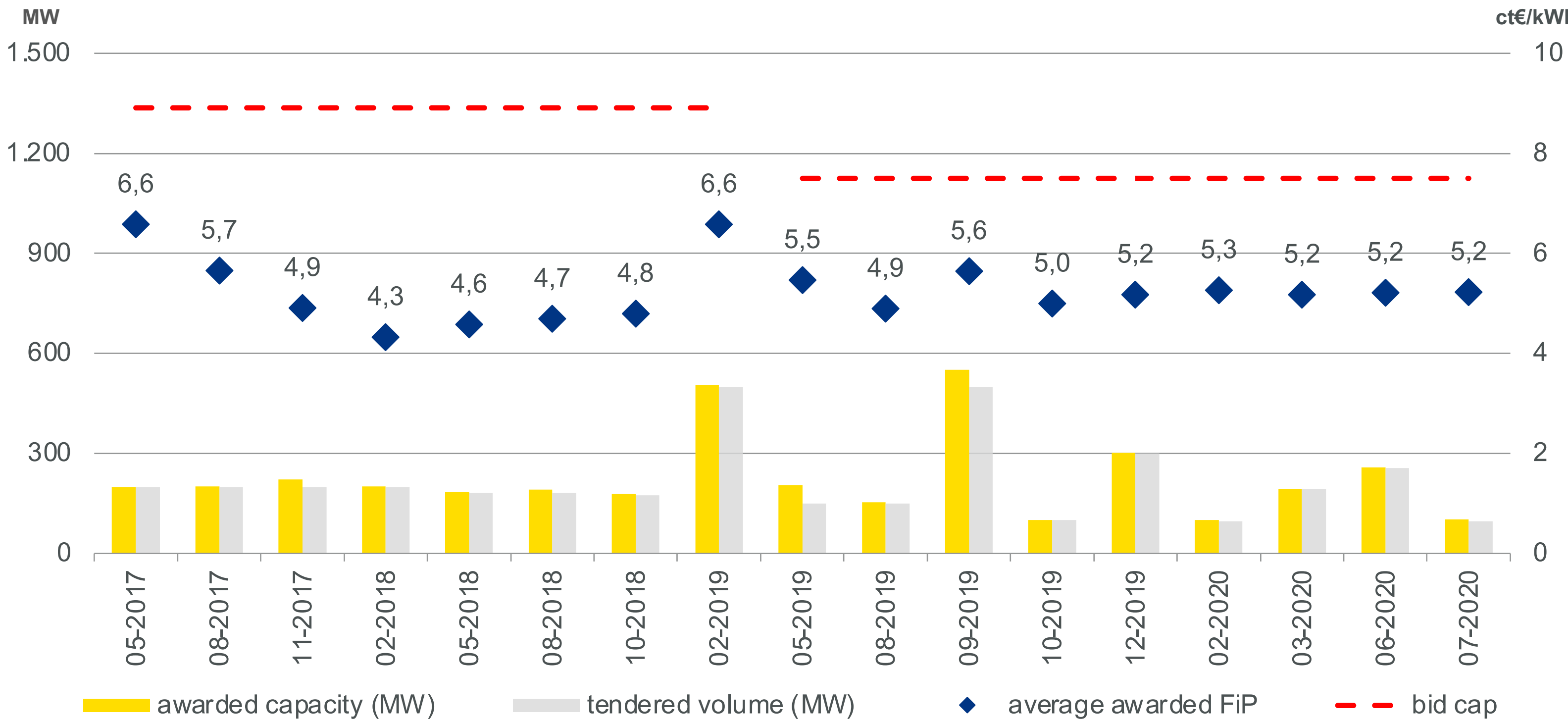
- As in 2019, undersubscribed auctions in 2020 indicate a rather low degree of competition among bidders. As a result, awarded feed-in premiums on average close to bid cap of 6,2 ct€/kWh.
- In total, only 2,3 GW of capacity was awarded in 2020 (2019: 1,8 GW). This awarded capacity is still significantly below the politically set target for new onshore wind capacity. As a consequence, no significant increase of new wind capacity coming online in the next years to be expected.

 Source: Bundesnetzagentur

DE: Development of feed-in premiums

Average FiP for new PV installations (> 750 kW) in 2020 continues to be in the range of 5,2 ct€/kWh

EEG Auction results for the PV solar Feed-in Premiums (FIP)



- In contrast to tenders for new wind capacity, auctions for new PV installations larger than 750 kW were all oversubscribed in 2020 leading to more competition among project developers as also reflected in the average awarded FiP being lower than the maximum bid size (bid cap of 7,5ct€/kWh).
- Lowest submitted bid in 2020 was 3,55 ct€/kWh showing the high degree of maturity and cost competitiveness large PV projects have reached.

 Source: Bundesnetzagentur

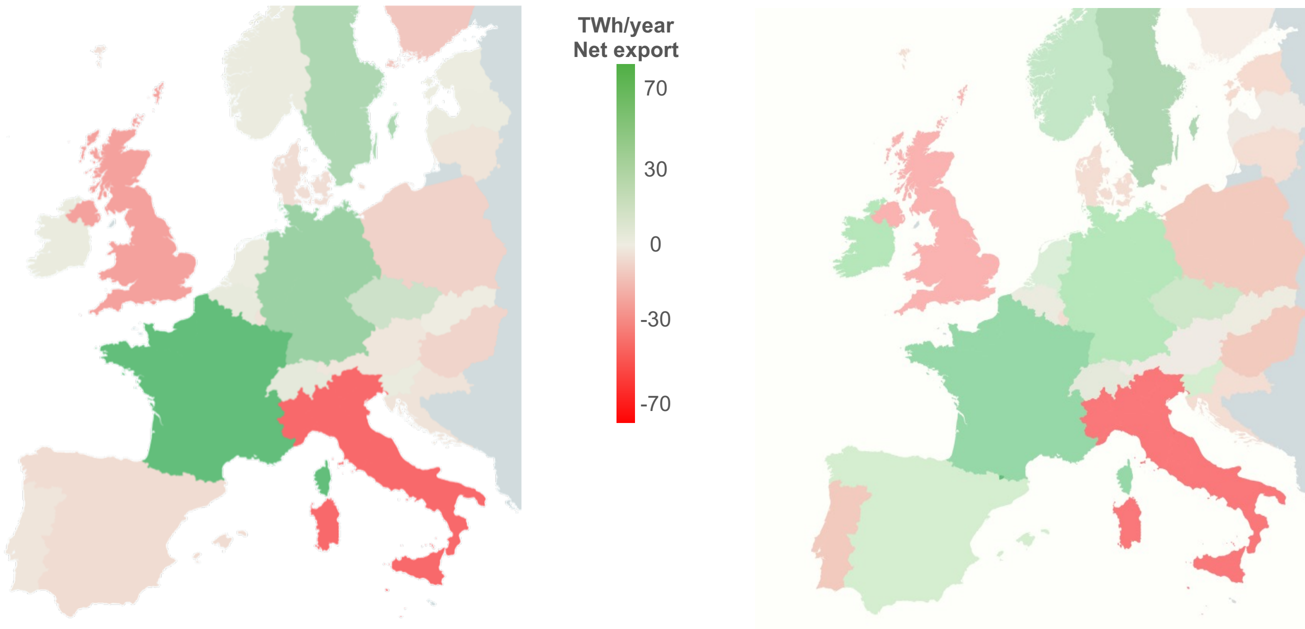
Wholesale market integration

Aggregated Exchange EU

Shift from importer to exporter in the Netherlands, Spain and Ireland
Reduced exports in France and Germany, reduced imports in the UK and Italy

Yearly Aggregated Import and Export Volumes

2019 **2020**



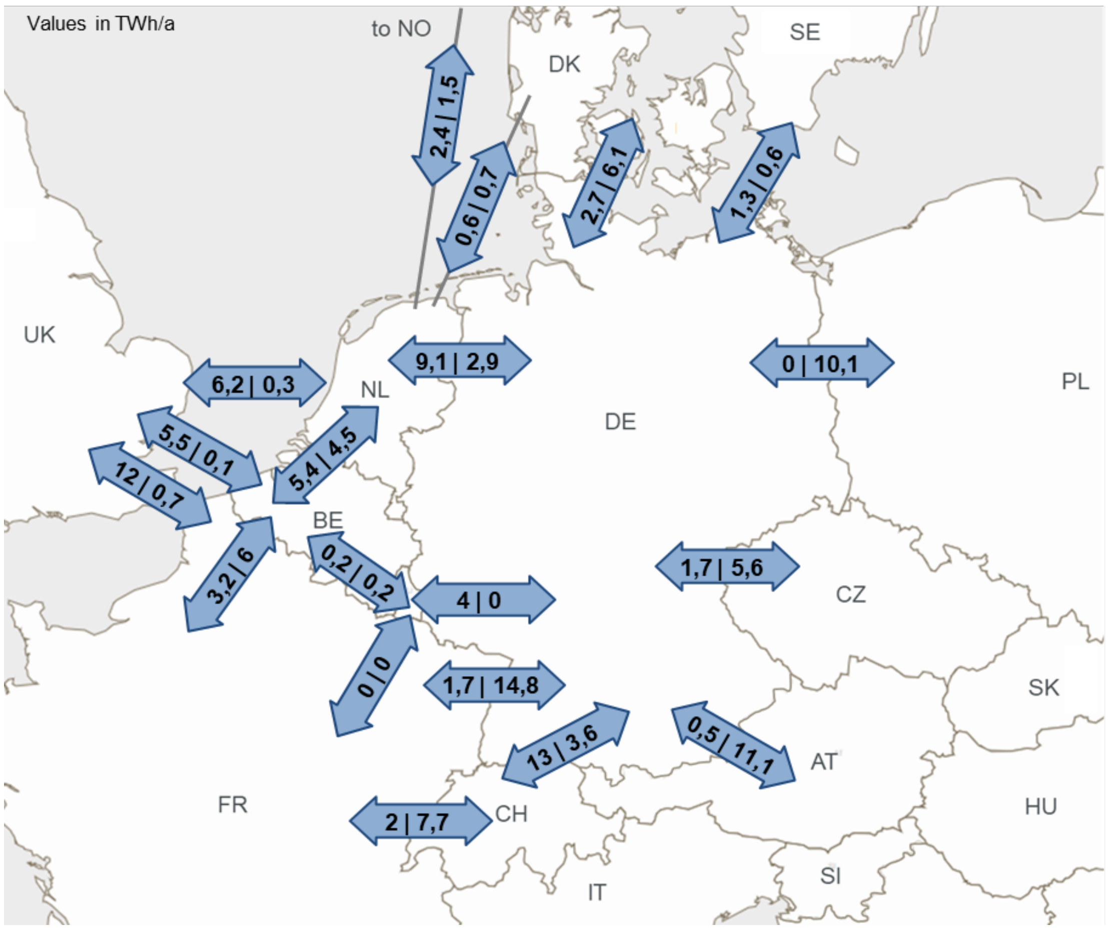
- The Netherlands, Spain and Ireland shifted from a net import position in 2019 towards a net export position in 2020. These three countries have a significant share of gas-fired capacity in their generation mix. The increased and very competitive margins for gas fired generation made these countries more competitive with net exports as a result.
- France and Germany exported less electricity in 2020 compared to 2019, whereas the UK and Italy imported less.
- Norway increased it's export position significantly due to a very competitive generation mix of hydro power and a high availability of the hydro buffers.

Source: ENTSO-E Transparency Platform

Cross-border Flows 2019

Most NL imports came from DE and most exports went to the UK
Most DE imports came from FR and most exports went to CH

Physical Cross Border Flows 2019



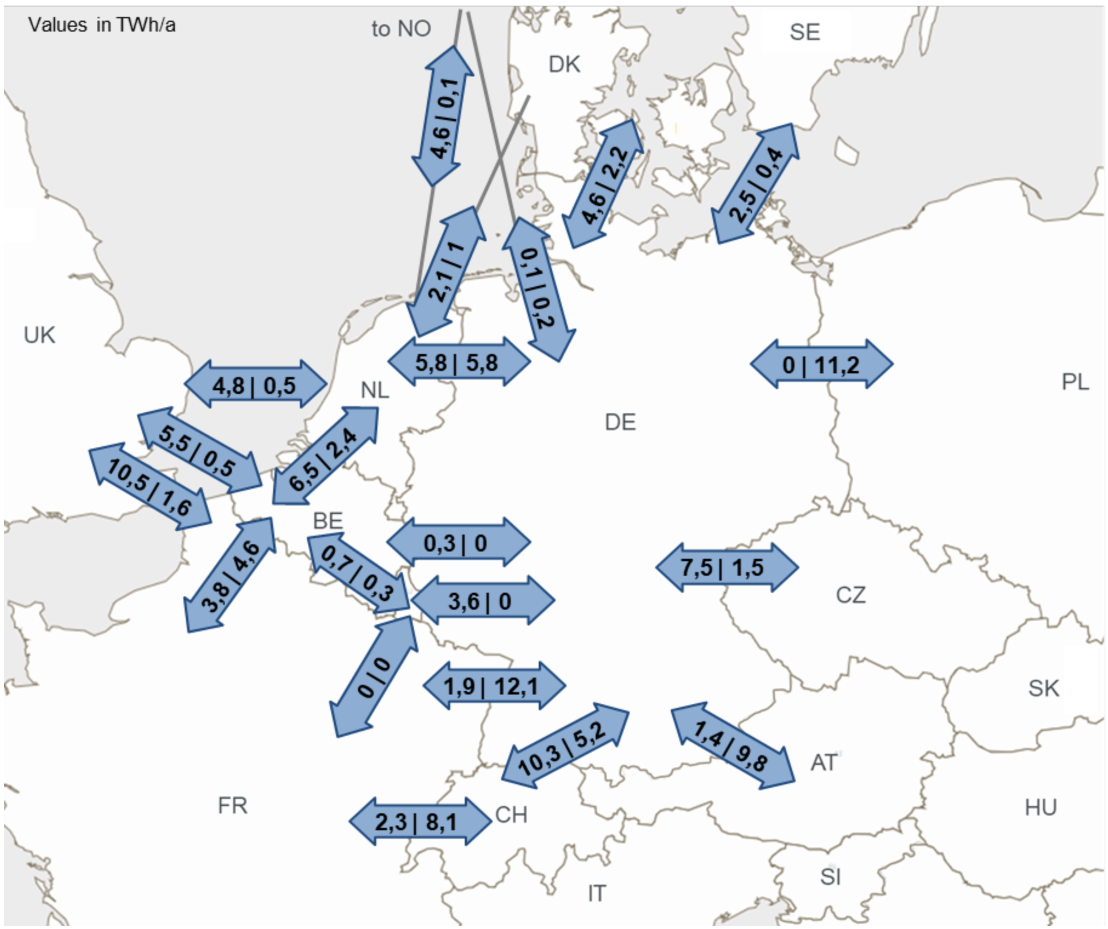
- The Netherlands received most of its imports from Germany (9,1 TWh). This is complemented by imports from Belgium (4,5TWh) and Norway via NorNed (2,4 TWh. The majority of exports were going to the UK (6,2 TWh), followed by Belgium (5,4 TWh).
- Germany's main exports went to Switzerland (13 TWh), Austria (11.1 TWh), Poland (10,1 TWh) and the Netherlands (9,1 TWh). Total imports were much lower as Germany is a net exporting country, but were mostly received from France (14,8 TWh), the Netherlands (2,9 TWh) and Denmark (2,7 TWh).
- Note that this figure shows physical flows between countries, which are different from scheduled commercial exchanges between bidding zones.

Source: ENTSO-E Transparency Platform

Cross-border Flows 2020

Go-Live of NordLink DE-NO interconnector and Allegro DE-BE interconnector

Physical Cross Border Flows 2020



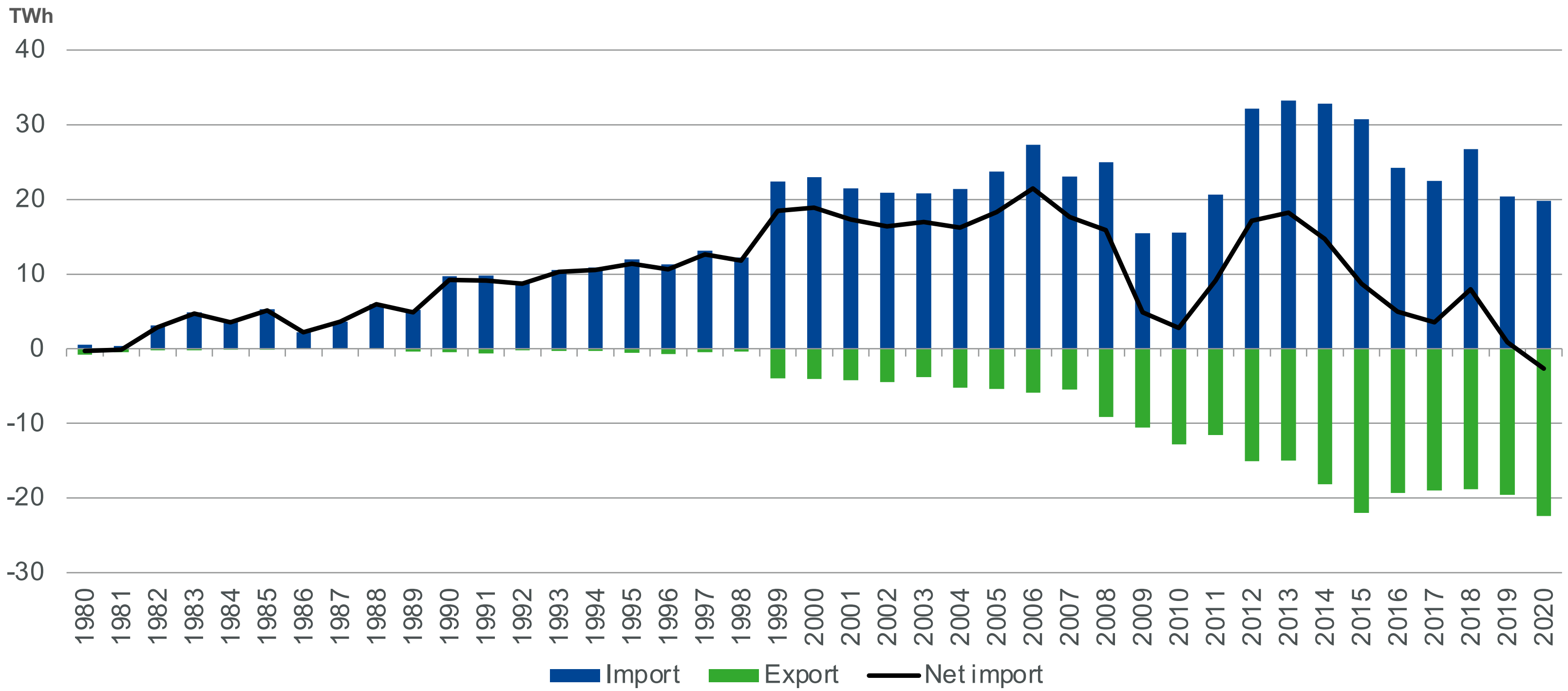
- NL – DE imports and exports were more balanced in 2020 due to a very competitive market gas-fired based capacity mix due to very high margins for gas-fired power.
- Netherlands became a net exporter in 2020.
- Go-live of Allegro interconnector between BE and DE on November 9th 2020 and NordLink between DE and NO on December 8th 2020 resulted in the first BE-DE and DE-NO flows respectively.
- Note that this figure shows physical flows between countries, which are different from scheduled commercial exchanges between bidding zones.

Source: ENTSO-E Transparency Platform

Cross-border flows NL

The Netherlands became a net exporter for the first time since 1981 with a net export of 2,6 TWh

Dutch yearly import, export and net import



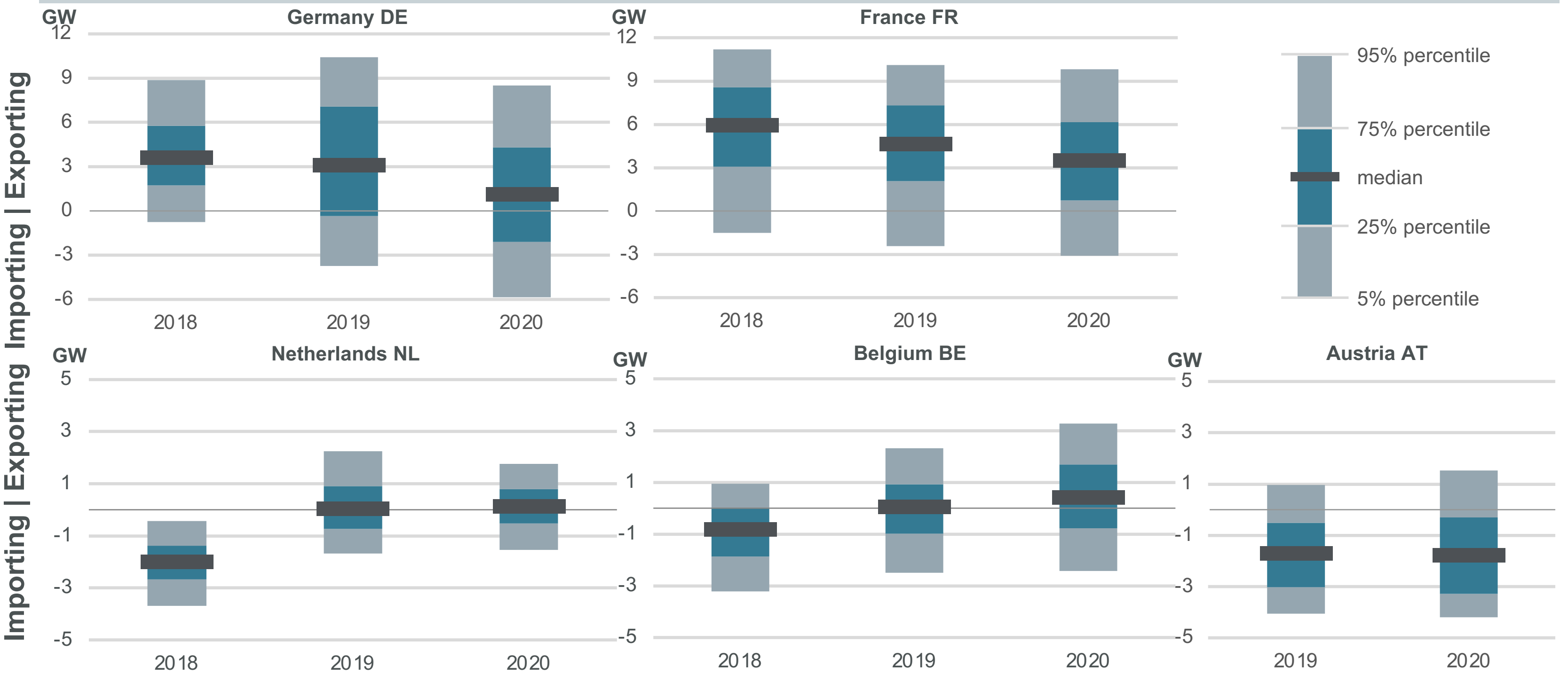
- For the first time since 1981 the Netherlands became a net exporter of electricity. This was mainly the result of decreased imports that show a decreasing trend since 2014 (with an exception for 2018). Exports have remained relatively stable within a range of 18 TWh to 22 TWh since 2014.
- The net export position reflect the improved competitiveness of gas-fired generation, which is the main source of power for the Netherlands.

 Source: CBS

Net Positions CWE

Increased and exporting net positions for both NL and BE
Decreased and exporting net positions for Germany and France

Spread of day-ahead net position in CWE



'Net Position' means the netted sum of electricity exports and imports for each market time unit (hourly and Day-ahead in above graph) for a bidding zone

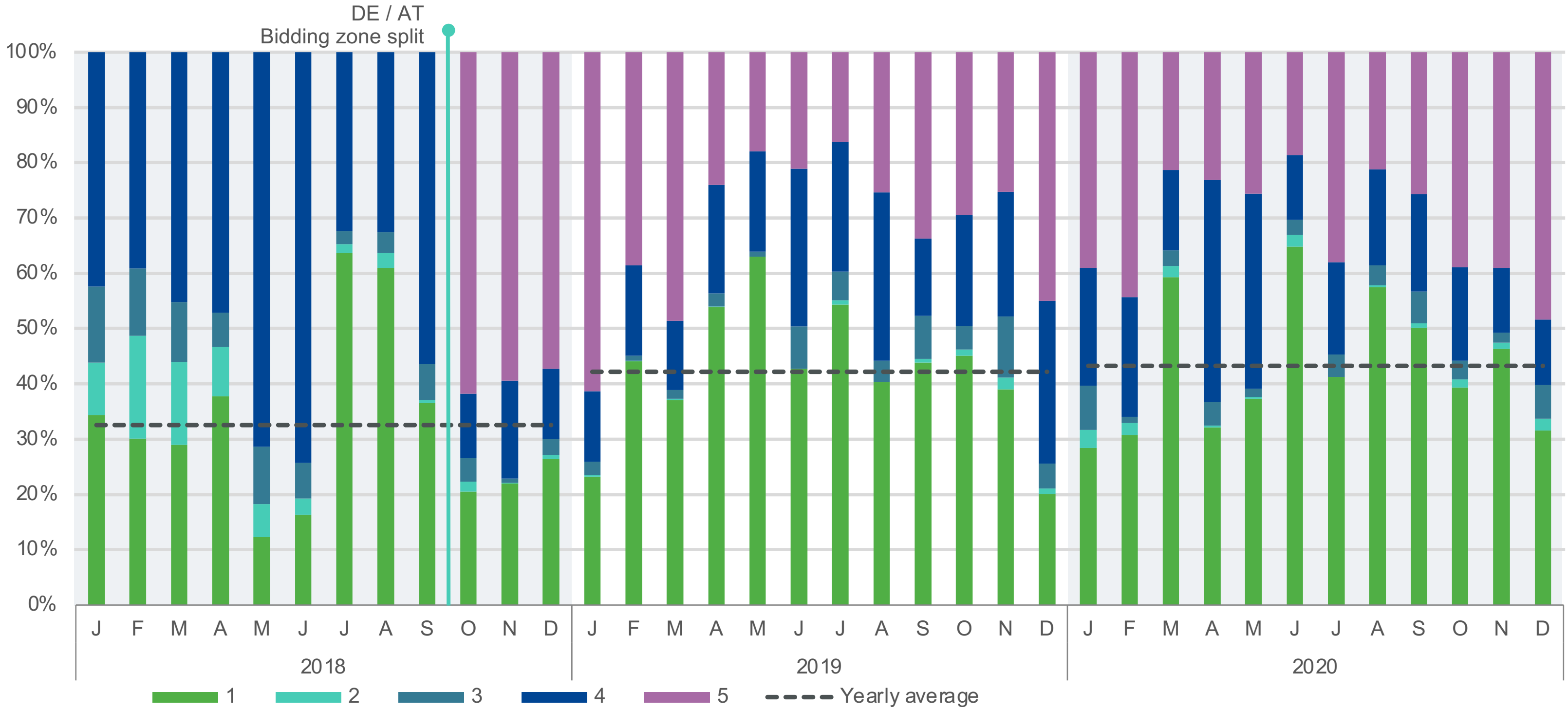
- Both NL and BE increased their annual export position in 2020 compared to previous years by an increased amount of hours with a positive net position (which reflects a net export of electricity).
- FR and DE had a decreased annual export position in 2020 compared to 2019. For France the export position is still dominantly exporting. For Germany the net position became much more volatile with a significant increase in net importing positions.
- Austria remained a dominant net import position with a slight increase in volatility.

Source: MRC Market Coupling

Price Areas in CWE

Stable amount of hours with full price convergence in 2020 compared to 2019, higher compered to 2018

Monthly Distribution of Day-ahead Price Areas in the CWE Region



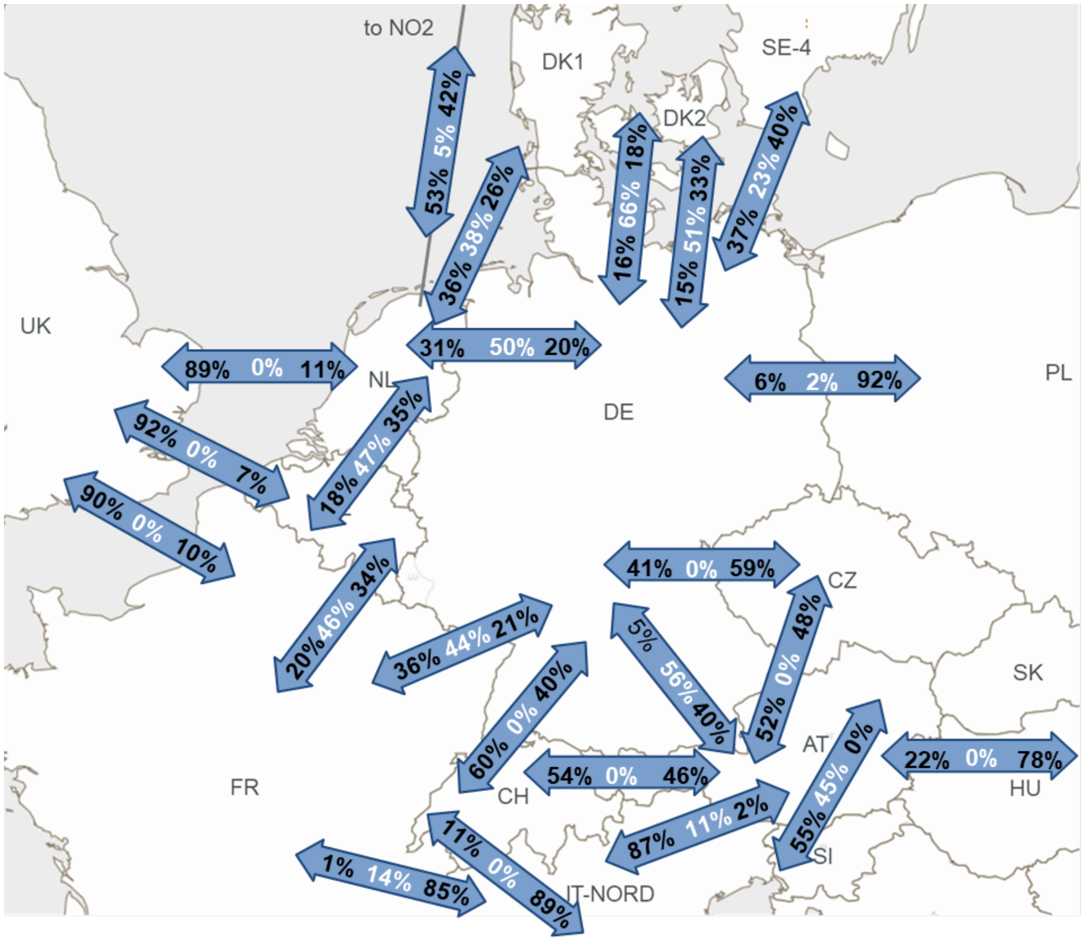
- The figure shows the time distribution of the number of day-ahead price areas in the CWE region bidding zones. When there is one price area, full price convergence occurs (all bidding zones have the same price).
- There was full price convergence (1 price area) for 43% of the time in 2020, which is almost equal to 42% in 2019 and significantly higher than the 33% in 2018.
- Full price convergence in 2020 was highest in June with 65% and lowest in January with 28%.

Source: MRC Market Coupling

DA Price Convergence 2019

High convergence within the CWE region & DE-DK

Day-ahead Price Convergence for Selected Countries in 2019



- Relatively high convergence for CWE countries and DE-DK. Lower convergence between CWE and other countries.
- Centrally located countries that are included in the flow-based DA market coupling had higher price convergence with each other.
- For some bidding zone borders there is inherently zero or low price convergence as:
  - Grid losses are implicitly included in market coupling (e.g. NL-GB, NL-NO2)
  - For explicit coupled borders, the capacity auction price needs to be added to the DA prices (DE-PL, DE-CZ, AT-CZ, AT-HU, all CH borders).

Notes for figure:

- DA price convergence in white, black numbers show how often the DA price was higher in that country.
- Percentages do not always count up to 100% due to rounding

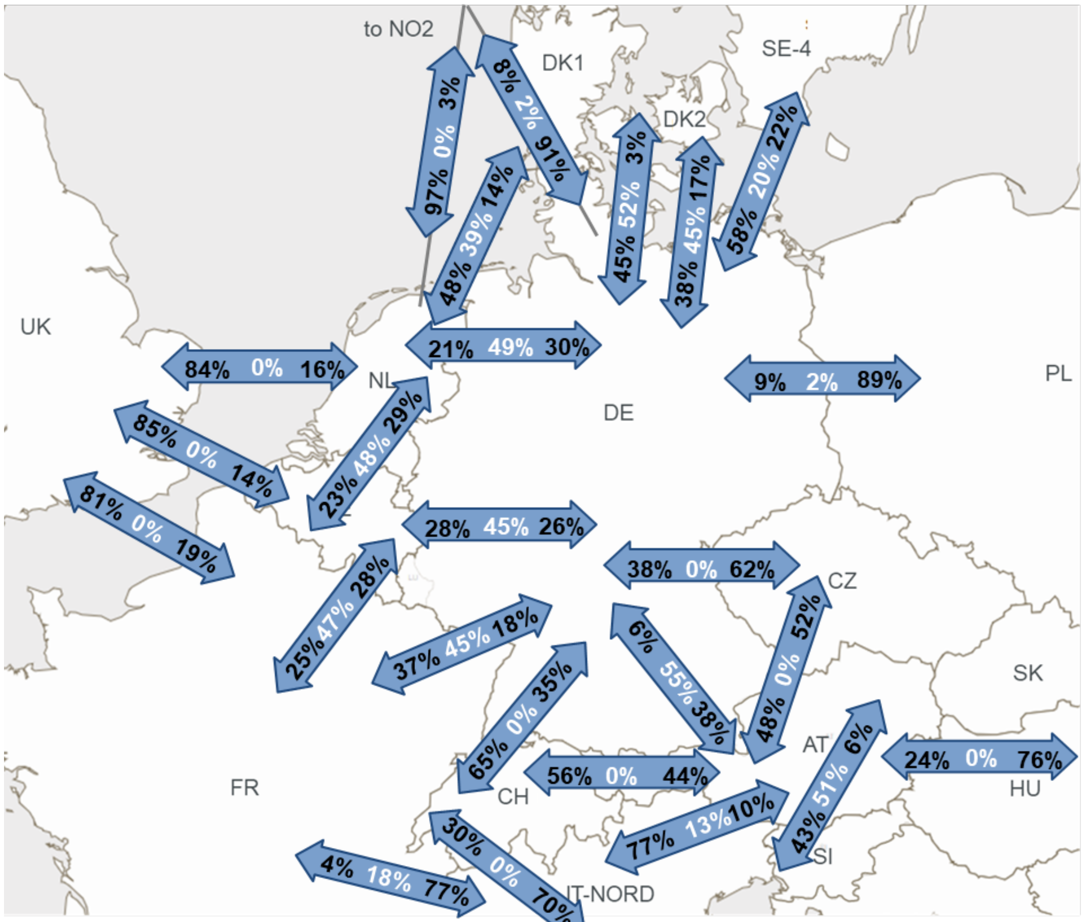
Source: MRC Market Coupling

TenneT

DA Price Convergence 2020

Similar convergence within all CWE borders in 2020 compared 2019

Day-ahead Price Convergence for Selected Countries in 2020



- 2020 DA price convergence remained roughly similar to 2019 within all CWE borders
- Full convergence for NL with DE in 49% of the time(-1%pp) which is comparable to 2019, and 30% of the time DE prices were higher than NL(+10%pp).
- Between DE had the highest full convergence with AT with 55% which is a reduction of 1%pp compared to 2019.
- BE prices less often higher than FR (-6 %pp) and less often higher than NL (-6 %pp).

Notes for figure:

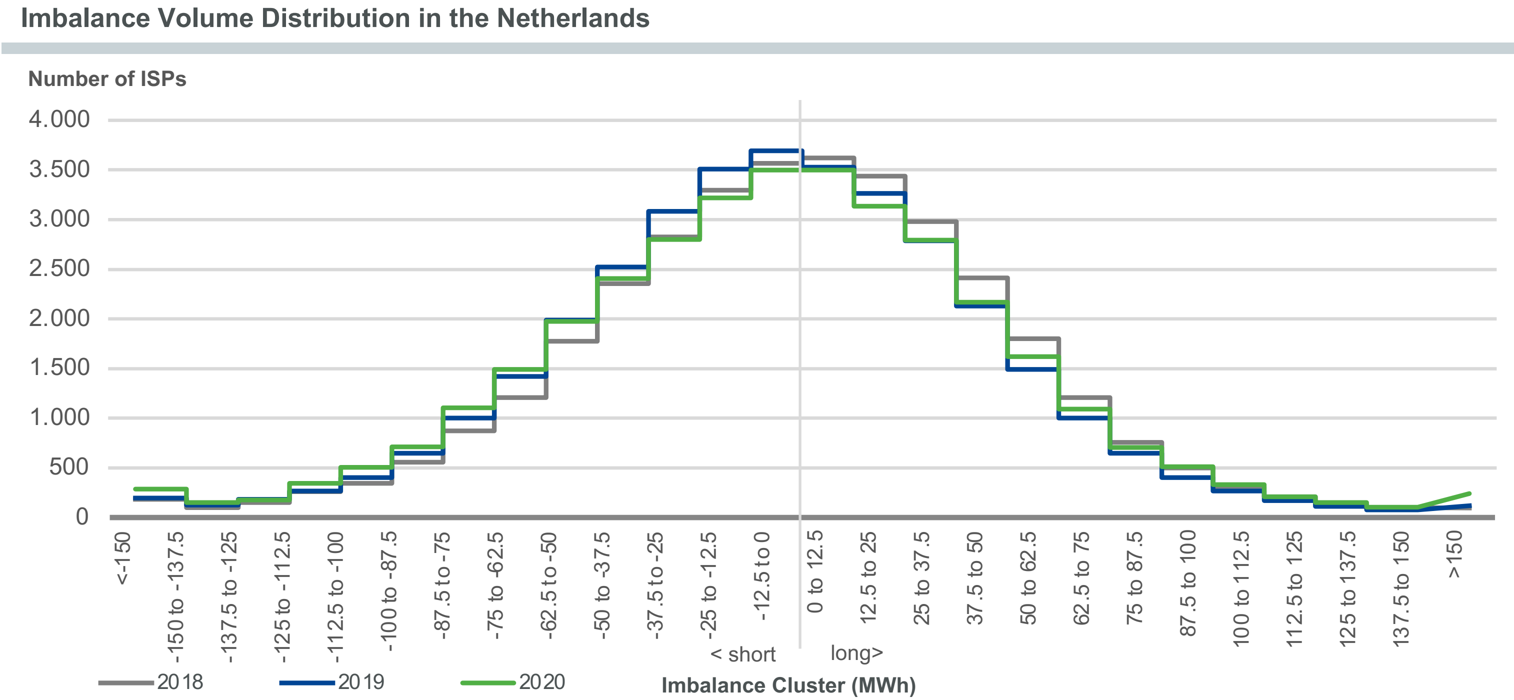
- DA price convergence in white, black numbers show how often the DA price was higher in that country.
- Percentages do not always count up to 100% due to rounding

Source: MRC Market Coupling

Balancing

Net Imbalance Volumes NL

Increased number of ISP's in long system Imbalance Cluster



- This figure shows the total number of Imbalance Settlement Periods(ISPs) per year in which the net system imbalance volume fell within a certain cluster of net imbalance volumes.
- The imbalance Volume distribution in 2020 shows some more skewedness towards the right side indicating an increase of the number of ISP's in a long system Imbalance Cluster compared to the previous year.
- Since 2013, a continuing trend was seen: a decreasing number of ISPs with low net imbalance volumes and an increasing number of ISPs with high net imbalance volumes. This trend seems to have stopped in 2019 compared to 2018.

Introduction | Main findings | Wholesale market prices | Fuel prices & generators | Capacity & generation | RES support schemes | Wholesale market integration | Balancing | Congestion management

Source: TenneT NL

Introduction

Main findings

Wholesale market prices

Fuel prices & generators

Capacity & generation

RES support schemes

Wholesale market integration

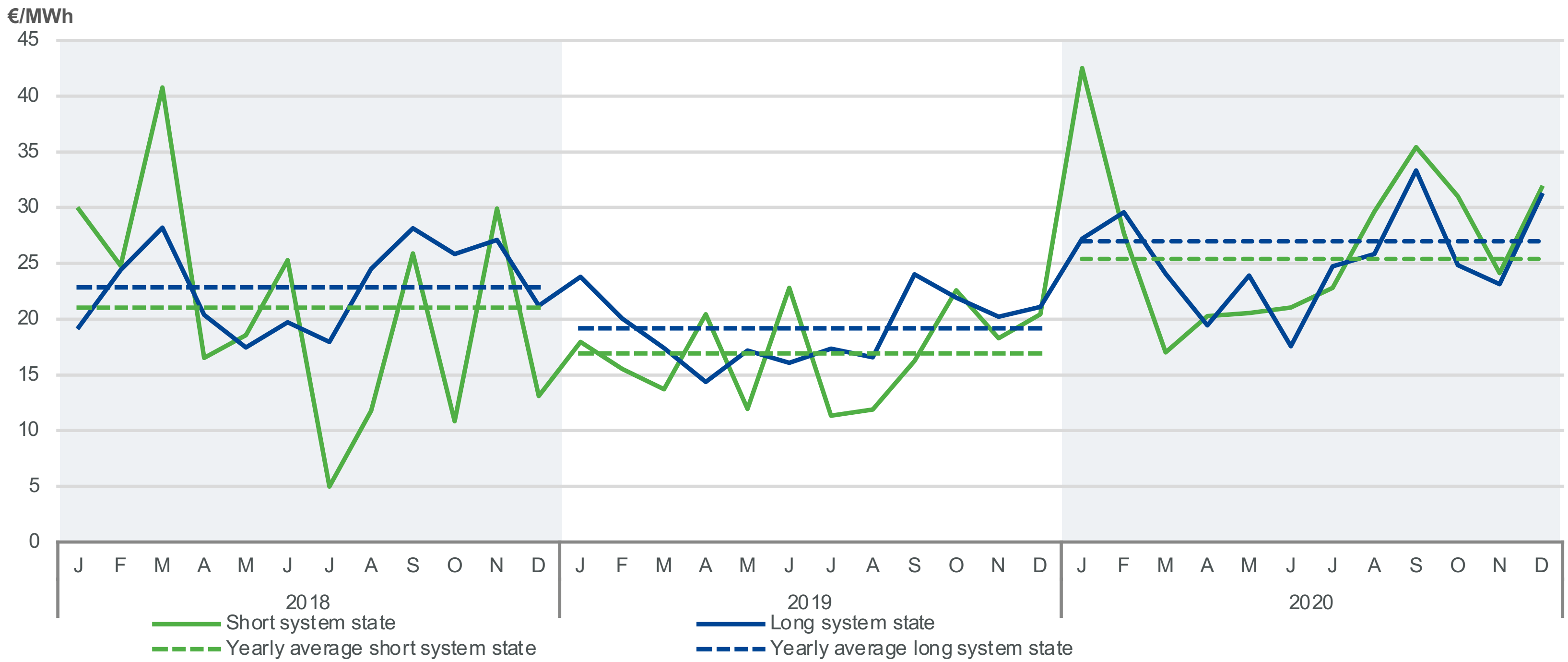
Balancing

Congestion management

Imbalance Price Delta NL

Average long and short system prices increased in 2020

Average Imbalance Price Delta in the Netherlands



In the AMU 2018 ISPs with dual pricing were not included. In the AMU 2019 and 2020 these are included using the weighted average ISP price.

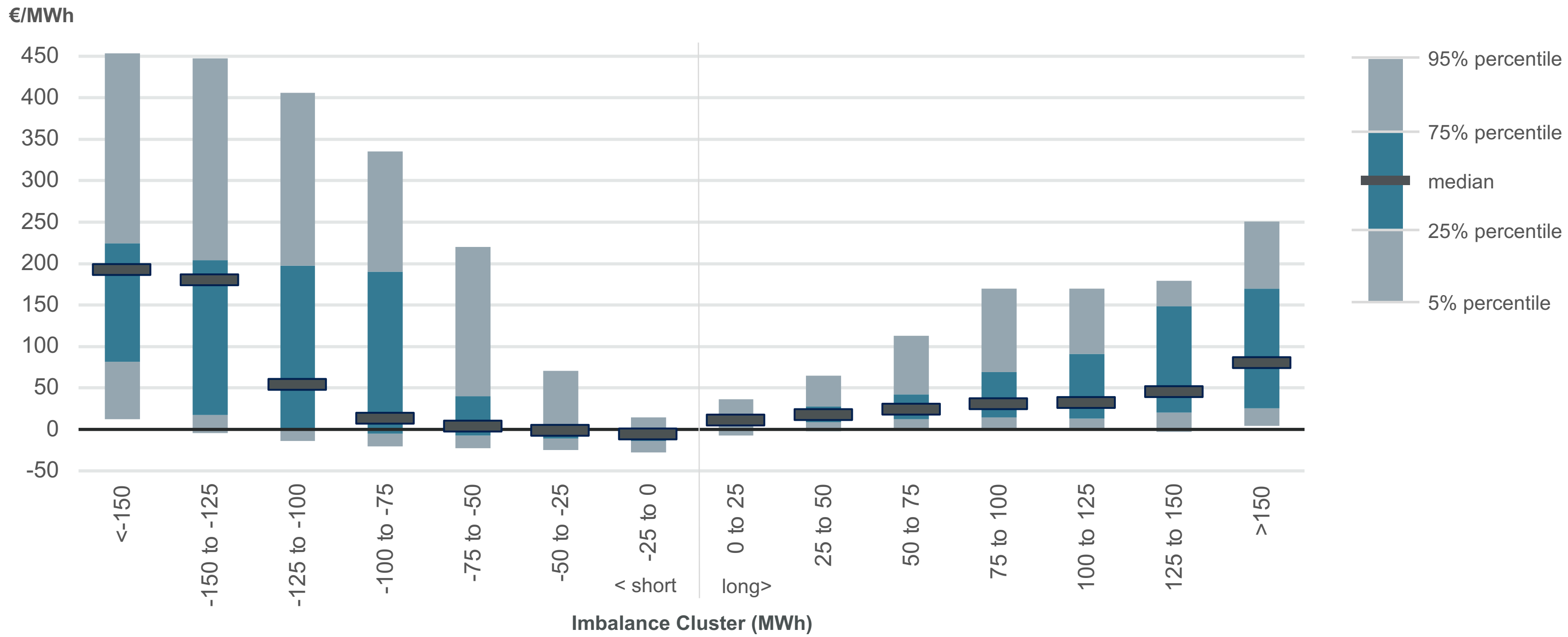
- The imbalance price delta is the difference between the imbalance price and the day-ahead price and can be considered as the penalty for being in imbalance.
- The average imbalance price delta of short system state (imbalance shortage) and of long system state (imbalance surplus) were higher in 2020 than in 2019.

Source: TenneT NL, MRC Market Coupling

Imbalance price delta spreads NL

Higher prices at higher imbalance volume clusters

Spread of Dutch Imbalance Price Delta 2020



- The figure shows the spread or variability in imbalance price delta, the difference between the day-ahead price and the imbalance price, for certain imbalance clusters.
- The spread is higher at larger imbalance volume clusters, which corresponds to the principle that the incentive to stay balanced or to help restore the system is larger with larger system imbalance volumes.
- As was the case last years as well (see AMU 2018 and 2019), the imbalance price spread includes negative values in most imbalance clusters. This can be attributed to the depressing price effect of IGCC (cooperation between TSOs to exchange imbalance volumes in opposite directions).

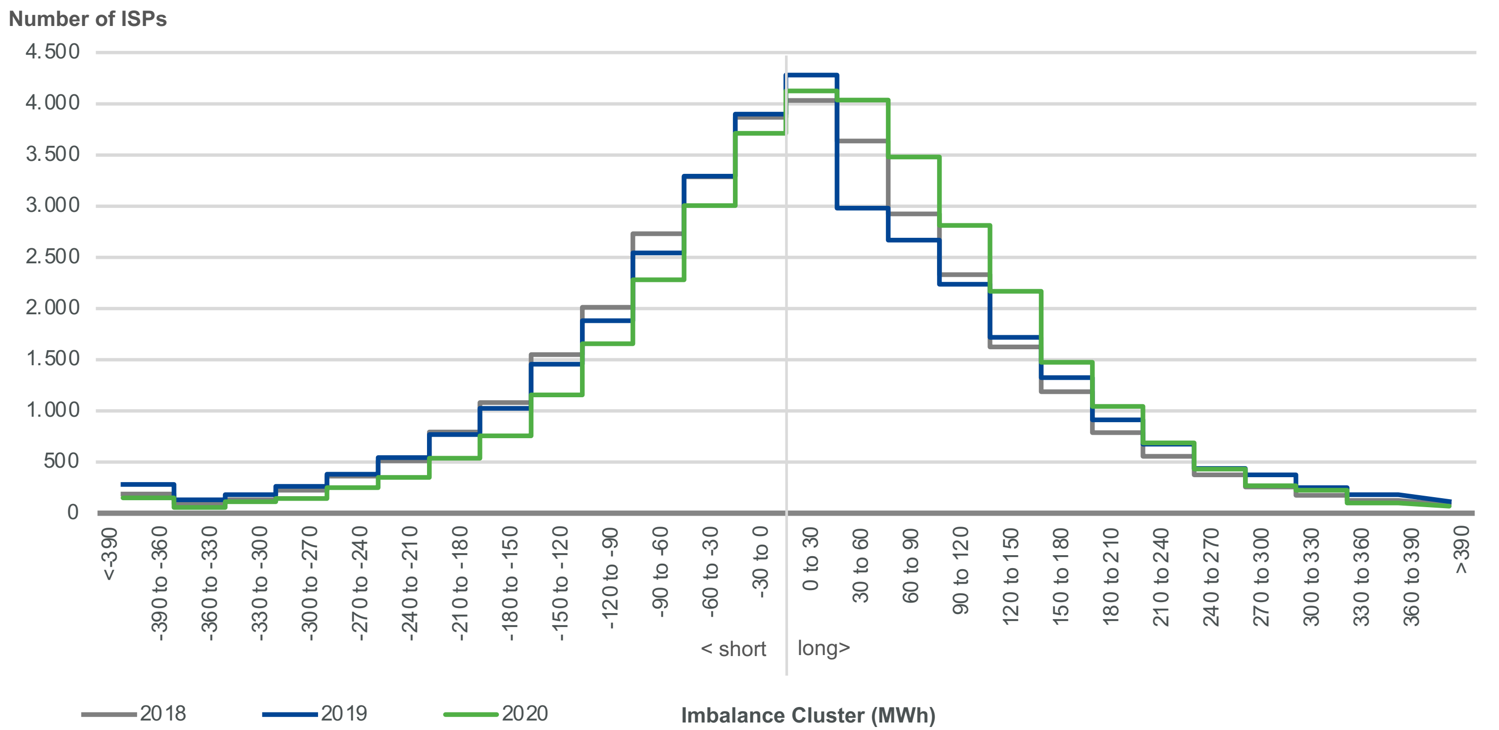
 Source: TenneT NL, MRC Market Coupling

Introduction
Main findings
Wholesale market prices
Fuel prices & generators
Capacity & generation
RES support schemes
Wholesale market integration
Balancing
Congestion management

Net Imbalance Volumes DE

Increased number of ISP’s in long system Imbalance Cluster

Imbalance Volume Distribution in Germany



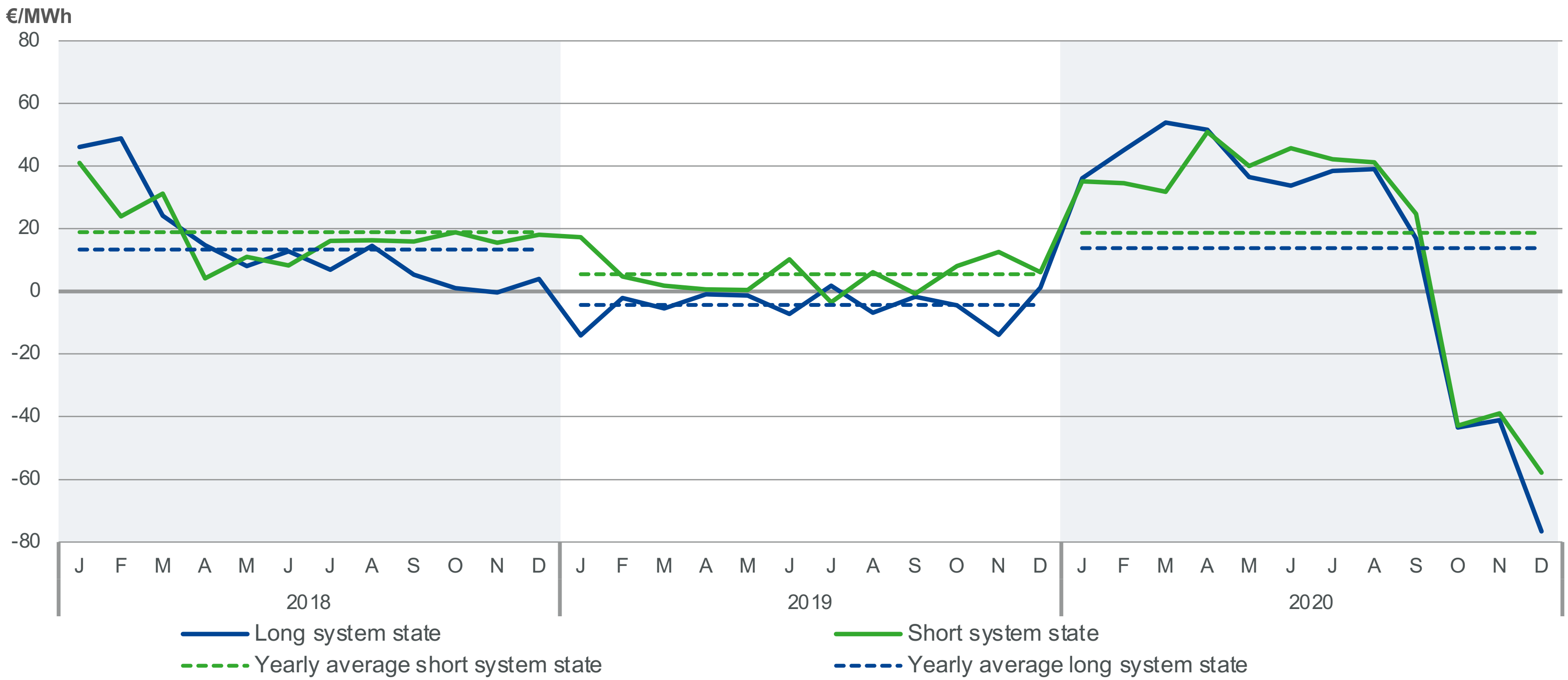
- This figure shows the total number of Imbalance Settlement Periods(ISPs) per year in which the net system imbalance volume fell within a certain cluster of net imbalance volumes.
- The imbalance Volume distribution in 2020 shows some more skewedness towards the right side indicating an increase of the number of ISP’s in a long system Imbalance Cluster compared to the previous year.

Source: ENTSO-E Transparency Platform

Imbalance Price Delta DE

Average long and short system prices increased in 2020, but Q4 prices became very negative

Average Imbalance Price Delta in Germany



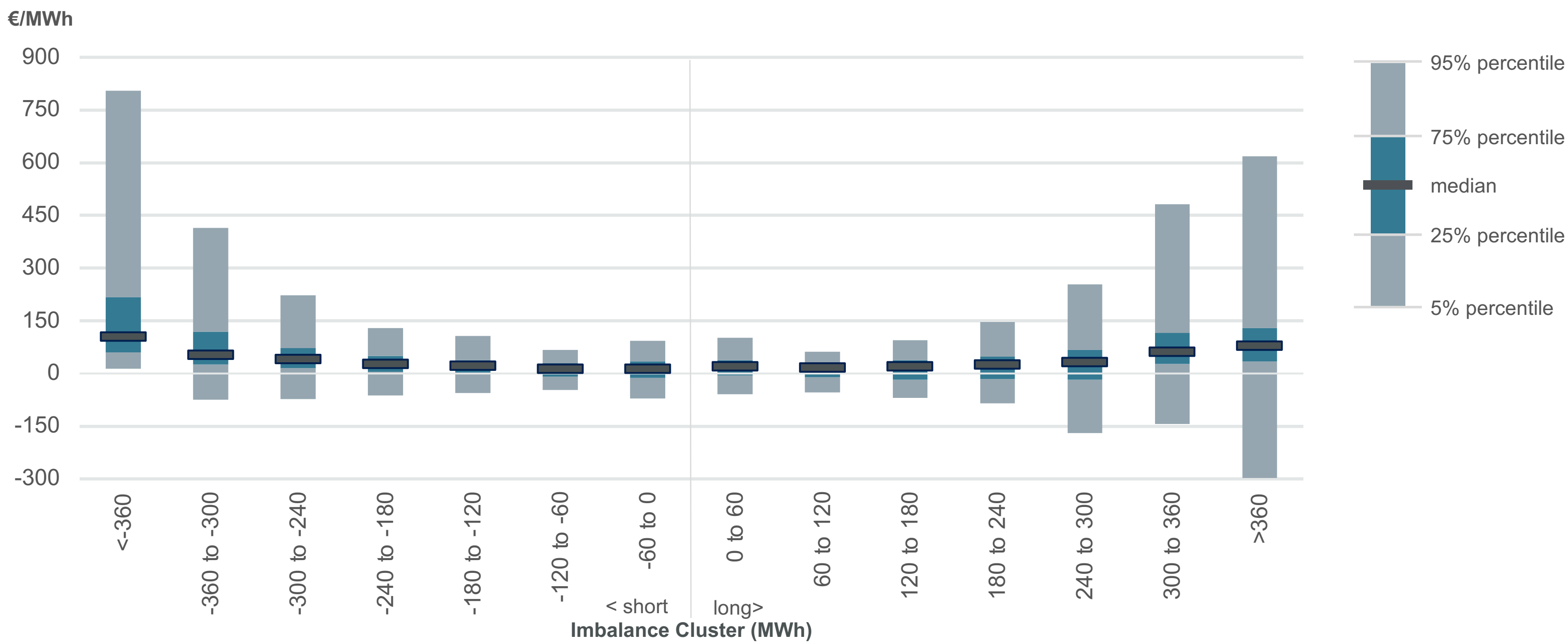
- The imbalance price delta is the difference between the imbalance price and the day-ahead price and can be considered as the penalty for being in imbalance.
- The average imbalance price delta of short system state (imbalance shortage) and of long system state (imbalance surplus) were higher in 2020 than in 2019, although became significantly negative since October 2020.

Source: ENTSO-E Transparency Platform, MRC Market Coupling

Imbalance price delta spreads DE

Higher prices at higher imbalance volume clusters

Spread of German Imbalance Price Delta 2020



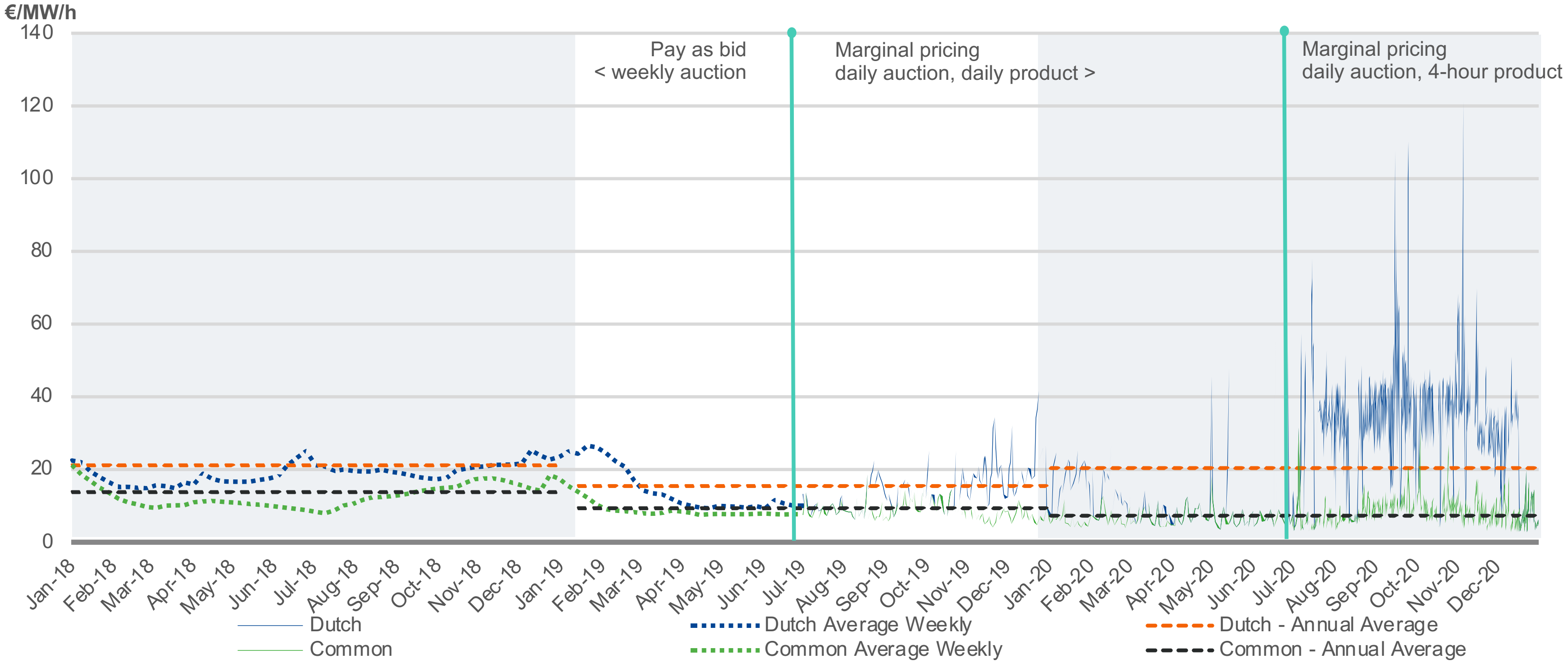
- The figure shows the spread or variability in imbalance price delta, the difference between the day-ahead price and the imbalance price, for certain imbalance clusters.
- A defining aspect of the current average pricing model is the local price peak around zero imbalance which is reflected in the graph in the -60 to 0 and 0 to 60 cluster. This is a difference with the imbalance price delta of approximately zero for small imbalance volumes in the Dutch system.
- The spread is higher at larger imbalance volume clusters, which corresponds to the principle that the incentive to stay balanced or to help restore the system is larger with larger system imbalance volumes.

Source: ENTSO-E Transparency Platform, MRC Market Coupling

FCR common & Dutch auction

4-hour products were auctioned instead of daily products since July 2020
Common annual average prices decreased, Dutch increased

Frequency Containment Reserve (FCR) Capacity Prices in the Common and Dutch Auctions



Note that since 01-07-2019 there is no separate auction for NL, the minimum capacity that needs to be active in the NL control area (34MW) is a boundary condition in the common auction algorithm.

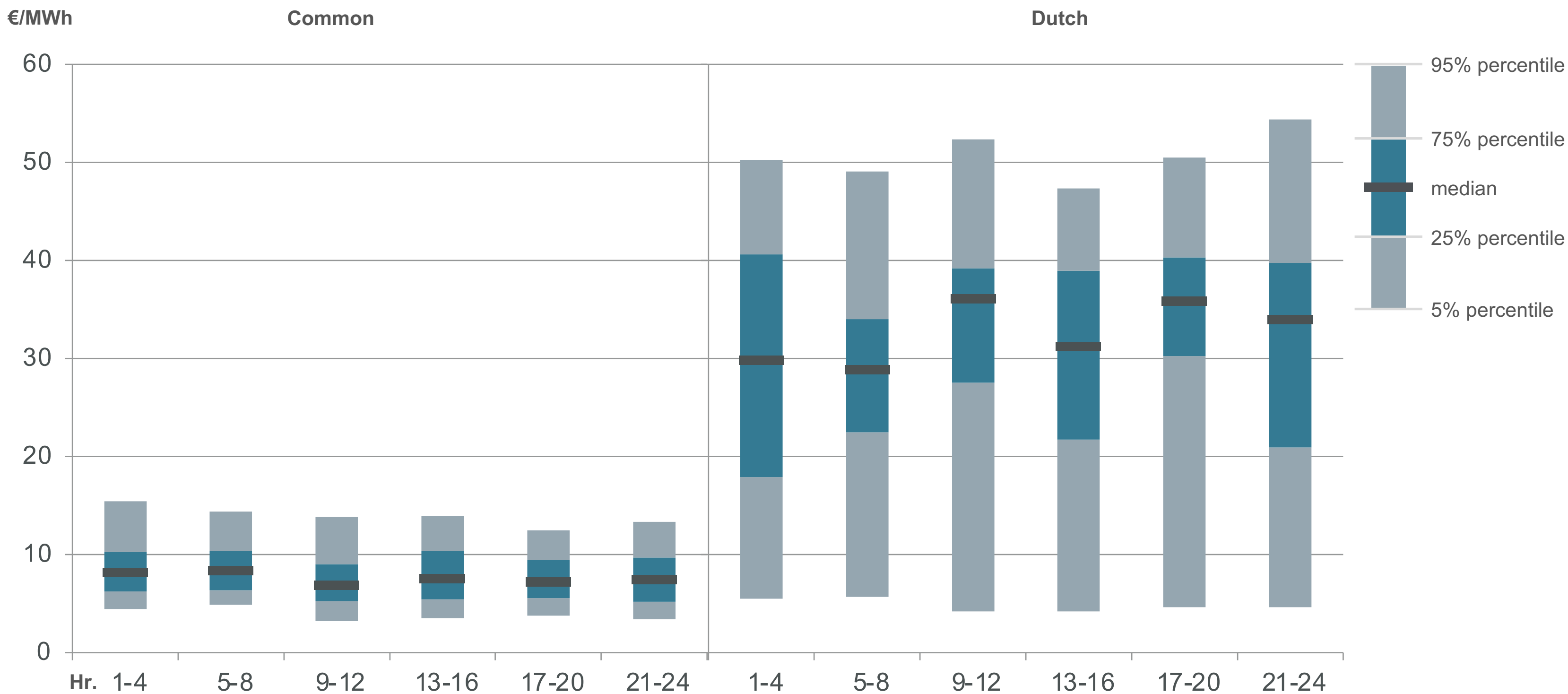
- From July 2020 the auction systematics changed for both the Common and Dutch Auction. The D-1 daily auctions for a daily product were replaced with daily auctions for six 4-hour products.
- FCR prices became more volatile due after the introduction of daily auctions in 2019. After the introduction of 4-hour products as of July 2020, volatility increased further.
- The prices for the common auction reached a record low price of 2,50 €/MW/h at 15-12-2020 for the 17h-20h product. Also the Dutch auction reached a record low price of 2,75 €/MW/h at 23-12-2020 for the 9h-12h.

Source: regelleistung.net

FCR common & Dutch auction

Hr. 1-4 and hr. 5-8 products have the highest prices in the Common auction
High variability in prices in the Dutch Auction

Frequency Containment Reserve (FCR) Capacity Prices in the Common and Dutch Auctions



- From July 2020 the auction systematics changed for both the Common and Dutch Auction. The D-1 daily auctions for a daily product were replaced with daily auctions for six 4-hour products.
- The Dutch market has most often the highest prices for the 9-12 and 17-20 hour blocks. For the same 4-hour products the common auction has most often the lowest prices.

Source: regelleistung.net

TenneT

Introduction

Main findings

Wholesale market prices

Fuel prices & generators

Capacity & generation

RES support schemes

Wholesale market integration

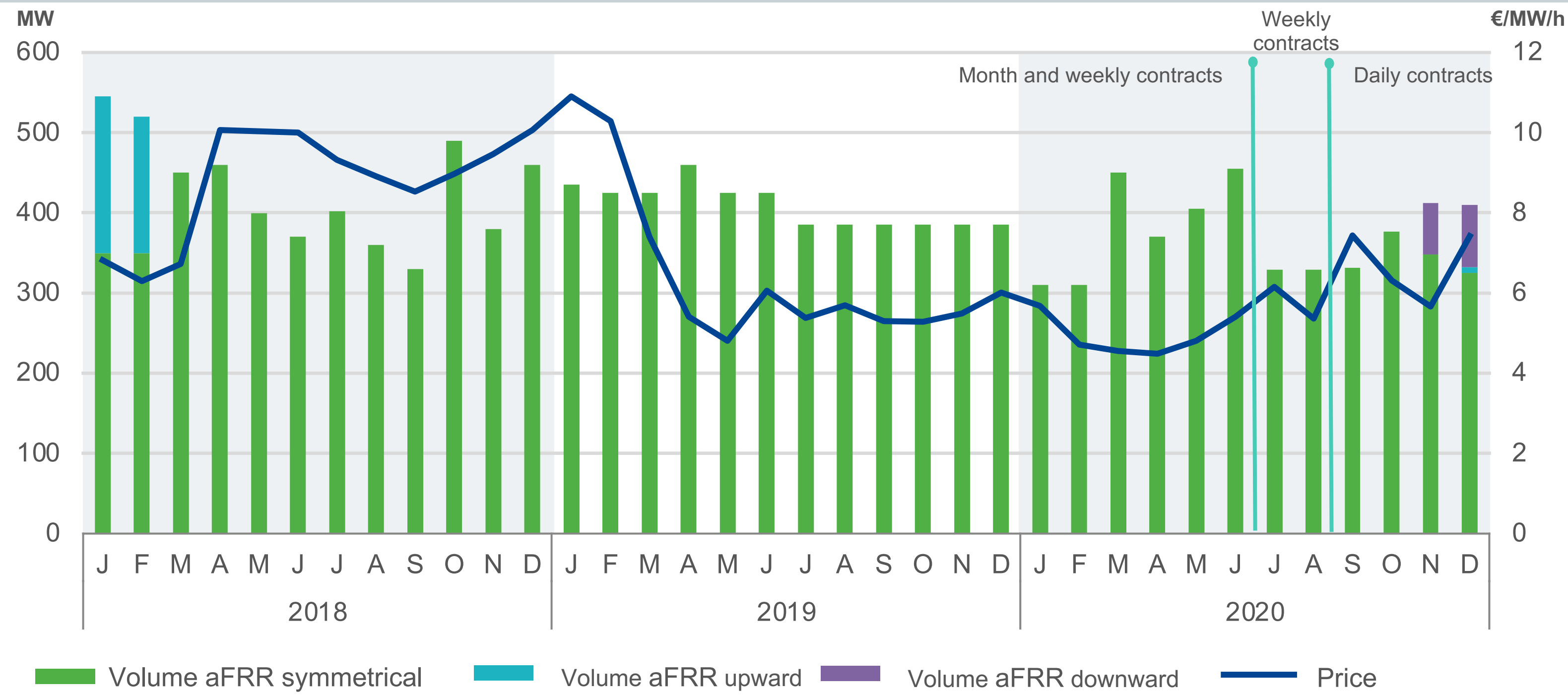
Balancing

Congestion management

aFRR in the Netherlands

Prices for aFRR increased during 2020
Introduction of daily contracts in September

Contracted automatic Frequency Restoration Reserve (aFRR) Capacity Volumes and Prices in the Netherlands



- After a small decrease in prices from January to April, prices for aFRR overall slightly increased.
- Since September aFRR is contracted on a daily basis for a 1 day period instead of Monthly and Weekly contracts. This was preceded by a period of two months, July and August, with only weekly contracts.
- Since 2018, a fixed amount of capacity for aFRR and mFRRda (see next slide) combined is contracted, contracting the least costly combination, instead of fixed amounts for aFRR and mFRRda products separately. Therefore there is a variation in monthly average volumes contracted.

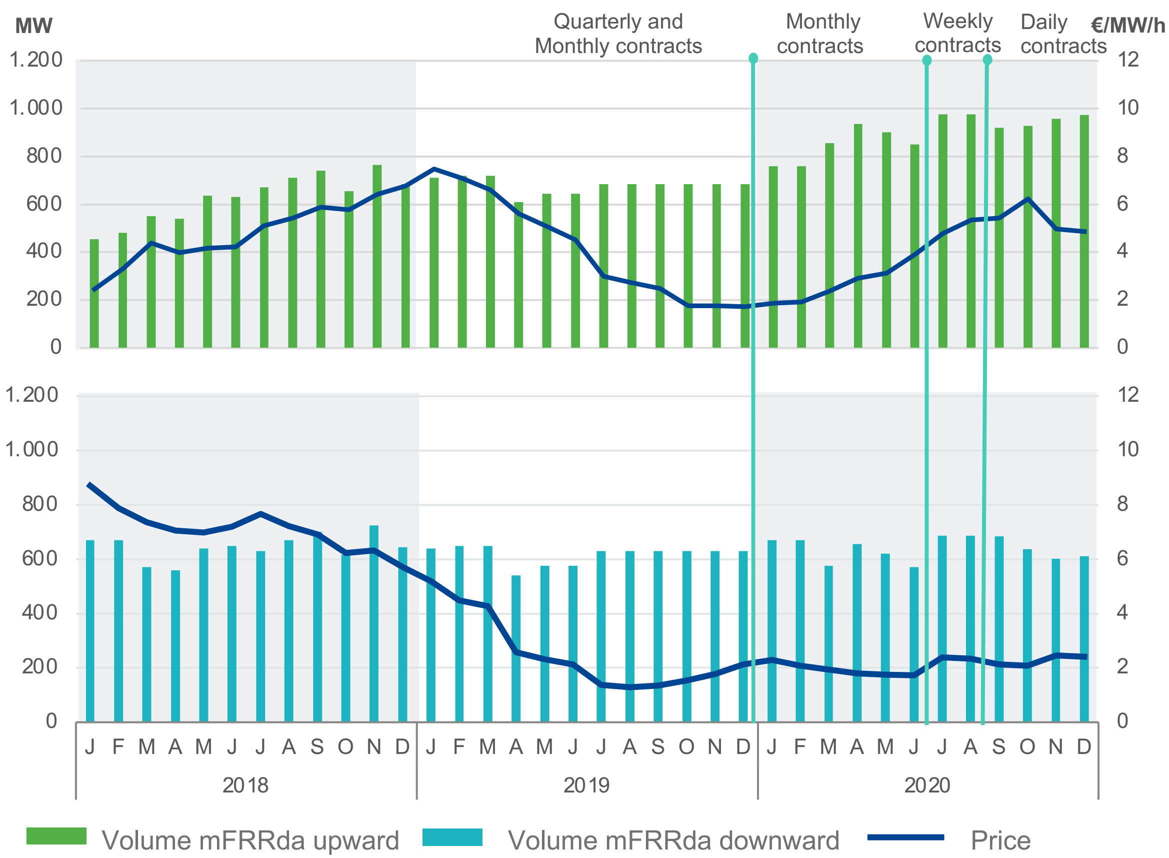
Source: TenneT NL

Introduction
Main findings
Wholesale market prices
Fuel prices & generators
Capacity & generation
RES support schemes
Wholesale market integration
Balancing
Congestion management

mFRRda in the Netherlands

mFRRda upwards prices increased during 2020
mFRRda downwards prices remained relatively stable during 2020

Manual Frequency Restoration Reserve directly activated (mFRRda) Capacity Volumes and Prices in the Netherlands



- Prices for upwards mFRRda reserves increased during 2020. This effect can partly be contributed to the increase in contracted capacity. The increased demand for upwards capacity is the result of the dimensioning of mFRR+aFRR that increased due to the operational return of Claus C 1.340 MW in 2020.
- Prices for downwards mFRRda slightly increased compared to the second half of 2019 and remained relatively table during the year.

Source: TenneT NL

Introduction

Main findings

Wholesale market prices

Fuel prices & generators

Capacity & generation

RES support schemes

Wholesale market integration

Balancing

Congestion management

aFRR in Germany

Introduction of balancing energy market in November 2020 aFRR prices on average lower compared to 2019

Automatic Frequency Restoration Reserve (aFRR) Capacity Volumes and Prices in Germany*

* Figures for 2020 include Austria (common tender to procure aFRR capacity jointly for both countries)

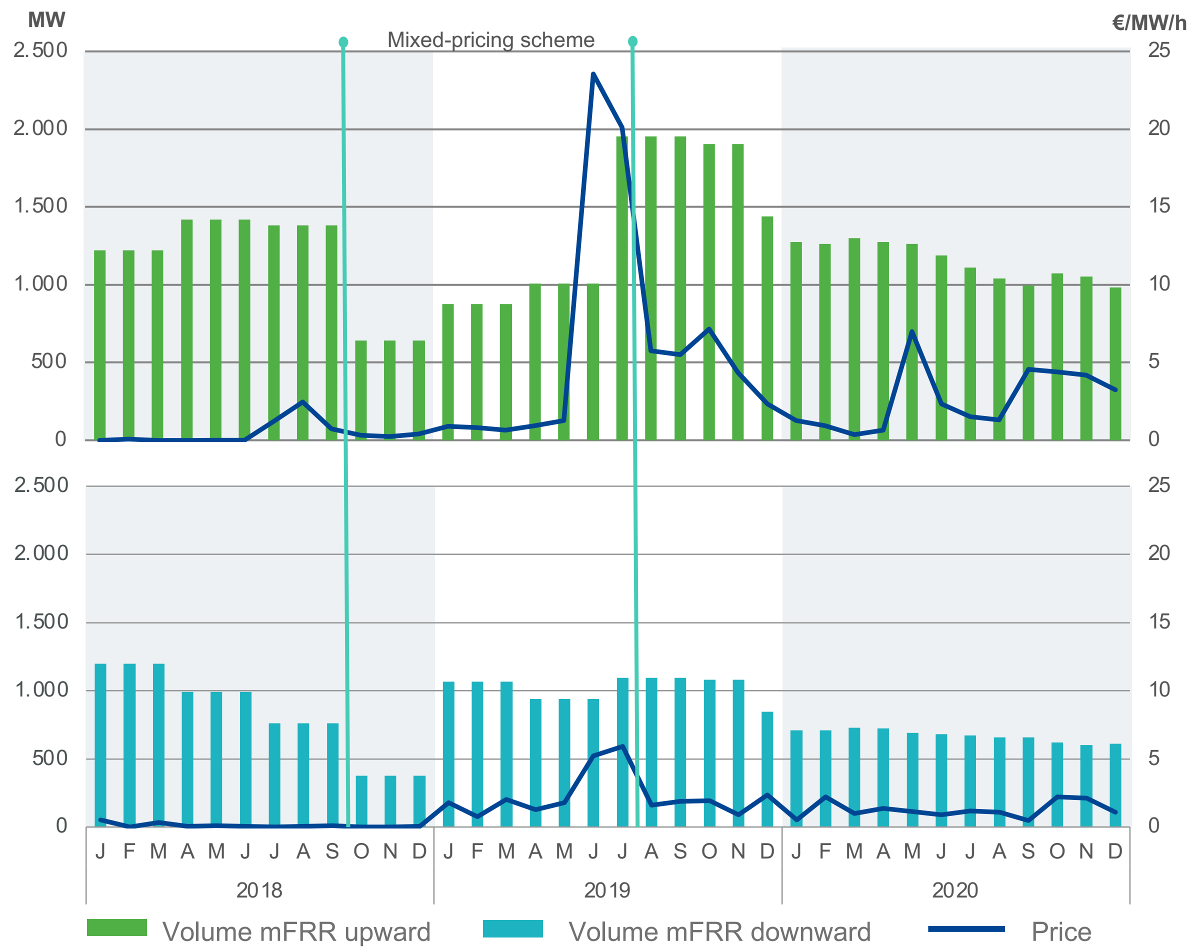
- Rather stable aFRR prices throughout 2020 with slightly increased volumes compared to 2019 as an outcome of new dynamic dimensioning approach for both aFRR and mFRR volumes (determined for each 4-h-product timeframe individually)
- Current balancing market design which was re-introduced in July 2019 (following a court ruling to abolish the mixed-price mechanism) proved again in 2020 to be efficient regarding a reliable balance service procurement. E.g., price spikes like in July 2019 have not occurred ever since the mixed price system was replaced. Extreme aFRR and mFRR prices in July 2019 can partly be attributed to the mixed-price system: low balancing energy prices encouraged some BRPs to deliberately deviate from schedule, in particular during periods with high intraday prices. This has been observed during 3 days in June 2019 leading to significant system imbalances. In response to these system imbalances, TSOs increased capacity volumes to be procured which resulted in these significant price spikes.

Source: TenneT DE

mFRR in Germany

mFRR volumes decreased in 2020
Higher prices volatility for upward mFRR during in second half of 2020

Manual Frequency Restoration Reserve (mFRR) Capacity Volumes and Prices in Germany



- In July 2019, mFRR upward volume was raised to 2.000 MW in response to significant system imbalances occurring in the German power system on multiple days in June 2019.
- Dynamic dimensioning of procured capacity for both upward and downward mFRR since 2020 volume decreased in 2020 to previous levels of around 1.000 MW for upward mFRR and 600 MW for downward mFRR indicating that effect of new dimensioning approach (volume determined for each 4-h-product timeframe individually).
- In line with EB GL, a balancing energy market was introduced in November 2020.

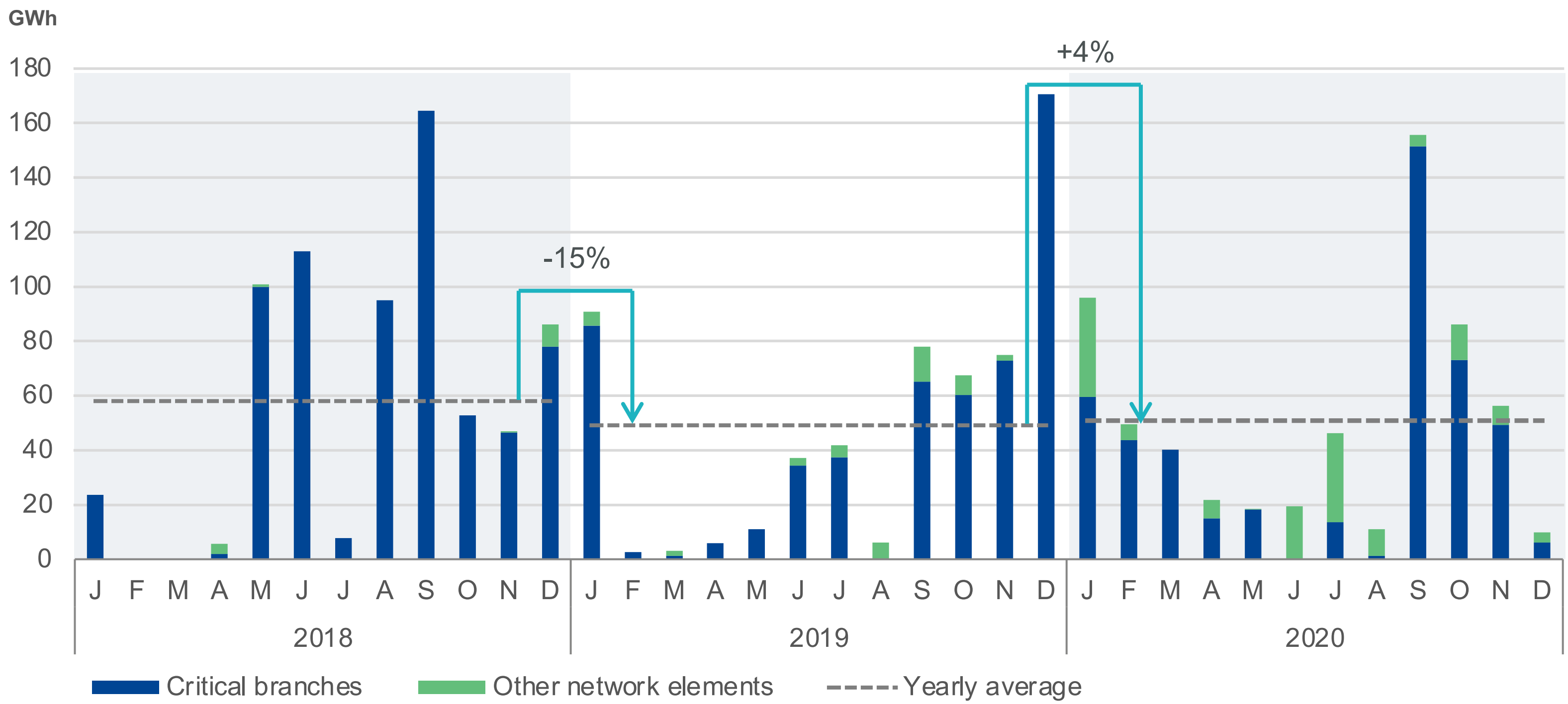
 7 April 2021 Source: TenneT DE

Congestion & management

Redispatch Volumes NL

Redispatch volumes remained roughly similar in 2020 compared to 2019
Most redispatch required on critical branches

Redispatch upwards and downwards volumes in the Netherlands



- Critical branches are lines that are included in CWE flow-based market coupling, as they significantly impact and are impacted by CWE cross-border exchanges. Redispatch takes place to ensure that grid operation remains within operational security limits.
- Average redispatch volumes remained roughly stable in the Netherlands with 49 GWh/month in 2019 and 51 GWh/month in 2020.

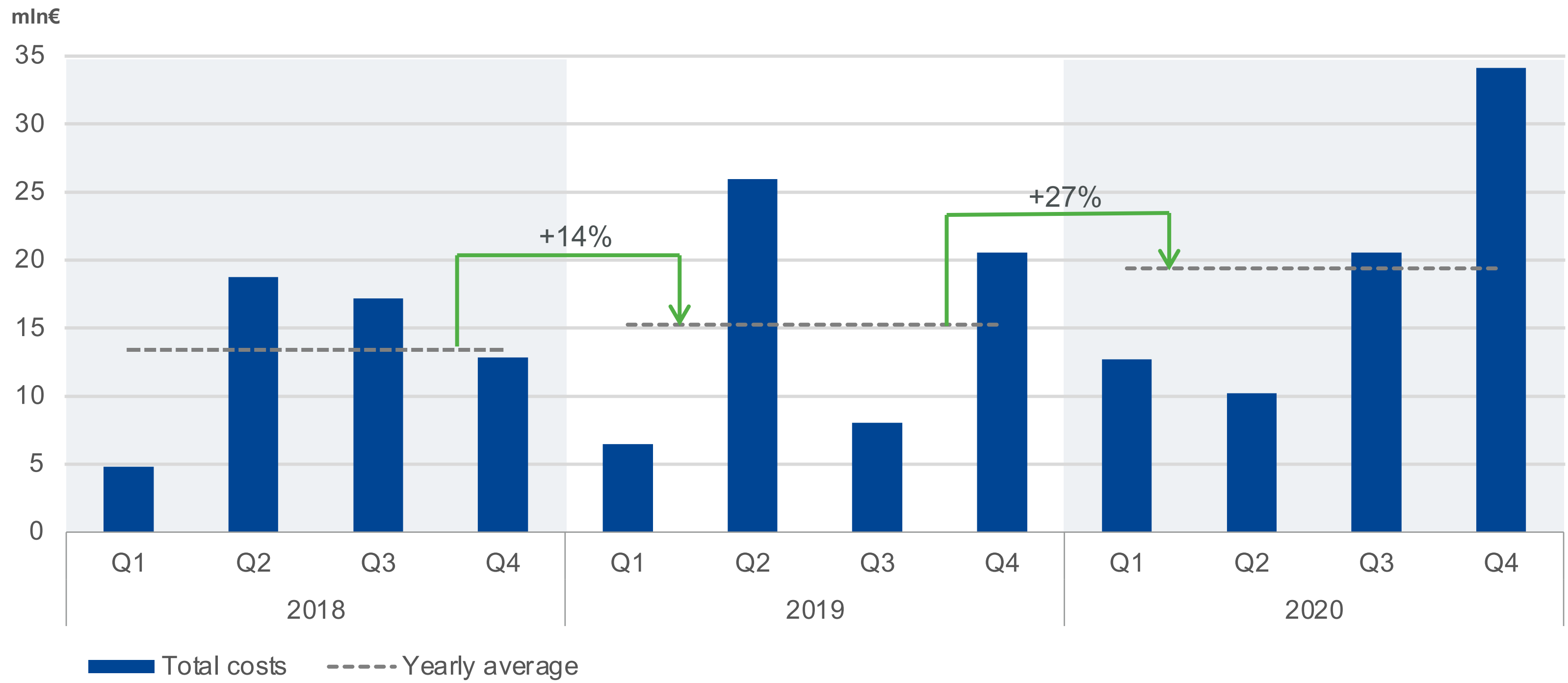
 Source: TenneT NL

TenneT

Congestion Management Costs NL

Costs for Congestion Management increased by 27% in 2020

Redispatch and Restriction Costs in the Netherlands



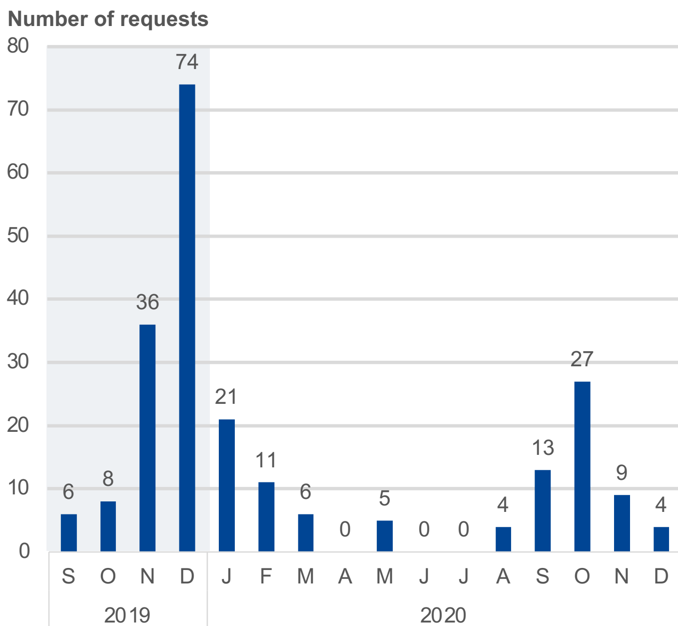
- This figure shows redispatch and restriction costs in the Netherlands. Restriction concerns contracts with market parties to withhold a share of production for a certain period. Total costs increased from €61,0 million in 2019 to € 77,6 million in 2020 with a slight increase of redispatch volume activated. A significant part of the cost increase is related to restriction contracts.

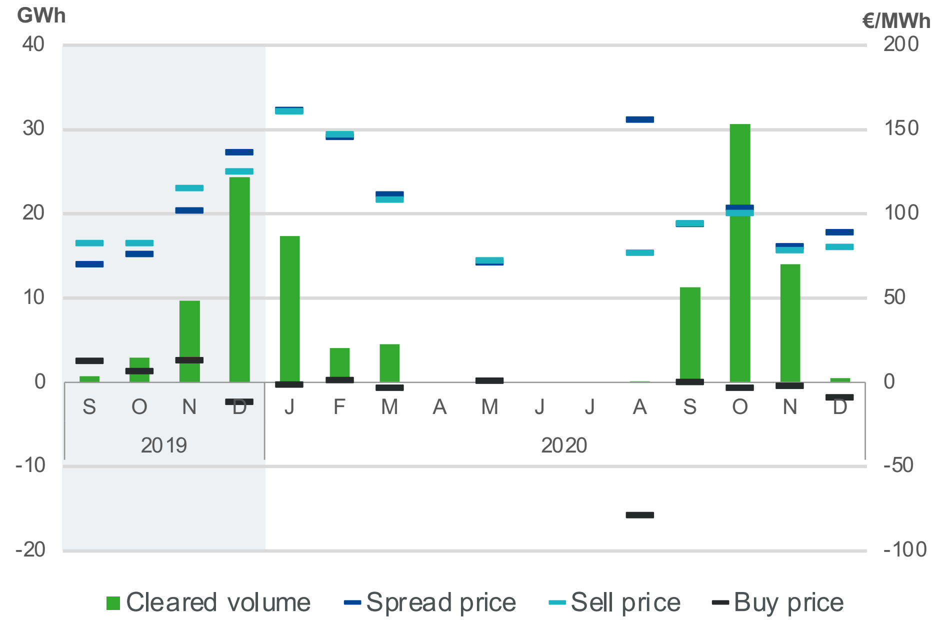
 Source: TenneT NL

GOPACS

83 GWh of redispatch volume contracted through GOPACS
Highest average IDCONS prices in January 2020 of 162 €/MWh

Number of congestion management request, cleared volume of IDCONS, and weighted average prices of cleared IDCONS





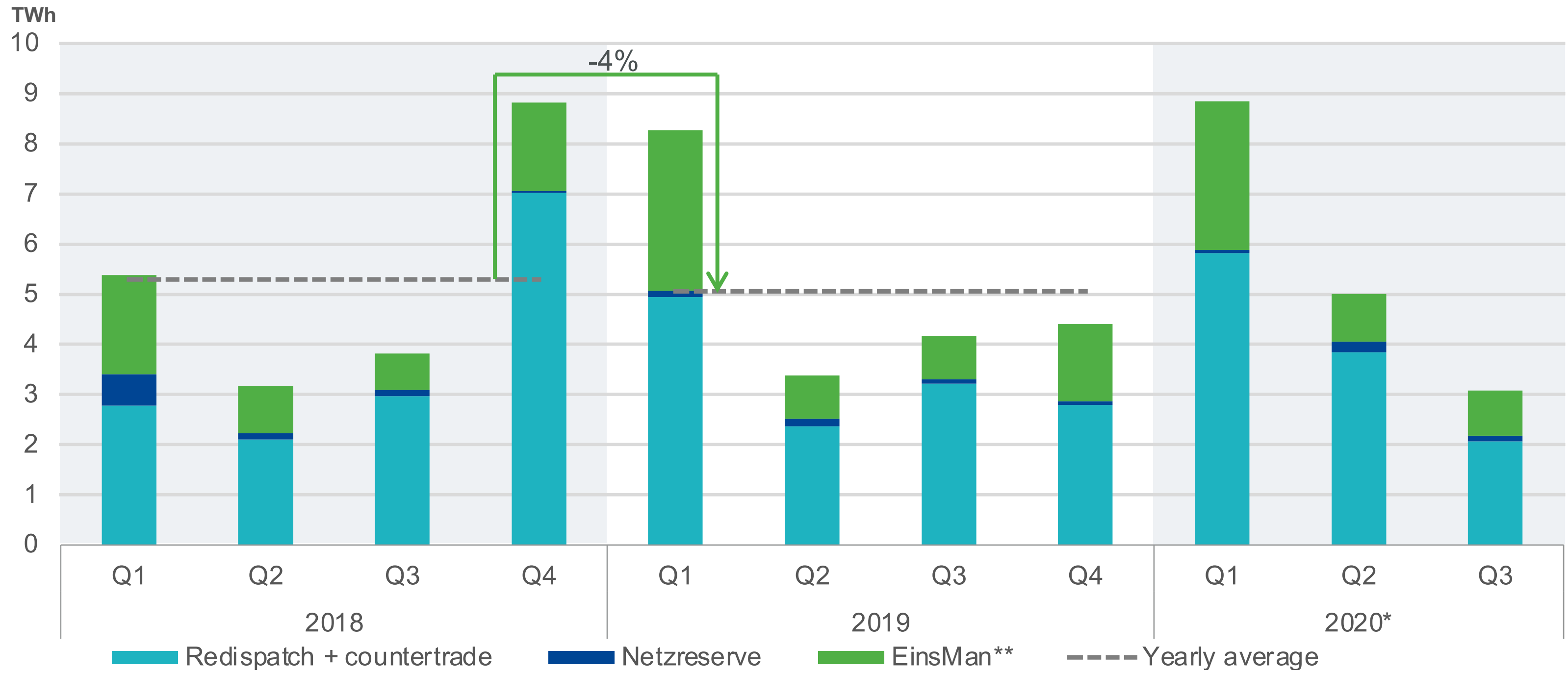
- In September 2019 the first Intraday Congestion Spreads (IDCONS) were activated via the Grid Operators Platform for Congestion Solutions (GOPACS). GOPACS is a Dutch TSO-DSO coordinated market-based congestion management platform that enables intraday bids with a geo-tag to be used for congestion management as well. An IDCONS is the spread the Grid Operator pays in order for a buy and sell bid to be cleared. For a more detailed explanation visit: www.GOPACS.eu.
- In total 83 GWh of redispatch volume was contracted through the GOPACS platform in 2020.
- Spreads were highest in January 2020 with 198 €/MWh. The average buy prices are typically around zero or negative.
- Most activated redispatch volume via GOPACS in October 2020.

Source: TenneT NL

Redispatch Volumes DE

Increased redispatch and countertrade
Slightly decreased EinsMan related redispatch

Redispatch Volumes in Germany



** For 2020 only costs for the first three quarters were available. ** EinsMan volumes exist only of downward adjustments.*

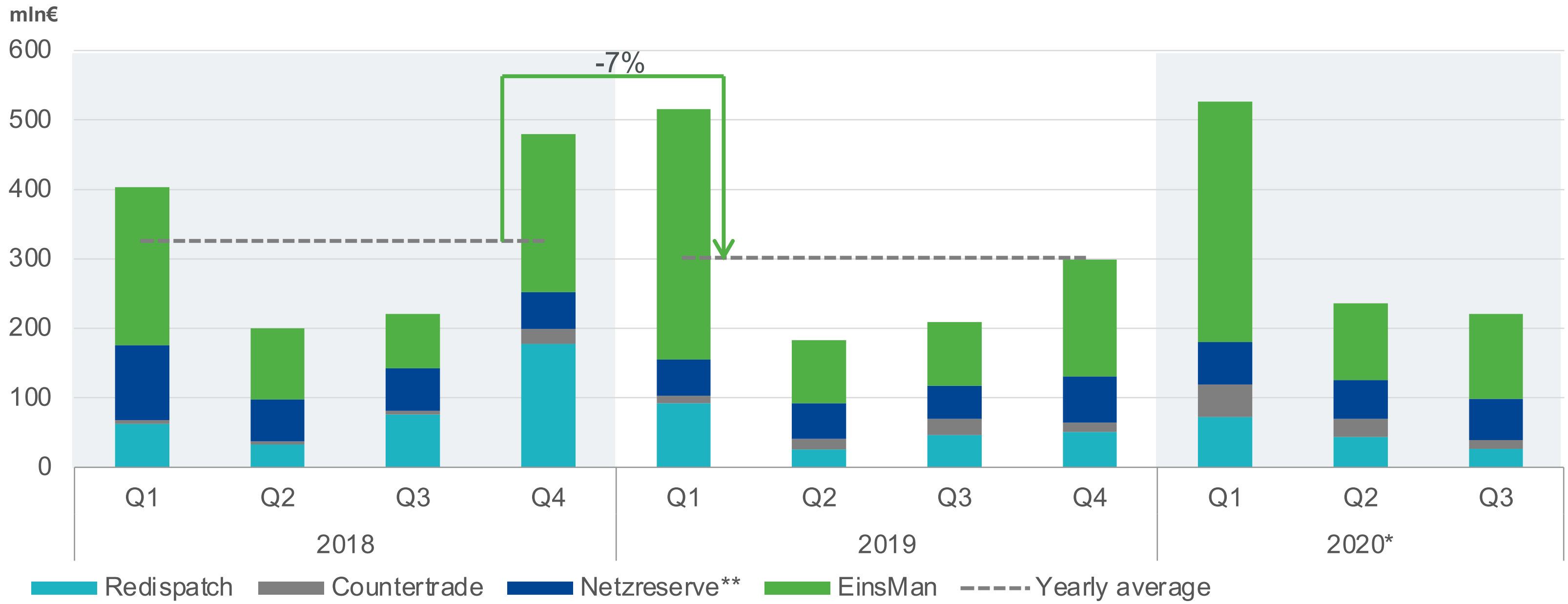
- RES curtailment (EinsMan) related redispatch slightly decreased in the first three quarters of 2020, especially in Q1. Conventional redispatch (conventional power plants > 10 MW) in combination with countertrade remained the most common process used for solving congestion in the German grid.
- The contracted Netzreserve plants are called upon when redispatch availability is insufficient. For the first three quarters of the 2020, the use of Netzreserve increased slightly, mostly in Q2.

Source: Bundesnetzagentur

Congestion Management Costs DE

Increased redispatch costs, mainly in Q2

Redispatch Costs in Germany



** For 2020 only costs for the first three quarters were available. ** Netzreserve costs for all years were given as yearly aggregated values. Therefore, costs were equally divided over the four quarters.*

- Costs for congestion management slightly increased the first three quarters of 2020 compared to 2018, mainly due to Q2. Biggest contribution to increasing costs due to EinsMan (high wind energy production). Netzreserve and countertrade costs also increased, redispatch cost decreased.
- Congestion management costs are generally higher in winter months, due to more stressed grid conditions. Due to different weather conditions in Q4, the overall costs in 2020 might have reached the level of 2019.
- When compared to the previous slide, redispatch measures show the lowest costs per GWh, and EinsMan the highest.

Source: Bundesnetzagentur

Annex

Annex (1/2)

	Day-ahead avg. price 2019	Day-ahead avg. price 2020	Physical import 2019	Physical import 2020	Physical export 2019	Physical export 2020	Net export position 2018	Net export position 2019
	€/MWh	€/MWh	TWh/year	TWh/year	TWh/year	TWh/year	TWh/year	TWh/year
AT	40,1	33,1	21,1	19,5	18,0	18,1	-3,1	-1,4
BE	39,8	31,9	11,7	12,6	13,4	12,1	1,6	-0,5
CH	40,9	33,9	25,1	22,7	27,4	26,4	2,3	3,7
CZ	40,2	33,6	8,6	10,4	21,3	20,2	12,7	9,8
DE	37,9	30,5	27,5	33,3	61,3	53,1	33,8	19,8
DK1	38,6	25,0	15,0	13,5	9,3	9,0	-5,7	-4,4
DK2	39,9	28,4						
EE	45,9	33,7	3,9	6,8	3,2	3,4	-0,7	-3,4
ES	47,7	33,9	15,8	10,9	9,7	16,7	-6,1	5,8
FI	44,1	28,0	16,0	8,9	3,9	6,7	-12,1	-2,2
FR	39,5	32,2	10,5	15,6	67,9	59,7	57,4	44,1
GB	48,9	39,6	24,9	23,0	2,2	4,3	-22,6	-18,8
HR	49,3	38,0	6,4	6,8	2,3	3,0	-4,1	-3,8
HU	50,4	39,0	15,0	16,9	6,8	6,5	-8,2	-10,5
IE	50,3	35,8	1,0	1,7	1,2	2,3	0,2	0,6
IT-CNOR	52,2	38,7	42,7	36,3	4,1	2,4	-38,6	-33,9
IT-CSUD	52,3	39,7						
IT-NOR	51,3	37,8						
IT-SARD	51,8	39,1						
IT-SICI	62,7	46,1						
IT-SUD	50,9	38,9						
LT	46,3	34,0	6,8	6,6	2,9	2,8	-3,9	-3,8
LV	46,2	34,4	2,8	2,5	2,8	1,6	-0,02	-0,8
NL	41,2	32,2	16,9	15,6	16,7	18,2	-0,3	2,6
NO1	39,4	9,3	11,3	2,4	11,1	14,9	-0,2	12,5
NO2	39,3	9,3						
NO3	38,6	9,5						
NO4	38,4	8,9						
NO5	39,3	11,5						
PL	53,2	45,4	15,7	17,8	6,8	6,4	-8,9	-11,4
PT	47,9	34,6	6,9	11,0	3,5	0	-3,4	-11,0
SE1	38,0	14,4	9,0	3,7	35,0	23,1	26,0	19,4
SE2	38,0	14,7						
SE3	38,4	21,6						
SE4	39,8	26,7						
SI	48,8	36,7	7,0	5,5	7,5	7,5	0,4	2,0
SK	41,5	34,0	13,4	12,9	11,7	11,8	-1,6	-1,1

Annex (1/2)

	Unit	2018		2019		2020		Source
		NL	DE	NL	DE	NL	DE	
Yearly average hard coal price (API#2 OTC)	€/MWh.th	11,2		8,0		6,3		[1]
Yearly average natural gas price (TTF OTC monthly)	€/MWh.th	22,0		14,1		9,1		[1]
Yearly average carbon price (EEX futures)	€/tCO2	15,4		24,9		24,7		[1]
Yearly average Clean Dark Spread base	€/MWh	13,4	6,8	2,8	0,9	-4,5	-5,1	[1,2]
Yeary average Clean Dark Spread new	€/MWh	17,9	11,3	7,2	5,4	-0,5	-1,1	[1,2]
Yearly average Clean Spark Spread base	€/MWh	8,6	2,0	8,7	6,8	6,1	5,5	[1,2]
Yearly average Clean Spark Spread peak	€/MWh	14,3	6,7	12,4	10,6	11,5	11,8	[1,2]
Average imbalance price delta long system	€/MWh	21,0	13,4	16,4	-4,3	25,4	13,8	[2,3]
Average imbalance price delta short system	€/MWh	22,9	18,9	16,4	5,5	27,0	18,7	[2,3]
Yearly average FCR price Dutch auction (symmetrical)	€/MW/h	21,2		15,5		20,4		[3,4]
Yearly average FCR price common auction (symmetrical)	€/MW/h	13,8		9,4		7,3		[5]
Yearly average aFRR upward price	€/MW/h	8,8	2,3	6,5	3,8	5,7	2,5	[3,4]
Yearly average aFRR downward price	€/MW/h		0,8		3,6		2,2	[3,4]
Yearly average mFRRda upward price	€/MW/h	4,8	0,5	4,1	6,1	4,0	2,7	[3,4]
Yearly avergae mFRRda downward price	€/MW/h	7,1	0,1	2,5	2,3	2,1	1,3	[3,4]
Redispatch volumes	GWh/year	696,3	21.181	589,5	20.235,0	610,2		[3,4,6]
Redispatch costs	mln.€/year	53,9	1.304	61,0	1.206,6	77,5		[3,4,6]

Sources
1) 1) energate 2) MRC Market Coupling 3) TenneT NL 4) TenneT DE 5) regelleistung.net 6) Bundesnetzagentur

For questions and comments please contact:

TenneT Customer Care Centre

tennetccc@tennet.eu

Project team:

Anton Tijdink, MSc.

Dr. Mathias Hoffmann

Alexandra Giasimaki, BSc.

Rosalie Brinkman, MSc.

Disclaimer

TenneT is a leading European grid operator (Transmission System Operator (TSO). We design, build, maintain and operate the high-voltage electricity grid in the Netherlands and large parts of Germany and facilitate the European energy market. We are committed to providing a secure and reliable supply of electricity, today and in the future, 24 hours a day, 365 days a year and to playing our role in driving the energy transition. We transport electricity over a network of approximately 23,500 kilometres of high-voltage connections, from wherever and however it's generated, to over 42 million end-users while keeping electricity supply and demand balanced at all times. With close to 5,000 employees, we achieve a turnover of 4.1 billion euros and a total asset value of EUR 23 billion. TenneT is one of the largest investors in national and international onshore and offshore electricity grids. TenneT makes every effort to meet the needs of society. This will require us all to take ownership, show courage and connect with each other.

www.tennet.eu