



Cross-border capacities in trading: Developments 2018–21

ElCom report

Bern, February 2022

Table of contents

1	Introduction.....	4
2	Annual capacities	5
3	Monthly capacities	6
4	Daily capacities.....	7
5	Price differences (spreads)	8
6	Optimisation of annual/monthly capacity versus daily capacity.....	9
7	Summary	16

List of figures

Figure 1 – Auctioned volumes and prices of annual capacities on the Swiss borders for the supply years 2018–22	5
Figure 2 – Top: auctioned monthly capacities per border, cumulative. Middle: auctioned monthly capacities per border. Bottom: auction price of the monthly transmission capacity per border. Includes data up to October 2021.	6
Figure 3 – Top: monthly average value of the auctioned daily capacities per border, cumulative. Middle: monthly average value of the auctioned daily capacities per border. Bottom: monthly average value of the clearing prices of the daily auctions per border. Includes data up to October 2021.	7
Figure 4 – Monthly average values of the hourly price differences (spread) between Switzerland and its neighbouring countries in the day-ahead auctions for electricity. Includes data up to October 2021.	8
Figure 5 – Average monthly temperatures in Italy, source: https://www.ilmeteo.it	9
Figure 6 – Example of decision-making for the nomination (i.e. usage) or return of long-term, cross-border capacity (monthly/annual capacity)	10
Figure 7 – Comparison of optimisation of annual capacity versus monthly capacity for imports from Germany assuming perfect trader foresight. Includes data up to October 2021.	11
Figure 8 – Comparison of optimisation of annual capacity versus monthly capacity for exports from Germany assuming perfect trader foresight. Includes data up to October 2021.	12
Figure 9 – Comparison of optimisation of annual capacity versus monthly capacity for imports from Austria assuming perfect trader foresight. Includes data up to October 2021.	12
Figure 10 – Comparison of optimisation of annual capacity versus monthly capacity for exports from Austria assuming perfect trader foresight. Includes data up to October 2021.	13
Figure 11 – Comparison of optimisation of annual capacity versus monthly capacity for imports from France assuming perfect trader foresight. Includes data up to October 2021.	14
Figure 12 – Comparison of optimisation of annual capacity versus monthly capacity for imports from Italy assuming perfect trader foresight. Includes data up to October 2021.	15
Figure 13 – Comparison of optimisation of annual capacity versus monthly capacity for exports from Italy assuming perfect trader foresight. Includes data up to October 2021.	15

1 Introduction

The framework and conditions under which electricity can be imported and exported in future are more uncertain than ever in light of the current debate over the continuation of bilateral relations with the EU. It now appears that Switzerland may also be dependent on greater electricity imports longer term – at least temporarily – as the planned decommissioning of the nuclear power plants will result in a substantial reduction in domestic power production which the expansion of renewable energies may not be able to offset quickly enough.

In view of this situation, the developments in commercial cross-border capacities – which are required on the electricity wholesale market to trade electricity with neighbouring countries – were analysed for the period 2018–21.

It is important to note that the capacity **volume** made available to the wholesale market depends on the physical conditions of the power grid. The volume is determined by the transmission network operators of the two countries.

The capacity **price** indicates the electricity price difference between the two countries expected by electricity traders. The higher the expected price difference, the higher the price for capacity. As the capacity volumes are auctioned for periods in the future, the prices resulting from the auctions are a gamble on the price developments which can be won or lost.

Theoretically, there is always a price for the capacity when the capacity available is less than demand (bottleneck). However, as all capacities constitute an option – with the exception of capacities in the intraday time frame – there may also be a price in the event of sufficiently high capacity between two countries (albeit generally lower).

The commercial cross-border capacities are sold in different time tranches: annual, monthly and daily capacities. In contrast to the borders between EU countries, there is still an explicit allocation of cross-border capacities in the intraday time frame for the Swiss borders. This is not covered by this study.

Cross-border electricity transport can be implicit or explicit. Explicit means two steps are required for transport: first, cross-border capacity must be purchased and, secondly, a trade on electricity supply must be concluded. This form of electricity transport is used EU-wide for annual and monthly capacities. The explicit form is also used for daily capacities on the Swiss borders. Implicit means the electricity transport takes place in a single step. The main trading algorithm takes account of the cross-border capacities provided by the transmission network operators and optimises trading under this premise. If no capacity is available, no trade on electricity supply can be concluded. In the EU, implicit cross-border electricity transport is used in the daily and intraday time frame.

2 Annual capacities

Annual capacities are auctioned at the end of November or early December and the auction is carried out by the Joint Allocation Office (JAO).¹ An auctioned megawatt (MW) of capacity represents the right to transport one megawatt hour of electricity from one country to another in every hour of the following year. Fig. 1 shows the development of volumes and prices since 2018.

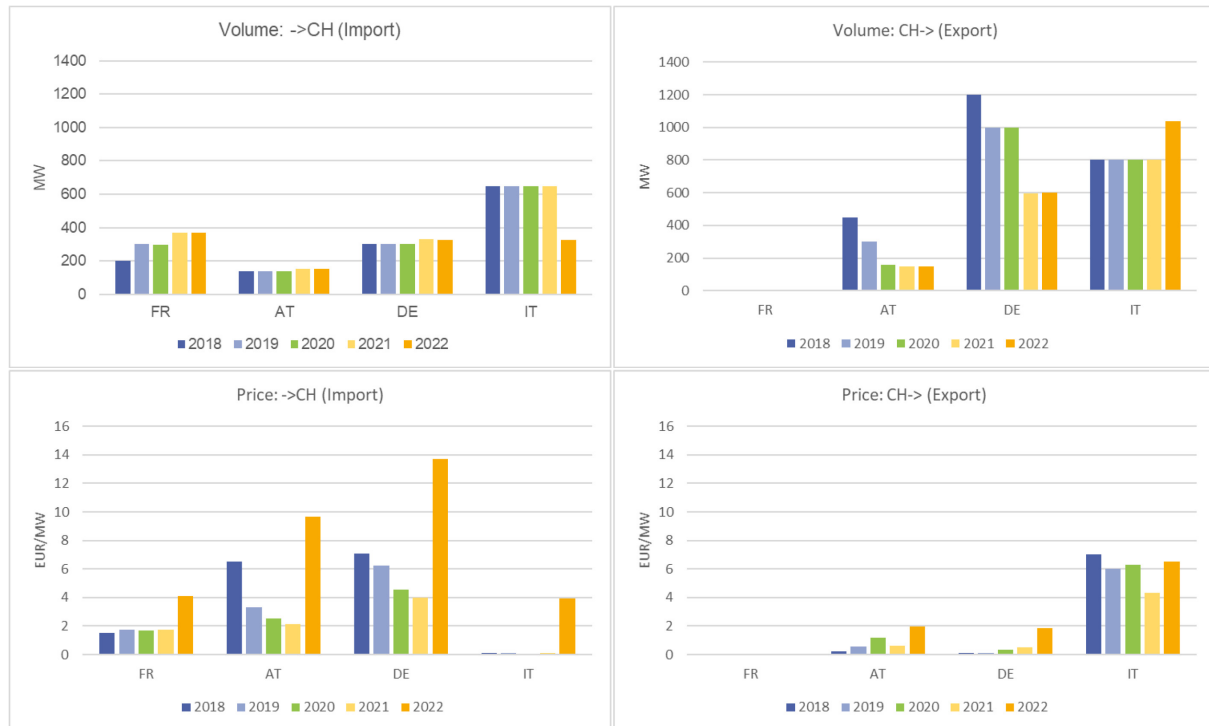


Figure 1 – Auctioned volumes and prices of annual capacities on the Swiss borders for the supply years 2018–22

Import volumes from France almost doubled whereas export volumes to Germany halved from 1200MW to 600MW. Export volumes to Austria also fell significantly. No annual capacity can currently be auctioned for export to France as the volumes allocated in the long-term contracts (LTCs)² do not permit any additional allocation of export capacities for free trading through an auction. In contrast, import volumes from France rose. One reason for this is the gradual expiry of the LTCs, making more import capacity available for free trading.

Italian import and export capacities remained constant up to 2021. The import volume fell and the export volume rose in 2021 as a new algorithm was introduced to calculate the available capacity.

There are currently still no conclusive explanations for the reduction in export capacities available. Swissgrid generally refers to failures of relevant grid elements.

The prices for importing electricity from Germany and Austria to Switzerland fell significantly up to 2021. This reflects the fact that market participants expect the price differences (spreads) between Germany/Austria and Switzerland to narrow (see section 5).

The extraordinary price increases in autumn 2021 resulted in a reversal of this trend – at least for the time being. It is not possible at the current stage to estimate how long this will last.

¹ <https://www.jao.eu/>

² Long-term contracts with France which guarantee a certain capacity volume for market participants, reducing the capacity available for free trading

3 Monthly capacities

Monthly capacities are auctioned in the middle to the end of the previous month and the auction is carried out by the Joint Allocation Office (JAO). An auctioned MW of capacity represents the right to transport one megawatt hour of electricity from one country to another in every hour of the following month. Figure 2 shows the development of volumes and prices since 2018.



Figure 2 – Top: auctioned monthly capacities per border, cumulative. Middle: auctioned monthly capacities per border. Bottom: auction price of the monthly transmission capacity per border.³ Includes data up to October 2021.

The volumes auctioned in the monthly auction vary significantly depending on the season and country. One of the reasons for the fluctuations may be short-term changes in the capacity made available due to modified maintenance plans – for example, there were major shutdowns on the import lines from France in February and April in early 2021. Only the import volumes from Germany are constant. There are seasonal variations in imports from Italy – more in winter and less in summer. A line can generally transport more electricity in winter due to lower temperatures. Imports from France were binary up to and including 2019: provided sufficient capacity was available, monthly products were auctioned, if not, no monthly capacity was allocated. A new method has been used to calculate the available capacity on the German and Austrian borders since 2020 which is expected to result in a slight increase in the capacity available.

³ NB: A market participant may return the auctioned annual capacity for a monthly auction. In return they receive the clearing price achieved at the auction for the monthly capacity. This means the total of the monthly auction volume shown in these graphics plus the annual auction volume does not usually reflect the effective cross-border capacity ultimately allocated (instead it is greater).

Export capacities to France – in the same way as annual capacities – were not auctioned due to the LTCs. The greatest capacity auctioned is that exported to Germany, which was even higher than that exported to Italy. Less monthly capacity was available in 2019. The reduction in exports to Germany in summer 2021 is also clearly evident: only around 500MW was available compared with 1,800MW previously.

The prices for imports from Germany and Austria rise during winter due to greater price differences at this time of year. The sharp rise for October/November 2021 is due to the very high prices and high spreads. There are generally high prices for exports to Italy during the summer as Switzerland adopts the much cheaper prices of its northern neighbours in summer whereas expensive gas-fired power plants continue to set the price in Italy. Demand in Italy is high during the hot summer months due to cooling requirements.

4 Daily capacities

Daily capacities are auctioned on the previous day and the auction is carried out by the Joint Allocation Office (JAO). A separate auction takes place for every hour. An auctioned MW of capacity for a specific hour represents the right to transport one megawatt hour of electricity from one country to another during this hour of the following day. Figure 3 shows the development of volumes and prices since 2018.



Figure 3 – Top: monthly average value of the auctioned daily capacities per border, cumulative. Middle: monthly average value of the auctioned daily capacities per border. Bottom: monthly average value of the clearing prices of the daily auctions per border. Includes data up to October 2021.

In the daily auctions, the highest import capacity is from Italy while the highest export capacity is to Germany. There has been significant seasonal variation in exports over the past two years: a cumulative

volume of just under 9,000MW is available for export in winter compared to less than 6,000MW in summer. This is primarily due to the significant seasonal variation in exports to Germany but the Italian seasonal variation also contributes to this trend.

The latest import capacities from September/October 2021 are of interest. Total capacity fell by 20% compared to the minimum of the review period and around 4,000MW were still available in total on average. There was a decline on all borders but import capacity from Germany to Switzerland fell most sharply.

One reason for this may be the grid bottlenecks within Germany: if there is a lot of wind – which generates electricity, in particular in northern Germany – German prices fall. As not enough electricity can be transported from the north to the south of Germany, the German export capacity to Switzerland is reduced to limit Swiss demand for German electricity and to avoid having to implement expensive redispatch measures in southern Germany.

However, the reduction on the German border is not extraordinary and occurs every autumn during the review period. The driving factor in the cumulative minimum is the border of Austria which has seen capacity reduced from over 500MW to almost 0MW since the beginning of 2021.

The daily capacity prices show clear seasonal cycles. Imports from the north are expensive in winter and cheap to free in summer, whereas imports from the south are practically free. Exports to the south are expensive in summer and cheap in winter. The cost of exports to the north is low, particularly in summer.

These trends reflect the differences in the day-ahead electricity prices. In the northern countries, these are well below the Swiss price level in winter. In contrast, the prices in Italy are higher than in Switzerland, particularly in summer (see section 5).

5 Price differences (spreads)

The prices of the day-ahead auction are used as a benchmark for the electricity price differences on the wholesale market between Switzerland and its bordering countries. The day-ahead auction involves an auction on the day before electricity supply for every hour of the delivery day where suppliers and buyers can submit their bids up to a defined point in time X on the EPEX Spot exchange which carries out the auction. The exchange then determines a clearing price for every hour based on supply and demand which is awarded to participants with higher (purchase) and lower (sale) offers for the volumes concerned. These spot prices are a good indicator of the fundamental price differences between countries owing to the large volumes traded and proximity in time to electricity supply.

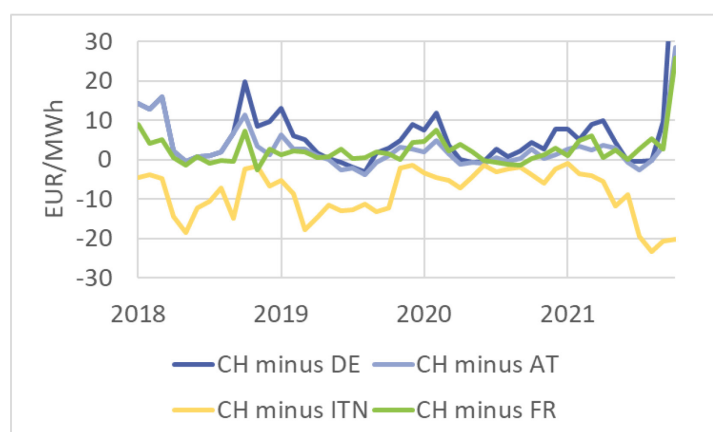


Figure 4 – Monthly average values of the hourly price differences (spread) between Switzerland and its neighbouring countries in the day-ahead auctions for electricity. Includes data up to October 2021.

The seasonal development of the differences in electricity prices follows the familiar classic pattern. Prices in winter rise more sharply in Switzerland than in Germany and Austria owing to greater demand and limited import capacity, primarily from Germany. This leads to higher spreads in winter. There is

also more hydropower available in summer with lower demand in Switzerland. This means the Swiss prices are at a similar level to those in Germany on average. Occasionally – but increasingly so – German prices exceed those in Switzerland, particularly when increasingly significant solar and wind production does not feed in enough cheap electricity due to a lack of sun and wind. This upward trend is reflected by the spreads and also in the prices for cross-border capacity for export to Germany.

The year 2020 stands out in the spread Switzerland minus Italy. In contrast to other years, electricity in Italy was not significantly more expensive than in Switzerland in summer 2020. One possible reason for this may be that the Italian economy did not recover as quickly as Switzerland's in 2020 after the lockdown period, which is why demand remained low and higher prices failed to materialise. Another factor may be climatic conditions. When the summer in Italy is cooler than usual, demand for electricity for cooling systems falls which can also result in lower prices. This was the case at least for June 2020, see Figure 5.

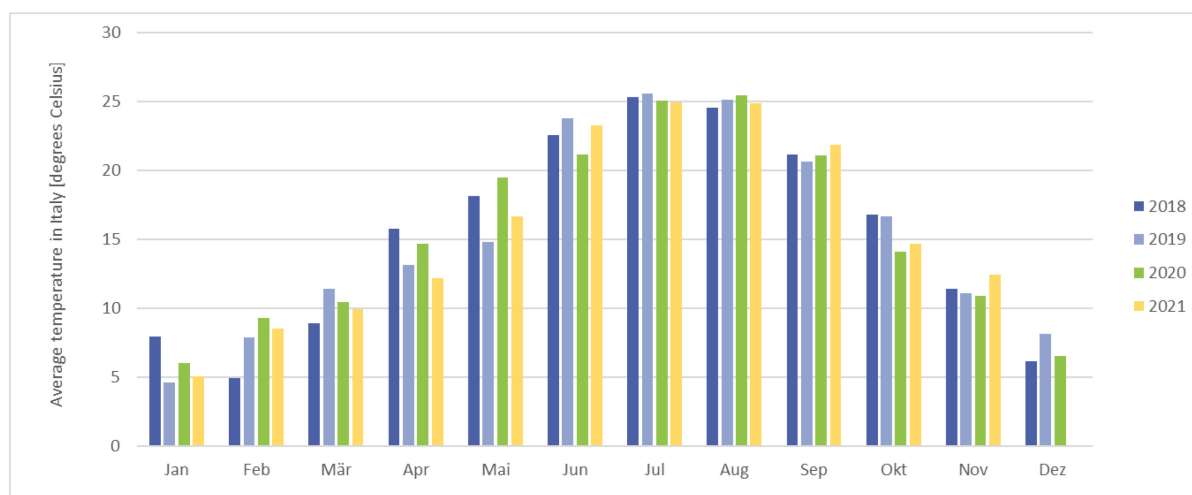


Figure 5 – Average monthly temperatures in Italy, source: <https://www.ilmeteo.it>

The extraordinary and historically unprecedented very sharp price rise in autumn 2021 resulted in a significant increase in price differences which was also reflected in the prices for the monthly and daily capacities and in the prices of the annual capacities for 2022. At the current stage it is not possible to estimate how long these currently high prices will last.

6 Optimisation of annual/monthly capacity versus daily capacity

Capacity auctioned in an annual or monthly auction must either be nominated two days before the delivery of electricity (i.e. D-2) or returned to the JAO auction platform. When returning capacity, the market participant receives the price for the cross-border capacity achieved in the daily auction by way of compensation. This is the use-it or sell-it principle. Capacity auctioned in the daily auction can also be returned but the market participant does not receive any compensation in return (use-it or lose-it principle). Returned daily capacity is then made available in the intraday time frame.

When deciding whether to nominate or return annual or monthly capacity two days before supply, the trader estimates the price differences between the two countries on the day of delivery and the price of the daily capacity auction. If the price difference is greater than the price of the capacity, it is worth nominating the annual/monthly capacity. Conversely, participants return capacity if they can achieve greater profit by doing so. Figure 6 provides an example of decision-making.

Trader decision on D-2: whether to nominate long-term capacity and thus use for energy transport, or return capacity and receive compensation in the amount of the daily cross-border capacity auction?

		Case 1		Case 2	
Paid for long-term capacity	EUR/MW	4	4	4	4
Expected price in cross-border capacity auction, for hour X	EUR/MW	7		7	
Expected spread in day-ahead auction between country A and country B, for hour X	EUR/MW		9		6
Expected profit	EUR/MW	3	5	3	2
		--> Nominate		--> Return	

Figure 6 – Example of decision-making for the nomination (i.e. usage) or return of long-term, cross-border capacity (monthly/annual capacity)

An analysis was carried out for all countries bordering Switzerland to determine whether a trader with perfect foresight (in other words who would always have known two days before delivery whether the price difference between the countries would be greater or less than the capacity price of the daily auction) would be better off at the auction of monthly capacity or of annual capacity. The profit/loss that would be achieved by nominating or returning the long-term capacity (year or month) is calculated for every hour and the optimal value determined.

As monthly capacities can be auctioned just one to two weeks before supply, they more accurately reflect the current price situations on the electricity markets of the two countries between which the capacity would enable the transport of electricity. The price of the monthly capacity stands at around the price difference between the two countries for this month. This means less profit tends to be made with monthly capacities than with annual capacities but conversely the risk of losses is lower.

Annual capacities are auctioned in the December of the previous year. Here traders must estimate the price differences for the entire following year. This entails greater uncertainty which means the profit/loss risk is higher.

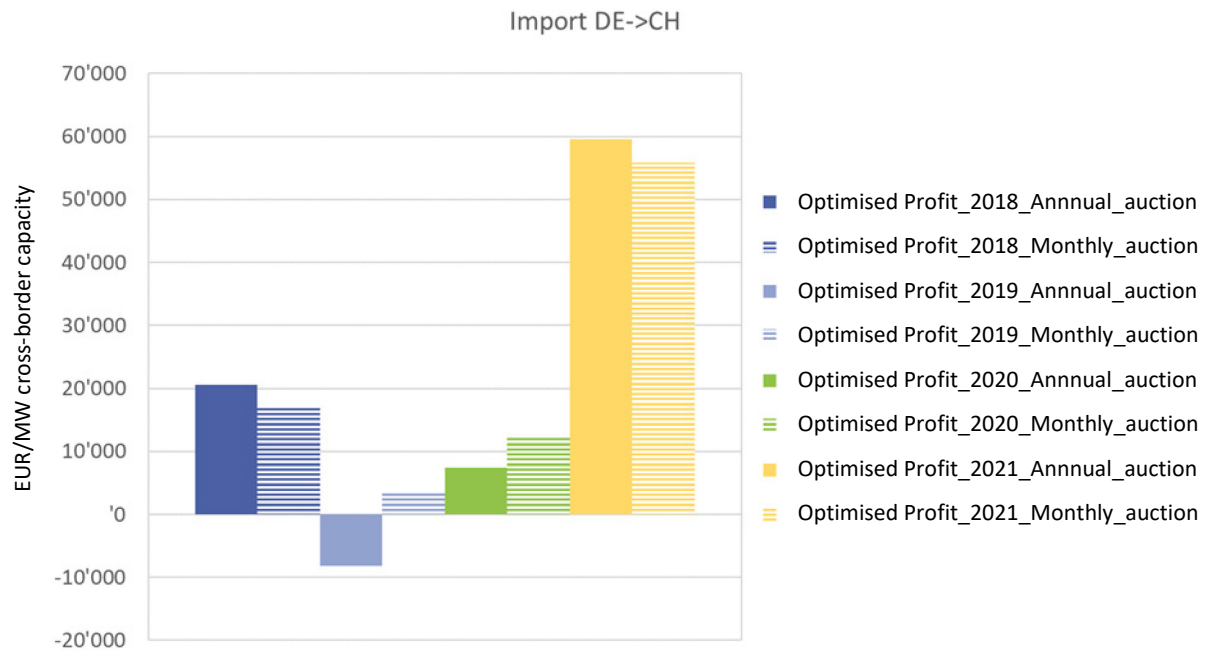


Figure 7 – Comparison of optimisation of annual capacity versus monthly capacity for imports from Germany assuming perfect trader foresight. Includes data up to October 2021.

For imports from Germany to Switzerland, there is no indication whether always using monthly capacity or always using annual capacity would be the better option. The optimised profit for the annual auction in 2019 was actually negative which means market participants incorrectly estimated the price differences in 2019 at the auction of annual capacity in December 2018. The high values in 2021 are due to the extraordinary high-price situation from September 2021. This also resulted in unprecedented high spreads which exceeded 150 EUR/MWh for some hours in October. The daily capacity prices were also very high. This means high profit was generated with long-term capacities, particularly with annual capacity as such high prices in autumn 2021 were not anticipated at the end of 2020.

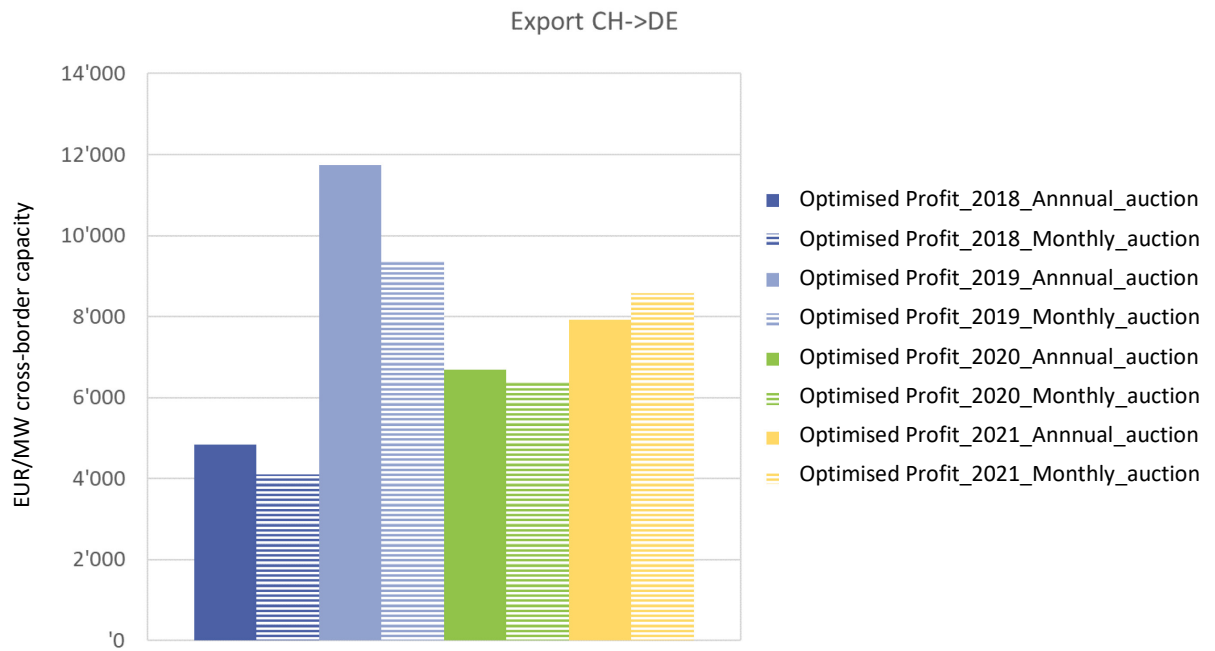


Figure 8 – Comparison of optimisation of annual capacity versus monthly capacity for exports from Germany assuming perfect trader foresight. Includes data up to October 2021.

It is noticeable that a profit would definitely have been generated on exports with perfect foresight. In 2018–20, the profit from optimisation at the annual auction was slightly higher than that at the monthly auction but this situation was reversed in 2021. Total profit potential is higher for imports. This is due to higher price differences on imports.

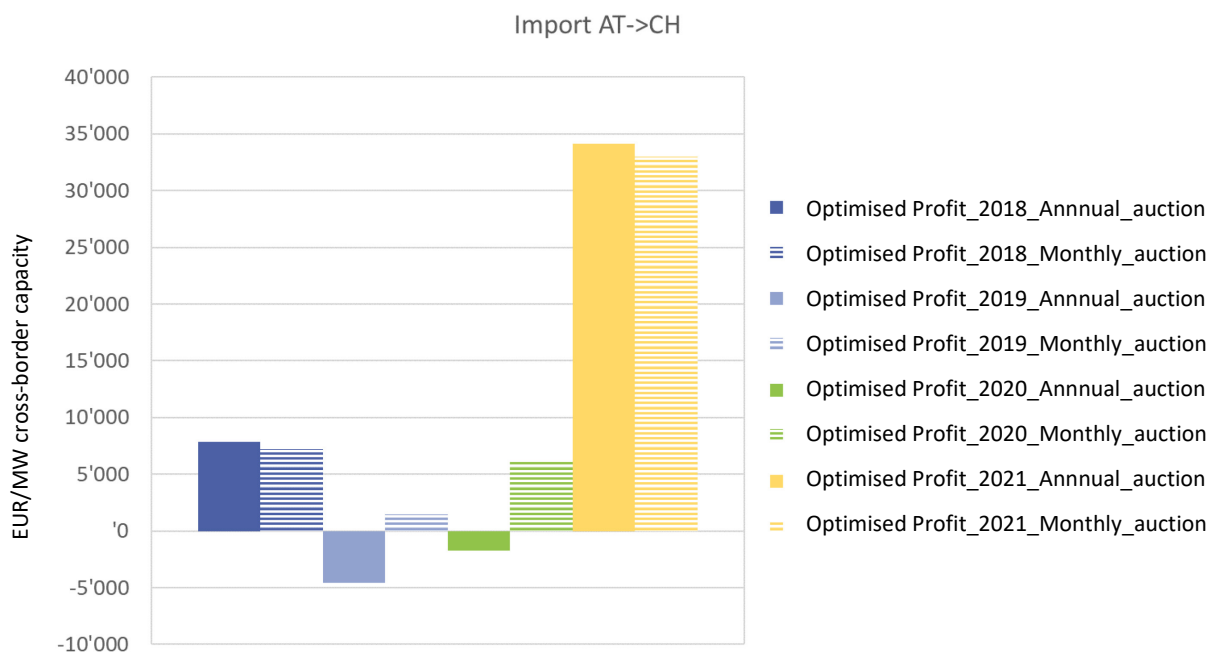


Figure 9 – Comparison of optimisation of annual capacity versus monthly capacity for imports from Austria assuming perfect trader foresight. Includes data up to October 2021.

Market participants made losses speculating at the annual auction for import capacity from Austria in both December 2018 and December 2019. Even in the event of perfect foresight – in other words if traders had known beforehand for every hour whether the electricity price difference or the price for the cross-border capacity at the daily auction would be higher – a loss would have been made overall for the entire year because the price for the annual capacity at the auction was too high. It is interesting to note that this also occurred on the market in 2020 where the trend of narrowing spreads between Austria and Switzerland should actually have been sufficiently evident.

However, a profit would have been generated in all years with perfect foresight at monthly auctions. The level of profit/loss is much lower for the Austria→Switzerland border than that for the Germany→Switzerland border.

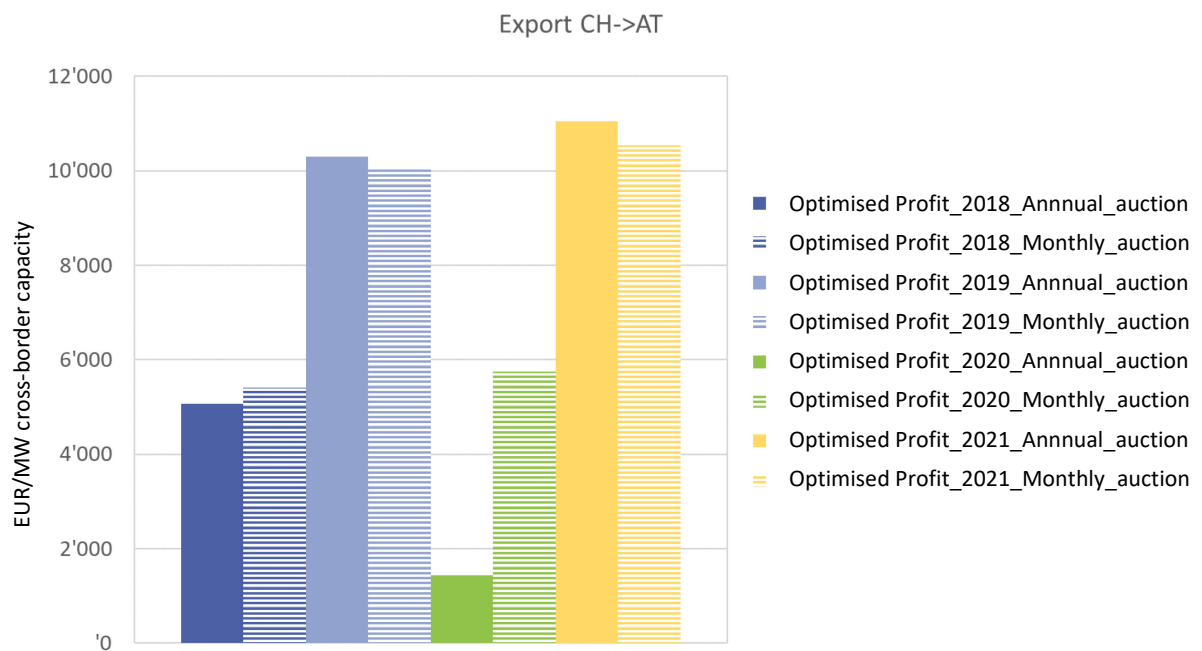


Figure 10 – Comparison of optimisation of annual capacity versus monthly capacity for exports from Austria assuming perfect trader foresight. Includes data up to October 2021.

Exports were (like exports to Germany) profitable in every year (always based on the assumption of perfect foresight). The level of profit potential is similar to that for imports. Here there is a difference to the border with Germany: the profit potential for imports from Germany is much higher than that for imports from Austria. However, the export profit potential is similar for both countries. This indicates the price differences are similar for exports to Germany and Austria but the price differences between Germany and Switzerland are greater than between Austria and Switzerland for imports. The reason for this may be that Austria cannot always fully adopt the cheap German prices.

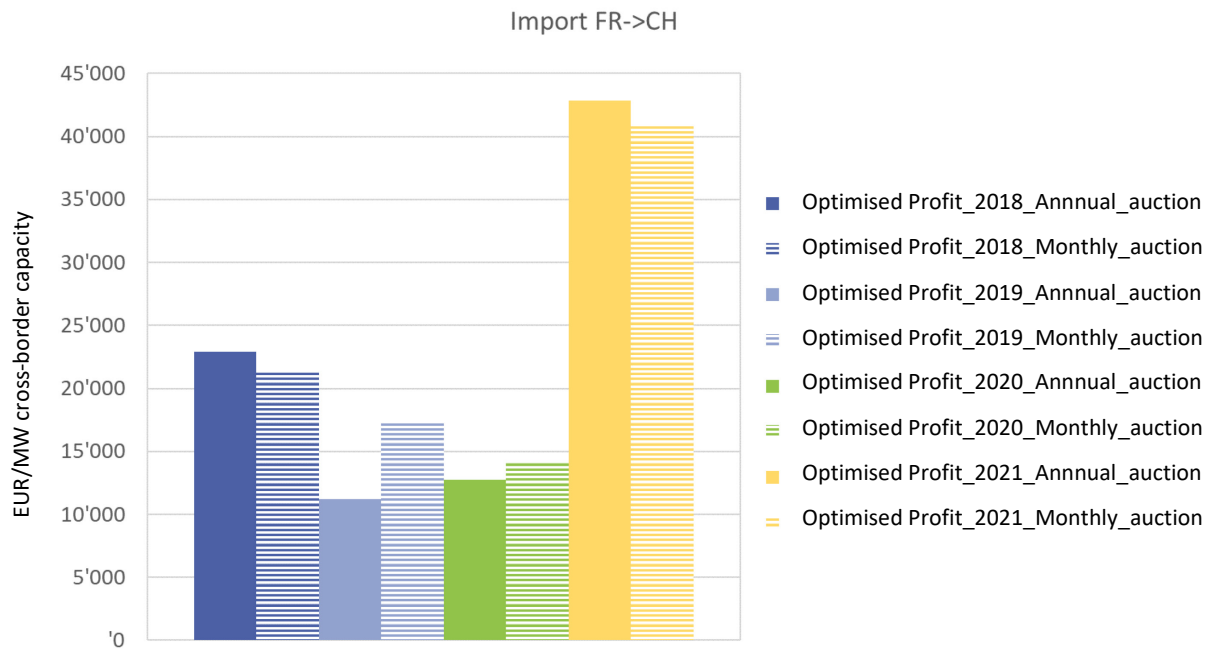


Figure 11 – Comparison of optimisation of annual capacity versus monthly capacity for imports from France assuming perfect trader foresight. Includes data up to October 2021.

There were positive best cases for every year analysed with regard to optimisation of imports from France, i.e. profit could be made in every year through optimisation with sufficiently accurate daily estimations of the market situation (price of cross-border capacity versus expected electricity price difference). The annual capacities provided greater profit potential in 2018 and 2021 as opposed to monthly capacities in 2019 and 2020.

Optimisation of exports was not calculated as neither annual nor monthly capacities were auctioned for export to France.

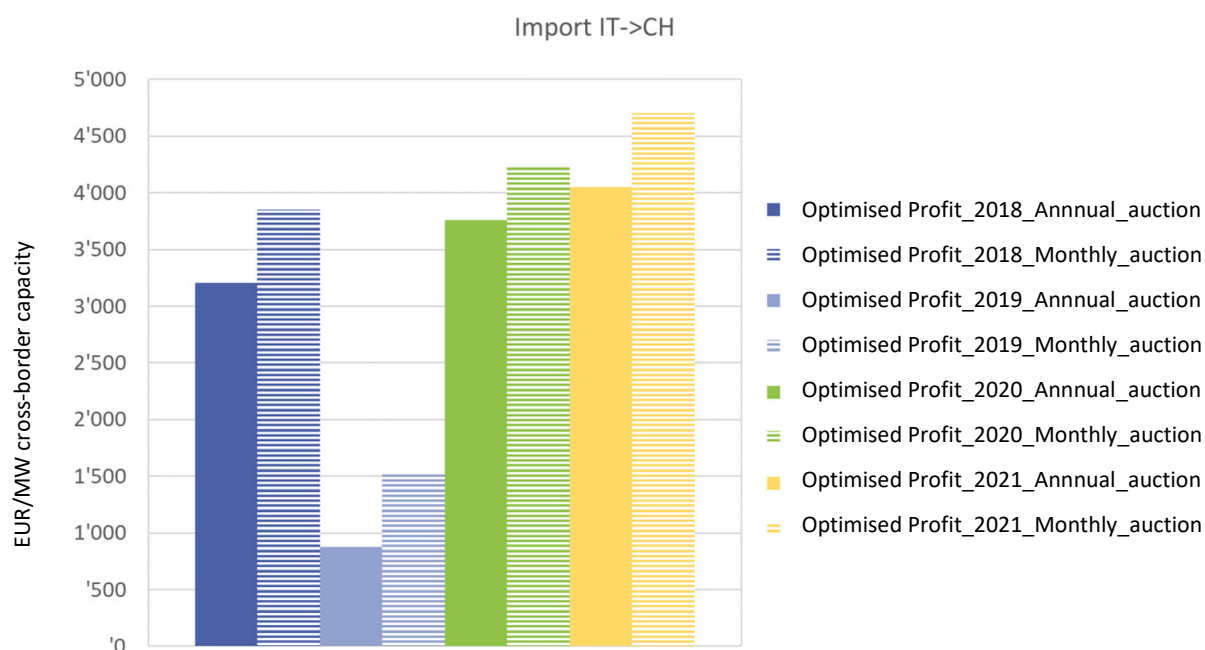


Figure 12 – Comparison of optimisation of annual capacity versus monthly capacity for imports from Italy assuming perfect trader foresight. Includes data up to October 2021.

The profit potential was positive in every year analysed for imports from Italy to Switzerland. Higher profits could have been achieved in every year by optimising monthly auction capacities.



Figure 13 – Comparison of optimisation of annual capacity versus monthly capacity for exports from Italy assuming perfect trader foresight. Includes data up to October 2021.

In relation to exports to Italy, it is clear that the market failed to anticipate the lower spreads in 2020 (see section 2.4) and the optimisation value is negative. The profit potential in other years is consistently positive with monthly auctions offering optimisation benefits.

Compared with the other borders, the absolute profit potential is the highest which is explained by the significant price differences between Switzerland and Italy. It is also much higher than the profit potential of imports from Germany to Switzerland.

7 Summary

There is no clear trend in capacity volumes with volumes neither rising or falling significantly. There is a latent risk of the management of cross-border capacities becoming more complex and the capacity volume made available for trading being reduced if Switzerland fails to conclude an electricity agreement with the EU. In this respect, the implementation of the EU's minRam rule⁴ needs to be monitored.

An electricity agreement would also pave the way for Switzerland's participation in EU market coupling. This is used for daily capacities and would improve the efficiency of managing the Swiss borders because it enables implicit electricity transport between the countries.

Cross-border capacity prices have generally fallen slightly, mainly because the electricity price differences between Switzerland and neighbouring countries have narrowed to some extent. However, the extraordinary electricity price developments in autumn 2021 led to a trend reversal. It remains to be seen whether this will last.

Profit can definitely be generated by optimising annual and monthly capacities over daily capacities. Accurate forecasts of market developments are nevertheless required and recent years have shown that the market can also be mistaken or surprised by unforeseeable events, such as the coronavirus pandemic or the extreme gas prices in autumn 2021.

⁴ Also see ElCom's report *Berücksichtigung des Schweizer Netzes in der Kapazitätsberechnung der EU* (Inclusion of the Swiss Grid in the EU's Capacity Calculation), <https://www.elcom.ad-min.ch/dam/elcom/de/dokumente/2020/beruecksichtigungdesschweizernetzesinderkapazitaetsberechnungdereu.pdf.download.pdf>