EUROPEAN
COMMISSION

Brussels, 16.12.2020
C(2020) 8842 final

REPORT FROM THE COMMISSION

on the availability of hydrofluorocarbons on the Union market

1. Background

Regulation (EU) No 517/2014 (the F-gas Regulation) put in place a quota system for hydrofluorocarbons (HFCs) (the "EU HFC phase-down") to reduce the supply[1] of these man-made gases to the Union market. Due to the scarcity created, manufacturers and users of products and equipment employing these gases (e.g. in refrigeration and air conditioning equipment, as foaming agents or aerosol propellants), are incentivised to switch to more climate-friendly alternatives. In this way, HFC emissions, which occur to a large degree during the equipment's useful life or as a result of inappropriate disposal, can be greatly reduced.

The F-gas Regulation requires the European Commission to publish a report on the availability of HFCs on the Union market no later than 31 December 2020 pursuant to Article 21(2). This report responds to this requirement.

The European Commission has monitored and analysed the EU HFC market employing external consultants since the beginning of the phase-down in 2015. This monitoring included price developments for HFCs and their alternatives, as well as the effects of the quota system on the market and on innovation. Set out below are the results of this monitoring with respect to HFC availability on the Union market since 2015 and the most relevant influential factors.

2. HFC price development and availability

2.1 Commonly used HFCs and HFC mixtures[2] with high global warming potential (GWP[3])

The price of conventional HFCs[4] on the EU market has been strongly affected by the phase-down. In the first two years of the implementation of the F-gas Regulation (2015 and 2016), there was no perceptible impact on prices of the most commonly used HFCs with high global warming potential (GWP). However, from mid-2017 onwards prices for R404A[5], R410A, R134a as well as R407C rose significantly reaching a peak in early 2018 at 6 to 13 times higher than the original price (see Figure 1). Due to the design of the HFC phase-down, price increases for HFCs with high GWPs had been expected, due to the scarcity created by the quota system, and were intended to stimulate the use of more climate-friendly alternatives. In line with economic theory, observed price increases roughly mirror the climate-warming effects of the different HFCs with higher prices for the more potent greenhouse gases.[6] The data collected also show that price increases were passed on from the upper to the lower levels in the supply chain (example for R134a shown in Figure 2).[7] Even though the observed

1 The quantities are measured in CO_2 equivalent in order to reflect the climate effect of the gases.

2 I.e. those gases and gas mixtures conventionally used up to 2015.

3 GWP is a measure of a how much a gas contributes to global warming once it reaches the atmosphere, compared to the same amount of CO_2 (GWP of 1). HFCs with high GWPs are several thousand times stronger warming agents than CO_2.

4 The term "HFCs" is used to mean HFCs and their mixtures.

5 All HFCs and HFC mixtures are denominated by the letter R followed by a number. R404A, R410A, R407C are HFC mixtures, while R134a and R32 are HFCs (i.e. single molecules).

6 See GWP for these gases in the legend of Figure 1.

7 Increases are shown as relative increases, i.e. in percent. Price increases were imposed in absolute terms, which results in lower *relative* increases at service company level (as gas prices are much higher at that level in the supply chain).

price increases were quite substantial, they never reached a 50 €/t CO_2 equivalent level that was regarded as proportionate in the impact assessment for the F-gas Regulation[8], at any level in the supply chain. There are regional differences in the pricing and price levels of gases, but the overall trends as described above are consistent across all countries surveyed.

The rapid price increases in 2017 took many companies by surprise. Some resorted to stocking HFCs quickly and in large volumes, other were caught unaware. In addition, many companies had stocked very high quantities in 2014, before the start of the phase-down. These reserve stocks kept prices at low levels during 2015 and 2016, but stocks started to be depleted by 2017. The low price signal may also have delayed the switch to lower GWP alternatives as there was less urgency for market players to act. As a result of these diverse reactions, **a limited availability of some of these high GWP HFCs was observed in the second half of 2017**. These limitations were not experienced in the same way in all Member States as the refrigerant market (most common use of HFCs) is rather heterogeneous. There were reports of shortages in Germany, Italy and Spain, while this was not the case in other countries. The most affected gases were R404A (now discontinued by some suppliers due to the relatively high GWP), R134a (widely used in the car air conditioning servicing market) and R410A (likely employed by some EU manufacturers for producing air conditioning equipment). At the time, concerns were expressed for the future by some stakeholders in view of the upcoming steep HFC phase-down step in 2018.[9]

During 2018, however, prices started to fall. These price reductions have continued until today (end 2019). Still, purchase prices at the lower levels of the supply chain (i.e. original equipment manufacturers (OEMs) and service companies) at the end of 2019 remain 4 to 6 times higher than those observed in 2015, while world market prices have remained rather stable in the same period. The incentive (price driver) to innovate further is therefore still in place. Moreover, the phase-down itself is providing a long term signal to companies that HFC supply will become more and more restricted, which in itself provides an incentive and a business case for developing climate friendly solutions.

Only few companies have reported a problem of a limited availability of HFCs over the last two years. In these cases, companies indicated that they could either not obtain the HFC from their current supplier or that they had to wait a certain time until they could obtain the quantity they requested. On the basis of these indications, it is clear that they were not in a situation where HFCs were unavailable. According to the latest feedback received from participating companies and market experts, almost no problems as regards the availability of HFCs occurred in 2019.

Overall, the price development is broadly in line with the expected dynamics of a market-based system, where supply and demand will eventually determine the price. With the adoption of the F-gas Regulation, the expectation was that suppliers would seek to maximize the value represented by their anticipated quota, and therefore pursue a strategy that includes the greatest value of a tonne of CO_2-eq in their pricing strategy. In the short term, the regulatory driver restricting the supply (the "phase-down") will lead to an increase in the value of quotas issued. In the longer term, it will eventually lead to the establishment of a new

[8] See SWD(2012) 364 - Impact assessment review of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases

[9] e.g. industrial stakeholders expressed concerns about the unavailability of some HFCs at the F-gas Consultation Forum on 6 March 2018 (https://ec.europa.eu/clima/events/articles/0106_en).

price equilibrium reflecting the conversion of the market to less CO_2-sensitive options, i.e. the average GWP of HFCs supplied to the market will be lowered considerably. The peak levels in 2018 corresponded to a price overshoot as a result of the diverse reactions of the various market players and a lack of preparedness as explained above.

For early 2020, some companies expect the price level for HFCs to stabilise at a low level. On the other hand, the lower phase-down step in 2021 may lead to renewed increases in gas prices, in particular for high GWP gases.

Figure 1: Average purchase prices of the most commonly used HFCs at service company level (price index, 2014 = 100 % (baseline))[10]

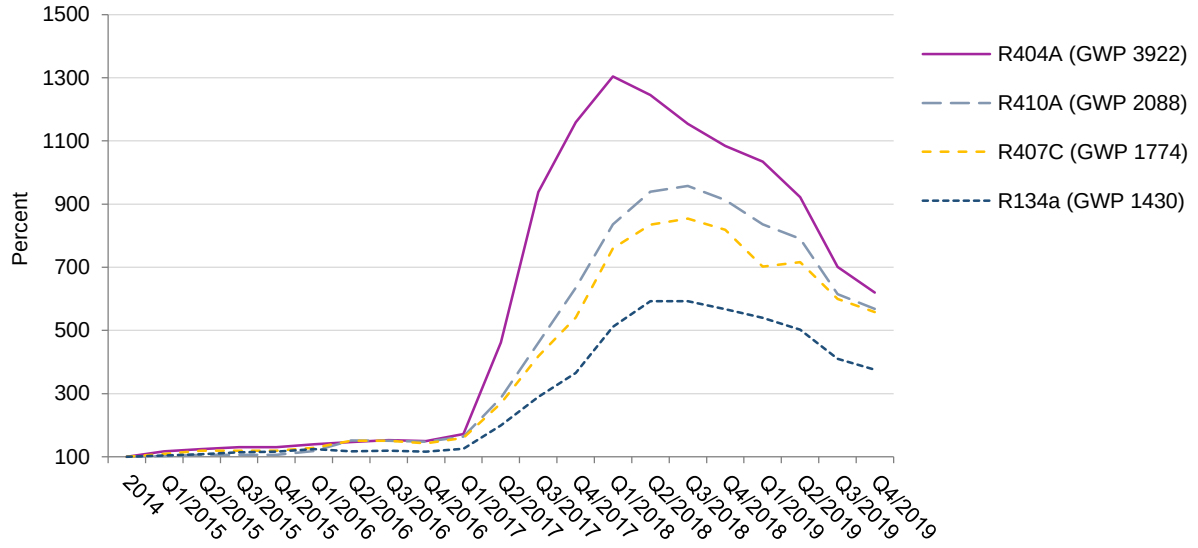
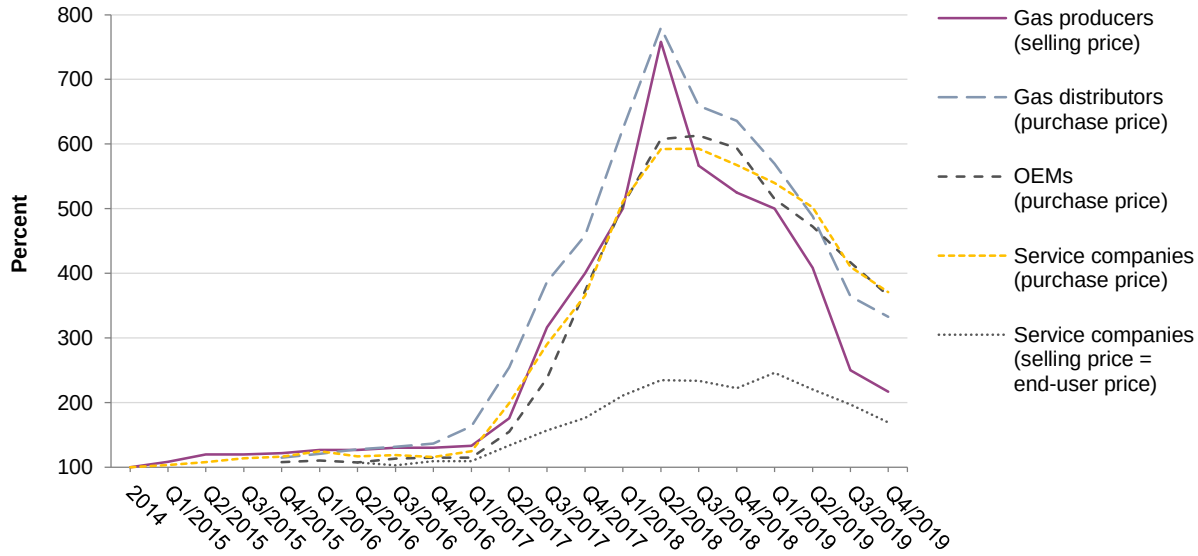


Figure 2: Development of average prices of R134a (GWP 1430) along the supply chain (price index, 2014 = 100 % (baseline))[11]



[10] Data as reported by 28 service companies from DE, EE, ES, FR, IT, PL and PO, with main input from DE and FR.

[11] Volunteered information from 70 to 80 companies covering AT, BE, CZ, DK, EE, FR, DE, IE, IT, PL, PO, ES, UK, with most data from DE, FR and IT. Companies include 3 gas producers, 10 gas distributors, 25 to 30 OEMs, 30 to 35 service companies, and 5 end-users (numbers for 2019 data).

2.2 Alternatives to HFCs with high GWP

Since mid-2017, more climate-friendly alternatives to high GWP HFCs have been used increasingly. The most prominent example is the replacement of R404A in commercial refrigeration, especially after major gas producers significantly reduced or even ceased their supply of R404A in 2017 and 2018. The most common alternatives used are R448A/R449A/R452A (blends of HFCs and unsaturated HFCs (HFOs[12])) as refrigerants for retrofitting existing systems, as well as very low GWP alternatives for new systems (e.g. natural alternatives such as CO_2 (R744), ammonia (R717), and propane (R290) technologies). From 2020 onwards, the placing on the market of stationary refrigeration equipment containing or relying on R404A and for servicing refrigeration systems with more than 40 tonnes CO_2 equivalent of F-gases (reclaimed and recycled R404A is allowed under specific conditions until 2030) is prohibited[13, 14]. This reduces the EU market demand for this and other highly global warming blends (GWP > 2 500) greatly, freeing up quota for other gases. However, some gas distributors claim that in 2019 there was a reduced demand for lower GWP alternatives for retrofitting existing, and for installing new, larger refrigeration systems, as high GWP HFCs such as R404A were (again) widely available, apparently partly from stocks built up in the anticipation that there would be a subsequent shortage.

In contrast to the conventionally used high GWP HFCs, prices for their synthetic alternatives with lower GWPs (i.e. medium-high GWP HFCs, HFC/HFO blends)[15] have remained relatively stable since mid-2017 or at least showed more moderate price increases, depending on their GWP. While in 2017 there were claims by some stakeholders that these alternatives were not yet sufficiently available, these supply issues seem to have disappeared in the meantime. The HFC R32, a R410A alternative with a medium-high GWP (675), is increasingly used in imported refrigeration and air conditioning equipment and the EU import quantity of HFOs and HCFOs[16] increased to 5.5 times in 2018 compared to the quantity in 2015. While an important reason for the increase in imports of HFOs is the use of HFO 1234yf in passenger cars as a result of the Mobile Air Conditioning Directive (Directive 2006/40/EC), H(C)FOs are increasingly used in many sectors including refrigeration, air conditioning and foams.

---

12 Hydrofluoroolefin.

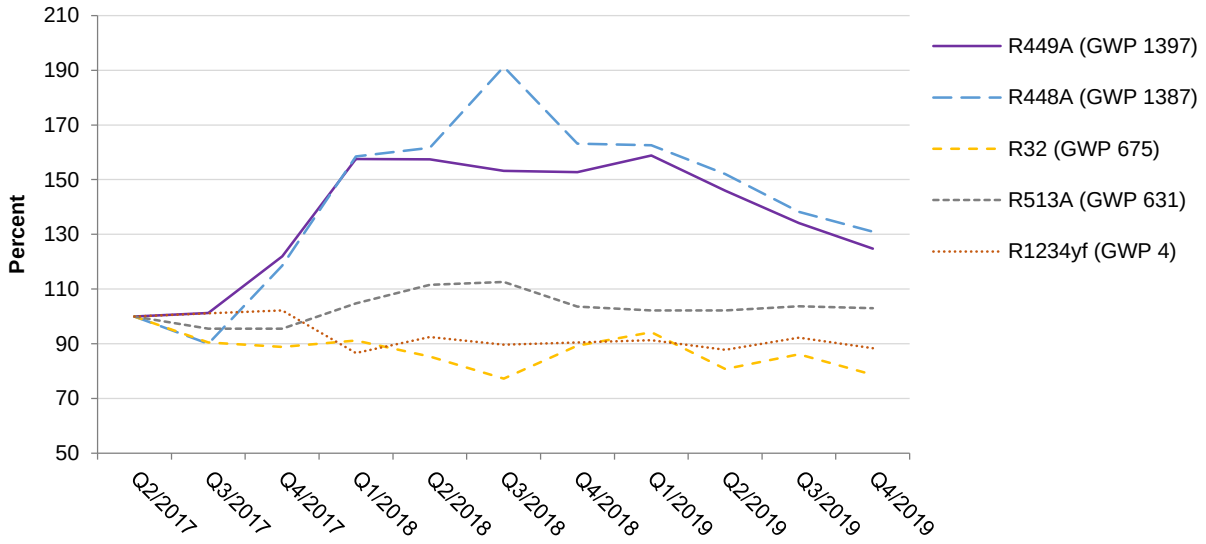
13 Excluding military equipment or if intended for applications designed to cool products to temperatures below - 50 degrees Celsius (Annex III, prohibition 12, of the F-gas Regulation).

14 Excluding military equipment or if intended for applications designed to cool products to temperatures below - 50 degrees Celsius (Article 13 (3) of the F-gas Regulation).

15 These include R32 (an HFC), R1234yf (an HFO), or HFC/HFO mixtures (e.g. R449A, R448A, 513A). some of these alternatives still have a relatively high GWP (see Figure 3)

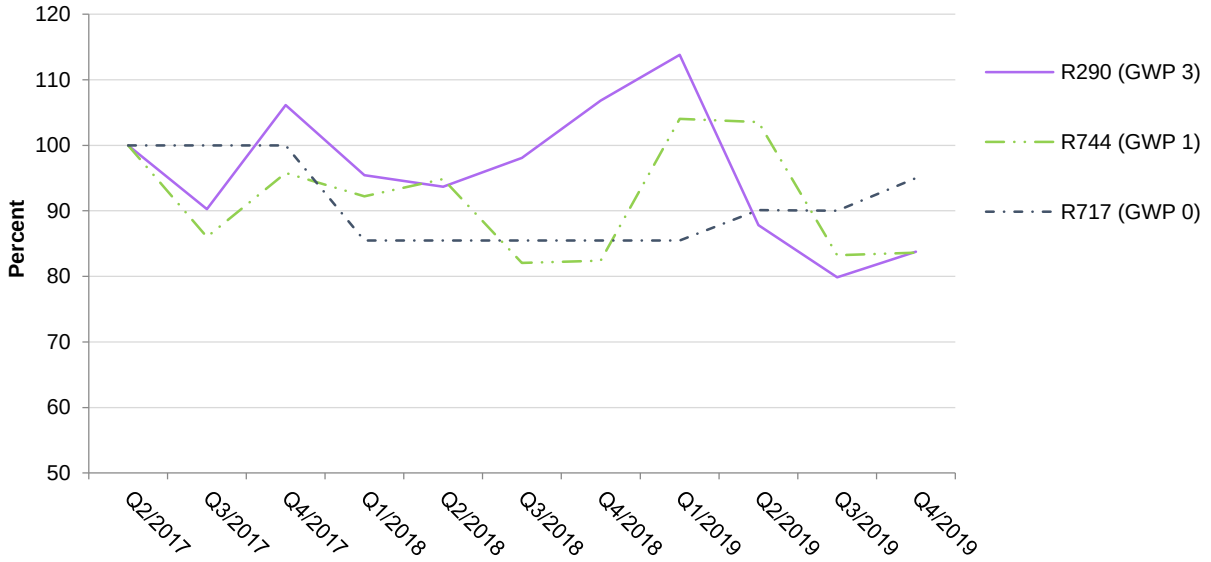
16 Hydrochlorofluoroolefin.

Figure 3: Development of average purchase prices of synthetic medium-high GWP alternatives at service company level (price index, Q2/2017 = 100 % (baseline))



Prices of natural alternatives such as CO_2 (R744), ammonia (R717) and propane (R290) with very low GWPs have seen modest price decreases compared to 2015. There is no constraint on their availability on the EU market, and they are available at low cost, comparable to the initial price level of high GWP HFCs in 2015.

Figure 4: Development of average purchase prices of natural alternatives at service company level (price index, Q2/2017= 100 % (baseline))



According to data reported under the F-gas Regulation, the total amount of HFCs supplied to the EU market (including in equipment such as air conditioners) dropped by 37% in CO_2 equivalent between 2018 and 2015, whereas the drop measured in volume was only 25%.[17] This shows a clear shift in the supply towards lower GWP HFCs and other alternatives. Furthermore, the increased use of alternatives, in addition to progress made in reducing

[17] See EEA F-gas Report 2019 https://www.eea.europa.eu/publications/fluorinated-greenhouse-gases-2019.

leakage rates, are expected to have contributed to alleviating the high prices seen up to early 2018.

2.3 Reclaimed HFCs

Reclaimed HFCs are not subject to the limits of the HFC phase-down and even high GWP gases can still be used to service larger refrigeration equipment. Reclaimed gases ensure the availability of essential HFCs on the market going forward, especially as the phase-down gets tighter. According to the annual company reporting under the F-gas Regulation[18], the amounts of reclaimed HFCs have tripled since 2015 and made up 4% of the EU virgin HFC supply in 2018 (measured in CO_2 equivalents). Still, given the amounts "banked" in equipment that reaches its end of life, there appears to be more untapped potential for increasing reclamation activities in the EU. Demand for reclaimed gases reduces the risk of illegal venting and inadvertent losses at the end of the useful life of equipment. Indications on prices for reclaimed HFCs received from companies providing data have ranged from 30% to 100% of the virgin substance price, while the price is usually at the lower end of this range in cases where the companies provided the recovered gases themselves and only paid for the reclamation. Feedback from the market has yielded conflicting information on the availability of reclaimed gases, which reflects the reality of a (growing) niche market that is not yet widely available to all users and across the Union.

3. Other factors for the availability of HFCs

3.1 Change of market structure

The patterns of the EU HFC market have changed over the last five years. The HFC bulk market has grown from just over 100 companies, including a few dominant gas suppliers, to some 2500 entities, many of which hold only small amounts of quota. This has had a profound impact on the traditional supply chain, in particular on traditional tier-one distributors which may have lost market shares to new competitors. Furthermore, there has also been increased quota transfer activities in the F-gas Portal & HFC Licensing System. In addition, new entrants have become more efficient in using their full quotas in recent years.[19]

As result, buyers today have more options to obtain the desired HFCs. Competition from a high number of smaller players is also likely to reduce gas prices and contribute to some of the price reductions observed since the beginning of 2018. However, it is also apparent that many new players appear to belong to the same company groups and quota transfers are often made within these groups. Some quota holders are manufacturers or end-users that have chosen to import themselves instead of sourcing the gas from distributors in the EU. Also, the fragmentation of the supply chain may have raised transaction costs as many new entrants will require support to physically supply the product to end-users (e.g. REACH registration, custom brokers, ADR qualified delivery services, licensed storage facilities).

This change in market structure is also apparent when examining trade data such as EUROSTAT imports. A shift from Rotterdam to other EU ports is apparent from 2016 to

[18] See EEA F-gas Report 2019.

[19] European Environmental Agency (EEA). Fluorinated greenhouse gases 2019. EEA Report No 20/2019. Figure 5.2. https://www.eea.europa.eu/publications/fluorinated-greenhouse-gases-2019

2018. These concern legal imports as the total overall quantities as recorded by EUROSTAT match very well the quantities reported under the F-gas Regulation. By way of example, the recorded increase in imports into countries such as Poland is fully covered by the increase of quotas given out to companies based in Poland.

The increased number of companies is a concern for implementation because of the need to ensure that these are legitimate companies that comply with the Regulation. Effective enforcement and control of such a large number of market players poses an increased burden on authorities.

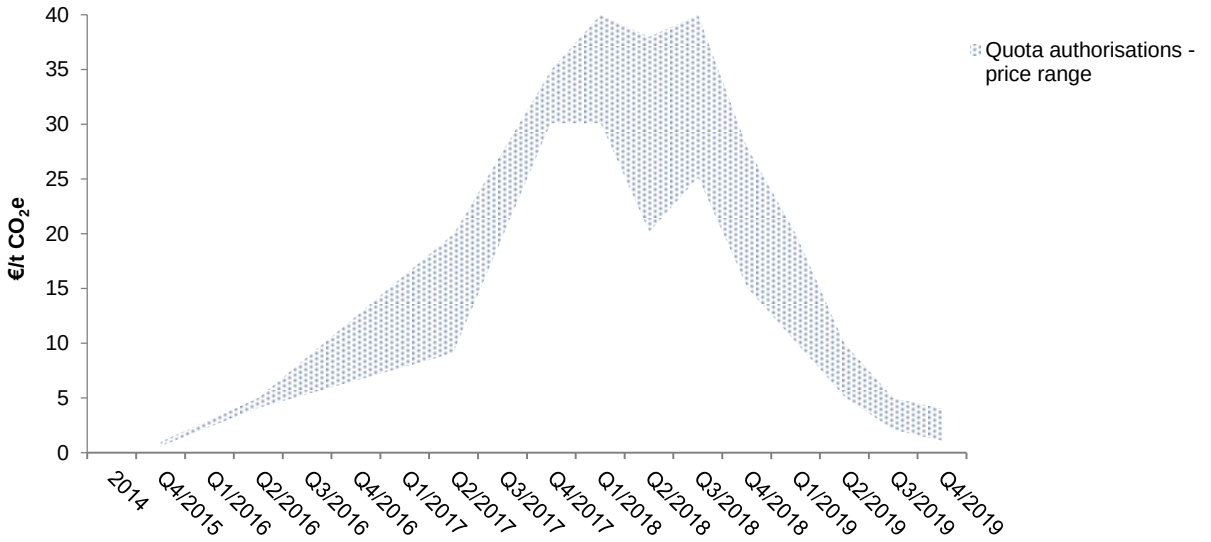
3.2 Effects on quota availability due to equipment pre-charged with HFCs

Refrigeration and air conditioning equipment that is pre-filled ("pre-charged") with HFCs when imported into the EU needs to be accounted for under the quota system since 1 January 2017. Importers of such equipment need to obtain quota authorisations from quota holders in order to cover their imports, thus affecting the total quantity of quotas available for bulk HFC imports (i.e. not in equipment). Authorisation prices rose in parallel to bulk HFC prices until mid-2018 and some participating companies reported that prices reached a level of over 40 €/t CO_2 equivalent. Since then, prices have fallen significantly to 1-4 €/t CO_2e at the end of 2019, which is comparable to 2015 prices (Figure 5). Given that authorisation prices are linked to quota scarcity, they can also be seen as a possible indicator of the likelihood of gas availability issues. The reported shortages by some market players in 2017/2018 coincided with peaks of authorisation prices. In 2018, equipment importers had built up a reserve of 2.5 times the quantity of authorisations used in 2018 in preparation for future years, which was equivalent to 36% of the 2019 maximum quota allocation.[15] This quantity can serve as a buffer in case gas prices should rise significantly in the near future, and should prevent that quota needed for bulk HFC provision would be used up by equipment importers to a relevant degree in coming years.

Furthermore, according to the latest EEA report, equipment imports represent only about 10% of the total imported amount (based on CO_2 equivalent). There has been a decrease between 2016 and 2018[20] in total imports of refrigeration and air conditioning equipment with HFCs in CO_2 equivalent, largely as a result of the ongoing switch to R32 with medium GWP (675) (from the previously used R410A (GWP of 2088)). This switch will also help that the authorisation reserve will last longer and that there would be little drain on the bulk HFC quota in the next years.

[20] From 19.2 (2016) to 14.9 (2018) million tonnes CO_2 equivalents (i.e. 22% decrease)

Figure 5: Development of quota authorisation prices since 2015 (price range, in €/t CO_2 equivalent)



3.3 Stockpiling

A number of stakeholders indicated, as reasons for the price reductions observed in 2018, that there was an oversupply of HFCs and consequently a low demand due to the stockpiling of HFCs in 2017 in preparation for the steep phase-down step in 2018. This "rational" behaviour by market players mirrored the large stockpiling that took place in 2014 in anticipation of the phase-down measure. Poland collected data on 2017 stockpiling at national level and found that quantities four times the annual Polish market were put in stock in preparation for the 2018 phase-down step. Industry confirmed that throughout the Union it was consistently observed that the availability of gas bottles became sparse in 2017 as distributors/users were stocking them in large amounts rather than using the gas and returning the bottles for refilling. Conversely, during 2019 companies were said to be rather reluctant to build up stocks and some companies raised concerns regarding uncertain future price and market developments. These activities can further explain the occurrence of the availability issues that were observed in late 2017 and the mitigation of these issues the following year, including the decline of prices.

3.4 Illegal imports

There is clear evidence of illegal imports of HFCs into the EU, a behaviour incentivised by the high EU prices seen in 2017 and early 2018 compared to the world market. Customs have increasingly been seizing illegal shipments as border enforcement is being ramped up. The European Anti-Fraud Office, OLAF, is investigating a number of leads of criminal activities. Some industry stakeholders maintain that the observed gas price decreases are to a large degree the result of illegal imports and their ready availability on the EU market, in particular in the case of R134a, which is used in significant quantities in the passenger car sector to service air conditioners. At this moment in time, and based on the data available, it appears that imports outside the quota system are mainly in the form of customs evasion ("smuggling"), since quantities for imports in EUROSTAT and F-gas Regulation reporting data match closely. Industry has pointed to discrepancies between Chinese export data and EU import data for some years (2018) as well as increasing imports to EU neighbouring

countries as reasons for concern. However, given that such discrepancies are not uncommon in international trade statistics and are often related to trade (re-)routing, it does not appear feasible on the basis of this data alone to make a sound quantification of the extent of illegal imports and hence their relevance for the price development and Union gas availability. Nonetheless, the Commission is taking these claims very seriously and is working together with industry and the Member States to put a stop to such activities. That these actions are having an effect was already confirmed in Poland where seizures of illegal HFCs by border controls, while maintaining the same intensity of effort, declined very significantly between 2018 and 2019.

4. Conclusions

There is currently no shortage of HFCs on the Union market, as a technology shift to lower global warming alternatives is ongoing and many such alternatives are available in sufficient volumes. Prices have come down from their peak in 2018 but innovation continues to bring new technologies to the market, in particular because more ambitious phase-down steps are in place. The reasons for declining prices from the 2018 peak include the successful transition to alternatives in some important sectors, better leakage prevention and higher reclamation rates, stock building in 2017 to prepare for the 2018 phase-down step, and the change of traditional supply chains. In addition, illegal imports would come on top of the legal supply of HFCs to the EU market and may also have had an effect on price levels in 2018. It will be important to closely continue monitoring the market and gas prices going forward, as well as effectively prevent any illegal activities, in particular as another phase-down step (to 45% of the 2015 baseline) is foreseen for 2021. The EU Customs Single Window – Certificate Exchange (EU CSW-CERTEX) project should, from 2021 onwards, greatly support these efforts by introducing automatic checks at customs of requirements under the F-gas Regulation.