

BASELINES: PAST PRACTICES AND CURRENT CHALLENGES

1. Scope of the Briefing Note

In 2015, at their Twenty-Seventh Meeting, the parties decided in decision XXVII/1 entitled “Dubai pathway on HFCs” to “work within the Montreal Protocol to an HFC amendment in 2016 by first resolving challenges by generating solutions in the contact group on the feasibility and ways of managing HFCs”.

The purpose of this briefing note is to provide background information about the following areas:

- The baselines agreed under the Montreal Protocol to date for CFCs, carbon tetrachloride, HCFCs and methyl bromide, as examples, in both non-Article 5 and Article 5 parties;
- The time lag between the year in which a decision was taken and the years of the baseline and initial control measures;
- The baselines that have been put forward in the HFC amendment proposals.¹

The information in this note is intended only as background material for the parties; it is not intended to be exhaustive and does not provide policy recommendations.

2. Existing baselines for ozone depleting substances

For almost all groups of ozone depleting substances (ODS)² controlled under the Montreal Protocol, the parties have established baselines with the aim of providing a benchmark or reference level for any control measures relating to production and consumption, such as a freeze or reduction steps. This section provides information on the Articles of the Montreal Protocol that are relevant to baselines; the elements used for baselines; the baseline years adopted for various ODS groups; and the time lag between the year in which a decision was taken and the years of the baseline and initial control measures.

2.1 Legal context and Articles relevant to baselines

Although the terms baseline and base level are commonly used in practice, these terms are not used in the Articles of the Protocol. Instead, when referring to the benchmarks necessary for determining the consumption and production levels allowed by control measures, the Articles have used phrases such as:

- ‘base year’ (Article 5(1 bis));
- ‘... the basis for determining [a party’s] compliance with the control measures relating to’ consumption or production (Article 5(3));

¹ UNEP/OzL.Pro.WG.1/resumed.37/3 and Add.1, UNEP/OzL.Pro.WG.1/38/3 and Add.1, UNEP/OzL.Pro.ExMOP/3/3 and Add.1, UNEP/OzL.Pro.28/5 and Add.1,

UNEP/OzL.Pro.WG.1/resumed.37/4, UNEP/OzL.Pro.WG.1/38/4, UNEP/OzL.Pro.ExMOP/3/4 and UNEP/OzL.Pro.28/6, UNEP/OzL.Pro.WG.1/resumed.37/5, UNEP/OzL.Pro.WG.1/38/5, UNEP/OzL.Pro.ExMOP/3/5 and UNEP/OzL.Pro.28/7, UNEP/OzL.Pro.WG.1/resumed.37/6, UNEP/OzL.Pro.WG.1/38/6, UNEP/OzL.Pro.ExMOP/3/6, and UNEP/OzL.Pro.28/8.

² The parties did not establish baselines or reduction steps for bromochloromethane and HBFCs; they adopted only phase-out dates.

- each party ‘shall ensure that’ consumption and production ‘does not exceed’ the consumption or production level in a specific year or years (used for all ODS baselines in Articles 2A - 2F and 2H, and Article 5(8ter)).

Baselines for controlled substances have been introduced into the Montreal Protocol, either in the original Protocol text or by amendments, at the same time as the initial control measures for new controlled substances were adopted. Some ODS baselines have also been revised through adjustments. The Articles of the Vienna Convention and Montreal Protocol do not contain any text that specifies how parties should determine baselines when adopting the baselines for controlled substances. The Meetings of the Parties have, therefore, been free to define in amendments or adjustments the baselines in ways that they considered appropriate (subject, of course, to the normal legal procedures for adopting amendments and adjustments and the rules of procedure for meetings).

The original paragraphs setting out Non-A5 control measures and associated baselines for Annex A substances (CFCs and halons) were included in Article 2 of the original 1987 text of the Montreal Protocol. The paragraphs that defined Non-A5 control measures and baselines for all subsequent new groups of ODS were also inserted into Article 2 (creating Articles 2A –2I) by various amendments.

The paragraphs that set out initial A5 baselines and related special provisions were included in Article 5 of the 1987 text. Subsequently, the baselines for A5 parties were defined by inserting or revising text in Article 5. For most groups of ODS, the text provided time lags for A5 parties’ implementation of the control measures set out in Article 2. However, in the case of HCFCs and methyl bromide, the A5 parties’ control measures were specified primarily within the text of Article 5 itself, instead of referring to the text of Article 2. Both approaches have the same effect in terms of defining the control measures for A5 parties. The method used for calculating the control levels, from which the baselines are derived, is set out in Article 3 on “*Calculation of control levels*”.

2.2 Elements of ODS baselines

Baselines may contain different elements and different forms of baselines have been adopted as benchmarks for a party’s compliance with the ODS control measures.

Most baselines are based on the consumption or production in a specific year or years:

- ODS consumption or production in a single specific year. Adopted in the baselines for CFCs, CTC and methyl bromide in Non-A5 parties, for example.
- Average annual ODS consumption or production during several years. Adopted in the baselines for CFCs, CTC and methyl bromide in A5 parties, for example.

Most baselines are defined by the consumption or production of one ODS group only; however, other elements have also been adopted:

- Baselines based only on the ODS group that is being regulated; the CFC consumption baseline, for example, is based on CFC consumption only (no other substances). Adopted in the baselines for most ODS, such as CFCs, CTC and methyl bromide in A5 parties and Non-A5 parties.
- Baselines composed of two ODS groups: the ODS group to which the baseline refers, plus another group that has a strong technological relationship with it. In the case of HCFCs, the consumption baseline in Non-A5 parties includes both HCFC consumption and a percentage of CFC consumption.

Baselines composed of both consumption and production:

- The initial production baseline for HCFCs in A5 parties was defined as average HCFC production and HCFC consumption in 2015 (later adjusted to average production in 2009-10). The Non-A5 HCFC production baseline was defined as the average of 1989 HCFC production + 2.8% of 1989 CFC production and 1989 HCFC consumption + 2.8% of 1989 CFC consumption.

For most groups of ODS the consumption and the production baselines have been based on the same elements and same years. For example, the baselines for consumption and production are the same in the case of CFCs, halons, CTC, methyl chloroform, and methyl bromide. However, the parties adopted different baseline elements for consumption and production in the case of HCFCs, as illustrated above. Section 3 provides further information.

2.3 ODS baseline years

The year or years chosen for baselines have varied from one ODS group to another, depending on a number of different technical, policy, financial and environmental factors considered by parties at the time the decision was made. Tables 1 and 2 below summarize the baselines and the year when MOP adopted the baselines, for selected ODS - CFCs, CTC, methyl bromide and HCFCs – as examples. They also show the time lag (number of years) between the decision year, the baseline year, and the year of the first control measure, to illustrate the various time periods and relationships between baselines and initial control measures.

Single year or average of several years: As noted above, ODS baselines in Non-A5 parties have generally been based on consumption or production in a single year, while baselines adopted in A5 parties have generally been based on the average of several years. The latter approach was usually intended to assist A5 parties in addressing periods of growth in ODS use, and/or situations where ODS use may fluctuate from year to year (as in the case of methyl bromide, for example), although growth pressures and fluctuations have existed in both A5 and Non-A5 parties.

Past or future baseline years: The baselines adopted for Non-A5 parties were often based on a recent year in the past, as illustrated in Table 1. For most groups of ODS, the Non-A5 baseline was set one year in the past, i.e. the year preceding the year in which the MOP decision was made. For HCFCs, the consumption and production baselines for Non-A5 parties were set 3 and 10 years, respectively, in the past (shown in Table 2, below). In contrast, the baselines adopted for A5 parties were generally set in the future. For example, the CFC A5 baseline was set 8 – 10 years in the future, while the methyl bromide A5 baseline was set 0 – 3 years in the future, as shown in Table 1 below.

Time lag between the baseline years of Non-A5 and A5 parties: The time lag (number of years) between the baseline years for Non-A5 parties and for A5 parties, has varied from one group of ODS to another. The time lag between Non-A5 and A5 baselines was 9 - 11 years for Annex A CFCs, Annex B other fully halogenated CFCs and CTC, 4 - 7 years for methyl bromide, and 20 to 21 years (initially 26 years) for HCFCs (Tables 1 and 2). Section 3 below provides further information.

Time lag between the baseline year and initial control measures: As noted above, baselines provide a benchmark for control measures. The length of the time lag between the baseline year and the first control measure, or between the decision year and the first control measure, influences the growth that could occur in the consumption / production of a substance before the initial control comes into force. A longer time lag that occurs in the future years (i.e. after the decision year) would allow greater growth to take place. The growth that occurs before the baseline year would be part of the consumption / production baseline while the growth that occurs after the baseline year would have to be reduced to comply with the requirement of the first control measure.

In Non-A5 parties, the number of years between the consumption baseline and the first control measure (namely, a freeze or initial reduction step) varied from 3 years for Annex A CFCs, 6 years for CTC, 4 years for methyl bromide, and 7 years for HCFC consumption, for example³ (Tables 1 and 2). The time periods between the baseline years and the first control measures also varied in a similar manner for A5 parties. The number of years between the consumption baseline and the first control measure in A5 parties varied from 2 - 4 years for Annex A CFCs, 5 - 7 years for CTC, 4 - 7 years for methyl bromide, and 3 - 4 years for HCFC consumption,⁴ for example (Tables 1 and 2). Section 3 below provides further illustrations.

³ The time period between the HCFC production baseline and first control measure was 15 years because the baseline was set 10 years in the past (1989), to mirror the existing HCFC consumption baseline.

⁴ The HCFC time period was reduced later, when the control measures for HCFC were accelerated in 2007.

Table 1: Baseline years for CFCs and selected ODS, year of decision, and year of first control measure⁵			
CFCs Annex A Gp I	Non-A5 parties	A5 parties	Years between A5 and Non-A5 provisions
Year of decision	1987 ⁽¹⁾	1987 ⁽¹⁾	nil
Baseline elements & year	Consumption or production in 1986	Average consumption in 1995-1997 ⁽²⁾	9 – 11 years
First control measure	1989 (freeze) ⁽³⁾	1999 (freeze)	10 years
Time between baseline and first control measure ⁽⁴⁾	3 years	2 – 4 years	-
Time between decision year & baseline year ⁽⁴⁾	1 year in past	8 – 10 years in future	-
Time between decision year & first control measure ⁽⁴⁾	2 years in future ⁽³⁾	12 years in future	-
Other CFCs Annex B Gp I			
Year of MOP decision	1990 ⁽⁵⁾	1990 ⁽⁵⁾	nil
Baseline elements & year	Consumption or production in 1989	Average consumption in 1998-2000 ⁽⁶⁾	9 – 11 years
First control measure	1993 (20% reduction)	2003 (20% reduction)	10 years
Time between baseline and first control measure	4 years	3 – 5 years	-
Time between decision year & baseline year	1 year in past	8 – 10 years in future	-
Time between decision year & first control measure	3 years in future	13 years in future	-
CTC			
Year of MOP decision	1990 ⁽⁵⁾	1990 ⁽⁵⁾	Nil
Baseline elements & year	Consumption or production in 1989	Average consumption in 1998-2000 ⁽⁷⁾	9 – 11 years
First control measure	1995 (85% reduction)	2005 (85% reduction)	10 years
Time between baseline and first control measure	6 years	5 – 7 years	-
Time between decision year & baseline year	1 year in past	8 – 10 years in future	-
Time between decision year & first control measure	5 years in future	15 years in future	-
Methyl bromide			
Year of MOP decision	1992 ⁽⁸⁾	1995 ⁽⁹⁾	3 years
Baseline elements & year	Consumption or production in 1991	Average consumption or average production in 1995-1998	4 – 7 years
First control measure	1995 (freeze)	2002 (freeze)	7 years
Time between baseline and first control measure	4 years	4 – 7 years	-
Time between decision year & baseline year	1 year in past	0 – 3 years in future	-
Time between decision year & first control measure	3 years in future	7 years in future	-

(1) The Montreal Protocol of 1987.

(2) The CFC (Annex A) production baseline for A5 parties was introduced later, by the 1997 adjustments, with the same years as the A5 consumption baseline.

⁵ Consumption and production measured in ODP tonnes.

- (3) In 1987 the Parties agreed to freeze CFC consumption 7 months following the entry into force of the MP, and the resulting initial freeze date was July 1989.
- (4) For simplicity, the number of years between decisions, baseline years and first control measures has been calculated from mid-year to mid-year. This provides an indicative period of time.
- (5) 1990 London Amendment agreed at MOP2.
- (6) The CFC (Annex B) production baseline for A5 parties was introduced later, by the 1997 adjustments, with the same years as the A5 consumption baseline.
- (7) The CTC production baseline for A5 parties was introduced later, by the 1997 adjustments, with the same years as the A5 consumption baseline.
- (8) 1992 Copenhagen Amendment agreed at MOP4.
- (9) 1995 adjustments agreed at MOP7.

Table 2: Baseline years for HCFCs, year of decision, and year of first control measure⁶

HCFC consumption	Non-A5 parties	A5 parties		Years between A5 and Non-A5 provisions
		Initial decision	Revised decision	
Year of MOP decision	1992 ⁽¹⁾	1995 ⁽²⁾	2007 ⁽³⁾	3 / 15 years
Baseline elements & year	Sum of 1989 HCFC consumption + 2.8% of 1989 CFC consumption ⁽⁴⁾	Consumption in 2015	Average consumption in 2009-2010	26 / 20 – 21 years
First control measure	1996 (freeze)	2016 (freeze)	2013 (freeze)	20 / 17 years
Time between baseline and first control measure ⁽⁵⁾	7 years	1 year	3 – 4 years	-
Time between decision year & baseline year ⁽⁵⁾	3 years in past	20 years in future	2 – 3 years in future	-
Time between decision year & first control measure ⁽⁵⁾	4 years in future	21 years in future	6 years in future	-
HCFC production				
Year of MOP decision	1999 ⁽⁶⁾	1999 ⁽⁶⁾	2007 ⁽³⁾	0 / 8 years
Baseline elements & year	Average of 1989 HCFC production + 2.8% of 1989 CFC production and 1989 HCFC consumption + 2.8% of 1989 CFC consumption	Average HCFC production and consumption in 2015	Average production in 2009-2010	26 / 20 – 21 years
First control measure	2004 (freeze)	2016 (freeze)	2013 (freeze)	12 / 9 years
Time between baseline and first control measure	15 years ⁽⁷⁾	1 year	3 – 4 years	-
Time between decision year & baseline year	10 years in past	16 years in future	2 – 3 years in future	-
Time between decision year & first control measure	5 years in future	17 years in future	6 years in future	-

(1) 1992 Copenhagen Amendment agreed at MOP4.

(2) 1995 adjustments agreed at MOP7 (Vienna).

(3) 2007 adjustments agreed at MOP19 (Montreal).

(4) The baseline adopted in 1992 included 3.1% of 1989 CFC consumption. In 1995 this was adjusted downward to 2.8%.

(5) For simplicity, the number of years between decisions, baseline years and first control measures has been calculated from mid-year to mid-year. This provides an indicative period of time

(6) 1999 Beijing Amendment agreed at MOP11.

(7) The time period between the baseline and first control measure appears unusually long because the baseline for HCFC production was set 10 years in the past, in the same year as the CFC freeze (1989), because of the technological link between these two groups of substances.

⁶ Consumption and production measured in ODP tonnes.

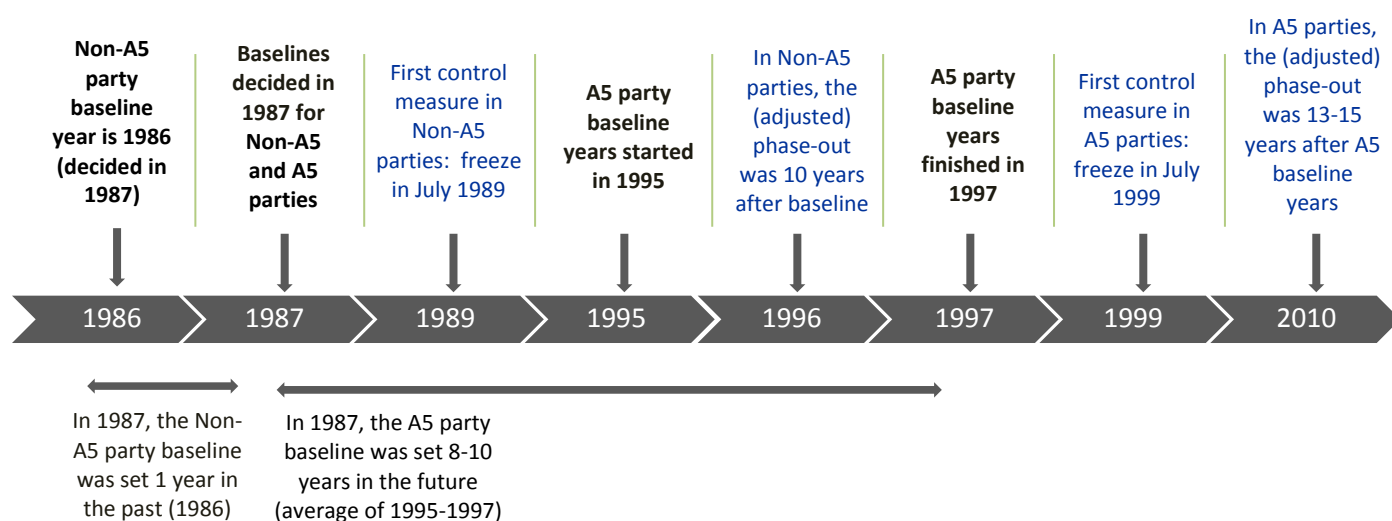
3. Evolution of ODS baselines

This section outlines the decisions taken by parties on the baselines for selected groups of ODS, as illustrative examples: Annex A CFCs, carbon tetrachloride (CTC), HCFCs and methyl bromide. The text also includes brief information about the initial control measures adopted for each group of ODS, to illustrate the variations in the period of time (number of years) between the baseline year(s) and the initial control measures.

3.1 Baselines for Annex A CFCs

Figure 1 below provides a schematic representation of the sequence of MOP decisions relating to Annex A CFC consumption baselines in Non-A5 and A5 parties. The figure also includes the first control measures, and the final CFC phase-out dates to illustrate the overall timescale.

Figure 1: Timeline of baseline decisions and key control dates for Annex A CFC consumption⁷



Non-A5 baseline for CFC consumption: When developing the original Protocol text of 1987 the negotiating countries faced major differences in opinions.⁸ They set up four working groups to deal with the most difficult issues; one of these working groups addressed control measures and baselines.

The eventual text adopted in 1987 established a consumption (and production) baseline for Annex A CFCs for non-A5 parties, as well as a freeze and two reduction steps.⁹ The baseline year for Non-A5 parties was set at 1986, one year in the past, even though consumption data from Non-A5 parties was limited. A historic baseline year was chosen to prevent countries increasing their consumption (or production) in order to increase their baseline level. In addition, the parties wished to send a clear signal to industry that it was necessary to take urgent steps to protect the ozone layer, as a precautionary measure.

It was not feasible to base the baseline on reliable data at that time, because no formal CFC data reporting existed (notably, even by 1989-1990 the reported data for 1986 CFC consumption was not reliable). Conscious of this fact, the parties inserted clauses in Article 7 that would allow parties to report ‘the best possible estimates’ of statistical ODS data for baseline years ‘where actual data are not available’ (Article 7, paragraphs 1 and 2).

⁷ Fig.1 refers to consumption baselines only. It includes the final CFC phase out dates in order to illustrate the total timescale. Table 1 refers to information on production baselines.

⁸ Tolba, MK & Rummel-Bulska, I, in Kaniaru, D (ed.) *The Montreal Protocol*, 2007, Cameron May, London, p.29-33.

⁹ The 1987 Protocol text included a 20% reduction step by July 1993, and 50% reduction by July 1998 for Non-A5 parties.

The CFC freeze for Non-A5 parties was scheduled at 7 months following the entry into force of the Montreal Protocol, resulting in a freeze date of 1 July 1989, 3 years later than the Non-A5 baseline year. In 1990 and 1992, in response to increased scientific concern and rapid technical progress in alternatives, the parties accelerated the CFC control measures through adjustments;¹⁰ however the baseline year was not changed. As a result, the final phase-out year (1996) occurred 10 years after the baseline year (1986).

A5 baseline for CFC consumption: In 1986, A5 parties consumed a small percentage of CFCs while Non-A5 parties accounted for about 90% of global CFC consumption, and the latter was seen as the major issue to be addressed. The debates leading up to the adoption of the Protocol in 1987 developed the concept that contributions for supporting the implementation of the Protocol should be commensurate with the amount of CFCs produced and used.¹¹ The 1987 text included other important concepts: that A5 parties should be able to meet their basic domestic needs; access to environmentally safe alternatives; the provision of subsidies, aid, credits etc. for the use of alternatives; and technical assistance (Articles 5 and 10 in the 1987 text).

The final text of Article 5 in 1987 included a ten-year delay in Article 5 parties' implementation of the control measures for Annex A CFCs in Non-A5 parties (set out in Article 2¹²) in order to meet their basic domestic needs.¹³ The 1987 text also specified two different parameters for determining the baselines for Annex A substances in A5 parties: either the average annual consumption for 1995-1997, or a consumption level of 0.3 kg per capita, whichever was lower.

The A5 consumption baseline years of 1995-97 were set 8 - 10 years into the future. The freeze date in Article 2 applied about 10 years later to A5 parties in the case of CFCs. The 1987 text also adopted (in effect) a cap on CFCs in A5 parties, by limiting annual consumption to a maximum of 0.3 kg/capita.

The 1990 London Amendment¹⁴ acknowledged that special provisions were required to meet the needs of developing countries, and expanded the Protocol text to include a financial mechanism (Article 10) and transfer of technology (Article 10A) to enable A5 parties to comply with control measures, leading to the establishment of the Multilateral Fund.

When the Annex A CFC control measures were accelerated by adjustments, the revised Non-A5 reduction steps and phase-out date also applied to A5 parties, with the 10-year delay specified in Article 5. However, in 1995 the Vienna adjustments reset the CFC measures for A5 parties, specifying to use the control measures adopted in 1990, not 1992, as the basis for the 10 year delay.

Production baselines for Annex A CFCs: Although all parties have consumed ODS, a limited number of parties have produced ODS. In 1986, only about 5% of global CFC production occurred in A5 countries.¹⁵ In total, about 14 Non-A5 and 9 A5 parties reported production of CFCs in the period 1989-1996.

The CFC production baseline for Non-A5 parties was adopted in the original Protocol text of 1987, using the same base year as the consumption baseline (1986). The 1987 provisions also set a cap on CFC production (Annex A substances) in facilities that were already under construction or contracted for, and provided for in national legislation in Non-A5 parties (under specific circumstances only)¹⁶ allowing the production from such facilities to be

¹⁰ The accelerated CFC measures included a 75% reduction by 1994 and phase-out by 1996 for Non-A5 parties.

¹¹ Tolba & Rummel-Bulska (above), p.33.

¹² At that time, this referred to compliance with the control measures for Annex A substances set out in Article 2.

¹³ The 10 year delay was applicable to any party that is a developing country and whose annual consumption of Annex A substances was less than 0.3 kg per capita for a specified period of time (Article 5(1) of the 1987 Protocol).

¹⁴ The 1990 London Amendment agreed by MOP2.

¹⁵ Tolba & Rummel-Bulska (above), p.30.

¹⁶ This clause applied only to production facilities that were under construction, or contracted for, prior to 16 September 1987, and provided for in national legislation prior to 1 January 1987, and also completed by 31 December 1990 (Article 2(6) of the 1987 Montreal Protocol).

added into a party's 1986 baseline, provided that such production did not raise the party's annual CFC consumption above 0.5 kg per capita.

The 1997 adjustments¹⁷ specified two different parameters for calculating the production baseline for CFCs (Annex A substances) in an A5 party: either the average production in 1995-1997, or a production level of 0.3 kg/capita, whichever was lower.¹⁸

3.2 Baselines for carbon tetrachloride

Non-A5 baseline for CTC consumption: Following further scientific evidence about the extent of ozone layer depletion, the 1990 London Amendment¹⁹ added control measures for carbon tetrachloride (CTC) and several other substances.²⁰ 1989 was adopted as the baseline year for Non-A5 parties, with a rapid 85% reduction step by 1995 (within 5 years) and phase-out (within 10 years).

The parties did not adopt a freeze, because a rapid reduction step was seen as technically and economically feasible. A historic baseline was selected, as for CFCs. The data on production and consumption of CTC was limited in 1990, and could not provide a clear basis for determining the baseline and therefore the baseline was largely a policy decision.

A5 baseline for CTC consumption: When control measures were adopted for CTC in the 1990 London Amendment, Article 5 was also amended so that an A5 party was entitled to delay its compliance with the control measures for 10 years in order to meet basic domestic needs. Mirroring the controls in Non-A5 parties with a 10-year delay, the first control measure for CTC in A5 parties was an 85% reduction step in 2005. In addition to not exceeding 0.3kg per capita limit for Annex A substances, A5 parties were not permitted to exceed an annual consumption level of 0.2 kg per capita of Annex B substances.

Article 5 of the 1990 London Amendment also set out two parameters for determining the baseline for CTC consumption in A5 parties (Annex B substances): either the average CTC consumption in 1998-2000, or a consumption level of 0.2 kg/capita, whichever was lower.²¹

Production baselines for CTC: The Non-A5 production baseline for CTC was adopted by the 1990 London Amendment, at the same time as the consumption baseline, and based on the same year (1989).

The 1997 adjustments²² specified two different parameters for calculating the CTC production baseline (Annex B substances) for A5 parties: either the average production in 1998-2000, or a production level of 0.2 kg/capita, whichever was lower.²³

3.3 Baselines for HCFCs

Figure 2 below presents a schematic representation of MOP decisions relating to HCFC consumption baselines for Non-A5 and A5 parties. The figure also includes the first control measures to illustrate the time period between decisions, baselines and the initial control measures in this ODS group.

¹⁷ 1997 adjustments agreed at MOP9.

¹⁸ Added to Article 5(3) by the 1997 adjustments.

¹⁹ The 1990 London Amendment agreed by MOP2.

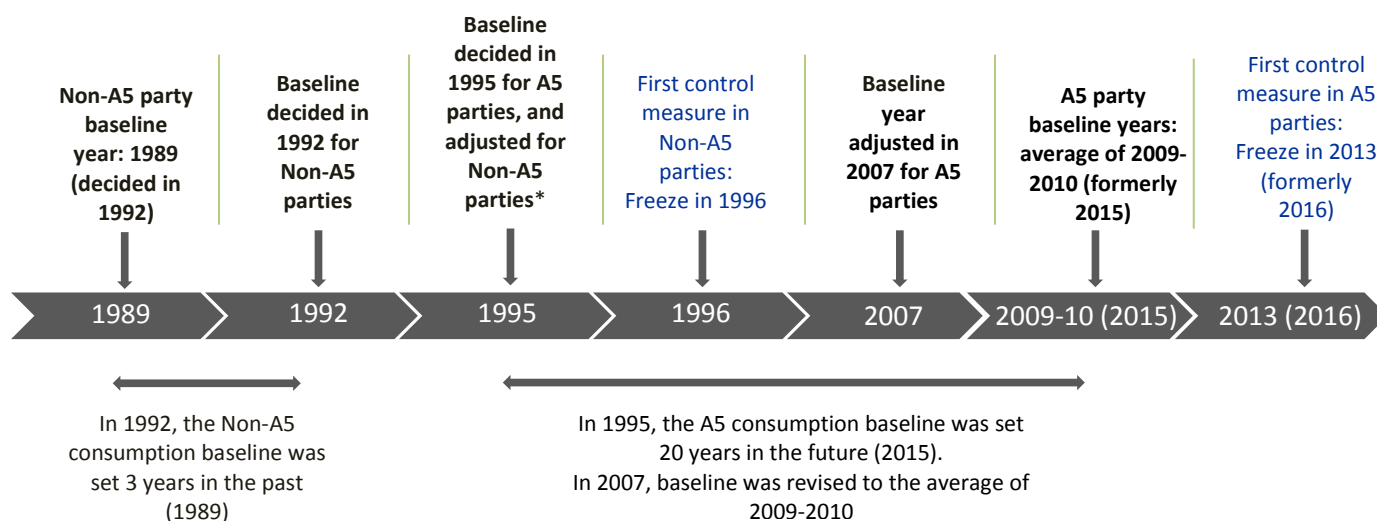
²⁰ Other fully halogenated CFCs and methyl chloroform.

²¹ Article 5(3) in the text of the 1990 London Amendment.

²² 1997 adjustments agreed at MOP9.

²³ Added to Article 5(3) by the 1997 adjustments.

Figure 2: Timeline of baseline decisions and first control measures for HCFC consumption



* In 1995 the CFC component of the Non-A5 HCFC baseline was reduced from 3.1% to 2.8%

Non-A5 baseline for HCFC consumption: Negotiations on HCFCs started before 1990, including discussions on reporting and future phase-out.²⁴ Initially, under the 1990 London Amendment, HCFCs were defined as transitional substances with only the requirement to report data under Article 7. Control measures were adopted for HCFCs by the 1992 Copenhagen Amendment, including a baseline for Non-A5 parties. The baseline was calculated as the sum of 1989 HCFC consumption + 3.1% of 1989 CFC consumption for Non-A5 parties. The 1995 adjustments subsequently reduced the percentage from 3.1% to 2.8%.²⁵

The approach adopted for the HCFC baseline differed from previous ODS baselines which had been based on the regulated ODS group only. When setting the HCFC baseline, the parties decided to combine HCFC consumption with CFC consumption on the grounds that a portion of the 1989²⁶ CFC consumption would need to transition to HCFCs. It was clear in 1992 that some CFC uses would need to switch to HCFCs, other uses would switch to HFCs or other chemicals, while a number of uses would switch to not-in-kind alternatives. The parties considered that the baseline calculation needed to account for the necessary switch from CFCs to HCFCs.

The baseline component of 3.1% CFCs (later 2.8%) was determined by making approximate calculations in metric tonnes, taking into account the ODPs of the substances. For example, it was generally assumed that, from 1989, a portion of CFCs would transition to HCFCs (in metric tonnes) at an average ODP of 0.05-0.06, estimated to be approximately 3% of CFC consumption around 1989. This could also comprise a mix of foam HCFCs with ODPs of 0.11 and 0.065 (average around 0.08), some HCFC-22 at ODP 0.055, and some uses of HCFCs with ODPs of 0.02-0.04. Such calculations resulted in an estimated shift from CFCs to HCFCs amounting to approximately 3% of CFC consumption.

The year chosen for the baseline of the Non-A5 parties, however, was similar to past practices; it was set 3 years in the past (in 1989), although the data on HCFCs were incomplete. As with CFCs, realistic data for specific HCFC substances were not available, and the baseline was largely a policy decision. In the same manner as for other ODS

²⁴ Tolba & Rummel-Bulska (above).

²⁵ 1995 adjustments agreed at MoP7 (Vienna).

²⁶ 1989 was the year in which the CFC freeze started in Non-A5 parties.

groups, Article 7 allowed a party to submit ‘the best possible estimates’ of HCFC baseline data ‘where actual data are not available’ (Article 7(2))²⁷.

When establishing the consumption baseline, the 1992 Copenhagen Amendment²⁸ also introduced a freeze on HCFC consumption in Non-A5 parties starting in 1996 (4 years later), as well as a series of reduction steps and phase-out by 2030. When the parties decided to accelerate the phase-out of HCFCs in the 2007 adjustments,²⁹ the baseline year (1989) remained unchanged in Non-A5 parties.

A5 baseline for HCFC consumption: HCFC control measures were not adopted for A5 parties when controls were adopted for Non-A5 parties by the 1992 Copenhagen Amendment. However, at that time, a clause was added in Article 5, noting that the parties would decide by 1996 the HCFC consumption baseline year and control schedules that would apply in A5 parties, taking into account a review and assessments (under Articles 5 and 6) and other relevant information.

Accordingly, the 1995 adjustments³⁰ introduced a baseline of 2015 for HCFC consumption in A5 parties, as well as a freeze in 2016 and phase-out by 2040. Unusually, the clauses specifying the control measures for A5 parties were inserted directly into the text of Article 5, rather than making reference to the control measures set out in Article 2.

When the HCFC control measures were accelerated by the 2007 adjustments,³¹ the baseline year was changed – it was brought forward to the average of 2009-2010. The freeze was revised to 2013, further reduction steps were added, and the phase-out date was adjusted to 2030 with a servicing tail up to 2040.

Production baselines for HCFCs: In the 1990s, about 20 parties reported production of HCFCs. The 1999 Beijing Amendment³² introduced an HCFC production baseline for Non-A5 parties, calculated as the average of the sum of 1989 HCFC consumption + 2.8 per cent of 1989 CFC consumption and the sum of 1989 HCFC production + 2.8 per cent of 1989 CFC production. The 2.8 per cent figure reflected the 2.8 per cent used in the consumption baseline for Non-A5 parties. The amendment also adopted a production freeze by 2004 without any reduction steps. Subsequently, the 2007 adjustments introduced reduction steps and a production phase-out in Non-A5 parties by 2020 with a servicing tail up to 2030.

Under the 1999 Beijing Amendment, a baseline and freeze were also adopted for production in A5 parties. The production baseline in A5 parties was initially set as the average of HCFC production and consumption in 2015 (26 years later than the Non-A5 baseline year). When HCFC control measures were accelerated by the 2007 adjustments, the A5 baseline was also brought forward and set as the average production in 2009-2010 (in tandem with the consumption baseline), the consumption phase out schedule was brought forward and the production phase out schedule was set.

3.4 Baselines for methyl bromide

Non-A5 baseline for MB consumption: Initial control measures for methyl bromide (MB) were added to the Protocol by the 1992 Copenhagen Amendment. As with previous ODS, the base year was set in a prior year (1991), with a freeze by 1995 in Non-A5 parties.

²⁷ Article 7, para. 1-2, required all parties to provide data or best possible estimates for each ODS groups in a specific year (1986, 1989 or 1991). The specified years were the baseline years of Non-A5 parties although all parties had to submit the information.

²⁸ The 1992 Copenhagen Amendment inserted a new Article 2F, setting out control measures for HCFCs.

²⁹ 2007 adjustments agreed at MOP19.

³⁰ 1995 adjustments agreed in decision VII/3 at MOP7 (Vienna).

³¹ 2007 adjustments agreed in decision XIX/6 at MOP19 (Montreal).

³² The 1999 Beijing Amendment agreed by MOP11.

The 1995 adjustments³³ added further control measures for MB in Non-A5 parties, namely several reduction steps and phase-out by 2010. The baseline year remained unchanged at 1991. The MB phase-out date was accelerated to 2005 in Non-A5 parties by the 1997 adjustments³⁴, which also adjusted the reduction schedule.

A5 baseline for MB consumption: When controls on MB were adopted for Non-A5 parties by the 1992 Copenhagen Amendment, a clause was added in Article 5, noting that the parties would decide by 1996 the base year and control schedules that would apply in A5 parties, taking into account a review and assessments (under Articles 5 and 6) and other relevant information.

The 1995 adjustments introduced a baseline and freeze for MB consumption in A5 parties. As for previous ODS groups, the parties established the baseline for A5 parties in future years (1995-98), and set a freeze date of 2002 (7 years in the future), allowing increased consumption for several years. As with HCFCs, the text defining the MB control measure for A5 parties was inserted directly into Article 5 rather than making reference to the control measures set out in Article 2 (the approach used for Annex A and B substances). The phase-out date was set at 2015 in A5 parties by the 1997 adjustments.

Production baselines for MB: The 1992 Copenhagen Amendment introduced a baseline and freeze for MB production in Non-A5 parties. As for previous ODS groups, the parties established the baseline for Non-A5 parties in the recent past (1991), and set a freeze date of 1995 (3 years in the future). The 1995 adjustments added reduction steps and a phase-out date for production, matching the schedule for consumption, and the Non-A5 production baseline (1991) remained the same.

The 1995 adjustments also adopted a production baseline and freeze for MB production in A5 parties, mirroring the dates adopted for consumption. As for previous ODS groups, the parties established the production baseline for A5 parties in future years (1995-98), and set the freeze date 7 years in the future, allowing increased production for several years.

4. Baseline provisions included in the HFC amendment proposals

All of the tabled HFC amendment proposals contain the following elements relating to baselines:³⁵

- Proposed text that would define HFC baselines for Non-A5 parties;
- Proposed text that would define HFC baselines for A5 parties;
- Baselines expressed in CO₂-eq.;
- A proposed method for converting metric tonnes to CO₂-eq. (Article 3).

The consumption and production baselines in all of the proposals are defined in a manner similar to the baselines for HCFCs, using a combination of two components:

- The average HFC consumption/production in specific years;
- Plus a percentage of an HCFC component related to consumption/production (average) in specific years.

³³ 1995 adjustments agreed at MOP7.

³⁴ 1997 adjustments agreed at MOP9.

³⁵ The North American proposal put forward by Canada, Mexico and the United States of America: <http://conf.montreal-protocol.org/meeting/oewg/oewg-37/presession/English/OEWG-37-3E.pdf>; The Indian proposal put forward by India: <http://conf.montreal-protocol.org/meeting/oewg/oewg-37/presession/English/OEWG-37-4E.pdf>; The European Union proposal put forward by the European Union on behalf of its 29 member States: <http://conf.montreal-protocol.org/meeting/oewg/oewg-37/presession/English/OEWG-37-5E.pdf>; and the Island States proposal put forward by Kiribati, Marshal Islands, Mauritius, Micronesia (Federated States of), Palau, Philippines, Samoa and Solomon Islands: <http://conf.montreal-protocol.org/meeting/oewg/oewg-37/presession/English/OEWG-37-6E.pdf>

The basis for including both HFCs and a percentage of HCFCs is because, while HCFCs are being phased-out, HFCs may be used as alternatives for some portion of HCFCs. The HCFC component is intended to account for this portion in the baseline.

All of the amendment proposals have put forward the same general recipe for calculating HFC consumption and production baselines, summarized in the following formula³⁶:

$$\text{Baseline} = \text{average HFC consumption / production in year } a \text{ to year } b + \left\{ \begin{array}{l} \text{x\% of average HCFC consumption / production in year } c \text{ to year } d \\ \text{or} \\ \text{x\% of HCFC consumption / production baseline} \end{array} \right\}^{37}$$

The amendment proposals have put forward three different parameters for defining the HCFC component:

- A percentage of the average HCFC consumption or production in specific years (North American proposal; European Union proposal for A5 parties). As far as consumption for A5 parties is concerned, the European Union baseline applies to the basket of HFCs and HCFCs. As far as production reduction steps is concerned, it only applies to HFCs;
- A percentage of the HCFC baseline consumption or baseline production³⁸ (Indian proposal, Island States proposal);
- A percentage of the average HCFC consumption or production allowed under the Protocol in specific years (European Union proposal for Non-A5 parties).

Tables 3 and 4 summarize the common and varying elements of the baseline calculations put forward in the HFC amendment proposals, for Non-A5 parties and for A5 parties, respectively. Further details are provided in the Annex.

Table 3: Elements of the baseline calculations put forward for Non-A5 parties in the HFC amendment proposals					
Non-A5 consumption baseline (CO ₂ eq) ³⁹	HFC component	HFC years (average)	HCFC component	% HCFC	HCFC years (average)
Indian proposal ⁽¹⁾	HFC consumption	2013 – 2015	% HCFC baseline consumption ⁽²⁾	25 %	1989 ⁽²⁾
Island States proposal	HFC consumption	2011 – 2013	% HCFC baseline consumption ⁽²⁾	10 %	1989 ⁽²⁾
North American proposal	HFC consumption	2011 – 2013	% HCFC consumption	75 %	2011 - 2013
European Union proposal	HFC consumption	2009 – 2012	% HCFC consumption allowed under the Protocol	45 %	2009 - 2012
Non-A5 production baseline (CO ₂ eq)	HFC component	HFC years (average)	HCFC component	% HCFC	HCFC years (average)

³⁶ As far as consumption for A5 parties is concerned, the European Union baseline applies to the basket of HFCs and HCFCs and not only to HFCs as it is the case with the other amendment proposals.

³⁷ Consumption / production allowed in a range of years (EU proposal) is a percentage of the baseline.

³⁸ HCFC consumption and production baselines for Non-A5 parties also include a percentage of past CFC consumption or production.

³⁹ Relating ODP tonnes to metric tonnes is in principle a similar mechanism as relating CO₂ eq. to metric tonnes. The only difference being that instead of multiplying the level of production and consumption by the ODP of the substances, it would be multiplied by their GWP.

All proposals	HFC Production	Same years as consumption	Same factors as above, applied to production	Same % as consumption	Same years as consumption
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¹ The chronological sequence of submission of the HFC amendment proposals has been altered in Table 3 in order to cluster the common elements put forward in the proposals.

² The HCFC baseline in Non-A5 parties is 1989 HCFC consumption + 2.8% of 1989 CFC consumption.

Table 4: Elements of the baseline calculations put forward for A5 parties in the HFC amendment proposals

A5 consumption baseline (CO₂eq)	HFC component	HFC years (average)	HCFC component	% HCFC	HCFC years (average)
Indian proposal ⁽¹⁾	HFC consumption	2028 – 2030	% HCFC baseline consumption ⁽²⁾	32.5 %	2009 – 2010 ⁽²⁾
Island States proposal	HFC consumption	2015 – 2017	% HCFC baseline consumption ⁽²⁾	65 %	2009 – 2010 ⁽²⁾
North American proposal	HFC consumption	2011 – 2013	% HCFC consumption	50%	2011 - 2013
European Union proposal ⁽³⁾	HFC consumption	2015 – 2016	% HCFC consumption	100 %	2015 - 2016
A5 production baseline (CO₂eq)	HFC component	HFC years (average)	HCFC component	% HCFC	HCFC years (average)
North American, Indian & Island States proposals	HFC production	Same years as consumption	Same factors as above, applied to production	Same % as consumption	Same years as consumption
European Union proposal	HFC production	2009 – 2012	Same factors as above, applied to production	70 %	2009 - 2012

¹ The chronological sequence of submission of the HFC amendment proposals has been altered in table 4 in order to cluster the common elements put forward in the proposals.

² The HCFC baseline in A5 parties is the average of 2009-2010 levels.

³ The consumption reduction steps for the A5 parties apply to the basket of HCFCs and HFCs.

5. Summary

Baseline as benchmark for control measures

- A baseline provides an important benchmark for setting any control measures, such as a freeze or reduction steps. The existing baselines established for ODS did not follow one fixed formula; they were developed to fit specific substances and circumstances.
- The Articles of the Vienna Convention and Montreal Protocol do not contain any prescribed methods for determining how parties should define baselines under the Montreal Protocol when adopting amendments and adjustments. The ODS baselines have been defined by the parties, based on a number of different environmental, technical, policy, financial and other factors considered by parties at the time.
- The baselines for newly controlled ODS were adopted by amendments, and in some cases the baselines were revised by adjustments at a later stage.
- ODS baselines were often adopted in the absence of reliable consumption data; this was the case, for example, for CFCs, CTC, and HCFCs in Non-A5 parties. Conscious of this fact, the parties inserted clauses in

Article 7 that would allow parties to report ‘the best possible estimates’ of statistical ODS data for baseline years ‘where actual data are not available’ (Article 7, paragraphs 1 and 2).

Baseline year set in the past or future

- The ODS baselines for Non-A5 parties were in most cases set at a consumption (or production) level in the recent past; the baseline year was generally set at least one year prior to the year in which the amendment or adjustment was adopted. This applied to CFCs, CTC and methyl bromide, for example. The HCFC baselines were set 3 and 10 years in the past, because they were partly based on a percentage of CFC consumption in the past (1989) (as shown in Tables 1 and 2 above).
- In contrast, the ODS baselines for A5 parties were in most cases set at a consumption (or production) level in the future; the baseline years were usually several years after the year in which the amendment was adopted. For example, the Annex A CFC consumption baseline was 8 – 10 years in the future, while the HCFC consumption baseline was initially 20 years in the future and then adjusted later, while the methyl bromide consumption baseline was set at a shorter timeline of 0 - 3 years in the future (Tables 1 and 2 above).

Baseline based on a single year or average of several years

- Most ODS baselines for Non-A5 parties were based on the consumption (or production) in a single year rather than an average of several years; for example, the Non-A5 baselines for CFCs, CTC, methyl bromide and HCFCs (Tables 1 and 2 above).
- In contrast, most of the ODS baselines for A5 parties were based on the average of several years of consumption (or production); for example, the A5 baselines for CFCs, CTC, and methyl bromide (Table 1). However, the A5 baselines for HCFCs were initially based on a single year, and later based on the average of several years (Table 2).

Baseline composed of one element or several elements

- For most groups of ODS, the baselines were based only on the regulated ODS group. For example, the baseline for CFCs comprised only CFC consumption (or production), while the baseline for MB comprised only MB consumption (or production).
- The Non-A5 baselines for HCFCs differed in that they included two key components: HCFC consumption (and production) and a percentage of CFC consumption (and production),⁴⁰ as shown in Table 2. A percentage of CFCs was included in the HCFC baseline because, at the time the baseline was adopted, some CFCs were still being consumed in Non-A5 parties, and the parties considered that some CFCs in certain sectors would need to transition to HCFCs. To take account of the amount that would need to transition, a percentage of CFCs was included in the HCFC baseline.

The examples outlined above illustrate the fact that the baselines established for different groups of ODS have some common features, but also show several different approaches. The baselines were determined by the parties to fit specific substances and circumstances, based on the elements that the parties have considered to be most relevant.

Baselines in the HFC amendment proposals

The consumption and production baselines put forward in the HFC amendment proposals follow the approach developed for HCFCs in that they contain elements relating to another group of substances. The HFC amendment proposals have put forward three different parameters for defining the HCFC component:

⁴⁰ The HCFC consumption baseline for Non-A5 parties is calculated from HCFC consumption and a percentage of CFC consumption, while the HCFC production baseline is calculated from both HCFC consumption and production and a percentage of CFC consumption and production.

- A percentage of the average HCFC consumption or production in specific years (North American proposal; European Union proposal for A5 parties). As far as consumption for A5 parties is concerned, the European Union baseline applies to the basket of HFCs and HCFCs;
- A percentage of the HCFC baseline consumption or baseline production (Indian proposal, Island States proposal);
- A percentage of the average HCFC consumption or production allowed under the Protocol in specific years (European Union proposal for Non-A5 parties).

The common and varying elements of the baseline calculations put forward in the HFC amendment proposals, for Non-A5 parties and for A5 parties, respectively, are summarized in Tables 3 and 4.

Annex: Baseline calculations and timing of initial control measures put forward in the HFC amendment proposals

The following tables provide information about the baseline elements put forward in the HFC amendment proposals for Non-A5 parties (Table 5) and for A5 parties (Table 6). The tables identify the proposed initial control measures in order to show relationships between the timing of baselines and control measures.

Table 5: Baseline calculations and timing of initial control measures in Non-A5 Parties put forward in the HFC amendment proposals (timing compared to the current year, 2016)				
Consumption baseline (CO₂-eq)	Average HFC consumption	+ x% of average HCFC component	First control measure	Second control measure
North American proposal	HFC in 2011-2013	+ 75% of HCFC consumption in 2011-2013	10% HFC reduction in 2019	35% HFC reduction in 2024
	3 – 5 years in past	3 – 5 years in past	3 years in future	8 years in future
Indian proposal	HFC in 2013-2015	+ 25% of HCFC baseline consumption in 1989 ¹	HFC freeze in 2016	10% HFC reduction in 2018
	1 – 3 years in past	27 years in past	0 years in future	2 years in future
European Union proposal	HFC in 2009-2012	+ 45% of HCFC consumption allowed under the Protocol in 2009-2012	15% HFC reduction in 2019	40% HFC reduction in 2023
	4 – 7 years in past	4 – 7 years in past	3 years in future	7 years in future
Island States proposal	HFC in 2011-2013	+ 10% of HCFC baseline consumption in 1989 ¹	15% HFC reduction in 2017	35% HFC reduction in 2021
	3 – 5 years in past	27 years in past	1 year in future	5 years in future
Production baseline (CO₂-eq)	Average HFC production	+ x% of average HCFC component	First control measure	Second control measure
North America, India, Island States proposals	Same as above	Same as above	Same as above	Same as above
European Union proposal	HFC production in 2009-2012	+ 45% HCFC production allowed under the Protocol in 2009-2012	Same as above	Same as above
	4 – 7 years in past	4 – 7 years in past	-	-

¹ The HCFC baseline in Non-A5 parties is 1989 HCFC consumption + 2.8% of 1989 CFC consumption.

Table 6: Baseline calculations and timing of initial control measures in A5 Parties put forward in the HFC amendment proposals (timing compared to the current year, 2016)

Consumption baseline (CO₂-eq)	Average HFC consumption	+ x% of average HCFC component	First control measure	Second control measure
North American proposal	HFC in 2011-2013 3 – 5 years in past	+ 50% of HCFC consumption in 2011-2013 3 – 5 years in past	HFC freeze in 2021 5 years in future	20% in 2026 10 years in future
Indian proposal	HFC in 2028-2030 12 – 14 years in future	+ 32.5% of HCFC baseline consumption in 2009-2010 ¹ 6 – 7 years in past	HFC freeze in 2031 15 years in future	Reduction steps to be determined for 2032-2049 period To be determined in future
European Union proposal	HFC in 2015-2016 0 – 1 year in past	+100% of HCFC consumption in 2015-2016 ² 0 – 1 year in past	Freeze in 2019 for combined HFC + HCFC 3 years in future	Reduction steps to be agreed by 2020 To be determined by 2020
Island States proposal	HFC in 2015-2017 1 year past to 1 year in future	+ 65% of HCFC baseline consumption ¹ in 2009-2010 6 – 7 years in past	HFC 15% reduction in 2020 ³ 4 years in future	35% reduction in 2025 9 years in future
Production baseline (CO₂-eq)	Average HFC production	+ x% of average HCFC component	First control measure	Second control measure
North American, Indian, Island States proposals	Same as above	Same as above	Same as above	Same as above
European Union proposal	HFC production in 2009-2012 4 – 7 years in past	+ 70% of HCFC production in 2009-2012 4 – 7 years in past	HFC freeze in 2019 3 years in future	Same as above -

1 HCFC baseline in A5 parties is the average of 2009-2010.

2 The consumption reduction steps apply to the basket of HCFCs and HFCs.

3 HFC reduction steps occur in the same year as the scheduled HCFC reduction steps.