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**Issues relating to the transformation of pledges for emission reductions into
quantified emission limitation and reduction objectives**

Technical paper

Summary

This technical paper presents issues relating to the transformation of pledges for emission reductions into quantified emission limitation and reduction objectives (QELROs). It provides a brief explanation of this transformation and illustrates the effect that different variables have on it. Chapter II introduces the concepts of QELROs and assigned amounts. Chapter III covers issues relating to the transformation of pledges into QELROs, including the effects of different variables on the resulting QERLO values. Chapter IV introduces additional considerations including which base year is used, the accounting of land use, land-use change and forestry (LULUCF) and the implications of efforts and achievements by Parties to date.

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I. Introduction

A. Mandate

1. The Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP), at its eleventh session,¹ requested the secretariat to prepare a technical paper laying out issues relating to the transformation of pledges for emission reductions into quantified emission limitation and reduction objectives (QELROs), for consideration by the AWG-KP at its twelfth session.

B. Scope of the note

2. This technical paper provides a brief explanation of the transformation of pledges into QELROs and illustrates the effect that different variables have on this transformation. Some of these variables, for example the length of the commitment period, could have a relative effect on the value of the QELROs without affecting the level of effort required to meet it. Others, such as the starting point of the emissions trajectory, can significantly affect the absolute value of the QELRO as well as the level of effort required to meet it. This document also refers to other matters being discussed by the AWG-KP which do not directly have an effect on the transformation of pledges into QELROs but that could change the level of effort required to meet these QELROs through changes in the accounting of emissions and removals during the commitment period. In extreme cases, the effect could lead to a weakening of the aggregate level of emission reductions originally pledged.

3. Chapter II introduces the concepts of QELROs² and assigned amounts. Chapter III covers issues relating to the transformation of pledges into QELROs, including the effects of different variables on the resulting QERLO values. Chapter IV introduces additional considerations including which base year is used, the accounting of land use, land-use change and forestry (LULUCF) and the implications of efforts and achievements by parties to date. The annex contains numerical examples of the transformation of pledges into QELROs.

C. Possible action by the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol

4. The AWG-KP may wish to take note of the information contained in this technical paper. It may wish to consider the implications of different variables on the transformation of pledges into QELROs and decide on next steps regarding work with pledges presented by Annex I Parties.

II. Background

5. Article 3, paragraph 1, of the Kyoto Protocol states that “the Parties included in Annex I shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A [to the Protocol] do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B”.

6. The QELRO, expressed as a percentage in relation a base year, denotes the average level of anthropogenic carbon dioxide equivalent emissions of greenhouse gases (hereinafter referred to as “emissions”) that a Party included in Annex I (hereinafter referred to as an “Annex I Party”) would be allowed to emit on an annual basis during a given commitment period. A QELRO equal to 100 indicates that the Party would emit during each year of the commitment period, on average, the same level of

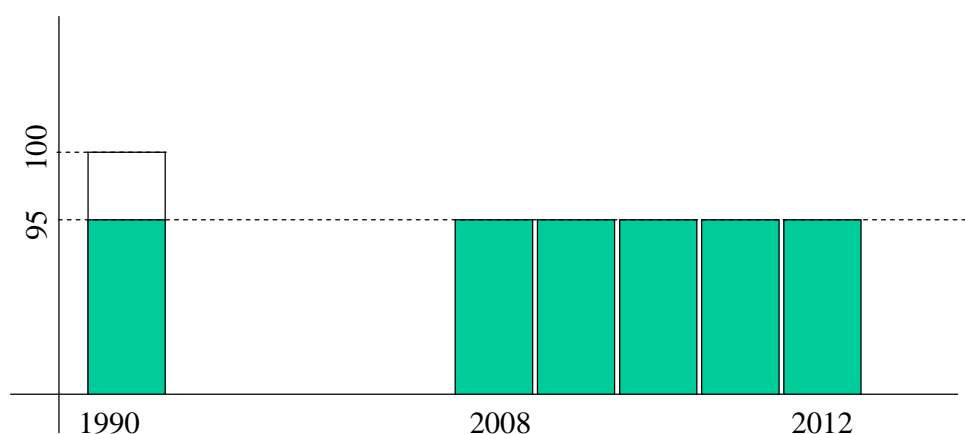
¹ FCCC/KP/AWG/2010/3, paragraph 28.

² The AWG-KP, at the first part of its sixth session, agreed that further commitments for Annex I Parties under the Kyoto Protocol should, for the next commitment period, principally take the form of quantified emission limitation and reduction objectives (QELROs). Article 3, paragraph 1, of the Kyoto Protocol uses the term quantified emission limitation and reduction commitments. This technical paper assumes that both terms refer to the same concept and uses the term QELRO throughout.

emissions in the base year. If the QELRO is higher than 100, average annual emissions during the commitment period would be greater than the level of emissions of that Party in the base year. Conversely, if the QELRO is lower than 100, average annual emissions during the commitment period would need to remain below the level of emissions attributable to that Party in the base year.

7. The QELRO is used as a basis for calculating the amount of total emissions, in terms of tonnes, that an Annex I Party would be allowed to emit during a commitment period (known as the assigned amount). Article 3, paragraph 7, of the Kyoto Protocol, establishes that “in the first commitment period, the assigned amount for each Party included in Annex I shall be equal to the percentage inscribed in Annex B of its aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A in 1990, or the base year period determined in accordance with paragraph 5 [of Article 3], multiplied by five”. With this approach, the assigned amount of an Annex I Party for a given commitment period is equal to the emissions that occurred in the base year, multiplied by the QELRO and multiplied by the number of years in the commitment period. Figure 1 illustrates this for an Annex I Party whose QELRO for the first commitment period is 95. In the absence of flexibility mechanisms, this Party is allowed to emit, on average, an amount equivalent to 95 per cent of its emissions in 1990 during each year of the commitment period. The actual emissions in each year of the commitment period could be above or below the QELRO as long as the average annual emission in the years of the commitment period is equal to or lower than the QELRO.

Figure 1. QELROs and assigned amount



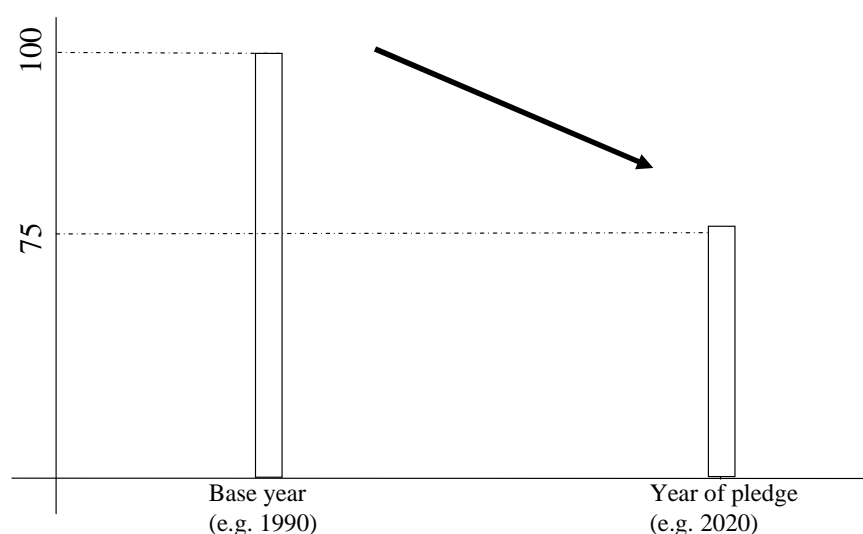
8. Total emissions of a Party during the commitment period do not need to be below, or even equal to, the assigned amount calculated on the basis of the QELRO. A Party can meet its commitments under Article 3, paragraph 1, of the Kyoto Protocol even if its total emissions during the commitment period are higher than its assigned amount by acquiring emission reduction units, certified emission reduction units, assigned amount units and/or removal units to compensate for the difference between its assigned amount and its actual emissions during the commitment period. These units are added to the assigned amount of a Party at the time of assessing compliance. Purchasing such units does not change the emissions that are attributed to the Party – its emissions profile. It only has effects on accounting emissions and removals during the commitment period as well as on the compliance of a Party with its commitments.

III. Transformation of pledges for emission reductions into quantified emission limitation and reduction objectives

A. Introduction

9. Annex I Parties have presented pledges³ for emission reductions, expressed as a percentage reduction, relative to a base year, which is to be achieved by a given year in the future. Such pledges do not denote the average emissions to be emitted in a commitment period; rather, they indicate a reduction to be achieved by a specific year. In other words, these pledges represent the end point of a trajectory of emissions that a Party sets itself to achieve. For example, if a Party has stated that it will reduce its emissions by 25 per cent below 1990 by 2020, this means that, by that year, the emissions of the Party should be 25 per cent below the levels of emissions of this Party in 1990 (see figure 2).

Figure 2. Parties' pledges represent an end goal to be achieved by a given date

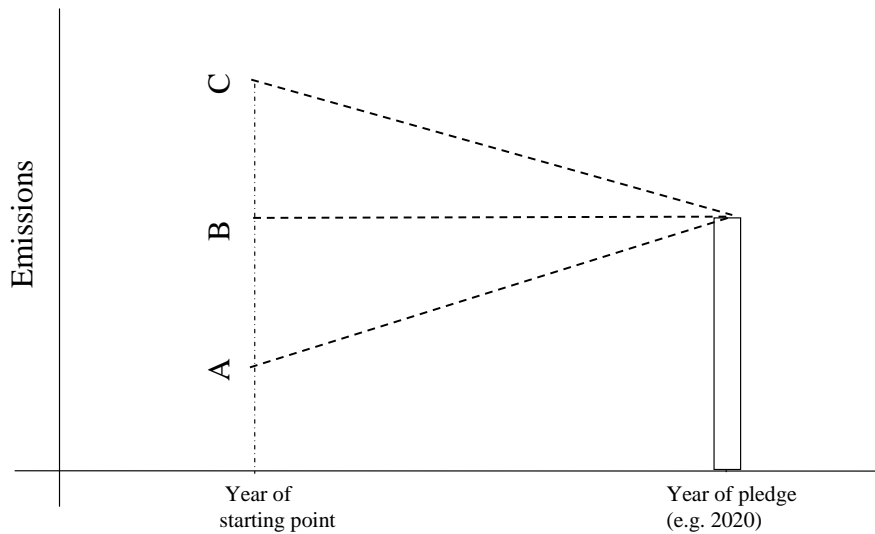


10. Pledges would need to be transformed into QELROs in order to establish the individual commitments of Annex I Parties that would be inscribed in Annex B to the Kyoto Protocol for the next commitment period. This transformation situates the pledges in the context of a commitment period and related accounting of emissions and removals. In practical terms, it involves calculating the average annual emissions relative to a base year, per cent, that would fit the emissions trajectory leading to the pledged target.

11. The emissions trajectory connects the level of emissions of the Party that occur in a year serving as the starting point to the level of emissions in the pledge year. While the trajectory can take several forms, in order to simplify the analysis it can be assumed to be a straight line. The trajectory will be downwards if the level of emissions in the starting point is above the pledge; upwards if the level of emissions at the starting point is below the pledge; or flat if the level of emissions at the starting point is at the same level as the pledge (see figure 3).

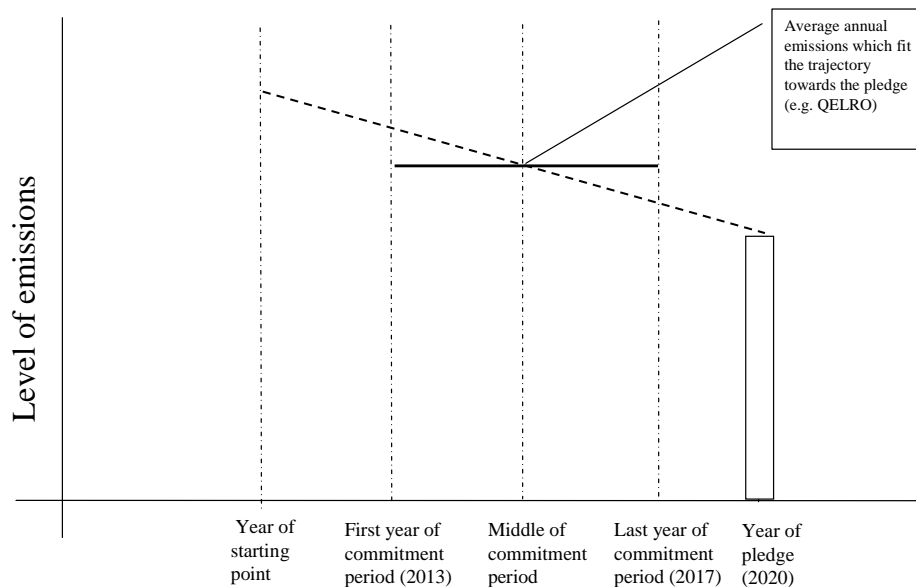
³ Latest information on these pledges is found in document FCCC/KP/AWG/2010/INF.1.

Figure 3. Possible emission trajectories in relation to a pledge



12. The assumption of a linear trajectory also simplifies the calculation of the QELRO. In this case, the average annual emissions that fit the trajectory (i.e. the QELRO) would correspond to the level of emissions at the midpoint of the commitment period. In other words, if a linear trajectory is assumed, the QELRO would be equal to the level of emissions at the midpoint of the commitment period. For example, for a commitment period of five years, the QELRO would correspond to the level of emissions in the trajectory that occur in the middle of the third year of the commitment period. It should be noted that the end of the commitment period does not need to coincide with the year in which the pledge is to be achieved. This point is illustrated in figure 4: for a five-year commitment period starting in 2013 and ending in 2017, the middle of the period will be in the year 2015. The QELRO in this case would be equal to the level of emissions at this point in time based on the trajectory.

Figure 4. Calculating a QELRO from the emissions trajectory leading to a pledge



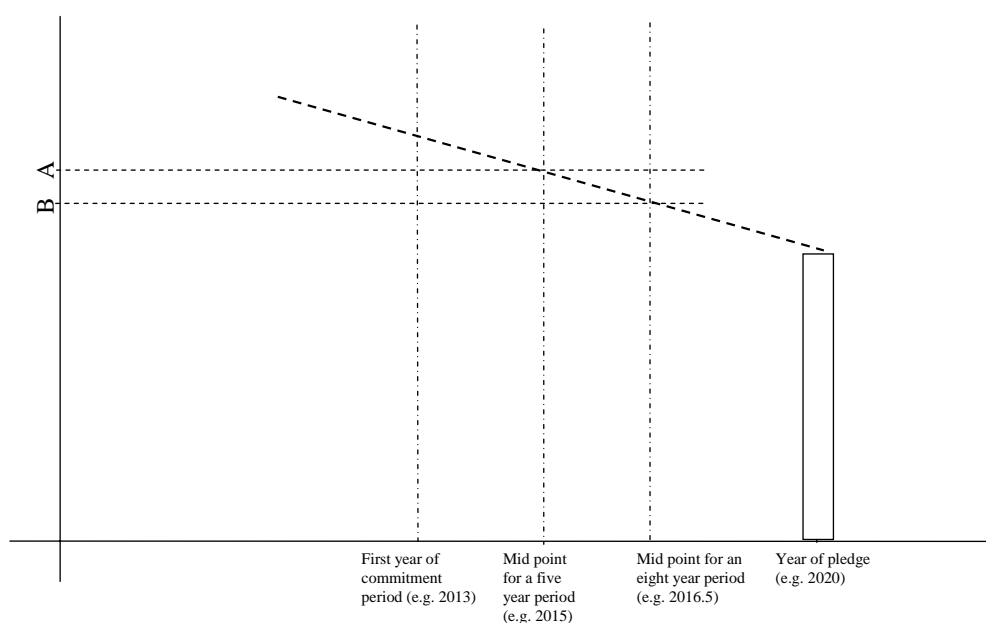
B. The effect of different variables

13. The following information is required in order to transform pledges into QELROs:
- (a) The pledge, which determines the end point of the emissions trajectory;
 - (b) The starting point of the emissions trajectory;
 - (c) The length of the commitment period, which determines the midpoint in the commitment period from which average annual emissions can be derived.
14. The choice of each of these parameters affects the calculation of the QELRO and can have a significant effect on the calculation. A more ambitious pledge, for example, would lead to a lower (more stringent) QELRO, and vice-versa. The remainder of this chapter considers the effect of variation in the length of the commitment period and the starting point of the emissions trajectory towards the pledge. Numerical examples are included in the annex.

1. Length of the commitment period

15. As explained above, a QELRO is equal to the level of emissions at the midpoint of the commitment period of the emissions trajectory leading to the pledge. Changes in the length of the commitment period shift the midpoint of the commitment period and, hence, change the value of the QELRO.
16. The AWG-KP is currently considering two options for the length of the second commitment period: five years and eight years. For a commitment period starting in 2013, the middle of the commitment period would be the middle of 2015 in the case of a five-year commitment period; and at the end of 2016 in the case of an eight-year commitment period. Figure 5 shows that the QELRO calculated for an eight-year commitment period (from 2013 to 2020) would be lower than that for a five-year commitment period (from 2013 to 2017); this is true only if the emissions trajectory is downwards. In the figure, B represents the level of emissions at the midpoint of an eight-year commitment period; and A represents the level of emissions at the midpoint of a five-year commitment period.
17. It should be noted that the length of the commitment period, while affecting the value of the QELRO for the second commitment period, should not have an effect on the absolute effort required to meet this QELRO. As figure 5 shows, the selection of the commitment period does not affect the emissions trajectory leading to the Party's pledge; the change in the value of the QELRO reflects the fact that a longer period has been agreed.

Figure 5. Comparison of a QELRO calculated for an eight-year commitment period (B) with a QELRO calculated for a five-year commitment period (A)



2. Starting point of the emissions trajectory

18. The second factor which affects the transformation of pledges into QELROs is the level of emissions chosen as the starting point for the Party's emissions trajectory. The level and year chosen affect the slope of the trajectory, which, in extreme cases, could lead to a shift in its direction (upwards to downwards, or vice versa).

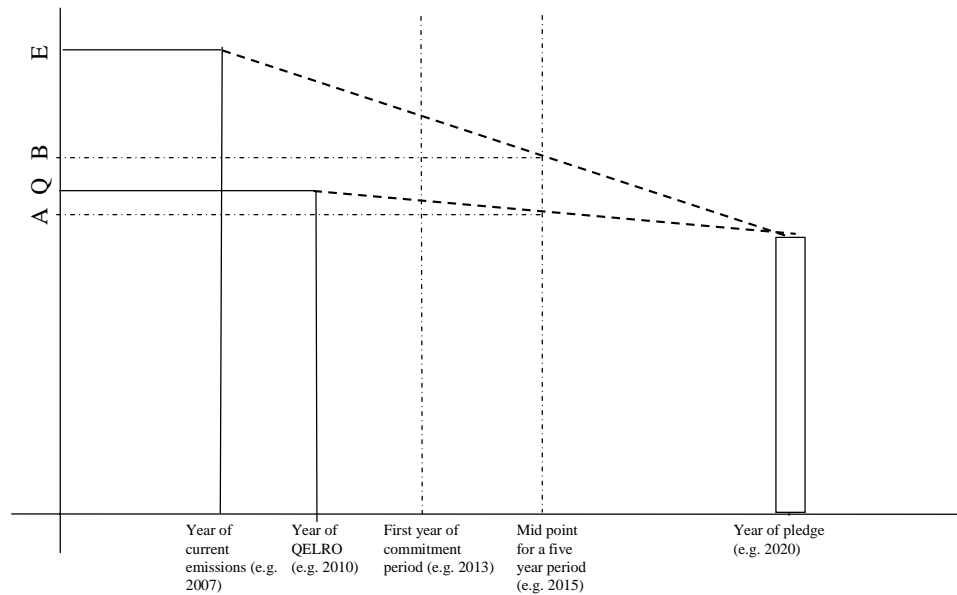
19. In the context of discussions under the AWG-KP, Parties have identified two options for the starting point of the trajectory:

- (a) The QELRO used for the first commitment period;
- (b) The current level of emissions (e.g. the level of emissions in the latest year of the Party's most recently reviewed greenhouse gas inventory).

20. The effect of selecting one or the other on the value of the QELRO for the second commitment period depends on the difference in the level of emissions between these two options; the larger the difference, the larger the effect. If the current level of emissions is close to the QELRO for the first commitment period, the effect of choosing one or the other would be negligible.

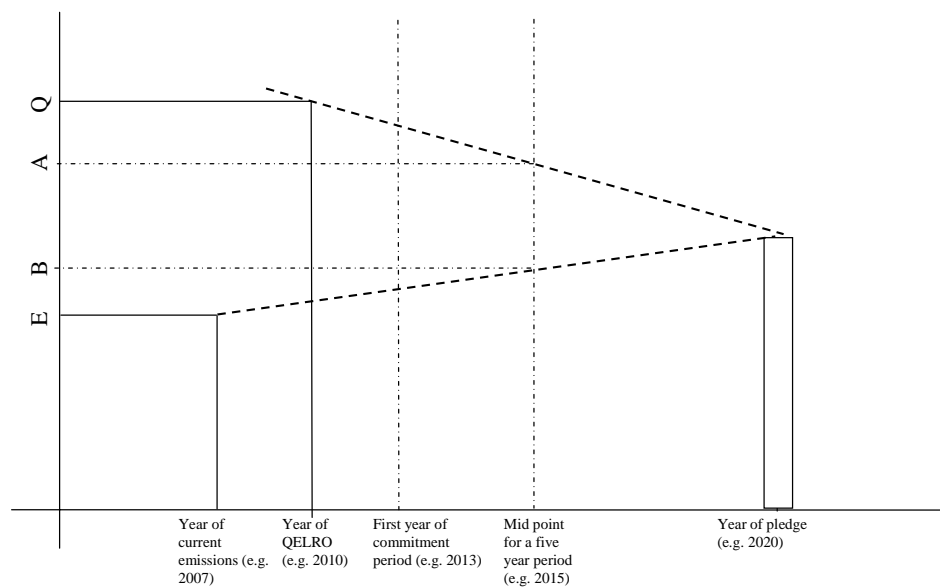
21. If the current level of emissions is above the QELRO for the first commitment period, the QELRO for the second commitment period will be higher if calculated using the current level of emissions as a starting point. This would lead to a higher assigned amount and to a higher absolute level of emissions that a Party can emit during the commitment period. Figure 6 illustrates this effect for a five-year commitment period starting in 2013. If the starting point chosen is the QELRO for the first commitment period (Q), the QELRO for the second commitment period would be equal to A. If the starting point chosen is current emissions (E), the QELRO for the second commitment period would be equal to B.

Figure 6. The difference between using the QELRO for the first commitment period (Q) and a higher current level of emissions (E) to calculate the QELRO for the second commitment period



22. Similarly, if the current level of emissions is below the QELRO for the first commitment period, the QELRO for the second commitment period would be lower if calculated using the current level of emissions as a starting point. This would lead to a lower assigned amount and to a lower absolute level of emissions that a Party can emit during the commitment period. Figure 7 illustrates an extreme case in which the slope of the trajectory changes its direction. If the starting point chosen is the QELRO for the first commitment period (Q), the QELRO for the second commitment period would be equal to A. If the starting point chosen is the level of current emissions (E), the QELRO for the second commitment period would be equal to B. The large difference between A and B is the result of the large difference between Q and E.

Figure 7. The difference between using the QELRO for the first commitment period (Q) and lower current level of emissions (E) to calculate the QELRO for the second commitment period



23. Unlike the choice of commitment period, the selection of the starting point has a direct effect not only on the value of the QELRO but also on the level of effort required to meet it. This results from changes in the slope of the trajectory which also changes the overall emission reductions to be achieved to reach the pledge. A higher QELRO would require less reductions in the commitment period. Conversely, a lower QELRO would require the Party to achieve additional reductions (or purchase additional units) in the commitment period.

24. In discussing choice regarding the starting point of the emissions trajectory, the following should be noted:

- (a) Most Annex I Parties have commitments to an absolute reduction in emissions during the first commitment period; this implies that, for these Parties, the current level of emissions should be higher than the QELRO for the first commitment period. An exception to this situation occurs if a Party experienced a large decline in emissions after the base year; in this case, the current level of emissions could be lower than the QELRO for the first commitment period;
- (b) Some Annex I Parties will meet their commitments for the first commitment period by adding removals from LULUCF activities and by purchasing units. The size of this purchase will be determined by the difference between the level of emissions during the commitment period and the assigned amount. Parties which will purchase a large number of units may do so because of their high level of emissions in relation to the QELRO. This means that, despite this purchase, real emissions, including current emissions, could be well above the QELRO.

IV. Other considerations

25. This chapter provides brief information on three issues being considered by the AWG-KP relevant to discussions on the scale of emission reductions to be achieved by Annex I Parties.

A. Land use, land-use change and forestry

26. The contribution of the LULUCF sector to the accounting of greenhouse gas emissions is twofold:

- (a) Article 3, paragraphs 3 and 4, of the Kyoto Protocol provides for the accounting of LULUCF during the commitment period. Paragraph 17 of decision 16/CMP.1 further establishes that, for the first commitment period, the “additions to and subtractions from the assigned amount of a Party shall be equal to anthropogenic greenhouse gas emissions by sources and removals by sinks measured as verifiable changes in carbon stocks, and non-carbon dioxide greenhouse gas emissions during the period 1 January 2008 to 31 December 2012 resulting from eligible LULUCF activities”. The accounting of LULUCF during the commitment period leads to additions to and subtractions from the assigned amount of a Party and, hence, these provisions are not directly relevant to the transformation of pledges into QELROs. However, they have an effect on the effort required to meet the QELRO;
- (b) Article 3, paragraph 7, of the Kyoto Protocol states that “those Parties included in Annex I for whom land-use change and forestry constituted a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalent emissions by sources minus removals by sinks in 1990 from land-use change for the purposes of calculating their assigned amount”. If the sector was a source of emissions in the base year, all emissions by sources minus removals by sinks reported in relation to the conversion of forests shall be

considered in the calculation of the assigned amount.⁴ The more emissions to be added, the larger the resulting assigned amount. These provisions are relevant for the calculation of assigned amount and are not directly relevant to the transformation of pledges into QELROs.

27. Rules to guide the treatment of LULUCF are unlikely to have a direct effect on the transformation of pledges into QELROs. However, different rules may influence the overall level of ambition of the pledges and can even undermine the stringency of the QELRO. Given the character of the LULUCF sector and associated high uncertainty, transparency as regards how the sector has been incorporated into the development of the pledge will facilitate further discussions on QELROs.

B. Base year

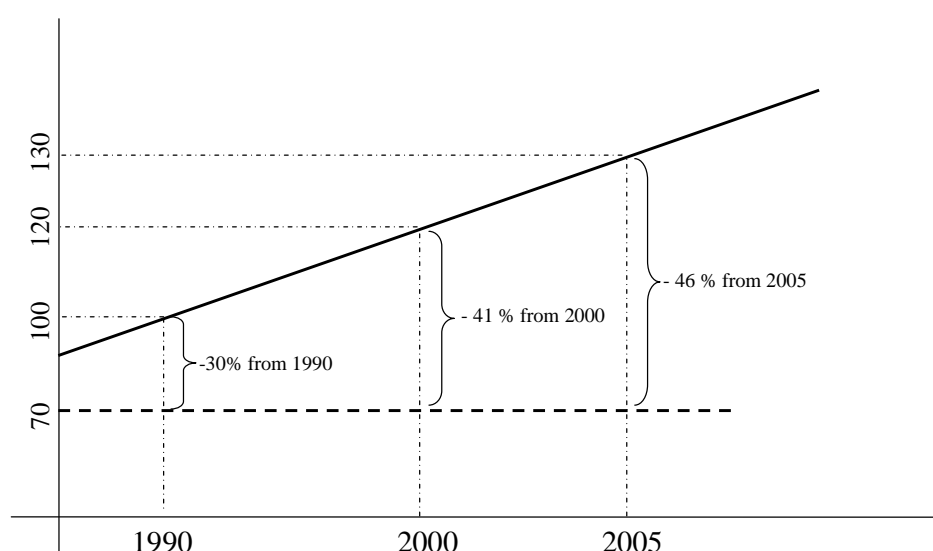
28. As explained above, a QELRO denotes an average level of emissions relative to a base year. For most Parties this base year is 1990. Article 3, paragraph 5, of the Kyoto Protocol states that the “Parties included in Annex I undergoing the process of transition to a market economy whose base year or period was established pursuant to decision 9/CP.2 of the Conference of the Parties at its second session shall use that base year or period for the implementation of their commitments”.

29. In the context of the work of the AWG-KP, some Parties have proposed the use of alternative base years to express QELROs.⁵ This proposal is reflected in those pledges that use a different base year than 1990.

30. If the intention of using an alternative base year is only to change the way a QELRO is expressed, a change in the base year would have relative effects in the value of the QELRO but not in the absolute effort required to meet it. The use of an alternative base year would lead to a different value of the QELRO, reflecting the different level of emissions in the new year used as based year.

31. Indeed, a pledge or QELRO could be expressed relative to a number of different base years without any implications for the absolute emission reductions to be achieved. Figure 8 illustrates how a 30 per cent emission reduction relative to 1990 can be expressed using alternative years, resulting in different percentages. It should be noted that it would not be possible to compare QELROs or pledges that use different base years.

Figure 8. Using different base years to express reductions



⁴ See paragraph 5(b) of the annex to decision 13/CMP.1 on the calculation of the assigned amount.

⁵ The AWG-KP is considering how QELROs could be expressed, which includes how the base year is expressed (see FCCC/KP/AWG/2008/8, paragraph 49 (c) (ii)).

C. Efforts and achievements to date

32. Individual Parties may or may not meet their QELROs for the first commitment period. If a Party's total emissions during the commitment period are lower than its assigned amount, this Party would meet its QELRO and would also gain a surplus in its accounting of assigned amounts. The Party can decide to sell surplus units to other Parties, or to carry over these units for use in subsequent commitment periods.⁶

33. Carry-over of all units from one commitment period to the next implies that the Party enters the commitment period with a surplus of units, i.e., units over and above its assigned amount for the new commitment period. This surplus would not have a direct effect on the transformation of pledges into QELROs. However, it would have an effect on the level of effort required by that Party to meet its QELRO. If a Party has not taken into consideration this surplus during the process of developing its pledge, it may have underestimated the efforts required to reduce emissions. The sum of the surplus from all Parties could be relatively high and may even undermine overall efforts to reduce emissions in the second commitment period.

34. It is equally possible that a Party will not be able to meet its QELRO during the first commitment period. If a Party fails to meet its QELRO and is declared by the enforcement branch of the Compliance Committee to be in non-compliance with its commitments under Article 3, paragraph 1, of the Kyoto Protocol, a number of tonnes equal to 1.3 times the amount of tonnes of excess emissions will be deducted from that Party's assigned amount in the second commitment period.⁷ In principle, a finding of non-compliance with a Party's commitments under Article 3, paragraph 1, of the Kyoto Protocol will not have a direct effect on how pledges are transformed into QELROs, since a determination of non-compliance will not be made until after the QELRO for the second commitment period has been agreed upon. However, it will have an effect on the efforts required to meet the QELRO for the second commitment period since the finding of non-compliance will result in a reduction of the assigned amount units available to that Party for that commitment period.

⁶ Carry over of units is subject to limits set out in paragraphs 15 and 16 of decision 13/CMP.1.

⁷ Paragraph 5 (a), Chapter XV of the annex to decision 27/CMP.1.

Annex**Numerical examples**

1. This annex contains numerical examples of transformation of pledges into quantified emission limitation and reduction objectives (QELROs). Three hypothetical cases are presented:
 - (a) Country A has an emissions profile in line with its QELRO: emissions in 2007 were at 1990 levels;
 - (b) Country B has an increasing emissions profile: emissions in 2007 were 30 per cent above 1990 levels;
 - (c) Country C has a decreasing emissions profile: emissions in 2007 were 50 per cent below 1990 levels.
2. All three countries have a QELRO for the first commitment period equal to 95 and have pledged a 30 per cent reduction from 1990 levels by 2020.
3. The table below presents the different possible results for the transformation of pledges into QELROs depending on the choice of the length of the commitment period (five or eight years) and the starting point of the emissions trajectory (current emissions or the QELRO for the first commitment period).

Transformation of pledges into QELROs for three countries

		Country A	Country B	Country C
QELRO for the first commitment period		95	95	95
Emissions in 2007 relative to 1990 (%)		100	130	50
QELRO for the second commitment period	<ul style="list-style-type: none"> • Starting point: QELRO for the first commitment period • Five-year commitment period 	82.5	82.5	82.5
	<ul style="list-style-type: none"> • Starting point: current emissions (in 2007) • Five-year commitment period 	81.5	93.07	62.3
	<ul style="list-style-type: none"> • Starting point: QELRO for the first commitment period • Eight-year commitment period 	78.75	78.75	78.75
	<ul style="list-style-type: none"> • Starting point: current emissions (in 2007) • Eight-year commitment period 	78.07	86.15	64.61

4. The table illustrates the large variation in the QELROs derived from pledges depending on the choice of variables. The largest differences are found for country C, which reflect the relatively large difference between its QELRO (95) and actual emissions in 2007 (79.2). For example, in the case of a five-year commitment period, the new QELRO would be 81 if the QELRO for the first commitment were

used as the starting point of the emissions trajectory and 63 if the starting point were the current emissions.

5. The transformation of pledges into QELROs uses the equation for a linear trajectory as follows:

$$NewQELRO = mY_m + c$$

Where:

m is the slope of the emissions trajectory towards the pledge

Y_m is the year in the middle of the commitment period

c is the intersect of the trajectory

The slope of the emissions trajectory (“m”) can be calculated as follows:

$$m = \frac{E_s - E_e}{Y_s - Y_e}$$

Where:

E_s is the level of emissions at the starting point of the emissions trajectory

E_e is the level of emissions [pledged][at the end date]

Y_s is the year of the starting point of the emissions trajectory

Y_e is the end year of the pledge

Finally, the intersect (“c”) can be calculated as follows:

$$c = E_s - (mY_s)$$

6. Figure 9 illustrates the use of the equations to transform pledges into QELROs.

Figure 9. Transforming pledges into QELROs

