Scenarios for the global carbon markets

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Abstract

The development of scenarios for supply and demand on international carbon markets shows that there is a strong tendency towards a supply overhang in the period 2013-2020. It can easily reach several billion credits if new market mechanisms are introduced without a concurrent increase of demand through stricter emission commitments for industrialized countries or the shift of advanced developing countries from being a seller to becoming a buyer of credits. The CDM can easily be destroyed by a long-term price slump due to a persistent supply overhang.

Looking at scenarios from the literature published between 2009 and 2012, the expected supply overhang has increased over time with supply estimates declining and demand estimates increasing over time. Therefore, a priority should be put on the increase of demand before new market mechanisms other than those specified under the Kyoto Protocol are introduced.

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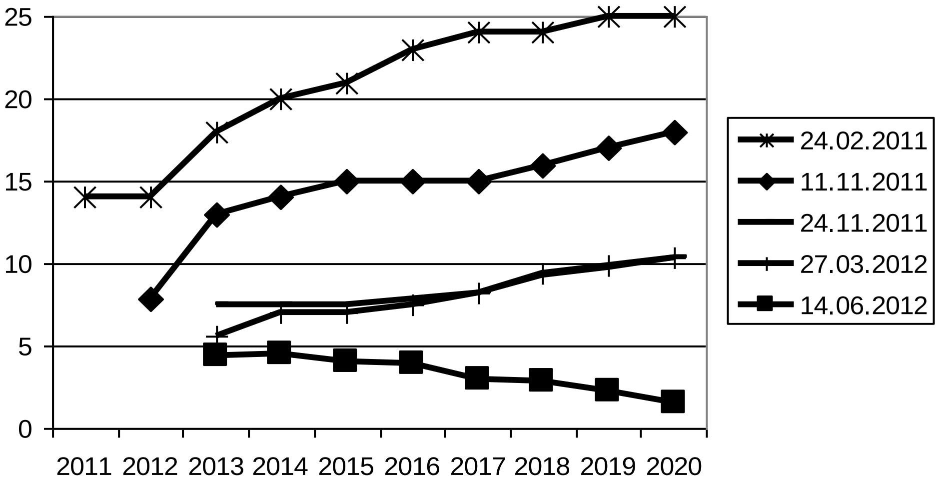
1. Background to scenario development

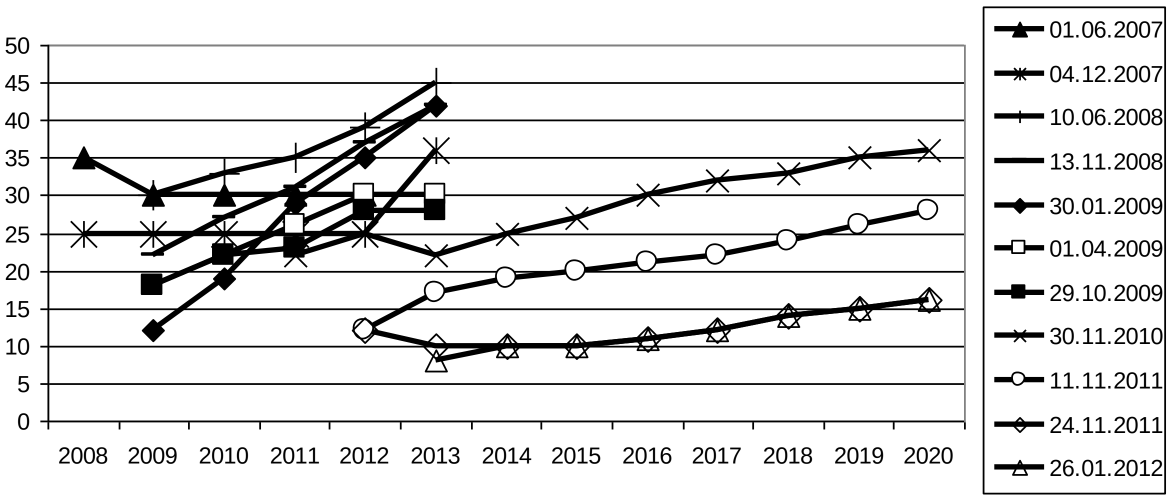
For a long time, analysts of international carbon markets predicted an increase of prices for emission credits over time (typical examples are Deutsche Bank 2007, Société Générale 2010, see also the series of forecasts from Point Carbon in Figure 1).

Figure 1: Price forecasts according to vintage years, €/t CO_2

a) Secondary Certified Emission Reductions (CERs)



b) EU Allowances



Source: Price forecasts from Point Carbon, various dates

Until the financial crisis struck in 2008, this was accompanied with an exponential increase of turnover in the different carbon market segments. After the fallout of the crisis cleared in mid-2009 and despite the failure of the Copenhagen conference, emission credit prices stayed surprisingly stable. However, with the massive decline of the price for Certified Emission Reductions (CERs) since 2011, the market for primary CDM projects has stalled to a large extent (Point Carbon 2012a). This situation has led to an increasing interest in the overall balance of supply and demand on the international carbon market.

The purpose of this research is to describe the most likely future scenarios for the role of carbon markets for global climate change mitigation for the periods 2013-2015, 2015 - 2020, and beyond 2020. Essential elements include factors influencing demand and supply, in the Kyoto protocol market and in other markets, existing, or anticipated. The role of the UNFCCC in setting conditions for the above will be assessed, and what the absence of a UNFCCC agreement on market based mechanisms might imply.

Three scenarios will be developed separately for the supply and the demand side. Each of the scenarios will cover the time slices defined above. Scenarios will include one "standard", most likely development, and one case for a very low and very high level of supply/demand. Finally, the different possible combinations of scenarios will be assessed.

2. Assumptions used in developing the scenarios

The assumptions used to specify the different scenarios can be grouped according to different criteria.

2.1. Degree of stringency, timing and nature of country emissions commitments

A key driving force for demand for emission credits is the existence of country-level emissions commitments. Their stringency, timing and the degree to which the commitments are taken seriously by governments determine how much demand actually materializes. The history of the UNFCCC regime in the last two decades has shown the role of each of these parameters. The UNFCCC itself only contained a non-binding target of stabilization of CO_2 emissions at 1990 levels by 2000 for industrialized countries. Only Germany, the UK and countries in transition reached this target. The Kyoto Protocol therefore included legally binding emissions commitments. In order to make them politically palatable, the timing reached more than a decade into the future, with a commitment period from 2008-2012. But due to the necessity to wait for the emissions inventories of 2012 and the existence of a 100-day "true up period" to cover unexpected gaps, actually compliance with the commitments needs only be achieved in early 2014… While the Kyoto Protocol contains incentives for compliance through a 30% "penalty deduction" from the emissions budget of the subsequent commitment period, countries can leave the Protocol with a one-year notice period and thus prevent non-compliance procedures. Indeed, in 2011, Canada withdrew from the Protocol in view of its looming non-compliance.

Due to the failure of the Copenhagen COP in 2009, for the time between 2012 and 2020 no legally binding commitments exist for any country. A number of countries has submitted unilateral pledges, as well as more stringent targets that would enter into force if an international agreement can be concluded.

The Durban Platform wants to develop a develop a "protocol, another legal instrument or an agreed outcome with legal force" by 2015 that enters into force by 2020. This could mean that a number of countries takes up commitments by 2020 whose nature currently is unclear.

2.2. Nature of the international climate policy regime

There are two principal forms of international climate policy. One which is embodied by the Kyoto Protocol is an international agreement that specifies national actions and thus functions in a "top down" manner. The other one is a bottom-up "pledge and review" process where each country specifies what it wants to do.

3. Supply scenarios

Three supply scenarios will be specified whose results are summarized in Table 1

Table 1: Overview about supply scenarios (billion credits)

Supply scenario	2013-2015	2015-2020	2020- (annual)
Low	1.7	2.6	0.4 (declining)
Standard	3.4	10.3	2.3 (constant)
High	3.4	21.3	4.5 (rising)

3.1. Low supply scenario

Essentially, the low supply scenario presumes the continuation of the CDM with its current rules and no substantial standardization beyond the one achieved to date. No new CDM projects will be submitted for registration after 2012 because project developers do not see a future for the mechanism. However CER prices are sufficiently high to make verification and CER issuance attractive for all projects registered until the end of 2012.

Due to the hollowing out of the second commitment period of the Kyoto Protocol, JI and AAU trading will stop in 2013. Given a stalemate in the UNFCCC process, no new market mechanism will be operational before 2020, which also means that neither REDD+ crediting or agricultural soil crediting will be implemented.

According to UNEP Riso Centre (2012a) the CER volume of projects submitted by June 2012[1] generated between 2012 and 2020 reaches 5.5 billion, assuming an overall failure and rejection rate of projects in validation of 24.7% and an issuance performance of 93.4%. Assuming the annual CER volumes from PoAs submitted until 2012 continue until 2020 brings in another 0.3 billion CERs (UNEP Riso Centre 2012b). Point Carbon (2012a) is much more conservative and expects issuance of 1.1 billion CERs in 2013-2015 and 1.6 billion in 2016-2020. I take the average of these estimates, reaching 4.3 billion, of which 1.7 billion accrue between 2012 and 2015 and 2.6 billion in 2016-2020. Annual credit supply from 2020 onwards declines as crediting periods of projects end.

3.2. Standard supply scenario

The standard scenario assumes expansion of CDM through ongoing standardization and facilitation of programmatic approaches. Due to a decision on the second commitment period at Doha, JI continues for Kyoto parties in the second commitment period. Kyoto parties agree not to limit AAU sales, but Russia does not take up commitments and thus no longer supplies AAUs. Sectoral crediting mechanisms will be operational from 2017 and complement the CDM in advanced developing countries. Sectoral trading is introduced in China, Mexico, Korea, and Chile from 2018. Pilot crediting of REDD+ starts in Indonesia from 2018.

Above the volume of CERs estimated in the low scenario, CER issuance expands every year as per the average growth of annual CER volumes of newly submitted CDM projects in the years 2007-2010, which reaches 183 million (UNEP Riso Centre 2012a). These years are chosen because the industrial gas projects had already been submitted before this date, and the pre-2013 announcement effect bubble had not yet started. For PoAs an annual expansion of 30 million CERs is assumed. In 2013-2015, CER issuance would thus reach 3.0 billion, in 2016-2020 8.9 billion. In 2020, expansion stops as crediting periods of projects from the high inflow period 2011-12 are ending.

[1] The remainder of 2012 will not see significant project inflow due to the EU deadline now being too close.

While JI projects determined in the first commitment period continue to generate 175 million ERUs per year (UNEP Riso Centre 2012c), ERU issuance is assumed to expand at the same rate as in 2009-2011, i.e. 27 million ERUs per year. 2012 is excluded because it had a last minute effect, with host countries trying to maximize ERU supply. ERU issuance in 2013-2015 thus reaches 0.2 billion; in 2016-2020 0.8 billion.

AAU sales come from Ukraine and Eastern European EU members; they would continue at the same pace as achieved in the years 2008-2011, with an average volume of 72 million (Kossoy and Guigon 2012, 2010, see also Aldrich and Koerner 2012 for a public discussion of AAU trades). Thus AAU supply would reach 0.2 billion in 2013-15 and 0.4 billion in 2016-2020, still only a small share of the accumulated surplus of over 5 billion excluding Russia and the surplus of Eastern Europe[2].

The estimate of supply from sectoral crediting is very difficult and requires a set of detailed assumptions. Sectoral crediting will be based on a no-lose target denominated in carbon intensity. I assume that it will cover the power sector, industry and road transport in Brazil, India, Indonesia, Thailand and South Africa, with a baseline that is set below the baseline that would have been applied under the CDM (for an interesting and detailed discussion about such a baseline for the power sector see Amatayakul and Fenhann 2009). I assume that the sectoral crediting baseline requires a carbon intensity reduction of two percentage points per year, while the sector achieve a reduction of four percentage points per year, leading to a credit of 2% of sector emissions. In order not to give an incentive to sector growth, the total sector emissions to which the intensity improvement is applied is fixed at 2009 levels. Given the experiences of the CDM, it takes five years before the full level is reached, i.e. in 2017 credits of 0.2% of sector emissions accrue, in 2018 0.4% and so on… This gives a total volume of 0.1 billion sectoral credits (see Table 2).

Table 2: Sectoral credit accrual (million)

	2017	2018	2019	2020
Brazil	1.2	2.4	3.6	4.8
India	5.4	10.8	16.2	21.6
Indonesia	1.3	2.6	3.9	5.2
Thailand	0.8	1.6	2.4	3.2
South Africa	1.2	2.4	3.6	4.8
Total	**9.9**	**19.8**	**29.7**	**39.6.**

Source of emissions data: IEA (2009), sectoral disaggregation

Total supply volumes from sectoral crediting would thus reach 0.1 billion.

Sectoral trading which would start in Chile, China, Israel, Korea and Mexico and from 2018 would set absolute caps that remain constant between 2018 and 2020. These countries would then no longer export emissions units abroad, but would shift towards the demand side.

Pilot crediting of REDD+ starts in Indonesia from 2018 with the province of Central Kalimantan (which has been selected by the Norwegian REDD programme as its focus, see Gaia Consulting 2011). According to National Council on Climate Change and Government of Central Kalimantan (2010) emissions from forest and peatland loss can be reduced by 200 million t CO_2 within ten years.

[2] Ukraine alone is likely to accumulate a surplus of 2.7 billion in 2008-2012 and 2.8 billion in 2013-2020 (Forth and Sterk 2012, p. 15).

Assuming a strong effect in the first years of the pilot programme, credit volume could reach 0.1 billion

3.3. High supply scenario

The high supply scenario is identical with the standard scenario for CER, ERU and AAU sales, but sees an acceleration of the new market mechanisms. NAMA and Sectoral Crediting would become operational from 2015 in all developing countries except LDCs as well as full crediting of REDD+. Crediting of sequestration in agricultural soils would begin in 2017 as well as for Net Avoided Emissions (NAE)[3].

Sectoral and NAMA crediting would be implemented in a way that does not jeopardize existing CDM projects but harnesses emissions reductions from sectors and activities where the CDM has not made inroads to date. I assume that CO_2 emissions from power, industry and the transport sector would be covered and that by 2020 the credit volume would reach 2% of sector emissions, ramping up linearly. Using IEA (2011) data and assuming the same percentage of baseline emissions growth between 2009 and 2020 as actual growth between 1999 and 2009, credit volumes would rise from 350 million in 2015 to 400 million in 2020, totaling 2.3 billion.

Michaelowa and Dutschke (2009) have provided a detailed estimate of REDD+ credit potential between 2012 and 2020, taking into account a number of drivers for credit generation. Adjusting their estimate to the period 2015-2020 would lead to 7 billion credits from REDD+.

According to World Bank (2012), the technical potential of sequestration in agricultural soils by 2030 reaches 12-14 billion t. Assuming that annual mobilization of the technical potential reaches 2% and is creditable, 0.3 billion credits would be generated annually, totaling 1.2 billion by 2020.

Assuming that utilization of one barrel of oil leads to 0.43 t CO_2 emissions (US EPA 2012) and this amount is credited for oil reservoirs under NAE, with crediting spaced over an assumed 40 year utilization rate of the reservoir, protection of 1% of oil reserves in Non-Annex B countries would generate 125 million credits per year[4]. Credit volume by 2020 would thus reach 0.6 billion.

3.4. Supply scenarios in the literature

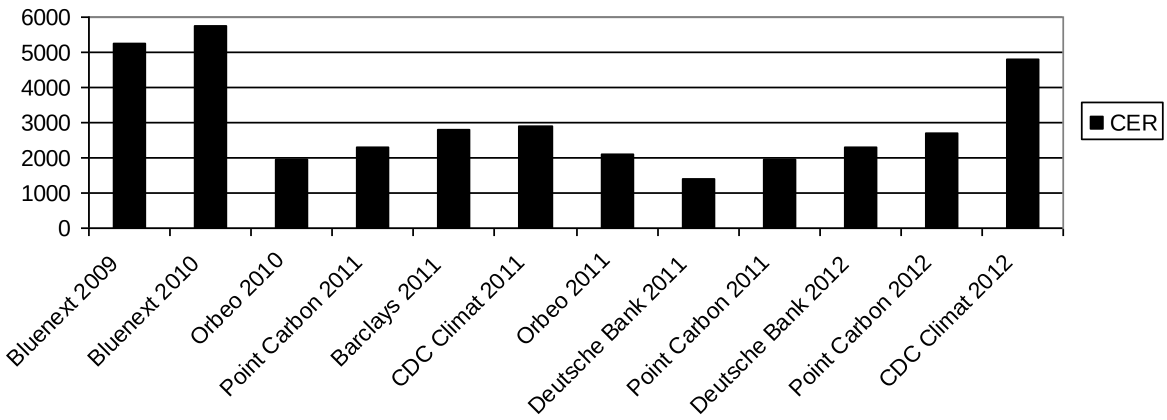
Kossoy and Guigon (2012a, p. 108) quote three supply scenarios for 2013-2020. The lowest by Deutsche Bank reaches 2.3 billion, the intermediate one by Point Carbon (2012 a, see also section 3.1) reaches 2.7 billion and the highest by CDC Climat 4.8 billion. The high value of CDC is surprising given that CER issuance rates are discounted substantially due to high perceived project risk (for the elaborate methodology see Cormier and Bellassen 2012). Linacre et al. (2011) quote four estimates, starting with 1.4 billion (Deutsche Bank), via 2.3 billion (Point Carbon), 2.8 billion (Barclays) and 2.9 billion (CDC Climat). All these scenarios assume that project inflow stops after 2012.

Figure 2 shows earlier supply scenarios with huge variations between those published at the same time as well as those published by the same institution in different years.

[3] This concept has been spearheaded by Ecuador which wants to test under the “Yasuni” initiative. The idea is essentially to get credits for not exploiting fossil fuel deposits (Republic of Ecuador 2012).

[4] According to CIA (2012) total volume of oil reserves in Non-Annex B countries is 1.17 trillion barrel, i.e. 501 Gt CO_2. Spaced over 40 years, annual use would be 12.5 Gt CO_2, and 1% of this volume is 125 Mt CO_2.

Figure 2: Supply scenarios for 2013-2020 published in 2009-2012 (million CERs)



Sources: Kossoy and Guigon (2012), Linacre et al. (2010), Bluenext (2010), Rapin (2009), Delbosc et al. (2011), Société Générale (2010)

4. Demand scenarios

Three demand scenarios will be specified (see the overview in Table 3).

Table 3: Overview about demand scenarios (billion credits)

Demand scenario	2013-2015	2015-2020	2020- (annual)
Low	0.4	0.5	0
Standard	1.0	2.6	0.5
High	6.9	16.7	3.7 (increasing)

4.1. Low demand scenario

The lowest demand scenario assumes that due to a complete disillusioning regarding mitigation policy no new demand arises. The remaining quota from the EU ETS will be filled up. Point Carbon (2012a) estimates that the total quota for CER/ERU imports into the EU 2008-2020 will be set at 1.75 billion, and that companies under the EU ETS will use approximately half of it before 2013, which would leave a demand of 0.9 billion in 2013-2020. I assume that 0.4 billion would be used in 2013-2015 and 0.5 billion in 2016-2020.

4.2. Standard demand scenario

In 2013, the EU and Switzerland will expand their commitment to -30%, keeping the rules for CER import as they are today. Deutsche Bank (2011) estimates total demand from the EU under the 30% case at 250 million from the EU ETS (above the 0.9 billion of our low demand scenario) and 735 million from government purchases, i.e. a total of 1 billion during 2013-2020. I assume that it is equally distributed throughout the period, i.e. 0.4 billion in 2013-2015 and 0.6 billion in 2016-2020. Demand from Switzerland and Norway (which introduces a -40% target) remains well below 50 million (see Berg 2012 for Switzerland, where maximal demand would reach 20 million).

After the Fukushima catastrophe and the temporary shutdown of all nuclear power plants, the Japanese emissions path and credit demand is more uncertain than ever. Already in 2012, energy-related CO_2 emissions are expected to increase by 160 Mt. This estimate is based on data about increases in oil and natural gas use cited in US Energy Information Administration (2012). Japanese 2020 energy-related CO_2 emissions could vary between 1.11 Gt in a full nuclear phaseout with renewables expansion and 0.96 Gt with an increase of nuclear energy compared to the pre-Fukushima situation, compared to 1.06 Gt in 1990 (see Agency for Natural Resources and Energy of Japan 2012). Adding the 0.2 Gt non-energy related GHG emissions and assuming that Japan sticks to the 25% reduction pledged in Copenhagen, the emission gap could reach 0.2 to 0.4 Gt in 2020. Assuming that Japan covers the "Fukushima gap" until 2013 through 50% CERs and 50% AAUs, immediate demand for CERs would increase by 0.1 billion. Afterwards Japan will only buy bilateral credits, for which demand would reach 2.1 billion.

Australian demand will develop as specified by Treasury (2011) modeling from 2015 onwards and reach 0.5 billion CERs by 2020 (Point Carbon 2012b). Of those, less than 0.1 billion would accrue in 2015.

Korean demand is currently rather unclear given the design of its emissions trading system which starts in 2015 has not been specified in detail. Taking the mid point of Point Carbon's (2012c) estimate range, demand would reach 0.8 billion credits, not all of which would be CERs. I assume that 0.1 billion would accrue in 2015.

I assume that sectoral trading starting in Chile, China, Israel, Korea and Mexico from 2018 would generate demand of credits equal to 1% of the total emissions from electricity generation and industry. Using data from IEA (2011) for 2009 emissions levels and assuming a doubling of emissions between 2009 and 2018 in these countries, annual demand would reach 130 million credits, i.e. 0.4 billion in total.

4.3. High demand scenario

Under this scenario, the 2015 COP leads to a renewed vigour of international mitigation effort, with an increased belief in carbon markets. The EU and Switzerland have a 30% target and allow unlimited imports of CERs into their respective ETS's. Assuming that compliance buyers in the EU ETS use CERs for 75% of total allocation, would generate demand of 4.5 billion credits in 2013-2015 and 6.8 billion credits in 2016-2020.

Japan covers the difference to 25% target fully by CERs/ERUs, generating a demand of 0.8 billion in 2013-2015 and 1.3 billion 2016-2020.

The US introduces a cap and trade system by 2015 with commitments and CER imports as per the Waxman- Markey bill, which allows an import of up to 2 billion credits per year. According to the estimates of USEPA (2009), credit imports reach 1.3 billion in 2015 and 7.0 billion in 2016-2020.

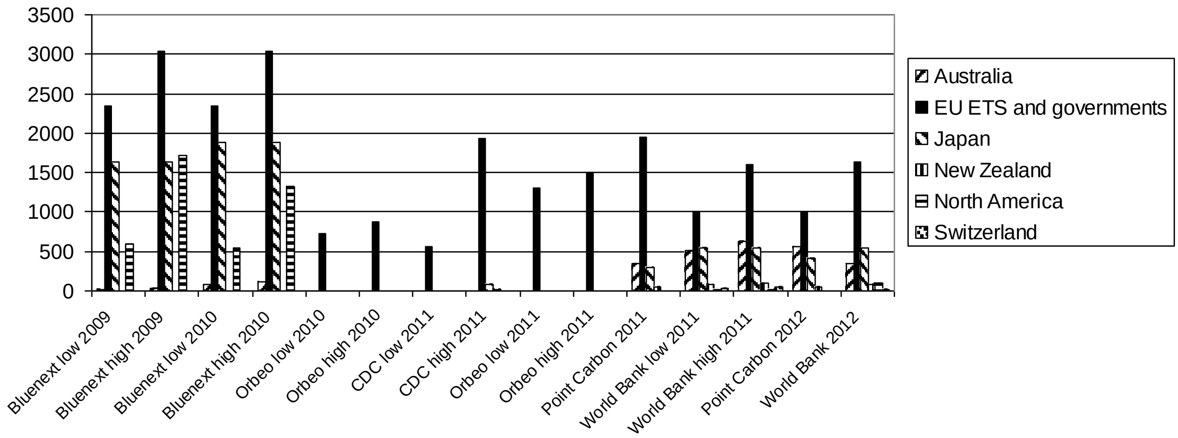
Canada joins the new treaty with a 2020 commitment comparable with the US commitment, i.e. a linear reduction of 17% compared to 2005's 560 million t CO_2 and introduces a cap and trade system with CER import thresholds comparable to the US rule, i.e. about 30% of allocation. This would generate a demand of 0.1 billion credits in 2015 and 0.7 billion in 2016-2020.

China, all OECD member states that are not Annex B members and the Gulf Cooperation Council (GCC) take up commitments by 2017 that lead to a linear deviation from business-as-usual that reaches 5% by 2020. Half of this difference becomes demand for international credits. I assume that business-as-usual is an extrapolation of the emissions growth of the country group achieved in 1999-2009, which reached 69% (IEA 2011). This demand increases from 70 million in 2017 to 370 million in 2020, totaling 0.9 billion.

4.4. Demand scenarios in the literature

Kossoy and Guigon (2012 a, p. 106) see a demand of 2.7 billion in 2013-2020 and Point Carbon (2012a) of 3.5 billion. Linacre et al. (2011) estimate a low scenario of 2.9 billion and a high scenario of 3.9 billion, assuming that the EU and Australia increase their emissions commitments to -30% and -15%, respectively. Figure 3 shows earlier demand scenarios and shows the strong variations between scenarios published at the same time as well as scenarios published by the same institution in different years. It is particularly striking to see that entire market segments are excluded by some analysts but not by others.

Figure 3: Demand scenarios for 2013-2020 published during 2009-2012 (million CERs)



Note : For the World Bank figures, the original publications assume that only 750 of the 1750 million credit limit import of the EU ETS in 2008-2012 will be covered. Given the pressure on CER prices, this assumption is unrealistic and one can assume that the entire volume will be used before the end of the second EU ETS period.

Sources: Kossoy and Guigon (2012), Linacre et al. (2010), Bluenext (2010), Rapin (2009), Delbosc et al. (2011), Société Générale (2010), Point Carbon (2012d).

5. Combinations of supply and demand

Only some combinations of supply and demand lead to a realistic outcome and will be discussed in detail. Given that generally, demand is lower than supply for each of the scenarios, only combinations of relatively higher demand with lower supply scenarios make sense. This should not obfuscate the situation that in most combinations a supply overhang leads to a low market price, which will reduce supply in the future. Such a situation can already now be observed on the market. It leads to many dysfunctionalities. For example, in a market with rapidly falling prices, buyers try to use legal loopholes in the forward contracts to avoid paying the originally agreed prices and renegotiate the contract.

5.1. Low supply and low demand

This combination yields an supply overhang of 1.3 billion in the period 2013-2015 and 2.1 billion in 2016-2020. While politically relatively realistic, this combination would lead to a massive pressure on prices, and probably the emergence of quality niches that allow a product differentiation on the side of the sellers.

5.2. High supply and high demand

This scenario initially generates a demand surplus but it is more than compensated by a supply overhang in the run-up to 2020. Thus a price spike similar to the one witnessed before 2008 could be expected.

5.3. Standard supply and high demand

Here, a consistent demand surplus exists which would lead to an upward price trend.

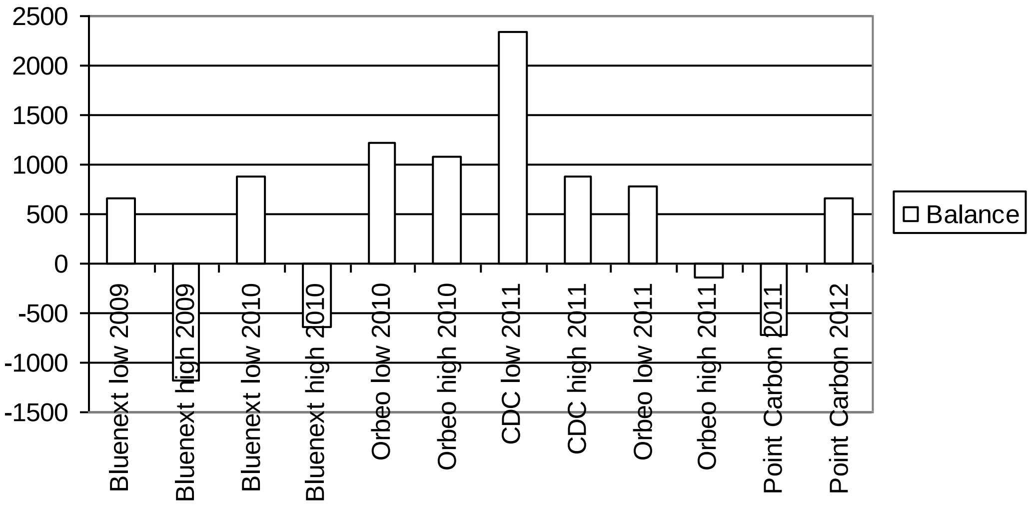
5.4. Low supply and standard demand

This is the most balanced combination of scenarios, with a small supply overhang in the first period and a balance between supply and demand in the second period.

5.5. Scenario balance in the literature

Point Carbon (2012a) sees a supply overhang of 1.0 billion under a scenario combination which is close to my low supply and standard demand estimate. Figure 4 shows the balance of a number of scenarios published between 2009 and 2012; the majority has a significant supply overhand. It should be noted that no AAU sales are included in the balance.

Figure 4: Supply-demand balance of scenarios developed between 2009 and 2012



Note : Positive numbers denote a supply overhang. For Point Carbon 2012, the value differs from the value quoted above due to the different treatment of the 2008-2012 quota of the EU ETS.

Sources: Kossoy and Guigon (2012), Linacre et al. (2010), Bluenext (2010), Rapin (2009), Delbosc et al. (2011), Société Générale (2010), Point Carbon (2012d).

6. Conclusions

The development of three supply and demand scenarios shows that under the current status of international climate policy, a supply overhang is quite likely, which will weigh on the market price. Table 4 shows that only for one out of nine combinations of periods and scenarios, a demand overhang would arise which can be easily covered by a small scahre of accumulated hot air.

Table 4: Imbalance between supply and demand for the combination of the equally likely scenarios (billion credits)

Scenario combination	2013-2015	2015-2020	2020- (annual)
Low	1.3	2.1	0.4
Standard	2.4	7.7	1.8
High	-3.5	4.6	0.8

Note: Positive values: Supply overhang

The generic message of my scenarios is supported by demand and supply estimates published by carbon market analysts in the last three years. Despite the lack of consideration of new types of supply such as NMM in these scenarios, most of them show a substantial supply overhang,

Under this situation, the introduction of new market mechanisms and the expansion of the CDM through further standardization and streamlining seem to be less important than the increase of demand through pressure on governments to increase mitigation ambition.

6.1. Which scenario combinations are most likely?

Under the current state of international climate negotiations, the standard and high supply scenario seem to be more likely than the low one. Regarding demand, the low and standard scenario have a higher probability than the high scenario. This means that an imbalance on the market is even more likely than shown in Table 4, and a high supply volume is confronted with a limited volume of demand.

6.2. Impact of the key factors on the overall role of carbon markets for climate mitigation

The main parameters that determine demand are the degree of stringency of emissions commitments on the national level, and the willingness of policymakers to acquire or allow entities subject to domestic climate policy instruments to use international credits. On the supply side, the key parameters are the eligibility of project types, the stringency of baseline methodologies and additionality determination. Given the current overhang of supply, the call of many stakeholders to broaden/simplify the approaches should not be dealt with as a priority, instead generation of demand should become the key approach.

6.3. The role of the CDM

The CDM has already been suffering from the recent price crash. Nevertheless, policymakers still want to broaden it. A broadened CDM alone will be able to easily cover all currently realistic demand scenarios. In case the high demand scenarios unfolds, there is still enough time to set up new mechanisms that can then cater for the increased demand.

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