

Suggested process for carbon analysis for CUSC amendment CAP164

Basic principles

The analysis should be as realistic as possible and ensure that all sources of lower or additional carbon are accounted for, but wherever possible ensure that the analysis is simple. Noting the forecast nature of the key variables, the process cannot be used as a prediction, but provide a method of assessing probable outcomes for given scenarios.

Consideration needs to be given as to whether the analysis should be undertaken for all amendments CAP161 to CAP166 or for only CAP164. This paper is presented in relation to assessing CAP164, but could be equally applied to other amendments.

The paper focuses on CO₂ impacts. It does not attempt to address the issue of balancing costs implications. However, the analysis should be consistent with that for the calculation of balancing costs so that the overall cost or benefit of the proposal can be assessed.

This paper sets out 4 main stages for a possible analysis method:

Stage 1 – Establish the baseline

Stage 2 – How would the profile be altered by CAP164?

Stage 3 – Calculating impacts on Carbon Dioxide emissions

Stage 4 – Multiply Carbon Dioxide savings/costs by shadow price of carbon

Stage 1 – Establish the baseline

What generation do we think would connect if CAP164 was not implemented?

- Contracted background forms the basis, but we cannot assume that it all connects.
- It would be unrealistic to assume that we can pick the exact projects that will commission successfully. Therefore, a drop out rate should be assumed taking into account the areas that projects are locating and estimating their likelihood of achieving planning.
- Once plant drop out has been assumed, it is to be expected that under the baseline some other projects will move forward to fill available gaps in the queue.
- Make assumption of effects of CAP150 and how this will bring the profile forward from that contracted at present.
- What capacity of existing plant will close and what type? This is needed later to estimate fuel mix of conventional plant displaced.

- The proposal is for this analysis to be carried out by zone, with a preference for SYS zones (as generation is already mapped to this).

Of course, this analysis will be subjective and required a number of assumptions to be made. A limited number of scenarios should therefore be constructed, rather than one sole baseline, for instance to estimate the effect of transmissions reinforcements being delayed.

Stage 2 – How would the profile be altered by CAP164?

- What projects in background are waiting for MITs reinforcement works and would therefore benefit from CAP164?
- How many of these could have their local works advanced to take advantage of CAP164?
- What proportion could bring forward their development projects? For example, how it this affected by the availability of turbines or the status of planning.

A similar analysis should be undertaken for Stage 1 to underpin Stage 2. Therefore, a zonal approach should be taken to analysing the likelihood of projects progressing in the queue. Again, given the subjectivity of this type of assessment, it is proposed to assess a limited number of scenarios for this.

Stage 3 – Calculating impacts on carbon dioxide emissions

General principle: Carbon Dioxide emissions will have to be calculated for each year as the Shadow Price of Carbon changes by year to reflect different value of abating carbon in each year.

Conventional generation displacement

- What amount of plant brought forward is renewable? How much is conventional? If conventional is it lower carbon intensity than that it displaces (e.g. nuclear or CCGT)? Recommend judgement is used based on baseline as established.
- What load factor will the renewable plant operate at? Is it possible to reflect regional differences in wind speeds? Constraints may have a bearing here as wider reinforcements may not be carried out under CAP164. It is proposed that load factors should be calculated by zone as per the analysis above. For instance, Zonal load factors are contained in Appendix 7 (page 92) of the GB SQSS Consultation Document “Review for Onshore Intermittent Generation”

<http://www.nationalgrid.com/NR/ronlyres/B6B8CABD-6D2C-4D1E-A48F->

- It is the marginal generation that will be displaced. Therefore, what should we assume as the marginal plant mix. Although theoretically the marginal plant at NBP would be displaced, constraints may prevent this from happening. It is proposed to undertake analysis by zone to estimate the extent to which this is the case.
- What are the Carbon Dioxide emissions of the conventional plant displaced? There are a number of different values of CO₂ per MWh available dependent on fuel type and source. It is proposed to use a range to ascertain the sensitivity of the analysis to this figure.
- It is proposed to estimate the potential for any additional Carbon Dioxide to be emitted as a result of this or other conventional plant being part loaded or warmed to provide reserve/response. CO₂ figures for this part of the analysis should be different to reflect the differing efficiency of part loading plant.

b) Losses

- How are losses affected? National Grid can model this and calculate additional losses given assumptions on what plant would be generating and where.
- If so, what is their carbon cost? Assume the increase in losses will result in increased output from the marginal plant which will be conventional as wind generates at very low marginal cost. Again, the extent to which this is provided at NBP or is affected by constraints should be assessed.

c) Transmission Infrastructure

Assume:

- Local works will be brought forward. The only carbon cost issue here is that the shadow price of carbon increases in future years.
- The investment programme would just continue anyway (ie the SO would “manage” until the reinforcements caught up but the reinforcements would be the same). That is, the investment programme would only change if the SQSS did.

The only effect is from bringing forward the local works to be priced at a different SPC. It is therefore proposed that transmission infrastructure is not taken into account for the assessment of CAP164.

Stage 4 – Multiply carbon dioxide savings/costs by the Shadow Price of Carbon

There are number of measurements of carbon cost. It is proposed to use the Shadow Price of Carbon, as this is likely to be consistent with the analysis Ofgem would use.

Other issues to consider

1. Over which period of time should the analysis be carried out over?

This is only a relevant question if you believe that CAP164 would not simply bring forward the investment profile, but would result in a higher ongoing level of renewable generation or lower outturn level of transmission asset investment than the baseline.

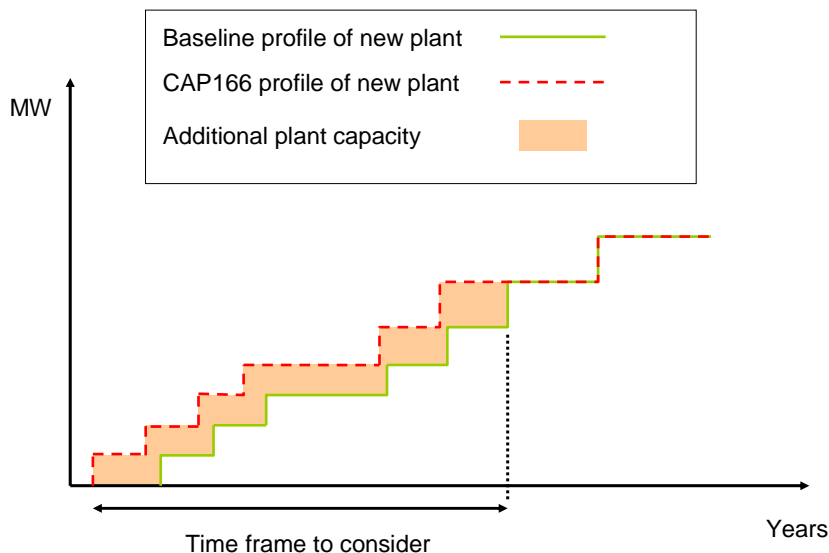


Figure 1: Profile is brought forward

For instance, figure 1 illustrates bringing forward the profile of new generation investment. The green line is the baseline profile whereas the red dashed line is the new profile. The increased capacity is shown by the areas between the two. Any benefit is derived from bringing forward that capacity in time and therefore there is a finite timescale over which this occurs.

If the belief is that CAP164 would result in additional renewable capacity over all then a different decision needs to be made. Figure 2 below shows the same diagram as figure 1 but illustrating this belief. The possible benefit is ongoing but for how long should it be counted?

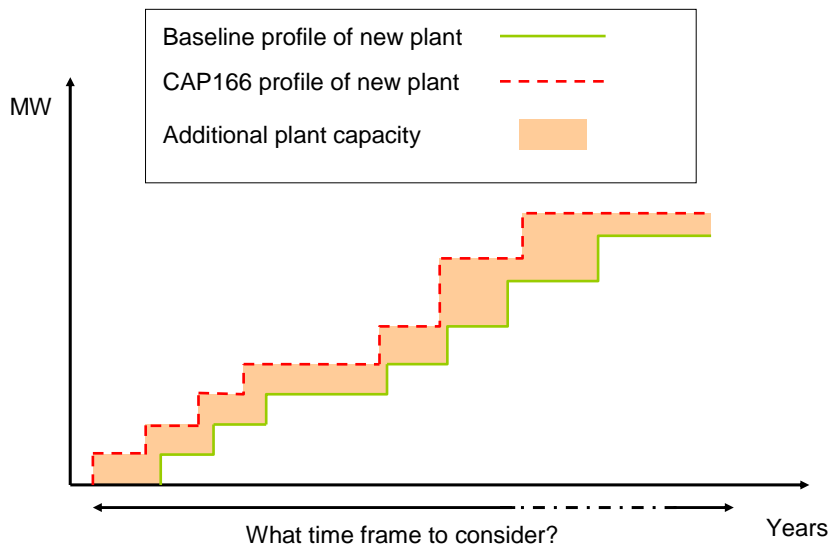


Figure 2: More capacity built overall

The proposed approach is to ascertain how the profile changes as a result of the analysis carried out in stage 2.

If the profile is simply brought forward, it is proposed that the cost benefit would be carried out for the period of the benefit in terms of increased CO₂ displacement. If the amount of benefit is deemed to be ongoing then it is proposed that the backstop date is the year 2020. However, beyond 2016 there is very little information in the TEC register. Therefore, the figures will be extrapolated from 2016 to 2020.

2. Should other emissions be taken into account?

Renewables have the ability to offset other emissions from power stations. DEFRA's website lists greenhouse gas emissions in total and by sector:

<http://www.defra.gov.uk/environment/statistics/globalatmos/alltables.htm>

The emissions listed for the power sector are Carbon Dioxide, Methane and Nitrous Oxide. Methane is estimated to be 20 times more harmful than Carbon Dioxide whilst Nitrous Oxide is 310 times. Even taking that into account Carbon Dioxide by far is the most prevalent pollutant from the power sector. Figure 3 below shows the three emissions as Carbon Dioxide equivalent (CO₂e).

Figure 4 below shows the total amount of emissions as CO₂e with the power sectors contribution identified separately. Again it is clear that Carbon Dioxide itself is the main pollutant to consider for the power sector.

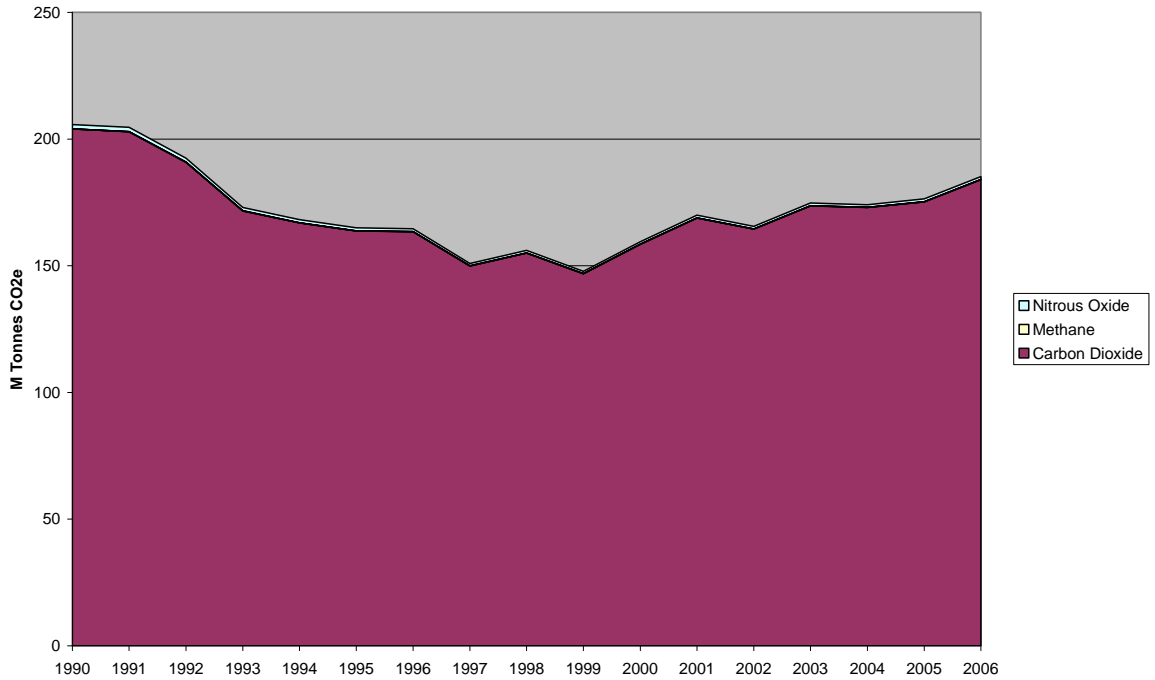


Figure 3: Power sector emissions by year

Finally, to try to put a cost a cost on this, using a shadow price of carbon of £24.3/tonne CO₂e gives a cost of Carbon Dioxide emissions from the power sector in 2006 of £4,470m, whereas the other two pollutants between them come to just over £30m.

It is therefore proposed to concentrate on CO₂ and not to include other pollutants.

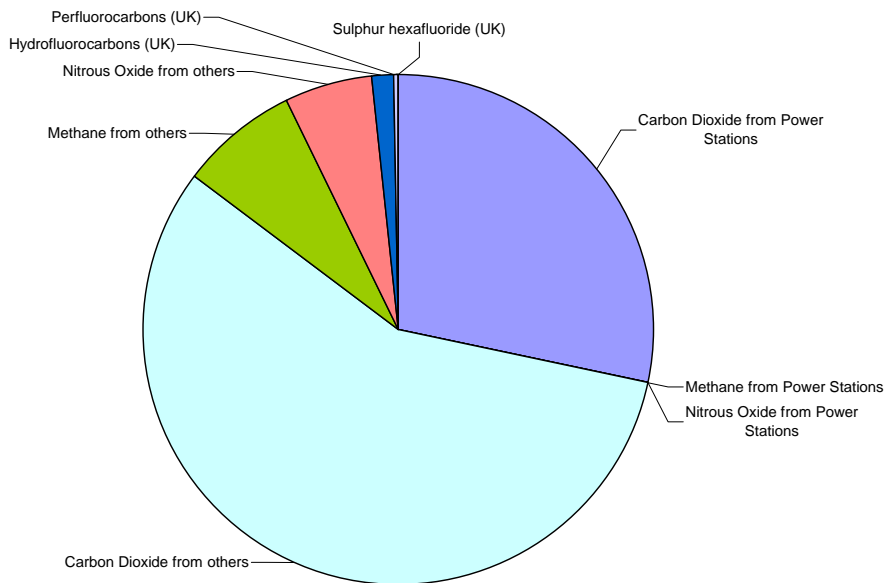


Figure 4: Total greenhouse emissions 2006 (CO₂e)

Possible Information sources for the analysis

1. TEC register

<http://www.nationalgrid.com/NR/rdonlyres/ECA41EF8-8198-45A9-9740-7F5EB657AA51/26489/TEC16June09.xls>

There is limited public domain information other than this. Previous confidential data requests from National Grid on this issue have not brought forward many responses. Therefore, the TEC register would appear to be a sensible place to start.

2. National Grid's works register.

http://www.nationalgrid.com/uk/Electricity/GettingConnected/gb_agreements/Reinforcement/

3. Information on planning success rates/commissioning success rates.

BWEA and SRF hold data on consenting rates

RE Stats database

<http://www.restats.org.uk/>

4. Environmental group info such as Scottish Natural Heritage

<http://www.snh.gov.uk/strategy/renewable/sr-rt01.asp>

5. Guidelines to DEFRA's Greenhouse Gas Conversion Factors for Company Reporting - June 2008

<http://www.defra.gov.uk/environment/business/envrp/pdf/ghg-cf-guidelines2008.pdf>

AND annexes

<http://www.defra.gov.uk/environment/business/envrp/pdf/ghg-cf-guidelines-annexes2008.pdf>

6. If using the SPC a different price for each year is set out in DEFRA guidance on its website. There a number of guidance documents which can be found at the following links:

<http://www.defra.gov.uk/environment/climatechange/research/carboncoast/pdf/background.pdf>

<http://www.defra.gov.uk/environment/climatechange/research/carboncoast/step2.htm>

<http://www.defra.gov.uk/environment/climatechange/research/carboncoast/pdf/HowtouseSPC.pdf>