Suggested process for carbon analysis a paper for Transmission Access Working Group 1 Meeting on 8 July, 2008

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 scenarios for given outcomes.

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 assumes that we are assessing CAP164, but could be equally applied to other amendments.

This paper focuses on CO2 impacts. It does not attempt to address the issue of balancing costs implications.

This paper sets out 5 main stages for a possible analysis method:

Stage 1 – Establish the baseline
Stage 2 – How would the profile be altered by CAP164?
Stage 3 – Conventional generation displacement
Stage 4 – Calculating impacts on Carbon Dioxide emissions
Stage 5 – Multiply Carbon Dioxide savings/costs by shadow price of carbon

The Carbon Costing Subgroup has come to conclusions on a number of issues. However, the views of the Transmission Access Working Group 1 members are sought on a number of questions where different opinions exist.

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, some form of average drop out rate could be assumed. Alternatively, a more detailed assessment could be undertaken which takes into account the areas that projects are locating and estimating their likelihood of achieving planning. Either of these will have differing degrees of accuracy and subjectivity.

- 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. This will again be a subjective exercise to ascertain

which plant this would be. Again, an average rate of filling gaps could be assumed, or something more specific to area could be undertaken as mentioned above under calculating the drop out rates.

- The suggestion is for this analysis to be carried out by zone, with a preference for SYS zones (generation is already mapped to this). Does the WG1 agree with this?

- 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.

It may be necessary to establish a limited number of scenarios rather than one sole baseline. Does WG1 agree with this?

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.

The recommendation is for a similar analysis undertaken for Stage 1 to underpin Stage 2. Therefore, if a zonal approach is taken analysing the likelihood of projects progressing in the queue, then this should form the basis of similar analysis for Stage 2. Again, given the subjectivity of this type of assessment, then using scenarios for this would appear sensible.

Stage 3 – 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. Zonal load factors are shown in Appendix 7 (page 92) of the GB SQSS Consultation Document “Review for Onshore Intermittent Generation”

http://www.nationalgrid.com/NR/rdonlyres/B6B8CABD-6D2C-4D1E-A48F-51789CA93484/22606/GBSQSS_Review_for_Onshore_Intermittent_Generation.pdf

- It is the marginal generation that will be displaced. Therefore, what should we assume as the marginal plant mix. Does this change from the mix now? A possible approach is to consider a range, for instance between lower carbon emitting CCGT usage at one end to coal at the other. Should this analysis be undertaken zonally rather than at NBP? Views sought from WG1.

Stage 4 - Calculating impacts on carbon dioxide emissions

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

a) Conventional plant displacement

- What are the Carbon Dioxide emissions of the conventional plant displaced? There are a number of different values of CO2 per MWh available. If a range is adopted as mentioned above then the appropriate values can be used.
- Would any additional Carbon Dioxide be emitted as a result of this or other conventional plant being part loaded or warmed to provide reserve/response? These two should be calculated together as it may be incorrect for example to calculate the average emission reductions for displaced generation and specific increases (if any) from increased reserve holding/warming.

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.

There has been some concern that this is a level of detail too far or is wider than we should be considering. However, an alternative view is that losses are important and directly relevant to electricity transmission. It would be incorrect to assume that lower carbon generation measured at “the factory gate” was to offset fully the same level of conventional generation, if losses were to increase. What does the WG1 think?

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?

Therefore, do we need to consider the carbon cost of transmission investment for the brought forward works, or is it somewhat tenuous to claim a benefit due to the differing level of SPC? Views from WG1 welcome.

Stage 5 – Multiply carbon dioxide savings/costs by shadow price of carbon

Is the SPC the correct measure to use or should we use the Social Cost of Carbon? Poyry use a Social Cost of Carbon in their analysis of straw men and constraint costs attached to the TAR report.

http://www.ofgem.gov.uk/Networks/Trans/ElecTransPolicy/tar/Documents1/Poyry%20-%20Transmission%20Access%20Review%20Analysis%20of%20Constraint%20Costs.pdf

The recommendation is to use the SPC as this is likely to be consistent with the values Ofgem would use. Views of WG1 are welcome.

Other issues to consider

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 outturn level of renewable generation or lower outturn level of transmission asset investment than the baseline.

For instance, figure 1 below 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 is occurs.

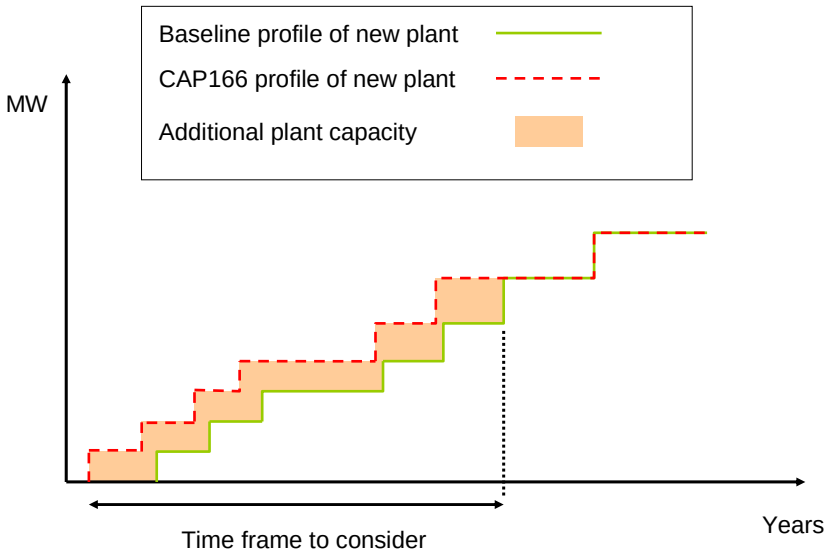

Figure 1: Profile is brought forward

If the belief is that CAP164 would result in additional renewable capacity over all then a more difficult 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? A possible approach to this would be to cease the analysis at 2020 in line with the renewable target. However, beyond 2016 there is very little information in the TEC register. The approach used for CAP148 was to extrapolate SYS figures.

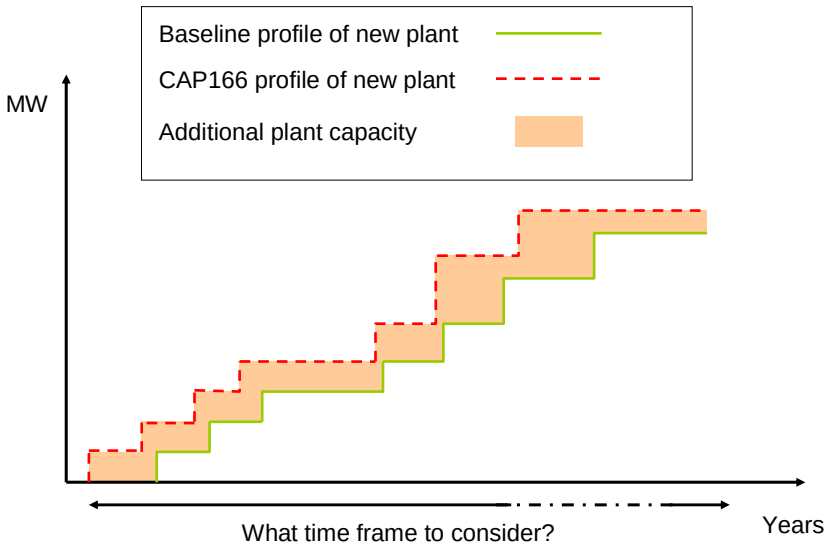

Figure 2: More capacity built overall

The more likely scenario would appear to be the bringing forward of the profile. It also has the benefit of simplifying the analysis. However, the definitive view should come out of stage 2 above.

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/globatmos/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 polluter from the power sector. Figure 3 below shows the three emissions as Carbon Dioxide equivalent (CO2e).

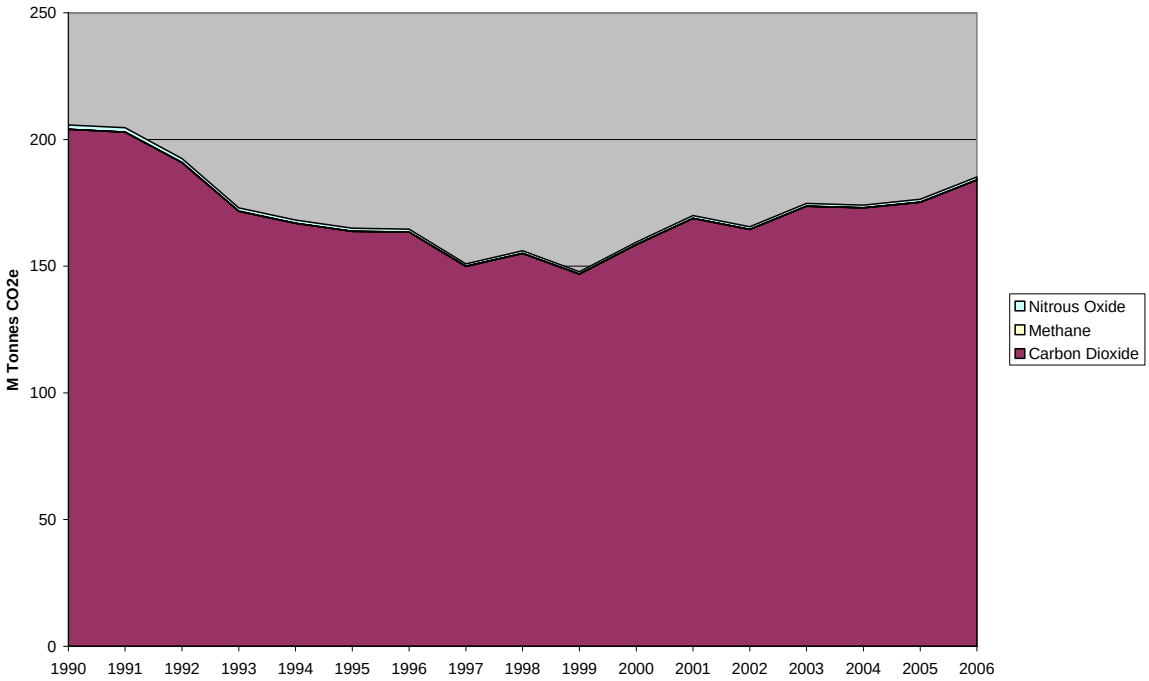

Figure 3: Power sector emissions by year

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.

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.

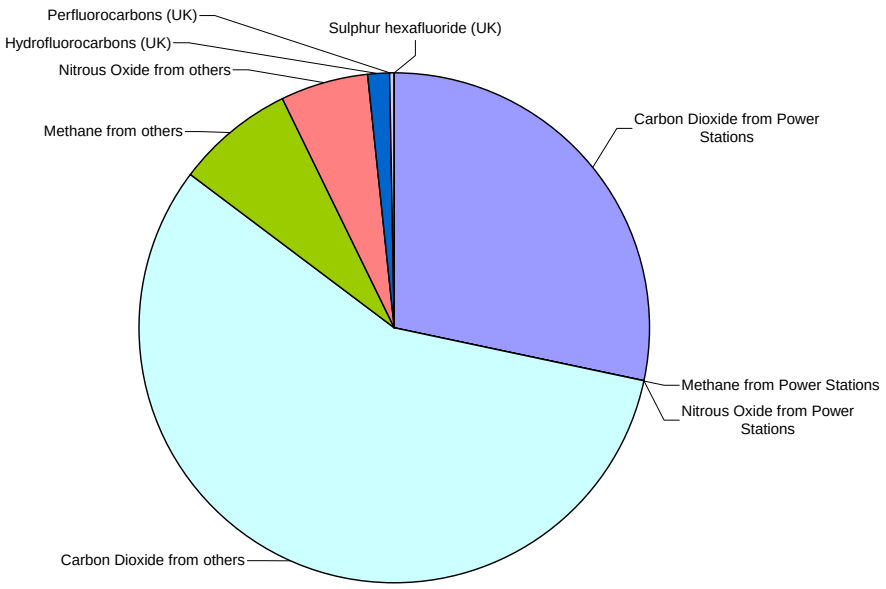

Figure 4: Total greenhouse emissions 2006 (CO2e)

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/carboncost/pdf/background.pdf

   http://www.defra.gov.uk/environment/climatechange/research/carboncost/step2.htm

   http://www.defra.gov.uk/environment/climatechange/research/carboncost/pdf/HowtouseSPC.pdf