

# Calculating Carbon Savings due to CAP 164

## A note on some of the issues

### Scope

This note gives some thoughts on what has to be taken into consideration in order to calculate any carbon savings from the implementation of CAP 164 (Connect and Manage with any additional constraint costs not targeted at specific users i.e. funded as constraint cost are currently funded). It does not give any figures but merely thoughts on how the various factors that people have mentioned may be treated.

### The basic carbon saving

On the assumption that the group is going forward on the basis that the modification would apply to all generation one would have to make an assumption on how much additional generation of various types would connect under this policy and at what load factor it would operate. At one extreme one could postulate that all additional plant connecting would be fossil fired and of the same or lower average carbon intensity than the plant it replaces. That is extremely unlikely. It is more likely to be the case that additional plant connecting would be either renewables, new nuclear build, CCGT plant or coal fired plant with a higher thermal efficiency than existing coal fired generation (carbon capture ready / implemented is unlikely for some time). Whatever the mixture of the additional plant it is likely that it will be of lower carbon intensity than what it replaces and it is necessary to make an assumption of what the mixture of new plant due to this modification is in order to work out a carbon saving due to the replacement of higher carbon intensity generation.

### Transmission infrastructure – offset or credit?

It has been suggested that additional transmission infrastructure constitutes a source of additional carbon emissions that should be offset from the carbon savings. In addition at the last meeting (28<sup>th</sup> May) some parties suggested that because you could connect more generation onto the existing infrastructure under this proposal there was a carbon saving related to transmission infrastructure.

My view is that you can not possibly need additional transmission infrastructure under this policy compared to either the status quo or allowing people to connect “early” with targeted constraint cost charge out as almost by definition the transmission infrastructure is being built as fast as it can and any type of “connect and manage” proposal is about connecting more plant to whatever infrastructure the TO’s have managed to build before the generators would otherwise connect. There is an argument that the TO’s may choose to build less infrastructure but this is primarily a matter for the SQSS rather than any connect and manage type proposal. It is the case that the local connection works may be undertaken to connect the generation earlier than would be the case if they were timed to fit in with wider transmission reinforcement and this advances associated carbon emissions.

Overall my feeling is that we should ignore carbon emissions associated with transmission infrastructure construction in any assessment. There is an argument (although more associated with SQSS issues) that transmission infrastructure investment could be reduced against whilst it is true that local transmission works may be advanced by connecting any generation earlier than it otherwise might be. I suspect that the overall effect is second or third order and not at all clear in what direction it is anyway.

## **Losses**

It has been suggested that there are increased losses associated with the adoption of CAP 164 over the adoption of a “connect and manage with targeted charge out of additional constraint cost” proposal. Having thought about this over some weeks I have come to the conclusion that if parties make rational decisions there should be no additional losses.

The logic for this is as follows. Any new generator that may connect under CAP 164 but would not connect under a targeted constraint cost charge out regime is only concerned about what happens during periods of constraint. For those periods when no constrain affecting the generator bites there is no difference in the situation of the generator between a “socialised constraint cost” regime and a “targeted constraint cost regime” because the targeted constraint cost charge out would be zero.

The generator therefore only considers those periods when relevant constraints bite. By definition if an export constraint bites the flows across relevant boundaries will be controlled to be at the maximum values allowed under the operational rules in the SQSS. The flows and therefore the transmission losses will be at exactly the same values whether the generator has decided to connect or not. In other words what is happening is if the new generator is running it will be resulting in generation local to it (the same side of the constraint boundary) being constrained down or off rather than having an effect on overall flows (and hence losses) on the system.

That deals with a comparison with a CAP 164 result compared to a “connect and managed with targeted cost charge out” system. If you want to compare a generic connect and manage approach with the current system there could be some additional losses, basically associated with a resulting higher utilisation of the network. There would be no additional losses at the times when constraints are biting (because as above when constraints are biting the relevant flows and hence losses are essentially fixed). However by connecting more generation on the exporting sides of constraints, compared to what is currently allowed, the period of the year when those constraints do bite may be increased which would result in increased losses. This is a natural and inevitable effect of getting the “maximum” utilisation of the transmission system for a greater number of hours each year.

## **Additional Part Loading of plant**

This has been brought up as a possible consequence of having more intermittent generation such as wind on the system. Obviously it would only have an effect on carbon emissions if the additional part loaded plant emitted more CO<sub>2</sub> as a result of being part loaded. For example if when it was windy energy limited hydro plant was

part loaded there would be no additional emission as a result of part loading. There would of course be no basic CO<sub>2</sub> saving at such times either, the savings would arise from the hydro generation operating at times when the wind was not blowing and when if it had not been operating at part load when the wind was blowing, it could not operate at all as it would have run out of water.

As regards additional carbon emitting plant being run at part load because of additional intermittent plant there are two possible causes for this that need to be considered separately.

#### Additional part loading in order to provide frequency response

Plant that is part loaded is required in order to provide frequency response for low frequency events. The question to be asked is how much if any additional frequency response may be required as a result of additional intermittent generation.

The requirement for primary and secondary response is currently determined by the largest sudden loss that the system is operated to cope with. My understanding is that the nature of wind in particular is not to produce very sudden large losses equivalent to a large generator tripping. It would be interesting to get an NGC view on what the level of wind generation would have to be before it of itself drove the need for additional frequency response. The possible need for additional frequency response that is topical relates to the possible use of 1600+ MW nuclear reactors that clearly could trip and would therefore increase the largest loss to be catered for from 1320MW to 1600MW+.

My suspicion is that we are nowhere near approaching the wind penetration where it would be a driver for increased frequency response and hence increased part loading to provide frequency response. It would be interesting to get an NGC view on this.

#### Additional Part loading in order to provide reserve

Reserve is provided to deal with demand / generation uncertainty over time periods longer than those for frequency response and I think it is much more likely that additional intermittent generation could effect the requirement for reserve than for response. The questions to be considered are how much additional reserve if any may be required and how much of this would optimally be provided by additional part loaded plant.

Since the introduction of NETA there has been an excess of part loaded plant on the system due to many generators wishing to balance their commitments internally. Whilst it is hoped that this “operational inefficiency” reduces over time, until it does it is providing reserve on part loaded plant. Should extra reserve be required it may be provided either on additional part loaded plant or gas turbines at rest or from conventional plant that is completely shut down, depending on the time scale for which the reserve is required. There is also considerable as yet unexploited scope to obtain reserve from the demand side, either through industrial / commercial user ancillary services contracts or simple additional price sensitivity conveyed to customers through “smart meters” / “smart appliances”.

Whilst it is clear that in principle additional intermittent generation could lead to an increase in the amount of reserve required it is not a simple matter to work out from that how much of this additional reserve if any would require additional thermal plant part loading.

## **Conclusions**

A full estimation of the carbon saved from the adoption of CAP 164 compared to a targeted cost charge out of additional constraint costs is complex. My thoughts under various headings are:

### Basic reduction

Need to make an assumption about the type of additional new plant that would connect and its load factors.

### Transmission Infrastructure

Overall effect may be very slightly positive or negative and significant changes more likely to relate to SQSS changes than CAP 164.

### Losses

CAP 164 compared to targeted constraint charge out scheme should have no effect on transmission losses.

### Thermal plant part loading

Thought unlikely to be any effect relating to frequency response but may be some effect due to the requirement for reserve.

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