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Review of the Electricity Allocation Factor

Report to the Major Electricity Users' Group

2 July 2010

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Executive summary

An emissions trading scheme (ETS) has been introduced in New Zealand. The government has decided that, for a time, it will compensate trade exposed firms for increases in the prices of their inputs due to the ETS by allocating them New Zealand Units (NZUs). An important element in calculating the number of NZUs to be allocated to (most) major electricity users is the electricity allocation factor (EAF). The intention is that the use of this factor will compensate major electricity users for the impact of the ETS on the price of electricity as an input into production.

In a consultation document released in December last year, the government proposed that the EAF be set at 0.52 NZU per megawatt hour (MWh) of electricity consumed. The Major Electricity Users' Group (MEUG) and others did not support this proposal and submitted that the EAF should be higher. The Parliamentary Commissioner for the Environment (PCE) submitted that the EAF should be much lower at around 0.20. The government decided to confirm the use of an EAF of 0.52 for the period up to the end of 2012. The government made its decision after receiving advice from the Ministry for the Environment (MfE) that it should not amend its proposal. MfE gave that advice on the basis of its analysis of submissions and reports and advice it had received from Concept Consulting Group Ltd. Government must complete and publish an independent review of the ETS, including the EAF, before the end of 2011.

We have been asked by MEUG to review all the relevant reports and submissions and advise whether it was appropriate and reasonable to both the government and businesses for MfE to recommend to the Minister an EAF of 0.52 NZU per MWh, given the information available to MfE at the time. If our conclusion is that it was not appropriate and reasonable, we have been asked to indicate what, in our opinion, would have been an appropriate and reasonable EAF for MfE to recommend. We have also been asked to recommend a process that the Minister should follow in the ETS review to be completed before the end of 2011, to determine an appropriate EAF to be effective from 1 January 2013.

On the basis of a thorough review of the evidence, we reach the overall conclusion that it was not appropriate and reasonable to both the government and businesses for MfE to recommend to the Minister an EAF of 0.52 NZU per MWh, given the information available to MfE at the time. In our opinion, an appropriate and reasonable EAF for MfE to have recommended would be 0.61 NZU per MWh.

We make a number of recommendations about the process for resetting the EAF. Broadly, these are designed to ensure greater transparency in the process and more opportunities for interested parties to make valid points and have them carefully considered.

Contents

1. Purpose

An emissions trading scheme (ETS) has been introduced in New Zealand. The government has decided that, for a time, it will compensate trade exposed firms for increases in the prices of their inputs due to the ETS by allocating them New Zealand Units (NZUs). An important element in calculating the number of NZUs to be allocated to (most) major electricity users is the electricity allocation factor (EAF). The intention is that the use of this factor will compensate major electricity users for the impact of the ETS on the price of electricity as an input into production.

In a consultation document released in December last year, the government proposed that the EAF be set at 0.52 NZU per megawatt hour (MWh) of electricity consumed.[1] The Major Electricity Users' Group (MEUG) represents the interests of most of the major users of electricity in New Zealand. MEUG and others did not support this proposal and submitted that the EAF should be higher.[2] The Parliamentary Commissioner for the Environment (PCE) submitted the EAF should be much lower at about 0.20.[3] The government decided to confirm the use of an EAF of 0.52 for the period up to the end of 2012. The government made its decision after receiving advice from the Ministry for the Environment (MfE) that it should not amend its proposal. MfE gave that advice on the basis of its analysis of submissions and reports and advice it had received from Concept Consulting Group Ltd (Concept Consulting). Government must complete and publish an independent review of the ETS, including the EAF, before the end of 2011.

We have been asked by MEUG to review all the relevant reports and submissions and advise whether it was appropriate and reasonable to both the government and businesses for MfE to recommend to the Minister an EAF of 0.52 NZU per MWh, given the information available to MfE at the time. If our conclusion is that it was not appropriate and reasonable, we have been asked to indicate what, in our opinion, would have been an appropriate and reasonable EAF for MfE to recommend. We have also been asked to recommend a process that the Minister should follow in the ETS review to be completed before the end of 2011, to determine an appropriate EAF to be effective from 1 January 2013.

In the next section of this report, we discuss the basis of the government's initial proposal of a 0.52 EAF. In section 3, we critically review the various submissions

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[1] Ministry for the Environment (2009) *Development of Industrial Allocation Regulations under the New Zealand Emissions Trading Scheme: Consultation Document*, December 2009, p.18. (Hereinafter, MfE consultation document).

[2] MEUG (2010) *Submission on Development of Industrial Allocation Regulations under the New Zealand Emissions Trading Scheme*, February 2010 (Hereinafter, MEUG submission) and Ministry for the Environment (2010) *Development of Industrial Allocation Regulations under the New Zealand Emissions Trading Scheme: Summary of Submissions,* April 2010, p.9. (Hereinafter MfE summary of submissions).

[3] Parliamentary Commissioner for the Environment (2010) *Feedback to the Ministry for the Environment on the Development of Industrial Allocation Regulations under the New Zealand Emissions Trading Scheme,* February 2010, p.2. (Hereinafter, PCE submission).

made on this proposal. MfE's treatment of those submissions in its advice to the Minister is reviewed in section 4. We summarise our conclusions in relation to the setting of the EAF for the period 2010 to 2012 in section 5. In section 6, we draw on our observations about the process followed to set the current EAF to recommend a process that the Minister should follow to determine an appropriate EAF to be effective from 1 January 2013.

2. The basis of the proposal

2.1 SEIP-TAG October 2008

To provide it with guidance and advice on technical design elements of the stationary energy and industrial processes emissions components of the ETS, MfE appointed a technical advisory group of officials and industry experts – SEIP-TAG. Amongst the main tasks in the terms of reference of SEIP-TAG was "advising on specific issues about electricity – how to assess the impacts of emission prices on electricity prices, as an input to options for assistance".[4]

2.1.1 The Halliburton report November 2008

To assist it with this task, SEIP-TAG established an electricity industry subgroup. The subgroup had MfE engage Dr Tom Halliburton of Energy Modeling Consultants Ltd to undertake modelling work to estimate the factor necessary to compensate electricity consumers for the price effects of carbon costs on electricity prices over the period from 2010 to 2032.[5] In his report, Dr Halliburton refers to this factor as the emission factor, but it is the EAF. He defines it as the difference between the short-run marginal cost (SRMC) of electricity generation with and without carbon costs, expressed as a ratio to carbon costs.

To calculate the alternative SRMCs over the period 2010 to 2032, Dr Halliburton uses the SDDP (stochastic dual dynamic programme) dispatch model. This replicates the operation of the wholesale electricity market in New Zealand under the assumption that the market is competitive, such that every generator always offers each plant at its SRMC of production. SDDP has been widely used for electricity market analysis in New Zealand over a number of years.

Dr Halliburton applies SDDP to estimated generation portfolios in each year from 2010 to 2032, and to estimates of fuel costs, demand growth and HVDC capacity over the same period. The generation portfolios he derives from work undertaken by the Ministry of Economic Development (MED) using the Electricity Commission's Generation Expansion Model (GEM). This incorporates various assumptions about

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[4] Technical Advisory Group (2008) *Stationary Energy and Industrial Process Component of the New Zealand emissions Trading Scheme: Final Report*, October 2008, p.48. (Hereinafter SEIP-TAG final report).

[5] Halliburton, T. (2008) *SDDP Modelling of Carbon Dioxide Emissions from Electricity Generation*, November 2008.

the management and retirement of Huntly coal units and the minimum running requirements of major thermal generation plant. The fuel cost estimates used by Dr Halliburton are the Electricity Commission's forecasts.

Dr Halliburton makes no allowance in his modelling for the price elasticity of demand for electricity. He assumes that demand will grow by 2.00% per year on average in the North Island between 2010 and 2012, slowing thereafter to only 1.38% growth in 2032. For the South Island, the assumption made is 1.51% growth per year on average in over the period 2010 to 2012. Demand growth will then slow to 0.51% in 2017 before rising slightly to 0.66% in 2032. The basis for these demand forecasts is not specified in the report.

Dr Halliburton's report provides estimates of the EAF in each year between 2010 and 2032 for various prices of carbon and the North Island and South Island separately. The carbon prices for which results are reported are $20, $40, $60 and $80 per tonne CO_2. The report does not contain any other sensitivity analysis – no indication of what the effect on the estimated EAF would be of, for example, different assumptions about fuel costs, demand growth, HVDC capacity and generation investment opportunities.

2.1.2 The final SEIP-TAG report October 2008

The final report of the SEIP-TAG indicates that its electricity issues subgroup was initially divided in its views on the best means to estimate the electricity price impact of the ETS. Some members considered there would be a significant impact on the price of electricity as generators sought to recover their cost of carbon across their portfolio. Some members considered the price of electricity would be capped by the long-run marginal cost (LRMC) of the next generation investment and pointed to the work of Concept Consulting for the Electricity Commission on the Market Design Review to support their view.[6]

Those of the second persuasion thought that a simple comparison of the LRMC with and without the ETS would be sufficient to determine any price uplift and that this could be determined "simply by assessing whether the trading scheme would, during the period between 2010 and 2012, result in renewable generation being built instead of thermal generation".[7] They argued that if sufficient renewable generation were built, there would be no electricity price impact at all. Those of the contrary persuasion pointed out that analysis by the Ministry of Economic Development around the long-term generation mix in a carbon constrained world was not consistent with the assumption that renewables would totally replace thermal generation. They favoured basing conclusions on the analysis being undertaken by Dr Halliburton, which had not been completed at the time SEIP-TAG was preparing its final report. As a result of the lack of resolution of this question by the subgroup at

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[6] SEIP-TAG final report, p.39. For the Concept Consulting work referred to see Electricity Commission (2007) *Market Design Review: Issues Paper – Survey of Market Performance*, pp.3-52-3-58.

[7] SEIP-TAG final report, p.40.

the time of preparing the final report, SEIP-TAG's initial recommendation was that "further analysis is completed to assist in determining a methodology for the allocation of emission units to compensate for the electricity price impact".[8]

2.1.3 The addendum to the final SEIP-TAG report November 2008

In November 2008, the electricity issues subgroup considered the results of the research undertaken by Dr Halliburton and issued an addendum to the SEIP-TAG final report.[9] It states:[10]

> *In consideration of the joint GEM (Generation Expansion Model) and the SDDP (Stochastic Dual Dynamic Programme) modelling the sub-group is of the view that the modelling fairly determines an electricity price impact on participants of the introduction of the NZETS, and that as a result of this modelling a reasonable methodology for allocation has been derived.*

The subgroup recommended that the EAF should, as a result of this research, be set for 2010 to 2012 at 0.52 NZUs per MWh – "the average electricity factor derived for the period 2010-12 **for all the carbon inclusive scenarios**".[11] [Emphasis added] Given that Dr Halliburton's report was very clear that his modelling did not take into account imperfect competition in the wholesale electricity market, it is reasonable to assume this factor was taken into account by the subgroup in endorsing the methodology of the modelling.

The industry members of the subgroup also put forward in the addendum three observations as "general considerations". First, that transmission and ancillary service costs are likely to increase under a high renewables future and this needs to be taken into account in future analysis. Second, the principles of pass through of carbon costs are not simple and further research is required into the effect on asset stranding for generators. Third, "timely completion of the allocation plan, and hence the determination of the allocation of units to eligible firms is imperative to provide industry a level of 'business certainty' ".[12]

2.2   The MfE consultation document December 2009

The MfE consultation document attributed the use of an EAF of 0.52 to the work of SEIP-TAG in 2008 and described it as "the **median** of the range of outcomes" [emphasis added] for the years 2010 to 2012 from the estimates using GEM to determine plant mix and SDDP to estimate the price impact of a range of plausible emissions prices.

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[8] SEIP-TAG final report , p.41.

[9] SEIP-TAG (2008) *Electricity Price Impact Sub-Group Addendum to the Final Report of the Technical Advisory Group —Stationary Energy and Industrial Process Component of the New Zealand Emissions Trading Scheme,* November 2008. (Hereinafter the SEIP-TAG addendum).

[10] SEIP-TAG addendum.

[11] SEIP-TAG addendum.

[12] SEIP-TAG addendum.

The subgroup recommendation was that the *mean average* EAF derived for the period 2010 to 2012 *for all the carbon inclusive scenarios* should be used and not the *median*. As it turns out, 0.52 is neither the mean nor the median; the actual mean and median are both 0.51. It remains a mystery how the figure of 0.52 was arrived at. The most likely explanation is that it is the mean average (and the median) of all the carbon inclusive outcomes over the period in the North Island only.

The SEIP-TAG electricity issues subgroup made its recommendation to use the mean average "for all the carbon inclusive scenarios", which covered carbon prices of $20, $40, $60 and $80 per tonne CO_2, in November 2008. The context was that there would be no cap on the price of carbon in the New Zealand ETS. The average price of NZUs over the period 2010 to 2012 was uncertain, but would probably be around $30 to $40 per tonne CO_2, based on international futures prices. The mean and the median for the modelling results with a carbon price of $40 per tonne were both 0.52. In contrast, the context in which the MfE consultation document was released in December 2009 was one in which the carbon price would effectively be capped for the period to 2012 at $12.50 per tonne CO_2.

Another element of the context in which the electricity issues subgroup made its recommendation was that stationary energy and industrial plants would become subject to the ETS on 1 January 2010. The context of the MfE consultation document was that these activities would not be subject to the ETS until 1 July 2010 – a delay of six months.

## 2.3   Conclusions on MfE consultation document

In our opinion, it was reasonable for MfE, in drafting the consultation document, to draw on the modelling by Dr Halliburton that had been endorsed by the electricity issues subgroup of SEIP-TAG as fairly determining the electricity price impact of the ETS on its participants and as being a reasonable methodology for deriving the electricity allocation factor. MfE did not present any evidence or reason to reject SEIP-TAG's conclusions in this regard.

The SEIP-TAG's subgroup endorsed a methodology as reasonable and an approach to modelling as giving a fair outcome. It applied these to come up with an appropriate figure for the context in which the subgroup was presenting its recommendation in November 2008. The figure it gave was 0.52. By the time the MfE consultation document was released in December 2009, however, the context had changed. The new government introduced significant amendments to the ETS passed under the previous government. There was now a cap on the price of carbon at $12.50 per tonne CO_2 and a shorter period for application of the initial EAF due to deferral of the inclusion of stationary energy and industrial processes in the ETS by six months. MfE should have reconsidered the subgroup's EAF figure in light of these changes. It should have asked what a reasonable figure was for the EAF using the methodology and approach endorsed by the subgroup. Alternatively, MfE could have had Dr Halliburton rerun his models to estimate the average EAF over the period from 1 July 2010 until 31 December 2012 for a carbon price of $12.50 per tonne CO_2 and

reconsulted the subgroup. For MfE not to have taken either of these actions was unreasonable.

Using the data for both the North Island and South Island[13] from the Halliburton report, but only half the 2010 figures, in calculating the average for the July 2010 to December 2012 period, the resulting average EAFs for carbon prices of $20, $40, $60 and $80 per tonne CO_2 are as plotted in Figure 1. If MfE had used a simple extrapolation to a carbon price of $12.50 per tonne CO_2 from the average EAFs estimated for carbon prices of $20 and $40 per tonne CO_2, it would have estimated the EAF to be 0.61. If, instead, MfE had extrapolated to $12.50 per tonne CO_2 from the linear regression of the four observations, it would have estimated the EAF to be 0.59. Either of these estimates is consistent with the methodology and approach endorsed by the SEIP-TAG subgroup in the context in which the MfE consultation document was released. These are values for the EAF that the findings and views endorsed by the subgroup would have produced in the new context.

Figure 1 Extrapolation of Halliburton EAF results to $12.50 per tonne CO_2
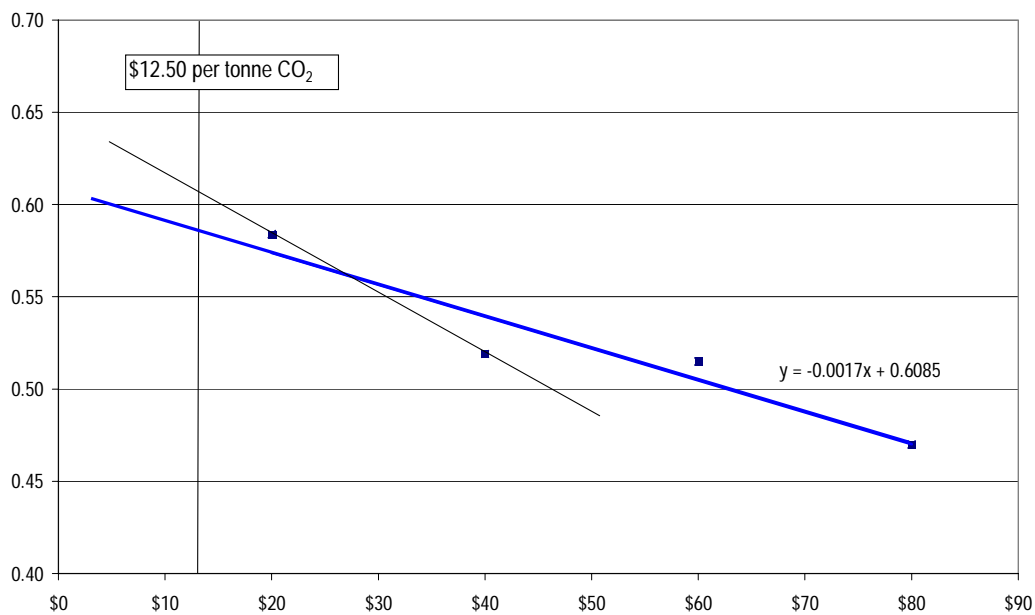
Source: NZIER

In our opinion, if a rerun of the Halliburton model to determine the EAF for a carbon price of $12.50 per tonne was not practicable, it would have been reasonable to both the government and industry groups for MfE to have used the 0.61 NZU per MWh figure.[14] We believe use of the higher figure was more appropriate because, as we explain in section 4 of this report, the social costs from underestimating the EAF are

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[13] The SEIP-TAG subgroup favoured the use of the average of all the carbon inclusive scenarios, not just those for the North Island.

[14] Indeed, given that prices cannot exceed the $12.50 cap, and are currently well below this level, 0.61 and 0.59 are effectively the *minimum* values of the EAF implied by the above extrapolations.

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greater than the costs from overestimating it. In our opinion, it was unreasonable for MfE to have used 0.52 knowing that the context had changed and the consequent implications of these changes for the EAF according to the Halliburton report.

3. Submissions on the proposal

Three submissions on the MfE consultation document commented in particular on the setting of the EAF – those of MEUG,[15] Norske Skog Tasman[16] and the Parliamentary Commissioner for the Environment (PCE).[17]

3.1 MEUG

MEUG submitted three grounds to support its view that the EAF should be higher than 0.52. First, MEUG noted that when the Climate Change Response (Moderated Emissions Trading) Amendment Bill was introduced into the House, the explanatory note claimed that during the transition period to the end of 2012 "… the increase in electricity prices is estimated to be 0.8 c/kWh …". MEUG pointed out that a price increase of 0.8 c/kWh, given an effective cap on prices at $12.50 per tonne CO_2, implies an EAF of 0.64, if an EAF of 0.52 equates to a increase of 0.65 c/kWh, as the MfE consultation document suggests. MEUG argued that "either the [EAF] needs to be amended to align with the statements by the Minister or a reconciliation as to why there is a difference should be published to allow interested parties to evaluate the Government's reasoning".[18]

Second, MEUG noted that the decision in the MfE consultation document to use an EAF of 0.52 is at variance with the research by Dr Halliburton on which SEIP-TAG based its recommendation of 0.52. MEUG suggested the 0.52 recommendation was based on the average derived from Dr Halliburton's analysis for the effect on electricity prices in the North Island of a carbon charge of $40 per tonne CO_2. It noted that the carbon price will effectively be capped at $12.50 per tonne CO_2 until December 2012 and that if Dr Halliburton's $20 per tonne figures for the North Island from the same table are used, the average EAF over the two and a half years of the transition phase ending in December 2012 would be 0.546, not 0.52.[19] MEUG also highlighted that, in his report, Dr Halliburton noted that his results represented a lower bound estimate of the impact on electricity prices.[20]

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[15] MEUG submission.

[16] Norske Skog Tasman (2010) *Submission on Development of Industrial Allocation Regulations under the NZ Emissions Trading Scheme: Electricity Emissions Factor,* 12 February 2010. (Hereinafter Norske Skog Tasman submission).

[17] PCE submission.

[18] MEUG submission*,* p.3.

[19] MEUG submission. MEUG used North Island data only and has not extrapolated to a carbon price of $12.50 per tonne CO_2, which is why its estimate is lower than our estimate of 0.59 to 0.61, as illustrated in Figure1.

[20] MEUG submission, pp.3-4.

Third, MEUG noted that the models used by Dr Halliburton take no account of the exercise of market power by electricity suppliers to offer strategically. This point was also made by Dr Halliburton in his report. MEUG appended to its submission a number of theoretical papers by Professor Andy Philpott and Tony Downward on this subject, together with a paper it had especially commissioned from a company associated with these two researchers, Stochastic Optimization Limited (SOL).[21] The purpose of the especially commissioned paper was to assess if the EAF might be materially affected by strategic pricing behaviour by suppliers. It found that it would and, more specifically, that if the large thermal generators strategically offered under the assumptions of a Cournot oligopoly model, the estimate of EAF under market conditions prevailing in 2008 would range between 0.613 and 0.689 tonnes CO_2 per MWh, depending on the prevalence of wet hydrological conditions.

3.2   Norske Skog Tasman

There is significant overlap between Norske Skog Tasman's submission as to why 0.52 is too low an EAF and MEUG's submission on the same matter. First, like MEUG, Norske Skog Tasman concluded that 0.52 is based on the North Island emission factor calculated by Dr Halliburton for the period 2010 to 2012. It adjusted the calculation to reflect the shortening of the transition phase from three years to 2.5 years and used linear regression to extrapolate the estimates to a carbon price of $12.50 per tonne CO_2, the effective price cap during the transition phase. By this means, it produced an estimate of 0.554 for the EAF.[22]

Second, Norske Skog Tasman claimed that because the model used by Dr Halliburton does not factor any degree of risk aversion or ability by generators to exercise market power, it "is not an appropriate model to use to estimate the electricity emissions factor, and at best should be used to estimate the lower bound."[23] Norske Skog Tasman pointed to the estimate of EAF undertaken by SOL for MEUG and argued that the range of 0.613 to 0.689 tonnes per MWh "is a more realistic prediction of the [EAF] likely to be realised in the electricity market and should be adopted by [MfE] for the purposes of allocation to trade-exposed industrial companies such as ours".[24]

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[21] Philpott, A and Downward, T. *Estimating a New Zealand Electricity Emissions Factor*, February 2010.

[22] Norske Skog Tasman submission, pp.2-3. Norske Skog Tasman used North Island data only, which is why its estimate is lower than our estimate of 0.59 to 0.61, as illustrated in Figure1.

[23] Norske Skog Tasman submission, p.5.

[24] Norske Skog Tasman submission, p.6.

3.3 The PCE

In her submission on the MfE consultation document the PCE stated:[25]

> *I recommend that the electricity allocative baseline rate is immediately reduced to a level that precludes any possibility of windfall profits by industry. I expect that this rate will be close to 0.2 credits per MWh.*

She went on to claim that the allocation of EAF to industrial firms "lessens the incentive to invest in low-carbon technology and emissions reductions" and further "allocation reduces the effectiveness of the ETS".[26] She rejected the 0.52 proposed in the MfE consultation document because she believed its recommendation was based on assumptions that lead to inaccuracy. She stated that the 0.52 is the average carbon cost for New Zealand's total electricity consumption:[27]

> *But industry won't be exposed to the average carbon cost. Rather, industry will face less than average carbon costs. This is because industry mostly consumes non-peak time electricity, when carbon costs are lower than at other times.*

The PCE went on to ask "So, what is the carbon intensity of the electricity consumed by industry?" She drew on recent work by Concept Consulting on the carbon intensity of residential heating for the gas industry and argued it suggests an EAF for all residential use of electricity of 0.90. She combined this figure with the overall EAF figure recommended by the electricity issues subgroup of SEIP-TAG of 0.52 to arrive at an implied EAF for industrial users of 0.21 NZU per MWh. On the basis of this calculation she claimed that a "rough estimate" of the "windfall profits" to industry from setting the EAF at 0.52 "will be substantial, potentially greater than $130 million per year".[28]

4. MfE's response to submissions

After releasing its consultation document, MfE sought advice from Concept Consulting in relation to the proposed 0.52 EAF. It published a summary of submissions in April 2010 in which it not only described the submissions it had received but also identified the issues contained therein, put forward its analysis of these issues and indicated the government's decisions in relation to these issues.[29]

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[25] PCE submission, p.2.

[26] PCE submission, p.3.

[27] PCE submission, p.4.

[28] PCE submission, p.5.

[29] MfE summary of submissions.

4.1 Summary of issues

4.1.1 Imperfect competition and lower carbon price

In its summary of submissions, MfE accurately identified the issue raised by MEUG and others that due to imperfect competition in the electricity market, prices will be higher than SRMC, which should lead to a higher EAF than 0.52 NZU per MWh. It also accurately identified the issue raised by Norske Skog Tasman and others that the carbon price will be capped at $12.50 per tonne CO_2 whilst the modelling behind the 0.52 factor recommended by SEIP-TAG was based on a higher carbon price. The modelling indicates that a lower carbon price implies a higher EAF factor than 0.52.

4.1.2 The PCE's submission

MfE also identified that the PCE submitted that a 0.52 EAF is too high, although it did not indicate the order of magnitude of the adjustment the Commissioner called for. Nor did MfE indicate that the Commissioner's submission was clearly shaped by her concern that the allocation of EAF to industrial firms "lessens the incentive to invest in low-carbon technology and emissions reductions" and "allocation reduces the effectiveness of the ETS".[30] MfE rephrased the Commissioner's reasoning around time of use by industrial users and did not refer to the Commissioner's claim that "industry mostly consumes non-peak time electricity".[31]

4.1.3 Points overlooked

MfE failed to identify in its summary of submissions MEUG's argument that an EAF of 0.52 NZUs per MWh is inconsistent with the claim in the explanatory note of the Bill that the effect of the ETS will be to raise the price of electricity to consumers by 0.8c per kWh. In our opinion, MfE knew from the submission that the 0.52 factor would be contentious and it was unreasonable for it not to address MEUG's point on this matter. This is particularly so given that the 0.8c per kWh estimate is described in the explanatory note as the impact under the assumption "that the carbon costs are fully passed through".[32] This suggests that officials expected very full pass through, which implies an EAF close to 1.00. Why MfE prepared documents for Parliament that suggested the EAF for the economy as a whole would be close to 1.00 and then proceeded to recommend regulations to the Minister that set the EAF for major industries at 0.52 requires an explanation, in our opinion.

4.2 Adequacy of analysis

4.2.1 Different carbon price and time frame

In relation to the claim that the modelling work undertaken by Dr Halliburton supported a higher EAF, given that the price of carbon was lower than previously

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[30] MfE summary of submissions, p.3.

[31] PCE submission, p.4.

[32] See Climate Change Response (Moderated Emissions Trading) Amendment Bill 2009, 85-1.

assumed and the term for which the EAF will apply was shortened, MfE simply noted that the SEIP-TAG electricity issues subgroup "recommended the use of an electricity allocation factor of 0.52 tCO$_2$/MWh until 2013".[33] In our opinion, this was not a reasonable response. What would have been reasonable was for MfE to recognise that the recommendation of the subgroup related to the methodology and approach of the modelling. The subgroup did not endorse 0.52 *per se* but arrived at it in November 2008 by applying the methodology and approach it did endorse as reasonable to the circumstances at that time. In our opinion, MfE should have recognised that, with changes in circumstances in the form of an effective cap of $12.50 per tonne CO$_2$ being placed on the price of carbon and the period over which the transitional EAF will apply being shortened, the methodology and approach endorsed by the subgroup lead to an EAF of 0.61 NZU per MWh, and MfE should have amended its recommendation to the government accordingly. In other words, MfE should have corrected its own mistake of not using 0.61 in the consultation document in the first place.

4.2.2 Imperfect competition

The imperfect competition argument is that the modelling results assumed the wholesale market to be perfectly competitive but it is not and so offer prices will at times be higher than SRMC, which should lead to a higher EAF than 0.52 NZU per MWh. MfE responded to this by considering the argument in the context of whether the key driver of electricity prices is the LRMC of the next likely entrant into the market or the SRMCs of existing producers.[34]

We have already noted this was the topic of a major debate in the electricity issues subgroup of SEIP-TAG. The subgroup "resolved" this issue by deciding that modelling that combined both LRMC and SRMC elements was reasonable and likely to give a fair outcome. The modelling did this by using the Electricity Commission's GEM to incorporate the LRMC of generation into the estimates of supply and by using SDDP, which mimics the offering behaviour of generators, assuming they act competitively, and the resulting outcomes of the wholesale electricity market, to combine these supply estimates with demand estimates.

a) LRMC vs. SRMC

The first point to note about MfE's analysis of this issue is that to treat it in the context of LRMC versus SRMC misses the point made by MEUG. The argument of MEUG (and others) is not about whether assuming electricity prices of major industrial consumers are based on SRMC or LRMC is the right basis on which to set the EAF. It is about whether, how frequently and to what extent generators are able to exercise market power and to offer their plants profitably above their SRMC, so that wholesale electricity prices are above the SRMC of the marginal plant dispatched to fulfil demand.

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[33] MfE summary of submissions, p.10.

[34] MfE summary of submissions, pp.10-11.

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b) SOL's modelling

MfE argued that the modelling by SOL submitted by MEUG in support of its submission is based on historical data and does not establish that, during the period 2010 to 2012, imperfect competition "would lead to a number higher or lower than 0.52".[35] This, however, overlooks the warning by Dr Halliburton about his own modelling results being conservative because:[36]

- "actual prices are unlikely to be less than those calculated by SDDP for any significant time"

- SDDP is risk neutral but generation companies are not and so expected costs are likely to be increased and

- marketing strategies by generators will increase market prices above SRMC.

The argument also overlooks that all modelling has to be based on historical data, to at least some degree, and Dr Halliburton's modelling is no different from SOL's in this regard. The relevant question is whether or not the way in which historical information has been used is appropriate, given the purpose of the modelling. MfE has not addressed this question in relation to SOL's modelling, but, in our opinion, how SOL used historical information was appropriate, given its purpose. Specifically, contrary to MfE's misinterpretation, the way SOL used data from 2008 does not limit the applicability of its results to just this specific year, or even just to years with similar hydrological conditions to 2008.[37]

MfE failed to give credit to SOL's approach. Both SOL and Dr Halliburton use models. All models are inevitably abstractions from the complexities of the real world. We know that the wholesale electricity market is not perfectly competitive, as Dr Halliburton's model assumes, and we know that the behaviour of large generators does not fully conform with the assumptions made by SOL. Both models provide insights, however, into the factors that will shape the EAF in practice. For MfE to have dismissed the work of SOL by suggesting it was based on historical data was an inadequate response.

c) Concept Consulting's advice

MfE's reference to recent work by Concept Consulting suggesting an EAF of 0.52 "may be too high" is not balanced. Other work by Concept Consulting estimates much higher pass throughs of carbon costs into electricity prices than 52%.[38] Some of this work was undertaken very recently for the Gas Industry Company. For a residential heating load profile it estimated a factor of 0.81 and for a night only

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[35] MfE summary of submissions, p.11.

[36] Halliburton, p.26.

[37] SOL's analysis used a selection of trading periods in 2008 as a source of typical market behaviours under a range of different market conditions, which could then be weighted according to generator behaviour in any given year to predict predict the EAF for that year.

[38] See Concept Consulting (2003) *An Electricity Emissions Factor,* p.16 and (2004) *Electricity Emission Factor Review,* p.9 for earlier estimates by the same consultants of the EAF as 0,600 to 0.650.

residential heating load profile it estimated a factor of 0.80. When distribution and transmission losses are factored into the analysis, the resulting estimates of "emission factors" are 0.890 and 0.879, or 0.884 on average.[39]

In its submission on the MfE consultation document, the PCE referenced one of these reports by Concept Consulting as the basis for it assuming that the EAF for residential consumers is 0.90.[40] That Concept Consulting was more or less contemporaneously providing apparently conflicting advice in other contexts to other clients was presumably known to MfE. At the very least, MfE should have referred to these other estimates and explained in its analysis why it did not take them into account, or, if it did take them into account, why it discounted them.

The advice MfE received from Concept Consulting is based on the erroneous view that the modelling by Dr Halliburton for SEIP-TAG took no account of the LRMC of generation. According to Concept Consulting:[41]

> *The 0.52 number was largely based on a short-term model used by the SEIP TAG process. This effectively assumed the fleet of electricity generators is a 'given' and calculated the price impact of a cost of CO_2 based on the short-run marginal costs of the marginal plant in an operational sense.*

The modelling for SEIP-TAG did not take the fleet of electricity generators as a given. It used the Electricity Commission's GEM and fuel cost assumptions to determine, on the basis of comparative LRMCs, what generators would be added to the "fleet" to expand capacity, and in what order and when they would be added. Concept Consulting's advice on this point is incorrect and its consequent conclusion that the methodology chosen will bias the results towards fossil fuel fired generators being the marginal generators is also incorrect.

What Concept Consulting has effectively done in this aspect of its advice to MfE is substitute its views about which generators will be the marginal generators in the years 2010 to 2012 for those derived from the Electricity Commission's GEM and endorsed by the SEIP-TAG. Concept Consulting has not provided any justification as to why MfE should replace the transparent analysis based on the Electricity Commission's GEM, as endorsed by SEIP-TAG, with Concept Consulting's view

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[39] Concept Consulting (2010) *Cost: benefit analysis for Increasing the Direct Use of Gas in New Zealand*, March 2010, pp. 28-31 and Table 4. The December 2009 version of the paper put out for consultation had the same table. A power point presentation on the report delivered in February 2010 noted that "this [i.e. 0.884] may be an overestimate for electricity for water heating use. However, this is unlikely to materially alter the conclusions." "The high electricity emissions factor is because of the economics of meeting a peaky load shape as best served by Huntly on coal, rather than a new renewable plant. The electricity emissions factor for a *baseload* demand shape would be a lot lower." The latter statement does not, however, square easily with Concept Consulting's estimate of night only heating being only marginally lower and the statement about water heating.

[40] PCE submission, p.5.

[41] Concept Consulting (2010) *NZ ETS Industrial Analysis and Advice on Electricity Contracts: Task One: Scoping Report*, February 2010, p.19.

based on factors that have not been so scrutinised and are not well documented. In our opinion, MfE should have identified that the premise behind this aspect of Concept Consulting's advice is not correct; the report on the modelling results clearly identifies the role of GEM and the LRMC of generation in the analysis.

According to Concept Consulting, another reason that an EAF of 0.52 may be high "relates to how CO_2 prices may feed through differently to baseload demand versus peak demand".[42] According to Concept Consulting:[43]

> *… a growth in baseload demand is likely to be predominantly met by new renewable plant, with a relatively low emission factor. Conversely, small customers (residential and SME's) have a much 'peakier' load shape.*

Concept Consulting goes on to claim that it has undertaken modelling that indicates that a growth in peaky demand will be met predominantly by an increase in output from existing thermal stations. It provides no details of this modelling.[44]

What is not clear, however, is the relevance of this observation to the value of the EAF in the period 2010 to 2012, even if it were accepted as correct. The purpose of the EAF is to compensate major electricity users for the impact of the ETS on the price of electricity as an input into production. What should determine the EAF is the extent to which the price of carbon introduced in the ETS is passed through to major electricity users in the prices they face. This will be determined by the offer behaviour of all generators and how this translates into wholesale spot and contract prices. The emission intensity of an increase in generating capacity occasioned by an expansion in demand from industrial users will only affect the EAF to the extent that the plant built to meet this demand is the marginal plant dispatched. In most circumstances, it is unlikely that new plant will often be the marginal plant setting the spot price.

A further argument advanced by Concept Consulting is:[45]

> *… while SRMCs are the appropriate metric to consider for scheduling and dispatch of generating plant and associated* spot *prices, they are not necessarily the appropriate metric to consider for electricity* contract *prices. The majority of electricity purchased by industrial customers (and indeed all customers) is via contracts. Such contracts are typically struck a year ahead, with prices that have been shown to be strongly linked to the LRMC … an SRMC approach would lead to materially higher numbers [for the EAF] than an LRMC approach.*

We have already noted that Concept Consulting overlooked that the modelling endorsed by SEIP-TAG incorporated LRMC considerations. Another difficulty with this argument is that it fails to explain why the *contract* prices would be systematically

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[42] Concept Consulting (2010), p.19.

[43] Concept Consulting (2010), p.20.

[44] Concept Consulting (2010).

[45] Concept Consulting (2010), p.19.

biased above or below the expected average of the *spot* price over the term of the contract at the time the contract was entered into. To expect such a bias it would be necessary to argue that generators and industrial firms have systematic differences relating to bearing price risk, which lead to this outcome. We know of no evidence to support such a contention. Contract prices should reflect the expected average of spot prices or there will be arbitrage opportunities available to participants in the market and the actions of arbitrageurs will bring contract and expected average spot prices back into line with one another.

d) Conclusions about imperfect competition

In our opinion, the analysis by MfE of the argument that because the market for electricity has imperfect competition, the EAF should be set higher, is inadequate. That is not to say, however, that we think that it was unreasonable for it not to increase the EAF on this basis.

The potential impact of market power on the EAF was recognised and duly considered by the subgroup of SEIP-TAG. The subgroup also knew that the modelling it had commissioned had incorporated both SRMC and LRMC factors into its analysis. In our opinion, it would have been reasonable for MfE to assume that the various factors relating to these points raised in submissions were broadly known to the subgroup and incorporated into its decision "that the modelling fairly determines an electricity price impact on participants of the introduction of the NZETS, and that as a result of this modelling a reasonable methodology for allocation has been derived".[46] We believe MfE could have reasonably used this as the basis to reject making any adjustment to the EAF for the imperfect competition arguments advanced in submissions.

4.2.3 The PCE's submission

The submission of the PCE is not explicitly analysed in the summary of submissions. The only reference is to others having suggested the 0.52 allocation factor may be too high. In our opinion, it would have been desirable for MfE to identify that:

- the Commissioner's claim that allocations undermine the incentives for firms to avoid emissions is not a widely accepted view because, provided NZUs are tradable, a firm with an allocation faces the same opportunity cost of emitting greenhouse gases as it would if it were not given any allocation and

- the assumption that "industry mostly consumes non-peak time electricity" that lies behind the Commissioner's numerical calculations supporting an EAF of close to 0.20 is not correct; major energy intensive industrial firms tend to operate on a 24 hour a day, seven day a week basis for most of the year and so consume electricity in both the peak and non-peak periods.

Failure to point out these errors may have left some readers, and possibly the PCE, thinking that MfE considered there was some validity in the points raised. Irrespective of whether MfE indeed thinks this, it should have provided some analysis of the

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[46] SEIP-TAG addendum.

PCE's submission, given the significance likely to be placed on it. Although we do not consider the PCE's submission has any validity, it is not adequate for MfE to be silent on it, leaving stakeholders uncertain as to how much influence, if any, the PCE's submission had on the recommendation to the Minister. This is especially so given that most stakeholders would consider the submission ill-founded, but had no opportunity to provide rebuttal evidence in cross-submissions.

4.2.4 Asymmetric social costs

One matter MfE did not raise in its analysis of submissions is the potential social costs from setting the EAF too low compared with the social costs of setting it too high. In our opinion, this should have been a key consideration; the objective of the ETS is presumably to provide a positive net benefit to New Zealand and the world.

In general, the consequences of permanently setting the EAF too low would be the relocation of economic activity (and potentially firms) overseas when it would be better for the New Zealand economy (and world) if they continued operating in New Zealand. Too low an EAF would have an adverse effect on global emissions also, provided the economic activity has lower emissions in New Zealand than it would have if production relocated to some other jurisdiction, which is very likely.

In contrast, permanently setting the EAF too high would not lead to inefficient reallocation of resources and would not have a detrimental effect on either the efficiency of the economy or the quality of the environment. This is because free allocations do not reduce the incentives on commercial firms to reduce emissions; profit maximisers respond to the opportunity cost of increasing/reducing emissions, which remains even if allocations to industry are too generous, provided NZUs are tradable.

The fact that the initial EAF is being set for only the first period, which ends in December 2012, means that the potential for long lasting adverse consequences from setting the EAF too low are moderated to some degree. They still exist, however, and the decision in the first period, and, probably as importantly, the reasoning that supports it, will undoubtedly shape the expectations of investors and large industrial firms. Setting an initial EAF that is too low will have more significant adverse social consequences than setting it too high. In our opinion, MfE should have taken this asymmetry of social costs into account when responding to submissions and advising Ministers. It did not.

5. Conclusions about setting current EAF

In our opinion, it was reasonable for MfE, in drafting its consultation document during 2009, to draw on the work of Dr Halliburton that had been endorsed by the electricity issues subgroup of SEIP-TAG as fairly determining the electricity price impact on participants in the ETS and as being a reasonable methodology for deriving the EAF.

The subgroup endorsed a methodology as reasonable and an approach to modelling as giving a fair outcome and came up with a figure that this methodology and approach indicated was appropriate *in the context in which the subgroup was presenting its recommendation in November 2008*. The figure it gave was 0.52.

By the time MfE's consultation document was released in December 2009, however, the context had changed. There was now a cap on the price of carbon of $12.50 per tonne CO_2 and a shorter period for application of the initial EAF due to deferral of the inclusion of stationary energy and industrial processes in the ETS by six months.

In our opinion, MfE should have reconsidered the actual EAF figure in light of these changes in circumstances. It should have asked what a reasonable figure was for the EAF in light of the results of the study the subgroup endorsed as regards methodology and approach. That assessment would have been assisted by asking Dr Halliburton to rerun his models with a carbon price of $12.50 per tonne CO_2. For MfE not to have done so was unreasonable.

If MfE had followed this course of action, a reasonable figure for it to have arrived at is 0.61 and not 0.52.

In our opinion, it would have been reasonable to both the government and industry groups for MfE to have used in its consultation document the figure of 0.61 NZUs per MWh and it was unreasonable for it to have used 0.52 knowing that the context in which this figure had been derived had changed.

In our opinion, the analysis by MfE of the argument that because the market for electricity has imperfect competition, the EAF should be set higher, is inadequate. Its criticism of the use of historical data by SOL is a poor argument. Moreover, we believe that MfE should have explicitly dealt with the fact that its advisors on submissions, Concept Consulting, had provided other clients, more or less contemporaneously, with apparently contradictory advice about the level of the EAF. Not to have dealt with this matter leaves stakeholders concerned about the influence Concept Consulting's advice may have had on the recommendation to the Minister.

The SEIP-TAG subgroup did not have the benefit of knowing the results of SOL's modelling before it reached its decision. Despite this, we believe it would have been reasonable for MfE to assume that the various factors relating to the effect of imperfect market competition raised in submissions were broadly known to the subgroup and incorporated into its decision. More specifically, MfE could reasonably assume that the subgroup, which included many industry representatives, factored in the likely effects of imperfect competition qualitatively when it concluded "that the modelling fairly determines an electricity price impact on participants of the introduction of the NZETS, and that as a result of this modelling a reasonable methodology for allocation has been derived".[47] We believe MfE should have used

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[47] SEIP-TAG addendum.

this as the basis for its response to the imperfect competition argument in submissions.

In our opinion, irrespective of whether or not MfE thinks there is some validity in the submission put forward by the PCE, it should have provided some analysis of this submission, given the significance likely to be placed on it by the general public. We do not consider the PCE's submission has any validity, but it is not adequate for MfE to have been silent on the matter, leaving stakeholders uncertain as to how much influence, if any, the PCE's submission has had on the recommendation.

Setting too low an initial EAF is likely to have more significant adverse social consequences than setting it too high. In our opinion, MfE should have taken this asymmetry of social costs into account in responding to submissions and advising Ministers. It did not.

Overall, in our opinion, it was not appropriate and reasonable to both the government and businesses for MfE to recommend to the Minister an EAF of 0.52 NZU per MWh, given the information available to it at the time. In our opinion, an appropriate and reasonable EAF for MfE to have recommended would be 0.61 NZU per MWh and, given the asymmetric costs, any doubts should have led it to err on the higher side..

6. Recommendations on resetting EAF

The process used by MfE in arriving at its recommendation to the Minister that the initial EAF should be 0.52, despite submissions to the contrary, contained sufficient flaws that we believe the Minister should reconsider the EAF, even at this late stage. If the decision is allowed to stand without careful and thorough review, stakeholders are justified in feeling dissatisfied with the process and sceptical of the reasonableness of the outcome. Failure to correct the proposed EAF of 0.52, when it has been shown to be the result of flawed process and analysis by MfE, will inevitably erode the confidence of investors and business interests in the review to apply from 1 January 2013. It will also undermine the relationship between MfE and these groups.

Even if the Minister is not of a mind to reopen debate on the value of the initial EAF, the following are our recommendations on the process to reset the EAF that should be incorporated in the forthcoming review of the ETS, if the mistakes of last time are to be avoided:

- a subgroup of industry experts and officials should be appointed to review all available evidence and to provide a recommendation

- the subgroup should consider both modelling that assumes the wholesale market is competitive and modelling that assumes there is imperfect competition, such as that produced for MEUG by SOL

- the subgroup should prepare a draft report setting out clearly and fully its recommendation and the reasoning behind it, including what factors it has considered and how

- the subgroup's recommendations should be released for consultation and interested parties should also have the opportunity to make cross-submissions

- the subgroup should provide a comprehensive analysis and response to all material and relevant points made in the submissions and cross submissions; this should accompany its final recommendations

- if advisors are used by the subgroup, or MfE, their terms of reference should be public and if they are providing advice on the EAF to other parties, this should be disclosed and any differences in advice explained and

- the Minister should issue a draft decision paper on the EAF and, after he or she has considered submissions and cross-submissions, a final decision paper, together with an analysis of all submissions and his or her response to them.