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Ontario Energy Board
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Your reference
EB-2012-0031

Our reference
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Dear Ms. Walli:

Hydro One Transmission Rates 2013-2014 (EB-2012-0031)
Written Statement of Experts

On behalf of the experts who participated in the Experts' Conference in the above-noted proceeding, and in accordance with Procedural Order No. 8, please find attached the Joint Written Statement of the experts.

Yours very truly,

Original signed by

Richard King
Partner

RK/mnm

Enclosure

Cop(y/ies) to: All Parties to EB-2012-0031

Joint Experts Written Statement – EB 2012 – 0031 (Filed: January 16, 2013)

The experts:

John Todd and Michael Roger, Elenchus, HQ Energy Marketing Inc. ("HQEM")

Cliff Hamal, Navigant Economics, Association of Power Producers of Ontario ("APPrO")

Ira Shavel and Andy Baziliauskas, Charles River Associates ("CRA"), Independent Electricity System Operator ("IESO")

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1. Purpose and scope of experts' evidence

I. CRA

The purpose of CRA's evidence is to satisfy the direction of the Board in Hydro One's last transmission rates case, namely, to prepare a "comprehensive study… to identify a range of proposed rates and the pros and cons associated with each proposed rate." That is what CRA's ETS tariff study does: it identifies five tariff options, including the current tariff, and qualitatively and quantitatively assesses their respective pros and cons vis á vis a number of relevant metrics relative to the status quo.

The scope of CRA's study was also informed by the Board's direction that the ETS tariff study be administered by the IESO with input from stakeholders, including Hydro One and intervenors from Hydro One's last rates case. In this respect, the IESO, with input from stakeholders, selected CRA and directed it to: (i) study five ETS tariff options (including the status quo) and to qualitatively assess them against four generally accepted rate-making principles (consistency of neighbouring markets, simplicity, fairness and efficiency); (ii) quantify changes in the net Ontario benefit, consumer surplus, producer surplus, and regional efficiency as a part of its evaluation of the five ETS scenarios; and (iii) quantify the effects of each ETS scenario on a number of specified market outcomes, including export/import levels, ETS tariff revenues, Ontario power prices, the Global Adjustment, wholesale market service charges, and frequency and duration of surplus baseload generation (SBG).

At the outset and over the course of the study, the IESO updated stakeholders on the status of CRA's ETS study and provided them with the opportunity to provide input on study parameters, methodology and findings. In January 2012, CRA presented its proposed approach to the ETS study to stakeholders. During its presentation, CRA provided a detailed explanation of the NEEM model (including geographic coverage, objective function and solution algorithm, model constraints, representation of load — which was explained to take the form of a non-chronological load duration curve — transmission representation, and assumed environmental policies and input pricing), a plan for assumptions development, outcomes to be quantified, and a methodology for quantitative evaluation of the ETS scenarios. CRA also distributed a detailed set of slides from this presentation to stakeholders. In addition, CRA presented a draft of its ETS tariff study report in May 2012 and provided stakeholders with the opportunity to ask questions and to provide input before CRA finalized its report approximately one month later in June 2012. In response to stakeholder requests, CRA modelled each ETS scenario under a different set of assumptions about adoption of the Western Climate Initiative in Ontario (results of this additional modelling were distributed to stakeholders), and CRA also responded to a number of stakeholder requests for additional data on intermediate model outputs and to questions about the model methodology and evaluation. The stakeholders who participated in the IESO's ETS tariff stakeholdering engagement included some of the intervenors in this proceeding (APPrO, Hydro Quebec, AMPCO, CCC).

II. Cliff Hamal, Navigant Economics

Cliff Hamal of Navigant Economics was asked by the Association of Power Producers of Ontario (APPrO) to offer an opinion regarding the level of the tariff on electricity exported from Ontario. Hamal's conclusion is that tariff should be reduced from $2/MWh, potentially down to $0/MWh. This conclusion is based on a wide-ranging assessment of the implications of a change in the tariff and on a variety of analyses.

The focus of this Joint Statement is to clarify areas of agreement and disagreement among the experts, which is provided in the sections that follow. While Hamal's analysis draws significantly on the CRA analysis, it involves substantial analysis beyond areas of overlap. As a result, this document's focus on only areas of agreement and disagreement with the CRA evidence leads to a somewhat incomplete and disjointed perspective on the complete Hamal evidence.

Hamal's conclusion that the tariff should be reduced is supported by conducting analysis that is independent of the CRA analysis, by relying on the CRA analysis and by demonstrating that shortcomings in the CRA analysis provide incremental support to conclude that a reduction is beneficial. Thus, the reduction in the tariff level is advised whether or not the CRA analysis is considered, AND whether or not one recognizes the shortcomings in that analysis. The focus in this joint statement naturally falls on areas of disagreement, but that disagreement is only related to third category of evidence—supporting the view that these analytical shortcomings only provide additional support for a conclusion that the tariff should be reduced. And even in that area the overlap is limited: since only Hamal makes a recommendation, only he addresses how limitations in the analysis affect the recommendation.

III. Elenchus

Elenchus' views are that Generally Accepted Regulatory Principles should be used by the Ontario Energy Board in establishing the ETS tariff in Ontario. A main criterion in these principles is cost causality. Should the OEB depart from cost causality while setting the ETS tariff, the reason for such departure should be provided, the amount of the subsidy to domestic customers should be established and clearly stated.

Navigant and CRA have not provided evidence or an opinion on what are Generally Accepted Regulatory Principles or on how they would apply in this case.

2. Areas of agreement between CRA and Hamal

I. Analysis of the ETS scenarios needs to consider the features of Ontario's market, including regulated rates, OPA contracts and Global Adjustment.

II. It is appropriate to calculate intertie congestion revenue (IC revenue) when export limits are constraining. The export trades are assumed to clear at a separate intertie price and the IC revenue is calculated by multiplying the quantity of energy exported times the price difference between the neighbouring region's price and HOEP less the ETS, uplift, and friction costs.

III. All of the change to producer surplus calculated in CRA's analysis is associated with OPG's non-prescribed hydroelectric generation.

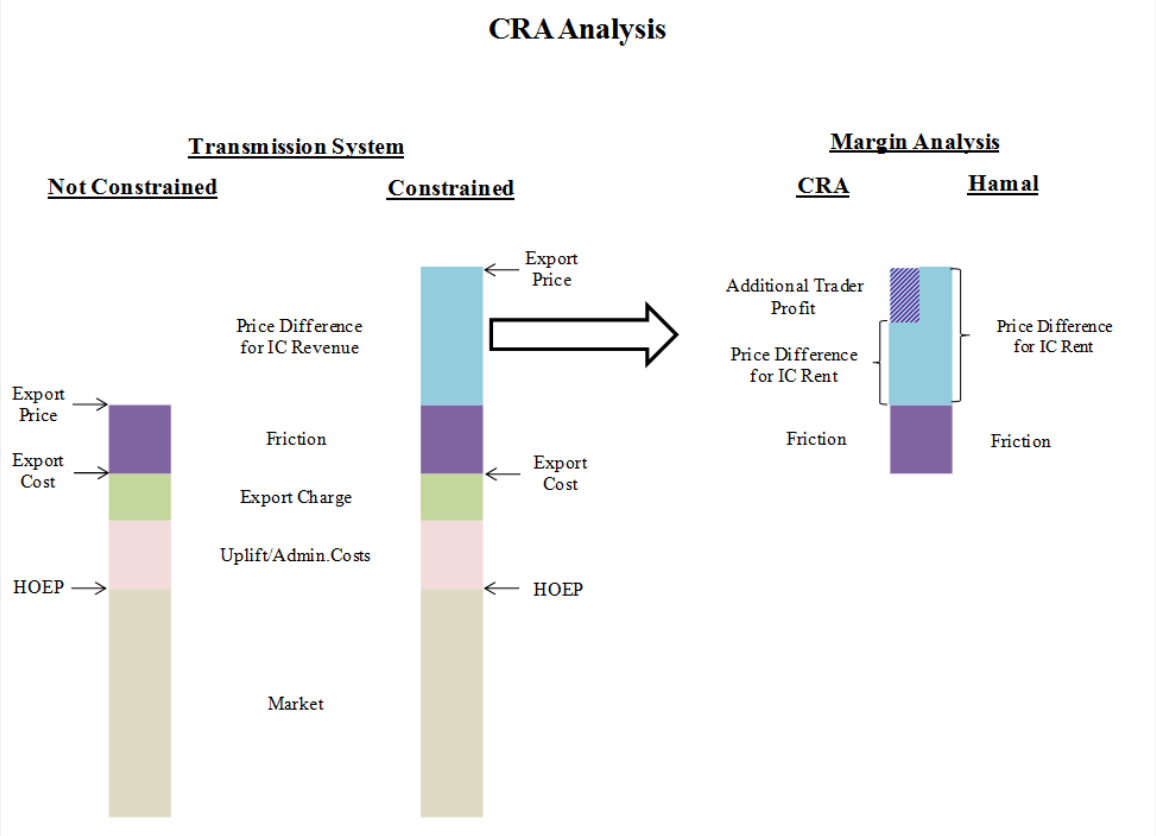
IV. 2013 model results are appropriate for evaluating ETS scenarios for the years 2013 and 2014.

V. IC revenue associated with exports accrues to the benefit of Ontario.

3. Areas of disagreement between CRA and Hamal

Joint Explanation of IC Revenue Calculated in the CRA Model

The CRA analysis concludes that there are exports when supported by price differences between the IESO market and neighbouring export markets, with the nature of the price difference dependent on whether transmission is constrained. The price in the export market must be at least as high as the cost of exporting the energy. This "export cost" includes the Ontario price (HOEP), uplift/administration charges and the ETS tariff, and is shown in the figure below. The CRA analysis also assumes the neighbouring market must have a price high enough to overcome a friction cost (which includes additional trader costs and a trader margin). Interpretation of the friction cost is discussed further as a separate point of disagreement, below. When transmission limits are not constraining, the model will reach equilibrium where the price in the export market is equal to the export cost plus the friction cost. The price in the export market will only be greater than the export cost plus the friction when the transmission limit is constraining flow. When an intertie constrains export flows, the model calculates an intertie congestion revenue (IC revenue). The IC revenue is calculated in the CRA model as the difference between the price in the export market and the export cost (HOEP + uplift + ETS tariff) plus friction.



To the right of the first two bars, the transmission constrained example is further detailed to demonstrate a difference of opinion between CRA and Hamal as to the allocation of the revenue

resulting from the difference between the export market price and the export cost. This includes the friction and the price difference for IC revenue. IC revenue either accrues to traders as additional profit or to the IESO as IC rent. Hamal concludes that all of the IC revenue should accrue to the IESO as IC rent, while CRA offers no opinion about the allocation of IC revenue between IC rent and trader profit. The different views of the experts on this point are presented as a separate point of contention.

I. Friction and Trader Margin

Cliff Hamal	Ira Shavel & Andy Baziliauskas
The friction in the analysis is paid to traders and provides for their profit, as well as any other costs they may have. It is important to note that as a deterministic model, there are no uncertainties. The overall energy balance is achieved in an optimization process where traders are assumed to export power whenever they can achieve this friction margin. Thus, as was shown in Figure 5 of Hamal's analysis, trades are made between regions with prices in equilibrium, subject to this friction cost, unless the transmission constraint becomes binding.	Friction costs are meant to reflect market participant behaviour (including a normal profit) and lack of full integration across markets that results in transactions that appear to be economic not occurring.

II. Distribution of IC revenue calculated in the CRA model

Cliff Hamal	Ira Shavel & Andy Baziliauskas
All of the IC revenue should accrue to the IESO as IC rent in evaluating the results. This assumption is the only alternative that is consistent with the rest of the analysis. The analysis assumes efficient market operations (subject to defined constraints) and traders are assumed to be adequately compensated through the friction (trader profit) assumption. When the transmission constraint is binding, one should still assume that the friction assumption provides sufficient incentive for trade. Traders would bid up the intertie congestion price (if it was explicitly modelled in the analysis) to the point where traders only receive the friction amount. Thus, IC revenue equals IC rent.	The CRA model calculates IC Revenue, but does not allocate the IC Revenue between IC Rent and trader profit. The allocation of IC Revenue would require a complex empirical analysis based on data that is currently not available to CRA. CRA is also unaware of any existing empirical studies of trader profit or IC Rent, and no evidence in this regard has been submitted in this proceeding.

III. Treatment of changes in IC rents

Cliff Hamal	Ira Shavel & Andy Baziliauskas
While the process by which IC rent is paid out is subject to uncertainties and delays, in evaluating the export tariff, IC rent should accrue to consumers. There is no process by which producers would recover these amounts. Further, consistent with the rest of the analysis, it is not reasonable to assume traders would recover any of this rent. In actual practice, money from IC rents may be held in reserve to cover unexpected payments to TR holders. In a typical year, the IESO should not expect to have to pay the incremental IC rents resulting from a tariff change to TR holders. In justifying this conclusion, it should be noted that in a competitive market, TR holders will purchase those rights at a cost that will approximately equal the payments they expect to receive from monthly congestion payments. Thus, the upfront payment will cover the cost of congestion-based monthly payments without needing to draw on IC rents. Actual results will depend on the level of energy flow and price differences, and TR holders may experience profits or losses if unexpected system conditions arise. While the IESO should not have to draw upon IC rents to make TR payments, it does hold those funds in reserve against this possibility. This might happen if transmission congestion is greater than expected. In the opposite situation, with congestion less than expected by traders in purchasing the TRs, TR holders will have paid more for the rights than they receive in monthly congestion payments and the IESO will keep the difference. Over the long run (and also in equilibrium) the IC rents will not be needed to make TR payments.	CRA has not offered an opinion about the ultimate recipients of IC Rent. CRA understands that IC Rent collected by the IESO has largely funded shortfalls in the IESO's transmission rights account, and has therefore been disbursed to transmission rights holders.

IV. Consideration of changes in producer surplus

Cliff Hamal	Ira Shavel & Andy Baziliauskas
The producer surplus calculated in the CRA analysis will eventually accrue to consumers over the long run. To be specific, all of the calculated producer surplus results from changes in revenues to OPG's unregulated hydroelectric generation. As OPG is provincially owned, the producer surplus benefits the province. Over time, it might be used to reduce stranded debt of Ontario Hydro, which would otherwise be paid by consumers, or to benefit the province more directly, which will benefit taxpayers, who are largely electricity consumers.	The change in producer surplus calculated in the CRA model represents the aggregate change in the net incomes of producers of electricity in Ontario. In all ETS scenarios modeled by CRA, the change in producer surplus is associated with OPG's non-prescribed hydroelectric generation and therefore represents a change in OPG`s net income. As noted in the CRA report, the change in consumer surplus measures the change in electricity bills for Ontario consumers. CRA does not track the flow of funds that initially appear as a change in OPG's net income. OPG's sole shareholder is the Province of Ontario, and therefore changes in OPG's net income affect Ontario's fiscal balance, but CRA does not conclude that changes in OPG's net income will change the electricity bills of Ontario consumers.

V. Results of the CRA Analysis

Summary of Surplus Changes ($2011/MWh)

Surplus Component	2013 No Tariff	2013 EANC	2015 No Tariff	2015 EANC	2017 No Tariff	2017 EANC
CRA Analysis						
Consumer Surplus	-$16.1	$24.1	-$32.6	$60.1	-$18.9	$23.5
Intertie Congestion Revenue	$24.0	-$17.7	$10.1	-$7.9	$3.9	-$5.8
Producer Surplus	$9.6	-$29.2	$22.2	-$47.9	$10.5	-$18.6
Subtotals						
CS + ICR	$7.9	$6.4	-$22.5	$52.2	-$15.0	$17.7
CS + ICR + PS	$17.5	-$22.8	-$0.3	$4.3	-$4.5	-$0.9

Cliff Hamal	Ira Shavel & Andy Baziliauskas
The results above are from the CRA analysis. As discussed above, consumers are the likely beneficiaries of the IC revenue. Also, consumers/taxpayers are likely beneficiaries of the producer surplus. These sums are totaled for comparison purposes. Thus, largely the entirety of the Ontario Surplus will accrue to consumers.	The surplus changes calculated by CRA for all model years and CRA scenarios are presented in the CRA report. CRA's opinions about the treatment of producer surplus and IC Revenue are discussed above. CRA does not agree that the sum of consumer surplus and IC Revenue, as reported in the table prepared by Mr. Hamal, is a meaningful measure of welfare or surplus. However, the sum of consumer surplus, IC Revenue, and producer surplus, which is reported in Mr. Hamal's table, is a meaningful measure and is equivalent to the total surplus presented in the CRA report.

VI. CRA Analysis Results for No Western Climate Initiative Scenario

Summary of Surplus Changes - Assuming No Ontario WCI Participation ($2011/MWh)

	2013		2015		2017	
Surplus Component	**No Tariff**	**EANC**	**No Tariff**	**EANC**	**No Tariff**	**EANC**
CRA Analysis						
Consumer Surplus	-$16.1	$24.1	-$31.2	$57.1	-$18.5	$24.9
Intertie Congestion Revenue	$24.0	-$17.7	$18.6	-$13.0	$16.5	-$21.8
Producer Surplus	$9.6	-$29.2	$16.6	-$44.8	$8.0	-$13.6
Subtotals						
CS + ICR	$7.9	$6.4	-$12.6	$44.1	-$2.0	$3.1
CS + ICR + PS	$17.5	-$22.8	$4.0	-$0.7	$6.0	-$10.5

Cliff Hamal	Ira Shavel & Andy Baziliauskas
The results above are subject to the same limitation as the base scenario, but the difference between the two provide insight as to the effect of the WCI assumption.	The surplus changes calculated by CRA for all model years and CRA scenarios are presented in the CRA report. CRA's opinions about the treatment of producer surplus and IC Revenue are discussed above. CRA does not agree that the sum of consumer surplus and IC Revenue, as reported in the table prepared by Mr. Hamal, is a meaningful measure of welfare or surplus. However, the sum of consumer surplus, IC Revenue, and producer surplus, which is reported in Mr. Hamal's table, is a meaningful measure and is equivalent to the total surplus presented in the CRA report.

VII. Calibration of the CRA Model

Cliff Hamal	Ira Shavel & Andy Baziliauskas
The steps taken in calibration demonstrate weaknesses in the model and raise concerns about the validity of the model. This is particularly true with respect to prices and trade during periods of very low prices.	The results of the NEEM model calibration validate the model and demonstrate that it is an appropriate tool for measuring the effects of changes in the ETS tariff. With regard to low price periods, CRA tested the robustness of the model's outcomes during SBG events (when prices are normally low) using a variety of approaches, and as a result of these tests CRA is satisfied that the model's outcomes for these periods are reasonable. Furthermore, CRA recognizes that all models, including NEEM, predict outcomes imperfectly, but the relevant question is one of materiality. It is CRA's view that any imperfections in the outcomes predicted by the NEEM model, including those related to prices and trade during low price periods, are not material. The concerns raised by Mr. Hamal do not change CRA's view. CRA further notes that no evidence has been presented at this proceeding that relates to the materiality of any divergence between the assumptions of the CRA model and real world market conditions.

VIII. Evaluation of trading behavior in the CRA model

Cliff Hamal	Ira Shavel & Andy Baziliauskas
The analysis captures general trends in trading, but fails to reflect actual trading behavior, which results from price uncertainties, challenges in dealing with timing issues (day ahead and real time markets, to name just one such issue) and other issues. Instead, the deterministic model minimizes production costs subject to constraints that include transmission limits. As long as the transmission limits are not exceeded, the optimal energy flow between regions is achieved. The level of trading is "perfect" in the sense that the exact amount of trade is determined such that it minimizes overall costs. In the real world where traders must commit to exports and imports before final prices are known, such optimization is extremely rare. Analysis using the deterministic approach has value, but it is important to understand its limitations. For example, increasing the export tariff not only changes the breakeven point for a profitable trade, but it increases the risk of an unprofitable trade and increases the cost of trading generally, such that the reduction in trading from a tariff increase is greater than would be expected solely by consideration of price differences. Overall, the approach taken to model trading activities in the CRA model results in underestimating the benefits to reducing the tariff during non-SBG conditions. With respect to the stakeholder process, based on Hamal's limited personal involvement, participants did not view it as an opportunity to resolve all issues. It was recognized that the modelling had limitations, but that it was also unrealistic to expect substantially different approaches to be adopted. More importantly, it was recognized that shortcomings in modelling should be put in context relative to the conclusions that would be drawn. Thus, one reasonable	The NEEM model results show realistic patterns of differences between ETS scenarios; that is, the direction and magnitude of changes in outcomes are consistent with what one would expect by applying simple economic theory without quantitative analysis. With respect specifically to the effect of uncertainties, CRA's NEEM model is deterministic and does not model uncertainties explicitly. However, this is common practice in economic modelling unless there are compelling reasons to believe that modelling uncertainty would avoid biases in model outcomes. CRA does not believe that modelling uncertainty in its analysis of ETS scenarios would materially improve the accuracy of modelled outcomes, and doing so would substantially increase the costs of conducting the analysis. Similarly, in CRA's opinion not modelling 'timing issues' and other issues is appropriate and does not materially affect model results, and dealing with these other issues on a detailed level would also increase the costs of the analysis. The IESO reviewed the NEEM model assumptions and algorithms, and prior to beginning its quantitative analysis, CRA made a detailed presentation to stakeholders, which included a detailed description of the NEEM model and assumptions, and all stakeholders had an opportunity to provide comments and recommend changes to the model. CRA did conduct some additional modelling (related to changes in assumptions about implementation of the WCI) in response to stakeholder requests, but it did not receive any requests to revise the model to account for un-modelled uncertainties.

outcome would be to recognize modelling shortcomings when weighing the results and drawing a conclusion regarding the tariff level.	

IX. The effect of the export tariff on surplus baseload generation

Cliff Hamal	Ira Shavel & Andy Baziliauskas
The CRA analysis' conclusion that changes in the export tariff will have no effect on trade during SBG conditions is not credible. A change in the tariff will change the incentive for exports and, when the transmission constraint is not binding, a change in exports should be expected. The CRA analysis does not produce this result because the transmission lines are always constrained during SBG situations — no change in the tariff could increase exports. This is not reasonable and is not consistent with historical SBG conditions. This result occurs in the analysis because the analysis does not adequately model real-world operations. The analysis assumes efficient outcomes with no uncertainties, unreasonable price differences, and other factors such that the transmission limits are always constraining exports whenever SBG occurs. This is not true. Compounding this problem, the analysis is not able to properly reflect the implications of IESO actions in managing SBG on likely trading behaviour. Increasing the export tariff not only changes the breakeven point for a profitable trade, but it increases the risk of an unprofitable trade and increases the cost of trading generally, such that the reduction in trading from a tariff increase is greater than would be expected solely by consideration of price differences.	Modelling export responsiveness to changes in the ETS tariff during SBG periods is admittedly challenging. In the real world, the volume of exports during such periods depends on a variety of economic factors, including prices in export zones relative to Ontario prices, the export tariff, and other costs incurred by traders. In addition, export volumes especially during SBG periods, are influenced by a variety of non-economic factors, including transmission outages at export interties, transmission issues within Ontario, and the responses of system operators in export markets that may be simultaneously experiencing similar events. These non-economic factors are difficult to model, and they are impossible to model when they are idiosyncratic and are functions of events that cannot be anticipated (their effects can be viewed only in retrospect). CRA assumed a fixed intertie capacity (for all hours and in all scenarios and models years) during SBG periods that was lower than the theoretical non-simultaneous export capacity. Exports were found to be at the modelled capacity in all scenarios, including the status quo, with the result that exports during SBG periods did not vary across scenarios. This approach is supported by a variety of analyses of pricing and exports during the relevant periods and is validated by a sensitivity analysis involving running the model using different export limits. Although CRA agrees that actual exports during SBG events depend on a number of factors that are difficult to evaluate and therefore to model, it is confident that its approach to these challenges is appropriate and that the model results and its conclusions are reasonable. CRA further notes that no evidence has been presented at this proceeding that relates to the materiality of any revisions to the CRA model that would be required to remedy any

	alleged problems with the way that CRA models exports during SBG periods.

X. Analysis of tiered rate structures (tariffs that vary by time of day)

Cliff Hamal	Ira Shavel & Andy Baziliauskas
The CRA analysis of tiered rate structures is particularly problematic. The NEEMs model is not a chronological model, so it cannot adequately capture the effects of a twice-daily change in the tariff rate. The analysis uses load levels as a proxy for the on peak period, but this is a flawed approach. For example, based on data from the 12 months ending June 2012, only 70% of the highest load hours would fall in the 12 hours a day, 5 days a week period assumed as on-peak in the analysis. As a result of these problems, it should be expected that actual results from a tiered rate structure will be less attractive than what has been modelled.	The NEEM model represents the real world in a simplified way, to ensure tractability and to keep the costs of the analysis manageable. CRA is confident that the bundling of hours by load level in the model does not bias model results in a material way. CRA notes that stakeholders were made aware of the nature of the NEEM model's load curve at least by January 2012 when CRA made its presentation to stakeholders. The fact that CRA would be modelling two-tiered scenarios at the time was known to stakeholders, but no stakeholders expressed any concern that the NEEM model's load duration curve could not accurately model the two-tiered scenarios.