Renewable Preference Regulations 2008

Consultation on proposals for regulations

to be made under

the Electricity Act 1992

as amended by

the Electricity (Renewable Preference) Amendment Act 2008.

October 2008

Energy and Communications Branch

Ministry of Economic Development

33 Bowen Street

PO Box 1473

Wellington

New Zealand

ISBN: 978-0-478-33603-0 (HTML)

ISBN: 978-0-478-33602-3 (PDF)

Disclaimer

The opinions and proposals contained in this document are an explanation of government policy. They explain the rationale behind proposed draft regulations for the Electricity Act 1992.

Readers are advised to seek specific legal advice from a qualified professional person before undertaking any action in reliance on the contents of this publication. The contents of this discussion paper must not be construed as legal advice. The Ministry does not accept any responsibility or liability whatsoever whether in contract, tort (including negligence), equity or otherwise for any action taken as a result of reading, or reliance placed on the Ministry because of having read, any part, or all, of the information in this discussion paper or for any error, inadequacy, deficiency, flaw in or omission from the discussion paper.

Table of Contents

1. Purpose of this consultation document

1. The Electricity Act 1992 was amended by the Electricity (Renewable Preference) Amendment Act 2008 (the Act). It prohibits the operation of new fossil-fuelled thermal generation above 10 MW that uses more than 20 per cent fossil fuel, unless a specific exemption is obtained.

2. The Act provides for regulations to prescribe processes and parameters for exemptions. Section 62N of the Electricity Act 1992 (as amended by the Act) contains the required regulation-making powers.

3. This paper outlines the proposed design and substance for the regulations, including where applicable, the quantitative values.

1.1 Process

4. Interested parties are invited to make a written submission on the proposals. The Ministry's preference is for comments to be provided in response to specific questions asked in the proposals.

1.2 Note on references

5. The paper makes reference to sections of the Electricity Act 1992. These section references are to sections as amended by the Electricity (Renewable Preference) Amendment Act 2008 (the Act)

1.3 Posting and Release of Submissions

6. The Ministry may post all or parts of any written submission on its website at www.med.govt.nz. The Ministry will consider you to have consented this posting by making a submission, unless you clearly specify otherwise in your submission.

7. In any case, content of submissions provided to the Ministry are likely to be subject to public release under the Official Information Act 1982 following requests to the Ministry (including via e-mail). Please advise if you have any objection to the release of any information contained in a submission, and in particular, which part(s) you consider should be withheld, together with the reason(s) for withholding the information. The Ministry will take into account all such objections when responding to requests for copies and information on submissions to this document under the Official Information Act 1982.

Expressing your views

Submissions are due by **5pm, Wednesday 5 November 2008**. The Ministry prefers written comments to be provided by email to electricity@med.govt.nz. Otherwise they can be posted to:

Mark Pickup
Senior Policy Analyst, Electricity Group
Energy and Communications Branch
Ministry of Economic Development
PO Box 1473
Wellington
New Zealand

Phone: +64-4-462-4218
Fax: +64-4-473 7010

The Ministry may post all or parts of any written submission on its website at www.med.govt.nz. The Ministry will consider you to have consented to posting by making a submission, unless you clearly specify otherwise in your submission.

1.4 Privacy

8. The Privacy Act 1993 establishes certain principles with respect to the collection, use, and disclosure of information about individuals by various agencies including the Ministry. It governs access by individuals to information about themselves held by agencies. Any personal information you supply to the Ministry in the course of making a submission will be used by the Ministry only in conjunction with the matters covered by this document. Please clearly indicate in your submission if you do not wish your name to be included in any summary of submissions that the Ministry may publish.

1.5 Background papers

9. Supporting documents which outline prior Ministry analysis and the Cabinet decisions on the Climate Change (Emissions Trading and Renewable Preference) Bill are available on the Ministry of Economic Development website. These papers can be found at:

   www.med.govt.nz/electricity/renewables-pref/

10. Papers on the Select Committee's evidence and reports on the Climate Change (Emissions Trading and Renewable Preference) Bill can be found on the government website:

   www.parliament.nz/en-NZ/SC/

2. Introduction

2.1 Background

11. The Act implements a comprehensive restriction on the operation of new thermal plants (greater than 10MW that uses more than 20% fossil fuels) for a period of ten years to coincide with the establishment of the Emissions Trading Scheme (ETS).

12. However, it allows for exemptions which can enable peaking and firming roles for fossil-fuelled thermal generation to provide security of supply and to support a high renewables future, based on intermittent wind and hydro generation. This proposal concerns regulations which provide for the granting of exemptions from the prohibition.

2.2 Purpose of regulations

13. The Act provides for regulations to be made to prescribe the processes and parameters for exemptions. Section 62N of the Act contains the regulation-making powers.

14. The discussion paper covers the following key matters that are to be prescribed in the regulations:

    - Prescribing the limits for the average load factors, greenhouse gas emissions and start-up times for a plant to be exempted under s62G(1)(a), and how these limits are to be calculated and determined;
    - Prescribing the minimum energy efficiency level that a co-generation plant must operate above to be exempted under s62G(1)(c);
    - Prescribing the maximum fossil fuel proportion of total fuel energy input, the minimum energy efficiency level and the maximum greenhouse gas emission level for a plant that uses both renewable and non-renewable fuels to be granted an exemption under s62G(1)(d);
    - Prescribing the methodology for determining projected emissions savings and security of supply margins for a plant to be granted an exemption under s62G(1)(e);
    - Prescribing how applications for exemptions are to be made and dealt with; and
    - Authorising the Electricity Commission (the Commission) to charge fees under the Act (this regulation will be made under section 169(1)(128) of the Electricity Act 1992.
    - Prescribing the manner and amounts of these payments which the Commission can require (this regulation will be made under section 169(1)(28) of the Electricity Act 1992.

3. Detailed explanation of intended regulations

3.1 Defining load factor, emissions and start-up time for a plant to be exempted under s62G(1)(a)

15. Under section 62G(1)(a), the Minister may only grant an exemption if he or she is satisfied that the plant will be a non baseload plant and that:

    i. it has an average load factor less than a prescribed limit;

    ii. emits greenhouse gases less than a prescribed limit; and

    iii. has a start-up time less than a prescribed limit.

16. The Act refers to non-baseload and baseload plants. The term “baseload” is in common usage in the electricity generation sector but is not defined. Baseload plant is typically interpreted as meaning plant that runs almost continuously, while the term “non-baseload” is typically used to refer to plant that does not run continuously.

17. Non baseload plant can have a role in “firming” renewable generation all year round whose output is intermittent due to variability in wind or rainfall, but its greatest value is during winter when demand is at its highest and the supply of renewable generation may be less reliable.

18. The need for peaking plant to support renewable plant arises from several causes. Wind speed can change very rapidly, requiring backup generation to step into support when wind generation is idle. While dispersion of wind plant over a sufficiently wide area can reduce the risk of sudden dramatic drops in wind speed affecting overall generation levels, this can not totally eliminate the need for plant that can vary output instantly (ramp rate) to support wind generation. This requirement is expected to grow as the relative contribution of wind generation to New Zealand’s total energy generation grows.

19. Both hydro and some thermal plants can be used to provide this sort of rapid support. Partially loaded hydro or thermal is able to increase output rapidly in response to changes in load. The next quickest response is provided by open cycle gas turbines (OCGT) fuelled by gas or diesel with typical start-up times between 10 to 15 minutes (from cold to full output).

20. Currently, diesel is stored for this purpose and is used in New Zealand’s sole 155 MW diesel-fired OCGT plant at Whiranaki. A further 200 MW of gas fired OCGT plant is planned for Stratford (along with underground gas storage) and a similar small OCGT plant (p40) has previously been built at Huntly.

21. A second circumstance is to support hydro generation where water inflow rates and therefore storage levels to the plant are variable. However, as water inflows change less rapidly than wind flow and are thus more predictable in the short term (within the week), and because some hydro has access to discretionary storage, the need for a plant supporting hydro generation to have rapid start-up capability can be less.

22. A plant operating in this manner is traditionally referred to as ‘hydro-firming’, and would be expected to have a similar load characteristic to that of Huntly as it operated in the 1980s and 1990s, when it largely performed this hydro-firming role.

23. The parameters for regulations that will define the permissible load factor, greenhouse gas emissions and start-up times for a plant to be exempted as non baseload plant under s62G(1)(a) are discussed in the following sections.

24. Because a fast start gas fired peaking plant is the most likely plant to be exempted under these regulations, the parameters are discussed relative to this plant type.

3.1.1 Proposed Fast Start Peaking Parameters – Gas Fuelled

25. A gas-fired peaking plant such as that planned for Stratford has a lower heat rate and lower emissions per unit of fuel than a diesel-fired plant such as at Whirinaki. Consequently this plant is generally more economically attractive than a diesel fired OCGT if sufficient gas is available.

3.1.1.1 Deriving the prescribed load factor

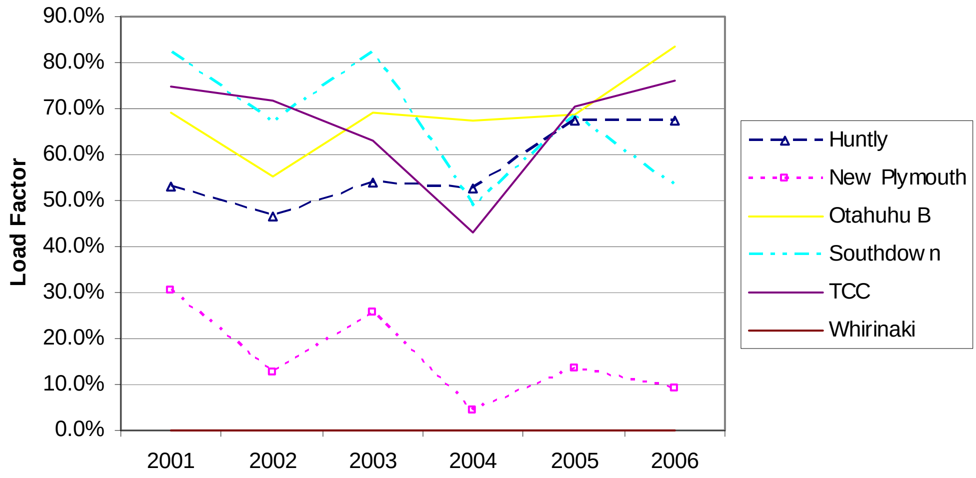
26. There is no current thermal plant in New Zealand operating primarily to support intermittent renewable generation that could provide a ready-made benchmark for the load factor for this plant. New Plymouth and Huntly as they were operated several years ago provides the nearest equivalent.

27. Table 1 and Figure 1 present the annual average load factors of major thermal plant in New Zealand in recent years.

Table 1: Thermal Plant load Factors

Year	Huntly	N Plymouth	Otahuhu B	Southdown	TCC
2001	52.8%	30.3%	68.9%	82.1%	74.8%
2002	46.4%	12.6%	55.4%	66.9%	71.9%
2003	53.9%	25.9%	68.9%	82.0%	63.0%
2004	52.7%	4.3%	67.2%	48.6%	42.9%
2005	67.6%	13.3%	68.7%	68.2%	70.3%
2006	67.2%	9.2%	83.4%	53.0%	76.0%
Average	57.5%	13.1%	68.7%	63.7%	64.8%

Figure 1: Thermal Plant load Factors



28. In general, a more restrictive load factor threshold would impose greater costs (and therefore higher electricity prices) and carries the risk that investment in such plant would be uneconomic. However, such costs and risks are difficult to quantify. A less restrictive (or high load factor) threshold increases the risk that the purpose of the Act could be defeated by allowing otherwise baseload plant to be exempted.

29. Based on the historical load factors in Table 1 and Figure 1, it is proposed that the allowable range factor should be in the range of 40% to 50%. This range is chosen as it lies between:

- the highest annual load factor of New Plymouth over the past five years which was just over 30%; and
- the average annual load factor of Huntly of 58% which operates as a mid range plant.

30. Further, it is representative of the load factor range that is expected for a plant whose purpose is to provide winter peak support and firming for intermittent renewable generation.

31. The need for emergency conservation measures this winter, along with the urgent need to bring units of the mothballed New Plymouth station back on line, highlights the requirement for adequate thermal backup for this winter and until greater volumes of renewable baseload generation and the necessary transmission is constructed.

32. Winter generation margins are expected to be tight over 2009 and 2010 and to remain so after the remaining New Plymouth units are finally retired[1]. To support the need for short term winter peak support it is proposed that the allowable average load factor for non baseload plant commissioned before 2011 should be set at 50%.

33. Plant commissioned from 2011 onwards could then be restricted to a lower average load factor of 40%, largely because the addition of new non baseload plant and baseload renewables in the interim should reduce the average load factor required of subsequent peaking plant.

34. An alternative to this specification is that all fast start gas peaking plant under s62G(1)(a) be restricted to a single maximum load factor in the range of 40% to 50% with no change over time.

3.1.1.2 Deriving the emissions limit

35. The relevant parameters of an example gas fired peaking or firming plant of this type are given below:

---

[1] The New Plymouth plant was being decommissioned due to the high cost of maintaining it and the discovery of significant amounts of asbestos. The single remaining 100 MW generating unit which had not had its asbestos stripped was temporally bought back into service this winter with staff requiring protective equipment to operate it. The longer term availability of this unit is not guaranteed beyond the winter 2009 due to the inconvenience of operating it using protective equipment and the high cost of removing the asbestos permanently.

- Heat Rate: 10,500[2] (MJ/MWh)

- CO_2 Emissions factor for (gas) fuel: 57.5[3] ($ktCO_2/PJ$)

36. Annual emissions from this example plant per MW of plant capacity would be:

Annual emissions = heat rate * emissions factor * hours per year

= 10,500 (MJ/MWh) * 57.5 $ktCO_2/PJ$ / 10^9 * 8,760[4]

= 5.29 $ktCO_2$/MW/year at 100% load factor

= 2.12 (kt CO_2/MW) at 40% load factor

37. The proposed emissions limit for this plant at a 40% load factor would be 2.12 (kt CO_2/MW).

38. Note that the regulations are expressed in terms of CO_2-e which requires the addition of non CO_2 gases (N_2O and CH_4) as their equivalent emissions in CO_2. However, the addition of these other gases generally does not make a material change the calculated emissions limit and so for the purpose of this calculation 2.1 (kt CO_2/MW) is taken as equivalent to 2.1 (kt CO_2-e/MW).

39. The expected start-up time for this type of plant from cold start to rated capacity varies but is generally under 20 minutes. A maximum value of 15 minutes is suggested as a suitable threshold. Whiranaki gas turbines are aero-derivatives (i.e. jet engines modified for stationary power). This type may have a faster start time than industrial gas turbines.

40. The recommended parameters of a fast start gas peaking plant under s62G(1)(a) are therefore:

- EITHER Load factor of between 40%and 50%

- OR Load factor: 50% for plant commissioned before 2011 and 40% thereafter

- Emissions limit: 2.12 $ktCO_2$/MW/year for a 40% load factor and 2.61 $ktCO_2$/MW/year for 50%

- Start-up time: Maximum of 15 minutes

---

[2] The value of 10,500 is the approximate mid point (rounded) of the range of heat rates from current General Electric gas turbines (greater than 10 MW in size).
Refer to: http://gepower.com/businesses/ge_oilandgas/en/downloads/gas_turb_perf.pdf
and http://gepower.com/prod_serv/products/aero_turbines/en/downloads/lm6000_sprint.pdf

[3] The value of 57.5 kt CO2/PJ used in this example is the net emissions factor of the weighted average of Maui and Kapuni (treated) gas from Table 4.1 NZ Energy Greenhouse Gas Emissions 1990-2006, MED.

57.5 kt $C0_2$/PJ = 52.3 (weighted average) * 0.995 (oxidation factor) / 0.904 (gross to net conversion)

[4] Division by 10^9 is required to scale PJ and MJ correctly to the same dimensions

Questions on fast start gas OCGT under s62G(1)(a)

A. Are these limits proposed for fast gas plant appropriate?

B. Should an allowance of 50% load factor be made to meet 2009 and 2010 winter peaks, or should a single value in the range of 40 to 50% apply to all years?

C. If not, what different values should be used?

3.1.2 Application of the limits to other plant types

41. It is proposed that the same limits will apply to all other fossil fuelled plants which could be exempted under s62G(1)(a).

42. The following sections discuss the implications of these limits on other plant types.

3.1.2.1 Fast start diesel peaking plant;

43. Diesel fired OCGT plant can be one of the appropriate current technologies for fast-start peaking plant.

44. However, in this role (due to the higher variable cost of the fuel) such a plant is likely to have a much lower utilisation, or load factor, than its gas fired equivalent. It does though have an advantage that storage of oil in tanks is generally easier to manage than contractual issues with gas delivery which may limit gas storage in pipes or reservoirs.

45. There is no current thermal plant in New Zealand operating that could provide a ready-made benchmark for a fast start peaking diesel plant to support renewables. Whirinaki operates for a different purpose, namely to meet security of supply guidelines. New Plymouth, as it operated in previous years provides the closest approximation to the required load factor.

46. The emissions of a Whirinaki type oil fired OCGT plant are:

- Fuel: Diesel
- Heat Rate: 11000 (MJ/MWh)
- CO_2 Emissions factor for (diesel) fuel: 73.4 ($ktCO_2$/PJ)

Annual emissions = heat rate * emissions factor * hours per year

= 11,000 (MJ/MWh) * 73.4 $ktCO_2$/PJ / 10^9 * 8,760

= 7.07 (kt CO_2/MW/year)

= 2.84 $ktCO_2$/MWyear at 40% load factor

47. The effective load factor limit that would apply to a diesel fired OCGT if it was subject to the same emissions limit can be calculated by solving the following equation that equates the annual emissions of the two plants.

$2.12\ ktCO_2/MWyear = 7.07\ (kt\ CO_2/MW) * X\ \%\ (load\ factor)$

X = 29.58%, rounded to 30%

48. A fast start diesel peaking plant under s62G(1)(a) will be subject to the same criteria under the regulations, as are described in section 3.1.1 for a fast start gas plant. However, in order to meet the emissions limit, it would be limited to an effective load factor of 30%, as described above, otherwise it would breach the emissions limit.

49. The start-up time for Whiranaki is 11 minutes from cold start to rated capacity. A value of 15 minutes would therefore accommodate most oil fired OCGTs.

3.1.2.2 Hydro firming plant

50. No distinction is to be made between the role of a peaking fast start versus hydro firming. Any plant that is proposed to be used for hydro firming will be subject to the same criteria.

3.1.2.3 Combined Cycle Gas Turbines (CCGT) plant

51. A CCGT will be subject to the same criteria. Typical CCGTs, however, are unlikely to fulfil two of the three criteria;

- A CCGT is unlikely to be economic if faced with a 40% to 50% load factor limit. Such a plant is normally assumed to require load factors of at least 60% to 70% to be economic under current market conditions.
- A CCGT plant is more than likely to meet or be under the emissions limit.
- A CCGT is more than likely to fail the minimum start time requirement. For example, Otahuhu C takes around four hours to reach rated generation output from a warm start and 12 hours from a cold start, although it can synchronise at a lower load in less time. Clearly this does not comply within the proposed 15 minute start-up limit.

3.1.2.4 Hybrid or fast start CCGT plant

52. A new development for gas turbines is the so called “fast start” or “hybrid” CCGT plant where the gas turbine can be decoupled or run without the secondary steam turbine stage. This allows the plant to start up faster than a normal CCGT (though not as fast as a pure OCGT plant), and to reach operating efficiencies of a CCGT plant when the steam recovery process is engaged.

53. However, this type of plant is generally not as efficient in open cycle mode as a pure OCGT which is designed to run without the secondary stage energy capture. This plant therefore has some of the characteristics of both an OCGT plant and a CCGT plant.

54. A hybrid CCGT plant is likely to comply with the emissions requirement, but is unlikely to comply with the 15 minute start-up limit, and is unlikely to be economic at low load factors 40% to 50%.

3.1.2.5 Coal plant

55. A current generation coal plant is unlikely to comply with the emissions requirement, is unlikely to comply with the 15 minute start-up limit, and is unlikely to be economic at low load factors of 40% to 50%.

Questions on other plant types under s62G(1)(a)

D. Are these limits proposed for other plant types appropriate?

E. If not, what different values should be used?

3.2 Period of measurement for load factor

56. Section s62C(3) outlines that the average load factor of a plant will be calculated by reference to the energy generated over the previous 12 month period unless otherwise prescribed.

57. A plant that is to be used for hydro firming (provides additional generation when hydro is unable to) must be able to operate on the basis of considerable annual production variability. While the annual average load factor of this plant may be 35% to 40%, in wet years such plant may operate at a relatively low load factor (e.g. less than 20%), and in dry years it may operate at much higher load factor (e.g. 50% or more).

58. Because of such large variations in annual load factor are likely, it is important that the threshold for permitted fossil-fuelled generation be calculated over a suitably long period. A period of 3 years is suggested to cover expected variation due to hydro uncertainty.

59. This means that for a prescribed load factor limit of (for example) 40%, a given thermal plant would be expected to run below this on some years and above on others, provided that the average over the last 3 years was 40% or less.

Questions on period of measurement for s62C(3)

F. Is 3 years a sufficient period for averaging load factor, bearing in mind that the renewable preference restriction only operates for 10 years?

3.3 Defining an acceptable emissions levels for co-generation plant to be exempted under s62G(1)(c)

60. Co-generation is an industrial process in which a useful by-product from electricity generation such as thermal energy from steam, which would otherwise be discarded, is re-used to improve the overall efficiency of the electricity generation process. This reuse of waste steam is more efficient than powering the entire process through electrical energy.

61. The energy efficiency of a co-generation process is the sum of both its electrical efficiency (power output divided by fuel input) and the thermal efficiency (useful heat output divided by fuel input) and is usually expressed as a percentage.

62. Typically cogeneration plants have overall efficiencies ranging from 60 – 80% Gross Calorific Value (GCV)[5], varying by technology. This compares to the efficiency of conventional thermal electricity generation of approximately 25 – 50% GCV.

63. An exemption criterion could be based on an overall energy efficiency threshold. The level of this threshold would need to:

- be greater than the efficiency level of the most efficient commercially available thermal power plant, i.e. around 50% (GCV).

- be low enough so as not to exclude economically viable and environmentally beneficial co-generation*.*

- take into account circumstances peculiar to New Zealand. Some New Zealand cogeneration plant may have relatively low overall efficiencies due to the strong seasonal nature of the host site energy demand. For example, a co-generation plant for a dairy may have to operate at part load (and hence less efficiently) during the shoulder months at the beginning and end of the dairy season.

- take into account that new co-generation plant may only reach full efficiency some time after operation commences if optimum operating conditions of the industrial process lag behind development of the electricity generation process, or vice versa.

64. A minimum energy efficiency level of 55% GCV is proposed. This standard is consistent with current co-generation best practice.

65. However, in order to accommodate variation in plant type and operation it is proposed that the electrical efficiency of the plant can not be less than 25% and the thermal efficiency of the co-generation process can not be less than 10%.

---

[5] Measures of efficiency are based on evaluating the energy content of fuel using either the net calorific value (NCV) or the gross calorific value (GCV). Efficiencies based on the GCV are typically lower than based on the NCV, because NCV subtracts the “waste” energy required to produce water vapour during combustion of the fuel, for natural gas the difference is roughly 10%.

66. The by-product that is recovered for use in electricity generation in some types of co-generation plant may be waste gas or heat that might otherwise have been flared into the atmosphere. For this type of co-generation plant a measure of the quantum of energy generated from this waste gas or heat should be included as part of the assessment of the efficiency of the plant.

Questions on co-generation under s62G(1)(c)

G. Is 55% GCV the appropriate benchmark to prescribe the required level of co-generation efficiency? Should this level be set lower or higher, or specified differently?

H. How should the benchmark be applied to seasonal co-generation processes and co-generation processes that are incrementally expanded over time?

I. How should the efficiency of a co-generation plant that is reusing (burning) waste gas or heat be assessed?

J. Is there a more appropriate benchmark and how should it be measured?

3.4 Defining an acceptable energy efficiency and green house gas emissions levels for plants that use both renewable and non renewable fuels under s62G(1)(d)

67. Section 62G(1)(d) of the Act permits an exemption from the renewable preference restrictions to be granted if the Minister is satisfied that the proposal uses an acceptable combination of renewable energy sources and fossil fuels that meets the requirements of section 62G(1)(d)(i) to (iii). The intent of this regulation is to allow for generation technologies that utilise recyclable material in conjunction with fossil fuel, for example, wood waste combined with natural gas.

68. An exemption will not be needed for a plant using less than 20% fossil fuel as the restriction on operation will not apply.

69. There is no current benchmark or guideline for this sort of standard or threshold. In its absence it is recommended that a minimum standard is set equal to the lower end of conventional thermal electricity generation, while at the same time requiring a reasonable proportion of renewable fuel. In this case, a plant would be required to have energy efficiency greater than 25% GCV for its generation, and use a maximum of 60% fossil based fuel.

70. Further, section 62G(1)(d) allows for a greenhouse gas emission limit to be prescribed, if required. At this stage it is not proposed to prescribe a greenhouse gas limit for this exemption, as there is insufficient information with which to establish an appropriate standard.

Questions on emissions under s62G(1)(d)

K. Is 25% GCV for energy efficiency an appropriate benchmark for this exemption category?

L. Is a 40% minimum for non-fossil fuel, or 60% maximum fossil fuel, appropriate for this exemption category?

M. Is there a better way to express the exemption requirements for this category which is intended for bio-fuel type plants which use some fossil fuel?

3.5 Defining the methodology for projecting emissions savings and the required level of security supply margins for replacement thermal plant to be exempted under s62G(1)(e)

71. This exemption category is intended to allow for the construction of new thermal plant provided it is linked to the retirement in whole or in part of an existing thermal plant. (section 62G(1)(e)).

72. Two caveats on this new construction under s62G(1)(e) are that the new generation plant along with any remaining part of the existing plant:

- will reduce greenhouse gas emissions by at least 20% (based on emissions from the existing thermal plant and projected emissions assessed in the prescribed manner); and

- will not reduce security of supply below prescribed margins (as assessed in the prescribed manner).

73. Both of these requirements require regulations to prescribe the assessment methodology.

3.5.1 Emissions comparison between existing and proposed replacement plant

74. A methodology is required for calculating values for the emissions of existing plant that would have occurred if the plant was not replaced and projected emissions for the proposed plant.

75. It is proposed that the applicant will be responsible for providing a projection of expected emissions for the replacement plant and residual existing plant. If accepted these will form part of the proposed terms and conditions of the exemption.

76. It should be noted that the emissions that can be proposed for the replacement plant and residual existing plant are limited by the requirements under section 62G(e)(i) – that these replacement emissions reduce total projected emissions by at least 20%.

77. Arithmetically this can be expressed as:

$$(X - Y) / X * 100/1 \geq 20\%$$

where X = Projected emissions from existing plant

Y = Proposed emissions from new plant and residual of existing plant

78. To project emissions of an existing plant, there are several simple methods that can be considered. These are:

- Use preceding full year's emissions; or
- Use an average of last three to five years' emissions; or
- Use a form of simple trend projection, linear or weighted (also known as exponential) smoothing
- Alternatively the Commission's Generation models applying a suitable market scenario could be used to forecast emissions of existing and replacement plant.

3.5.1.1 Using immediate prior years emissions

79. Using the preceding full year's emissions is the simplest approach. It has the drawback that the value for the immediate prior year may be biased due to extraordinary wet or dry conditions in that year.

80. This method would require the assessed technical emissions at the commencement of the new plant and of residual existing plant (operating at the load factor proposed by the applicant) to be 20% less than the immediate prior year's emissions from the existing plant.

3.5.1.2 Using a yearly average of past emissions

81. An average of the past few years' emissions is the next simplest approach. It has the advantage that the calculation is straight forward, and by using several years' data it would better account for variance due to differing dry and wet year hydrological inflows.

82. Three to five years is selected as the smallest range necessary to minimise the risk of averaging over a run of identical hydrological years e.g. all dry.

83. However, the measure could be either an under or over-estimate if the longer term trend for the plant had been on a long term increase or decline in usage.

84. This method would require the assessed technical emissions at the commencement of the new plant and of residual existing plant (operating at the load factor proposed by the applicant) to be 20% less than the average of the past three to five year's emissions from the existing plant.

3.5.1.3 Using a simple trend of past emissions

85. Forecasting emissions of the residual plant using a simple extrapolation from past trends in emissions of the existing plant would be another method for projecting future emissions. There are several methods by which such a trend or projection can be calculated; such as linear regression or a simple weighted average or smoothing.

86. However, a forecast based on very few data points may not be the best unbiased estimator of the underlying trend, as it would be overly sensitive to a single outlier.

87. Under this method the estimated emissions from the new and residual existing plant on the commencement of operation of the new plant would need to be 20% less than the value predicted by a simple trend line based on at least the past 10 years' emissions from the existing plant.

88. This method would require the assessed technical emissions at the commencement of the new plant and projected emissions of residual existing plant (operating at the load factor proposed by the applicant), to be 20% less than the projected emissions from a simple trend of the existing plant.

3.5.1.4 Using market scenario modelling of emissions

89. Forecasting emissions using a simulation model would allow future emissions to be assessed relative to any renewable targets under a range of potential futures.

90. Under this method the estimated emissions from the new and residual existing plant on the commencement of the operation of the new plant would need to be 20% less than the value predicted from the EC's modelling of generation from the existing plant.

91. This method could provide a better assessment of future generation emissions than use of historical values but could lead to significant debate over the accuracy and correctness of the assumptions made within the modelling scenarios chosen.

3.5.1.5 Selection of method of assessment

92. Huntly is the most likely plant to be retired under this exemption. The following section considers how these methods could be applied to Huntly emission.

93. Emissions figures for Huntly using average annual load factors from 2001 to 2006 from the Commission's centralised data set and the 2007 generation values from the MED Energy data file are provided in Table 1 below. Owing to rounding and averaging in the calculation of the load factors and the emissions factors used, the figures provided may not precisely equal reported actual emissions.

Table 2: Calculated Huntly Emissions

Year	Huntly emissions (kt CO2/yr)
2001	4,576
2002	4,015
2003	4,669
2004	4,561
2005	5,854
2006	5,822
2007	4,153

94. Table 3 following, provides forecasts of estimated emissions for 2008 using the preceding full year's emissions; the average of last 3 and 5 years' emissions; linear trends based of four and seven years data, a simple exponential weighting and simulation modelling.

Table 3: Projected Emissions

Estimate Method	2008 Huntly emissions (kt CO2/yr)	Emissions less required 20% reduction (kt CO2/yr)
Last year (2007) value	4,153	3,322
Average of last 3 years	5,276	4,221
Average of last 5 years	4,845	3,876
7 year Linear Trend	5,311	4,249
4 Year Linear Trend	4,783	3,827
Exponential weighting	4,827	3,861
Simulation Modelling	4,980	3,984

3.5.1.6 Evaluation of method of assessment

95. The simplest methods rely on averaging or projecting historical emissions.

96. Previous Year: This method is rejected because the inter year variation is too high. For example if data from 2006 was used instead, then this value would be over 1,500 kt CO2 higher. This means the value predicted is unduly biased by the last year.

97. Average of last three or five years data: This method has the advantage that the value is averaged over several years and therefore is less likely to be biased by an individual wet or dry year.

98. Exponential Smoothing: Another simple projection method is to use exponential smoothing or weighting of past values to project future data. Table 3 and Figure 2 include a simple exponential smoothing that computes a yearly forecast from the previous three year's data using the weights 0.6 to the past years data and 0.2 to each of the two year's prior to that; e.g.

$$Y_{t+1} = Y_t * (0.6) + Y_{t-1} * (1-0.6)/2 + Y_{t-2} * (1-0.6)/2.$$

$Y_{t+1} = Y_t * (0.6) + Y_{t-1} * (0.2) + Y_{t-2} * (0.2)$ (simplified).

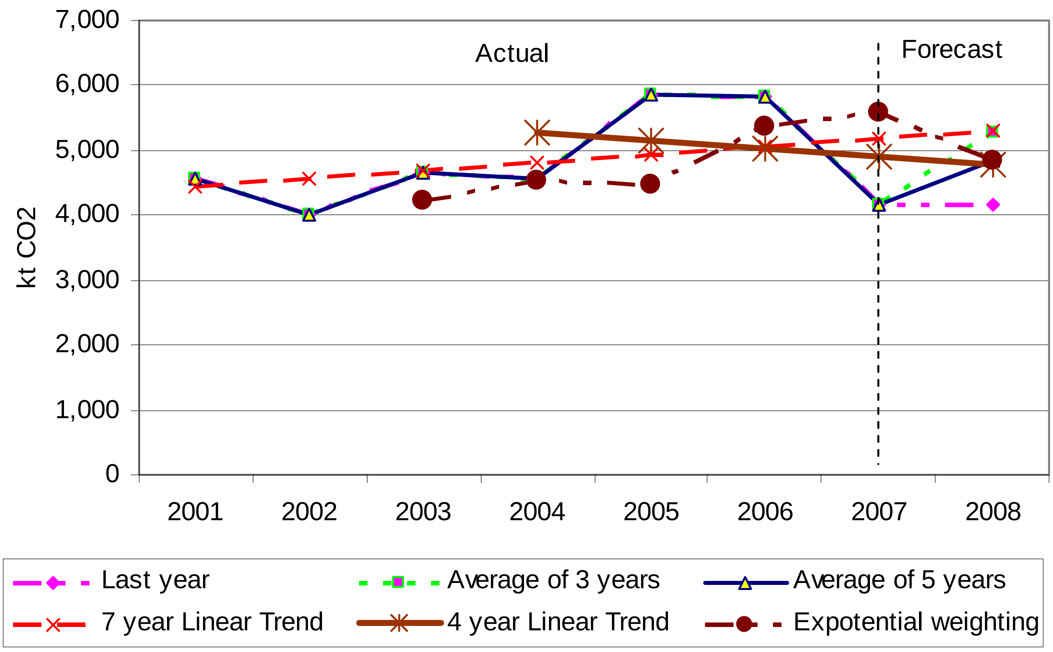
where Y_t is the yearly emissions amount for year (t)

99. In this equation the weight of 0.6 has been chosen to give a greater emphasis to the immediate prior year.

100. Linear Trend: A simple trend line provides a forecast of emissions. In Figure 2 it can be seen that the longer series using all seven data values predicts rising emissions, while a shorter series of only the most recent four years data predicts a decline as it places greater weighting on the lower 2007 value. However, in general reducing the number of data values on which a prediction is based increases the risk of bias in the projection.

101. Figure 2 following plots the 2008 forecast of Huntly emissions using some of the methods listed in Table 3.

Figure 2: Estimated Huntly Emissions by Year



102. Simulation modelling: the value presented in the simulation modelling was from a simulation run carried out to assess the 90% renewable energy target. Modelling to date by the EC and MED indicates that as carbon price rises and the volume of cheaper renewable generation grows, the output of the Huntly station gradually declines, till at some point in time it becomes uneconomic and ceases altogether. Exactly when this happens, and whether it occurs during the ten year term of the renewable preference, is dependent on a large number of assumptions including; the longer term on gas price, gas availability, the expected carbon price, and the volume and locations of alternative renewable plant.

3.5.1.7 Proposed method of assessment

103. The regulations require a method of projecting emissions.

104. The simplest method which takes into account past variance is to use a simple formulation of previous years data as in the formulae described for a simple exponential smoothing, such as the example formulation;

$$Y_{t+1} = Y_t * (0.6) + Y_{t-1} * (0.2) + Y_{t-2} * (0.2)$$

105. Alternatively, a simulation model could be used by the Commission to project the future emissions. Because such a formulation will vary according to the assumptions used it will not be possible to fully prescribe its form in regulations. Instead it will be necessary to appropriate requirements for the Commission's modelling.

106. Using simulation modelling the proposed methodology for assessing projected emissions of an existing plant (were it to remain in operation) for comparison purposes with the projected emissions of its replacement plant would be a requirement that the Commission forecast the projected emissions of the existing thermal plant proposed (which is to be replaced), by simulating the future operation of the power system having regard to the expected load factor and emissions of that plant as if the proposed replacement was not built

107. Further, such a simulation would be based on a reasonable scenario of the future expected operation of the electricity system having regard to:

- the expected size, timing and location of demand growth;
- the expected load factor and emissions of all thermal stations;
- the expected size, timing and location of committed generation projects and expected or modelled generation projects;
- the expected timing of decommissioning, removing or de-rating of decommissioned generation assets; and
- the expected transfer capacities and capabilities of the grid.

108. It is proposed that regulations will prescribe that projected emissions of an existing plant (were it to remain in operation) for comparison purposes with the projected emissions of its replacement plant shall be estimated by the Electricity Commission using simulation models.

Questions on forecast emissions under s62G(1)(e)

N. Is simulation modelling the most appropriate projection method to assess projected emissions?

O. If not, can you recommend a different and better approach to estimating projected emissions?

3.5.2 Security of Supply

109. Section 62G(1)(e) also requires that together the residual and new plant must not reduce the security of supply below prescribed margins.

110. Security of supply margins are defined by the Commission, under guidance from the Government Policy Statement on Electricity Governance (the GPS) for the purpose of it entering into reserve energy contracts.

111. In the GPS, the Commission is required to use reasonable endeavours to ensure that the generation and transmission system is capable of maintaining a mean winter energy margin of 17% for New Zealand overall and 30% for the South Island. These margins are the percentage amount that supply is expected to exceed demand in an average winter.

112. It is proposed that the values from the security of supply margins set by the Commission, as directed by the GPS, are used as the prescribed margins for the purpose of Section 62G(1)(e)(i). Accordingly, it is proposed that regulations will prescribe that the exemption may only be granted if it is expected that the mean winter energy margin remains above 17% and 30% in New Zealand and the South Island respectively.

113. Normally, the Commission assesses security of supply and reserve needs over a three year period. Implementing this regulation will require it to measure the exemption against the assessed three year period, and to make a forecast of any further period for the remainder of the renewable preference.

114. In effect this means that the operation of a new plant, in the Commission's assessment, can not cause the actual mean year energy margins for either or both of the South Island or New Zealand to drop below the Commission's mean winter energy margins and/or be so close to them that the Commission is compelled to contract additional reserve energy.

Questions on security under s62G(1)(e)

P. Is the requirement not to reduce the security margin below 17% and 30% % in New Zealand and the South Island respectively, appropriate for this exemption?

Q. If not, how else should it be expressed?

3.6 Defining how exemption applications are to be made and processed

115. It is proposed that regulations be drafted to specify how an application for an exemption is to be made and dealt with and to specify that this should occur within reasonable time limits where applicable. The proposed application process (in addition to those requirements specified in the Act) is that:

iv. applications for an exemption must be made to the Commission in writing;

v. the Commission must acknowledge receipt of an application and advise the applicant of the expected cost of processing it,

vi. the Commission may request further information from the applicant within a reasonable period of time and if that information is not provided the Commission may treat the application as withdrawn;

vii. if an application is incomplete, the Commission must notify the applicant in its acknowledgment and give the applicant an opportunity to resubmit its proposal.

viii. if the Commission decides to convene a public conference for the hearing of oral submissions, the Commission must give notice of the date of the conference in the Gazette.

ix. the Commission must publish a summary of submissions from the public conference.

x. the Commission recommendation must include recommended terms and conditions if the recommendation is that an exemption should be granted.

xi. individual timeframes for each step will not be specified in the regulations however:

  a. the Commission must make reasonable efforts, such that the overall process will be completed within 60 working days, subject to any extended consultation process that may be required to comply with the Act; and

  b. the Minister must make reasonable efforts to make his or her decision on the application within a specified time period (indicatively 20 working days) after receipt of the Commission's recommendation.

Questions on how applications are to be made

R. What timings are reasonable for the stages of the application process and for the overall process to be completed?

S. Do you have any recommendations to improve the application process?

3.7 Defining how fees and charges may be recovered by the Commission for exemption applications.

116. Section 169(1)(28) permits regulations to prescribe the matters for which fees are payable under the Act, the amounts of those fees and who they are payable to. This provision enables the Commission to recover its costs of processing exemption applications, which would include the costs of running consultation exercises.

117. Section 62N(fa) allows regulations to be made authorising the Commission to recover any costs incurred in connection with the exercise or performance by the Commission of any power or function relating to the application. This provision enables the Commission to recover any cost for additional expert consultancy or advice necessary to consider an exemption.

118. The following maximum fees (Table 4), for the Commission's costs, are suggested for exemption applications.

Table 4: Proposed maximum fees for exemption applications

Fee Purpose	**$**
Administration costs for application for exemption	$15,000
Administration costs for variation of terms and conditions	$5,000

119. A fee of $15, 000 for an application, if charged, represents a partial recovery of the costs for at least two to three weeks of analysis of the application by Commission staff, including some time for review of submissions. The proposed value for a variation of an exemption is less, as it is assumed that less work is required for variation of an application compared to the original processing.

120. The purpose of charging a fee is so that the party that most benefits (the applicant) pays the cost.

121. In addition to this application fee, it is proposed that a regulation be made under Section 62N(fa) to allow the Commission to recover reasonable costs incurred for additional expert consultancy or advice.

Questions on fees

T. Are the fees proposed in Table 4 for exemptions appropriate?