



UNIVERSITY  
OF WOLLONGONG  
AUSTRALIA

University of Wollongong  
Research Online

---

Sydney Business School - Papers

Faculty of Business

---

2007

# Renewable Energy Strategies in England, Australia and New Zealand

Geoff Kelly

*University of Wollongong, [gkelly@uow.edu.au](mailto:gkelly@uow.edu.au)*

---

## Publication Details

This article has been accepted for publication by Elsevier and will be published as: Kelly, G, Renewable Energy Strategies in England, Australia and New Zealand, *Geoforum*, 2007, 38(2), 326-338. Journal information available [here](#).

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library:  
[research-pubs@uow.edu.au](mailto:research-pubs@uow.edu.au)

---

# Renewable Energy Strategies in England, Australia and New Zealand

## **Abstract**

The development of renewable energy sources is of prime interest to many countries seeking to pursue greenhouse gas emission reduction obligations. The increased use of renewables offers the possibility of not only contributing to emission reduction, but at the same time improving energy supply diversity and security, and developing employment and business in related supply industries. Two main mechanisms are in common use, one a quota (quantity) instrument often associated with tradable certificates, and the other a prescribed pricing mechanism. This paper considers the renewable energy development strategies of three countries (the UK, Australia, and New Zealand) all using a variant of the quota/certificate approach as the central instrument in their programs. The regulatory frameworks defining the application of the certificate systems differ notably, and the likely differing outcomes suggest that these regulatory settings may be at least as important as the selection of the basic policy instrument, in determining the overall success of programs of this nature.

## **Keywords**

Cross-national comparisons; climate policy; renewable energy; tradable certificates, quota systems, Kyoto Protocol

## **Disciplines**

Business

## **Publication Details**

This article has been accepted for publication by Elsevier and will be published as: Kelly, G, Renewable Energy Strategies in England, Australia and New Zealand, *Geoforum*, 2007, 38(2), 326-338. Journal information available [here](#).

## Renewable Energy Strategies in England, Australia and New Zealand

Geoff Kelly  
Graduate School of Business  
University of Wollongong  
Wollongong NSW 2522  
Australia.

Email: [gkelly@uow.edu.au](mailto:gkelly@uow.edu.au)  
Telephone +61 2 4221 3850  
Fax +61 2 4221 4709

# Renewable Energy Strategies in England, Australia and New Zealand

## **Abstract**

The development of renewable energy sources is of prime interest to many countries seeking to pursue greenhouse gas emission reduction obligations. The increased use of renewables offers the possibility of not only contributing to emission reduction, but at the same time improving energy supply diversity and security, and developing employment and business in related supply industries. Two main mechanisms are in common use, one a quota (quantity) instrument often associated with tradable certificates, and the other a prescribed pricing mechanism. This paper considers the renewable energy development strategies of three countries (the UK, Australia, and New Zealand) all using a variant of the quota/certificate approach as the central instrument in their programs. The regulatory frameworks defining the application of the certificate systems differ notably, and the likely differing outcomes suggest that these regulatory settings may be at least as important as the selection of the basic policy instrument, in determining the overall success of programs of this nature.

*Keywords:* Cross-national comparisons; climate policy; renewable energy; tradable certificates, quota systems.

# Renewable Energy Strategies in England, Australia and New Zealand

## 1. Introduction

The pursuit of renewable energy (RE) development has emerged as a common and significant component of national greenhouse gas (GHG) reduction efforts. While commonly targeted at electricity generation because of the scale of its contribution to emissions, RE adoption has wider economic implications, through the conservation of existing 'premium' hydrocarbon resources such as oil and gas (Meyer, 2003), the creation of employment, and supply industry development. RE programs are commonly associated with multiple energy policy objectives - environmental sustainability (including greenhouse gas emission reduction), containment of energy cost, enhancement of supply security and broader issues of industry development. The initiatives undertaken by different countries are reflective of their relative weighting of these sometimes competing objectives.

The development of RE has been pursued through a broad range of policy instruments in different countries. This paper compares the RE development programs of three countries – the UK, Australia and New Zealand – and seeks to identify the main factors influencing their level of achievement. The three countries are all upper-income OECD members with political and legal systems sharing much common background. In each country RE-based electricity (REE) generation has been the principal target of their initiatives, and in each a form of tradable certificate system has been a central feature of programs. The UK has over time used two markedly differing approaches to REE markets, and employs a broad range of supporting measures; Australia introduced the first truly mandatory national REE consumption quota system; and NZ has undertaken its certificate system based not on nationally mandated consumption quotas, but on the international basis provided by Kyoto Protocol allowances. The UK has the longest history of structured programs, and hence the approach here will be to first examine the UK approach, and then compare the two smaller economies with that model of development.

The discussion first considers the instruments in common use before moving to a depiction of the strategies adopted by the three countries, their approaches to overcoming barriers to RE deployment, and a brief assessment of the factors influencing the success achieved.

## 2. Instruments for RE Development.

Development of renewable energy in recent years has been largely driven by the need to reduce greenhouse emissions. While the allied benefits of energy supply security and potential employment have not of themselves been the major drivers, most operational programs have been shaped within the context of those other objectives and a constraint of minimum cost. As an adjunct of direct emission reduction programs, RE programs employ a similar range of instruments, though with two approaches (tradable certificate systems, and 'pricing' systems) tending to prevail.

The International Energy Agency (IEA, 2004) provides a broad survey of RE promotion instruments in use in IEA countries which illustrates well how RE programs must address two dimensions simultaneously, in promoting both the **supply** and **demand** for REE. On each side of the market, both the cost of physical (capital) capacity and the operating cost of that capacity must be addressed. Combinations of instruments are therefore common including incentives such as tax exemptions and direct subsidies, government demonstration by REE purchase, voluntary (suasion) programs and, overarching all others, regulation by government where required to compel a specified consumption of renewable energy. The use of regulation to facilitate REE deployment is illustrated by the two schemes which have emerged as the principal instruments in this field.

In the first, demand is created by government mandating a certain minimum level of REE purchase, provision of such REE being undertaken by suppliers whose processes are accredited, and whose generation of REE is certified, by government. The certificates so created (attesting to a quantity of REE, and hence to a reduction in GHG emissions) are able to be traded separately to the electricity proper, for purchase by parties liable for the minimum REE purchase requirement. In such a system, the price of certificates is determined by bargaining between certificate suppliers and purchasers, and there is commonly little if any differentiation between alternative forms of REE. Such systems are essentially quota (quantity-based) systems, with certificate prices being market determined.

The second system regulates not quantity but price, and leaves determination of total REE purchase to the interaction of suppliers and purchasers. Such systems may have separately specified prices for different technologies, obviating competition between different REE forms and promoting the development of alternative technologies. The pricing system is decidedly more interventionist in nature than the quota system, and has been responsible for the greater part of REE growth in recent years. By end 2001 for example, three countries alone (Denmark, Germany and Spain) were responsible for 84% of installed REE capacity in the EU, all using variants of the pricing system (Meyer, 2003).

Individual national schemes may vary widely around these central themes. The Mandatory Renewable Energy Target scheme in Australia is an example of the first type,

and the German ‘feed-in mechanism’ (FIM) an example of the second. It is the latter which has been responsible for the largest national REE capacity addition to date (Menanteau et al, 2003).

## 2.1 *Tradable Permits and Green Certificates*

It is important to note a distinction between the use of tradable permits for environmental pollution reduction, and the use of tradable certificates for such commodities as 'green' electricity. Tradable permits have a long history of environmental application, as for example in acid rain reduction programs (Clarke, 2002). In the classical model, regulatory limits are applied to a range of pollution emitters with differing compliance costs. Were regulation alone to be applied, then the total compliance cost could be unnecessarily high, as high abatement cost firms would be obliged to abate as much as low abatement cost firms. Permit trading systems allow trade to take place between high- and low-abatement cost firms, with high cost firms able to buy permits from those firms able to generate them at lower abatement cost. The process of trade thus facilitates total cost reduction in achieving the required emission reductions (Pearce & Turner, 1990; Tietenberg, 1980).

Renewable energy certificates differ however in so far as they are directed at a specific segment of GHG emissions, those *induced by* firms through their consumption of fossil-fuel-based electricity. Commonly, such firms (and individuals) are required to purchase a common fraction of their energy supply from renewable sources of lower (or zero) induced emissions. There exists an element of market choice, in that consumers are able to either provide their own renewable energy, or purchase from others whose cost of provision is lower. The tradable (or 'green') certificates attest to the production of the REE, and the consequent reduction of fossil-fuel-based energy (Bertoldi & Huld, 2006; Morthorst, 2003; Morthorst, 2000).

Importantly however the broader total cost minimisation achievable by the tradable permit system does not occur. Energy consumers required to purchase or generate REE may well possess other abatement avenues of lower cost than that associated with increased use of REE - but cannot substitute those for their purchase or generation of REE. It is only when an element of fungibility is introduced through the interfacing of certificate systems with broadly based emissions trading systems that true cost minimisation may become possible. Such a combination of systems is at present far from universal.

Notably also the certificate supply side differs to that in a true tradable permit model. In that model, potential providers of emission reduction are likely to be already in the field in which emission reductions may be created and traded and, at least within national schemes, reasonably informed as to the nature and risk of the requisite reduction activity. In the developing REE field however, most significant activities imply investment in new projects, often of long leadtimes, with the risk attendant to any new project development, and often dependent on political undertakings for long term commitment of funds. In

essence, green certificate schemes depend on inducing the supply of an environmental service (the generation of REE) by private investors - and overall scheme success in turn depends on the effectiveness with which that is achieved.

### **3. The Countries**

The countries discussed are relatively high-income, OECD member countries with a long engagement in international climate change initiatives. The UK and New Zealand have both ratified the Kyoto Protocol although Australia has not progressed to that stage (UNFCCC, 2005). Their indigenous energy resources differ markedly in scale, New Zealand having least and in particular having rapidly diminishing gas reserves, leaving coal as the principal non-renewable fuel source (IEA, 2004/1). Australia possesses large reserves of both hydrocarbon fuels and coal, and is a major world coal supplier (EIA, 2004/1). The UK is the largest producer of petroleum and natural gas in the EU, although it is predicted that it will shortly become a net importer. The UK also has substantial coal reserves, although the industry has reduced radically in scale following privatisation in the 1990s (EIA, 2005). Selected characteristics of the three countries are shown in Table 1.



**Table 1**  
Selected Variables

Variable	UK	Australia	NZ	Note
GDP/capita (\$US,PPP, 2003)	27,490	28,520	22,920	1
Electricity use per capita (kWh/person) <sup>1</sup>	6,158	10,502	9,088	2
CO <sub>2</sub> emission per capita (tCO <sub>2</sub> /person) <i>fuel combustion only</i>	8.94	17.36	8.55	2
Total energy/GDP (PPP) (toe/thousand 1995\$US)	0.16	0.23	0.23	2
<u>GDP contribution %</u>				
Agriculture	1	3.4	4.6	3
Manufacturing	26.3	28.2	27.4	
Services	72.7	68.4	68	
<u>Export contribution %</u>				
Agriculture	6.6	22.8	58.2	4
Manufactures	82.8	24.1	31	
Mining	10.6	37.6	4.9	
<u>Emission sources %</u>				
Agriculture	7.9	19.8	54.4	5, 6, 7
Energy use	85.4	74.7	38	
Industry & waste	6.6	5.4	7.7	
Note	Source			
1	<i>The Economist</i> , 2005			
2	EIA, 2005			
3	CIA, 2004			
4	WTO, 2003			
5	CoA, 2002			
6	HM Government, 2001			
7	MfE, 2001			

Several variables deserve comment. First, both high electricity usage and per capita greenhouse gas emission rates in Australia reflect the major role played by coal based energy within the Australian economy, mirroring the export importance also of coal to that country (supplying 28% of world coal exports in 2003 (EIA, 2004)). The Australian electricity supply industry contributes around 37% of the country's total greenhouse gas emissions (Nolles et al., 2002). Second, New Zealand's emission data is notable for the contribution of agriculture, indicative of its role in the New Zealand economy, and shown also by the agricultural component of total exports.

<sup>1</sup> Units are listed in Appendix 1

## 4. The United Kingdom

### 4.1 Overview: UK RE support programs

In a major environmental irony the first UK step to promote RE arose from moves to advantage nuclear power. In 1990, to benefit state-owned nuclear generation, a tax was imposed on nuclear power's principal competitor, coal-based power, together with a purchase quota for the more expensive non-fossil fuel based power. The initiative was framed in terms of non-fossil fuel based power generally, as the first round of the Renewable Non-Fossil Fuel Obligation (NFFO) (Mitchell and Connor, 2004).

The NFFO was a quantity regulation coupled with a tax, the Fossil Fuel Levy (FFL), to pay for purchase of the higher priced non-fossil fuel based power. REE generators tendered for the supply of specified quantities of power against quotas for different types of REE (Meyer, 2003). Over eight years REE capacity targets were raised to a final target of 1500MW for the year 2000 (Connor 2003). NFFO achievements though fell far below that target.

The Blair government in 1997 adopted a policy for RE to supply ten per cent of Britain's electricity by 2010, leading in 2002 to a new program - the Renewables Obligation (RO), essentially reversing the process of the NFFO. Where the NFFO effectively contracted capacity for generation at set prices for different renewables, the RO imposed an REE quota on bulk power purchasers, who in turn negotiated REE prices. Accredited generators were granted Renewables Obligations Certificates (ROCs), for each MWh of generated REE. ROCs were separable to the electricity, so generators might sell the power and associated certificate to different purchasers (Mitchell and Connor, 2004). A penalty/buyout mechanism allowed firms to buy out their RO obligation for £30/MWh, receipts being redirected to companies who had met their obligation. Further incentive came in the exemption of REE from the Climate Change Levy (CCL), a tax on electricity consumption levied on non-domestic sectors (Meyer, 2003).

There were therefore four price factors for potential RE generators to consider – the price of the energy generated, the value of the CCL exemption, the price of the ROCs, and the receipts from buyout payment redistribution. In 2003 terms, the approximate value of each was

- energy 1.5 – 1.8 p/kWh
- CCL exemption 0.086 p/kWh
- ROC value 3.0 p/kWh
- recycled 'buyout' 1.5 p/kWh

The third and fourth components - both significant - were exposed to significant price uncertainty from the market for ROCs, and suppliers' buyout decisions. Further price risk became evident in 2003 when two major electricity suppliers failed owing large buyout payments, while other suppliers were late in paying buyout obligations so that 'recycle' funds were not available (Mitchell and Connor, 2004).

Adoption of the certificate scheme marked a shift towards greater market influence on RE development, assigning determination of the RE technology development path to market forces. Early results of this second approach were little different to those of the first, less than 2.5% of total generation in 2003/4 being REE (the largest component being from landfill gas, technology unlikely to offer long term growth). Capital grants were commenced to technologies viewed as having long term potential, but not viable under the RO regime alone. Some £117 million was directed to offshore wind energy to 2005, that technology being targeted as the largest component of REE in projected 2010/11 generation. Generation was projected to almost reach the government's 10% REE target in 2010, contingent on "...assumptions on the potential barriers to progress..." in the implementation process (NAO, 2005). Those assumptions have not been tested, and several of the barriers rest on operational features of the ROC scheme itself, including wholesale electricity market pricing, and questions over the value of ROCs. Achievement of declared targets would however depend on implementation rates far higher than any to date.

The success of the REE initiatives may also be measured in their efficiency as reflected in delivered RE prices, although the evidence on outcome prices at first sight appears mixed. Tendered prices under the NFFO had indeed declined, suggesting the approach may have provided efficiency forcing through competitive bidding (Connor, 2003). On the other hand, prices being delivered by the market-based RO process in 2003 were similar to prices from the German 'feed-in' model (FIM), embodying effectively risk free prices determined by regulation. It is also most relevant that many of the tendered NFFO projects were never built, partly for price reasons (Mitchell and Connor, 2004).

#### *4.2. Barriers and success factors in RE deployment.*

The fifteen years of structured REE initiatives in the UK to 2005, under two markedly different approaches, delivered results well below declared targets. Various factors have been suggested as contributing to the low deployment achieved.

##### *4.2.1 Perceptions of low investment security*

Private investment depends on the perceived security of returns. Risk factors present in REE development included price risk, sales volume risk, and the potential for the value of output to be influenced by market rules. In the market based RO regime, unlike the NFFO, contracts were commonly of short duration, with prices generally lower as contract length increased. Overarching specific market risk was the uncertainty of government policy – the actual change to the RO system of itself demonstrating a substantial policy shift, with later indications in the 2003 Energy White Paper of a further policy shift to carbon trading (Mitchell and Connor, 2004). The potential for such policy shifts is a clear disincentive to high fixed cost REE investment. Inducement of private investment (in this case in the supply of an environmental service), can only succeed

“...where there is a *demonstrable* financial advantage to all parties.” (Bailey et al, 2004) (*italics added*).

#### 4.2.2 *Energy market interactions and prices*

In addition to cost pressures from the NFFO itself, generators also faced cost pressure from newly deregulated electricity markets. In 2001 the New Electricity Trading Arrangements (NETA), a construct for electricity trading which sought to mimic commodity markets, was introduced. Under NETA, REE generators enjoyed no different status to fossil fuel generators and were duly penalised for any supply variability. Initial results from NETA showed an average revenue reduction to small generators of 34.8% (Mitchell and Connor, 2004). REE providers operating under the RO scheme faced the same difficulty - a problem not only for existing REE generators, but of arguably greater consequence as a disincentive to investment. An objective conflict was evident between the use of market constructs designed to reduce prices, and the REE deployment deterred by that process.

A further incompatibility with competitive market operation was evident with the principal technology being deployed, wind generation. With typically over 85% of the delivered cost of wind power ascribable to investment costs, output costs were virtually determined through *ex ante* equipment efficiency, operators having minimal ability to respond to competitive pressures. Given that, it was not apparent “...why one should set up a complicated green certificate market for installations, which have no flexibility to compete in this market.” (Meyer, 2003)

#### 4.2.3 *Difficulty in securing planning approvals*

Problems with planning approvals for REE generation (particularly windpower) could be argued to be generic to such development, and independent of the promotion system employed. Certain issues arose however which were due in part to the nature of the NFFO and the RO. The pursuit of short timeframes for development, and an emphasis on lowest prices, necessarily encouraged development of the most promising sites. This led to a seeming ‘wind rush’ with many applications in a short time for development in only few sites. This in turn created a negative public response (Mitchell and Connor, 2004) which might arguably have been mitigated had the approach to cost allowed a broader range of locations to be addressed. The haste for development also led to large scale importation of generation equipment, to the major detriment of the local supply industry (Menanteau et al, 2003).

#### 4.2.4 *Technology selection*

While the NFFO provided differentiated treatment for various REE technologies, the RO scheme essentially narrowed opportunity to near-market technologies, being technology indifferent and rewarding lowest cost. This effectively precluded REE options with supply diversity values, and those with development potential, neither value being

incorporated in short term market prices. Measures were taken to address this through a complementary capital grant process, where alternative technologies might receive effective capital subsidies. Early major beneficiaries were offshore wind installations, and bioenergy projects, some £169 million being directed to those two technologies alone. This explicit diversion from market-based development may well represent acknowledgement of the inadequacies of that mechanism in securing coherent RE development (Connor, 2003).

#### *4.2.5. Players*

The significant risks facing individual REE generators in the open RO system market effectively biased participation towards vertically integrated, larger electricity firms able to accept greater financial risk and internalise that risk (Meyer, 2003; Mitchell and Connor, 2004). While arguably delivering cheaper REE in the short term by focusing on the larger projects of likely interest to such firms, the approach discourages smaller firms unable to carry the requisite risk, or raise finance. It is these, however, who may provide broader market development, both through their focus on REE generation only (having no competing conventional generation) and by addressing smaller scale initiatives with attendant geographical and supply diversity, and future development potential. While a range of capital grants is being provided to encourage such sources, these grants do not diminish market risk in later operation.

#### *4.3. Prospects*

The UK RE programs were implemented against challenging objectives which they have yet to meet. While a secondary objective of nominal RE cost reduction appears to have been achieved, this has arguably been at the expense of the primary objective of RE deployment (Mitchell and Connor, 2004). A recent National Audit Office review indicated that the 2010 REE target of 10% of generation may be met, but acknowledged the possibility of a shortfall of at least 25%. Achieving the objective required "...a step change in the level of renewable generation..." and the addressing of the various barriers to development discussed above (NAO, 2005). It is notable that more recently targeted capital grants have been used to address technologies not being sustained by the RO scheme, suggesting that solely market based approaches may not be capable of delivering desired policy outcomes, in the presence of multiple objectives.

## **5. Australia**

### *5.1 Overview: Australian RE support programs*

From 1990 the Australian Government approached RE promotion through a range of education and grant initiatives, many of a modest scale, the largest (Renewable Energy Development Initiative of 2004) having seven year funding of \$A100M (IEA, 2003). Virtually all significant expenditure delivered capital or operating subsidies. A major

program emerged in 1997 when, shortly before the Kyoto COP3 Conference<sup>2</sup> the Howard government released a range of climate change measures. Among them was a commitment to "...set a mandatory target for energy retailers [and other large electricity buyers] to source an additional two percent of their electricity from renewable sources by 2010." In addition to promoting RE uptake, the initiative was argued as providing for the development of industries able to compete internationally (CoA, 1997). Initial aims were clearly broad.

The Mandatory Renewable Energy Target (MRET) came into operation from April 2001. Its core was a requirement for large electricity purchasers to proportionately contribute towards a target of 9500GWh of REE purchase by the year 2010, and for a further ten years. Compliance was demonstrated by the purchase (or generation) and surrender of Renewable Energy Certificates (RECs), each equivalent to 1 MWh generated by accredited REE generators. RECs were created by generators registering the generation of the appropriate amount of energy, which could take place some considerable time after actual generation. The ability of generators to 'bank' eligible generation for later REC creation has connotations for REC market pricing, implying as it does an information asymmetry between suppliers and purchasers.

The MRET target increased over nine years from 2001. Liable parties who did not fulfil their obligations faced a penalty or buyout payment of \$A40/MWh,<sup>3</sup> around half that of the UK scheme (3p/kWh) (Oxera, 2005). Unlike the UK scheme receipts went to government rather than complying firms. The MRET program was projected to become the second largest contributor to Australia's overall stationary source GHG reduction. (AGO, 2003) and is the focus of this discussion as the principal vehicle for volume RE development in Australia.

Definition of the MRET objective was contentious. Through major industry pressure, the 'headline' figure of 2% of national generation became a fixed figure of 9,500GWh, which in reality represented a projected level of 0.2% in 2010, the focal year of the program. It was further predicted that by 2020, the end of the program, the 9,500GWh would not have prevented an actual reduction of 1% in the RE component through demand growth (AGO, 2003). In comparison, the UK objective in 2004 was an increase in RE contribution by 2010 of a little over 7% from 2003 levels, with the announced intention to extend the Renewables Obligation requirement by a further 5% by 2015/6 "...subject to the cost being acceptable to the consumer." (HM Govt, 2004). Implementation demands implied by the UK program were thus significantly greater.

The MRET program had been only briefly in existence when it was subject to a government review, the 'Parer Inquiry' of 2001, which recommended termination of the

---

<sup>2</sup> COP3 - the Third Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC).

<sup>3</sup> The penalty payment is non deductible for tax purposes and hence its effective value depends on the corporate tax rate of the time (McLennan Magasanik, 2003).

MRET among other schemes and replacement with an emissions trading system. The recommendation was not adopted, but caused significant disquiet among RE investors regarding future government policy (AGO, 2003). A second review (the ‘Tambling Review’) was carried out after two years of operation, and made a number of recommendations, of which four were significant addressing aspects considered problematic with the program at that time. They were

1. to extend the MRET scope to reach a target of 20,000 GWh by 2020
2. to extend the scheme past 2020 such that investors might recoup investments made after 2005
3. to allow generators which commenced operation before 2005 to generate RECs until 2020, at which time their baselines would be reset and
4. to index the buyout charge for inflation from 2010 to 2020 (AGO, 2003)

While other administrative recommendations were either agreed or referred to other existing funding initiatives, the four central recommendations were all rejected by government, emphasising that it would not extend or increase the MRET (AGO, 2004).

Discussing the issue in June 2004 an energy White Paper stated a view that “...a better path is to build on the successful outcomes of MRET to more directly promote the development and demonstration of a broader range of low-emission technologies...” (CoA, 2004). Vehicles for this purpose were \$A100 million funding for solar electricity and hot water development, and a Low Emission Technology Development (LETD) Fund of \$A500 million over 15 years.

LETD criteria included a permissible development timeframe up to fifteen years, and a minimum GHG reduction contribution of 9.5MtCO<sub>2e</sub> per annum. Technologies envisaged were those which were “...low emissions technologies that will underpin the value of Australia’s resource base...” (AGO, 2005). Given the nature of RE technologies, and the public good characteristic of the resources concerned, a focus on renewables would appear unlikely under such criteria, leaving renewables development in Australia to rest on the MRET program and its 9,500GWh target.

## *5.2. Scheme Outcomes.*

The outcome of the MRET to 2004 is not adequate to judge its long term effectiveness. Administratively the scheme had functioned as intended - by 2004, slightly over 7.7 million RECs had been created, against the Act’s requirement of 3.2 million. Around \$A900 million appeared to have been invested, with \$A1100 million further investment appearing “...firmly committed.” (Rossiter, 2004). There had been no significant failure to comply with the provisions of the Act. By early 2004 the number of approved RE generators had approximately doubled (Kent and Mercer, 2005). These indications were positive, but underlying them were potentially problematic issues for the MRET in its role of long term RE development.

### *5.2.1. Hydro generation*

Unlike the UK, large existing hydro generators were not excluded from the scheme, despite its aim of inducing new RE investment. For the first three years of the MRT, some 53% of eligible generation came from hydro (Rossiter, 2004), the two principal suppliers of which were both publicly owned (Snowy Hydro, 2005; Hydro Tasmania, 2005). The next highest amount (around 17%) arose from the deemed lifetime contribution of solar water heaters credited at the time of purchase (Rossiter, 2004), suggesting that the contribution to actual generation from hydro in that period was much higher than 53%.

The role of hydro had earlier been the subject of major contention, with suggestions that much if not all of its eligible generation could be achieved from existing facilities, due to two issues around the baselines determined for hydro plant. First, these were claimed to have been set lower than their already achievable output. Second, performance requirements against baselines were asymmetric. All generated energy over the determined baseline capacity was eligible for RECs. When suppliers generated at levels below baseline however, no requirement existed to make up the deficit. Combined, these factors were suggested as making it possible for nearly one quarter of the total MRET demand to be provided by existing hydro plant without any capacity addition, in part on a “business as usual” basis (BCSE, 2003). The major role played by hydro generators also potentially affected REC market operation as discussed below.

#### *5.2.2. Investor confidence*

Several factors posed risk to the investor confidence necessary for mobilisation of private capital. First, the overarching policy framework for RE development appeared in question – initially from the Parer Report’s recommendation for MRET termination (CoA, 2002) and later from the Government’s own espousal of targeted but modest capital subsidy funding for alternative technologies (CoA, 2004). Debate on these alternatives in the early years of a long term program could not positively influence investor confidence in long term industry returns. Second, the REC market process itself made room for uncertainty over the market price for RECs, the basis of investment return. Certain improvements had arisen from the Tambling Review in relation to market transparency in regard to potential REC supply from hydro (AGO, 2003). While this addressed an information issue, the situation remained where REC market prices could be far more influenced by the actions of large hydro generators than by other smaller renewable generators. That situation might further impact on investor confidence through uncertain REC pricing over the timeframe required to amortise capital.

#### *5.2.3. Technology focus*

The technology neutral approach of the MRET essentially mandated technologies with the lowest immediate private cost, thereby excluding the valuation of externalities associated with particular forms of RE. These included equipment industry development, ‘fuel’ supply industry development, long term cost reduction and various environmental values including salinity and weed control associated with energy crops. The Tambling Review in seeking extension of the MRET argued clearly for such issues



to be recognised, noting that wind energy in Australia for example could account for some 41% of Australia's renewable energy (AGO, 2003). Others were even more positive, suggesting that by 2010 Australia might have 5,000 MW of wind generation, some 6 % of the country's total electricity consumption (AusWEA, 2004) Implicit in those expectations was recognition of experience elsewhere that wind generation costs decline substantially with industry scale. Current markets however do not incorporate future pricing effects, to the detriment of such technologies and industry development.

In the first three years of the MRET the number of approved RE generators nearly doubled – but almost half that increase comprised landfill gas and photovoltaic sources, unlikely to provide a long term volume base (Kent and Mercer, 2005). Wind development remained as the most likely candidate for volume RE electricity production in Australia (BCSE, 2003) – but program settings failed to provide a coherent development path for that to occur.

### *5.3. Prospects*

The MRET appears likely to deliver its first objective of 9,500GWh of RE generation by 2010, although it was suggested that 'banking' generation in earlier years might lead to a 1000GWh shortfall in that year (AGO, 2003). Other implicit objectives however were less likely to be achieved. Curtailment of the program to its original scope implies that its contribution to industry development (both in 'fuel' and equipment supply) is likely to be minimal. Investment to meet the target is expected to tail off by 2007 (AGO, 2003). No basis exists therefore for the development of an equipment supply industry. The program has also been constrained in its ability to bring forward technologies other than near-market technologies, that role now seeming to have been allocated to capital subsidy funding programs such as the Low Emissions Technology Development Fund, in a manner similar (albeit on a much smaller scale) to developments in the UK program.

In all, the MRET program appears to have delivered its modest initial energy goal. However notwithstanding its innovativeness as the first mandatory national certificate program (Rossiter & Wass, 2004) it appears unlikely in its present form to be a vehicle for major renewables development in Australia.

## **6. New Zealand**

### *6.1 Overview: NZ RE support programs*

New Zealand's initiatives to address climate change effectively commenced with the Energy Efficiency and Conservation Act of 2000 which led to a National Energy Efficiency and Conservation Strategy in September 2001 (EECA, 2001). This adopted three core policy components to pursue sustainability – energy efficiency, energy conservation, and development of renewable energy systems. It incorporated New Zealand's Kyoto undertaking to reduce 2008 to 2012 average CO<sub>2</sub> emission levels to those of 1990. As shown in Table 1, New Zealand's emissions are unusual for their high

agricultural component, and correspondingly lower energy use component. That profile constrained the actions which could be taken to pursue the Kyoto target and forced greater emphasis on options such as renewable energy development. That option also however had constraints, New Zealand already having a high (29%) proportion of RE generation

The Strategy faced significant demands as emissions had risen substantially through the 1990s and 'business as usual' (BAU) growth was projected to continue at 1.7% annually (EECA, 2001), although early analyses had indicated that New Zealand would achieve its Kyoto undertakings. RE development was seen as playing a major role as one of three main instruments. These were an emissions charge (a carbon tax), negotiated emission reduction agreements with industry as an alternative to emissions charges, and the *Projects to Reduce Emissions* program. The emissions charge was to commence in 2007, but was subsequently rescinded in late 2005 (NZCCO, 2005). Negotiated industry agreements and the *Projects* program were both in operation by 2004 (NZ Government, 2004). It is the *Projects* program, and its RE development component, which is the focus here.

The *Projects* program sought to lower New Zealand's overall emissions by, *inter alia*, encouraging development of RE, principally for power generation. A potential additional contribution of 25 to 55PJ/a to the existing of renewable energy generation was considered feasible, a nominal target of 30PJ/a being adopted (NZ Government, 2004). That objective was of a similar order to that adopted by Australia, whose 9,500GWh/a target equated to some 34PJ/a (EECA, 2001). Comparison to UK objectives could be seen in the target percentage for RE supply. The UK Renewable Obligation consultation paper posed a target of 10% of all electricity generation by 2010 (Connor, 2003) as compared to the NZ Strategy target of an additional 6.5% (of 2001 levels) (EECA, 2001). Given the already high level of renewable generation, the target was challenging.

New Zealand shared with the UK and Australia a common orientation towards wind generation as the principal RE supply, although its relative potential was considered significantly higher than either. Early assessments even suggested the possibility for wind to supply total electricity demand. Technically feasible wind generation was believed to be around 100,000GWh/a, (three times New Zealand's 2001 consumption), due to a combination of the country's long coastline, and location across the path of prevailing north westerly winds (EECA 2001/1). Wind was therefore expected to play a major role in future RE supply.

The New Zealand scheme differed to others in the origin of its certificates. Where the UK and Australia created a form of regulatory property for trade by virtue of mandated national consumption levels, New Zealand built its certificate process on the basis of its Kyoto undertakings. There, tradable quantities were expressed as 'Assigned Amount Units', Assigned Amounts being those assigned against each country according to its commitment in the first Kyoto Commitment Period, 2008 – 2012 (UNFCCC, 2004).

Each certificate thus represented an emission equivalent of one tonne of CO<sub>2</sub>, and a debit against New Zealand's 'Assigned Amounts'.

In the *Projects* program the Government made available to project developers these certificates as an incentive for projects which would reduce New Zealand's emission levels. Certificates may be sold separately to any related electricity or other energy. Program eligibility grounds included economic and environmental additionality – projects could not be financially feasible on a BAU basis, and must contribute a minimum reduction of 10,000 tonnes of CO<sub>2</sub> equivalent emission in the period 2008 - 2012. Certificates were awarded to competing projects through a tender process, the incentive amount to successful bidders being based entirely on the potential sale value of the certificate - at end 2004, around \$NZ15 internationally (NZCCO, 2005).

## 6.2. *Scheme Outcomes.*

The first two program tender rounds were conducted in 2003 and 2004, making available four and six million units respectively, representing potential abatement of ten million tonnes of CO<sub>2</sub> emission in the period 2008 – 2012. Selection criteria for the first round included preference for projects contributing to energy supply security, and with emission reduction before 2008. Second round criteria were relaxed to encourage wider participation, with both preferences removed. Instead, projects were assessed on the basis of a bid "price" (the emission units sought per tonne of emission reduction) and project risk (NZCCO, 2005).

Wind projects accounted for 31% of the first round awards, other major projects being cogeneration (31%), geothermal generation (20%) and landfill gas based generation (9%) (NZ Government, 2004/1). The first successful projects from the second round included landfill gas collection, mini hydro, and wind installations, reflecting again the role on renewables in the program (NZCCO, 2005). It is clearly too early to judge the implementation success of the *Projects* program given the need for development stages to be negotiated, but early outcomes demonstrated success in bringing forward emission reduction projects which might otherwise not have arisen. Several aspects of the approach adopted deserve comment including the type of credit used, the barriers encountered, and the nature of the generation industry.

### 6.2.1. *Use of emission credits*

The decision to base the tradable certificate scheme on Kyoto units was taken at a time when analysis of New Zealand's 'nett position' showed New Zealand to be in credit against its Kyoto commitment. In a 2005 reappraisal however the perceived surplus became a roughly similar deficit (NZ Government, 2005; NZ Government, 2004). The position reversal implied also a reversal of expected trading returns, from receipts of some \$NZ500 million to potential expenditure of the same order, based on \$15/tonne CO<sub>2</sub> prices. The extent to which the decision to utilise Kyoto emission credits as incentives was based on the perception of availability of 'surplus' credits is not clear.

### *6.2.2. Potential barriers to implementation*

Steps were taken to address several of the barriers to project implementation encountered elsewhere. These included

- controversy over environmental amenity in terms of wind, hydro and power transmission generally (Keenan, 2005; Blechynden, 2005) was already widespread. The Clarke Government sought to address that through amendments to New Zealand's core environmental management legislation, to ensure that broader national interests were given due weight alongside more specific local interests (MfE, 2005).
- market compatibility: technical and commercial difficulties associated with renewable energy sources such as wind within quasi-commodity markets for electricity were recognised and work commenced to address potential barriers. In a major first report (*Wind Energy Integration in New Zealand* (Energy Link/MWH, 2005)) potential problems and methods of approach were identified as the basis for continuing study. The general tenor of the report was summarised in a quotation from a US study (Kema-Xenergy, 2004) noting that the impacts of large-scale wind energy generation "...are viewed not as an obstacle to development, but rather as obstacles that must be overcome."

### *6.2.3. Industry ownership and behaviour*

In markets elsewhere there was recognised a potential disadvantage to smaller renewable generators in competing and dealing with established generators in short term electricity markets. That issue would appear of lesser importance in New Zealand, given the continuing major presence of government-owned supply companies in those electricity markets. In 2004 those companies accounted for over 60% of total power generation, owned the national transmission grid, and serviced over 50% of retail customers nationally (Aurora Energy, 2004). In that situation conflict between national energy objectives and market operation would be a lower risk than in those countries with substantially private market participants.

### *6.3. Prospects.*

While still at an early stage, the relatively ambitious RE program commenced in New Zealand has shown success in bringing forward projects of the type required to move to a lower carbon generation base, with wind showing indications of being the principal long term addition to existing RE generation. Initial steps had been taken to address certain of the issues encountered as problems elsewhere, and these, together with the additional incentive to government provided by worsening emission projections, suggested the potential for continuing RE development in New Zealand.

## 7. Differing Systems, Common Elements.

The three RE development schemes discussed here share a common theme in their use of tradable certificate processes, to pursue cost efficiencies in the adoption of low emission energy forms. The UK and Australian schemes differ from the New Zealand scheme in both the supply and demand side of the market. (A summary of scheme characteristics is given as [Appendix 1](#).) On the supply side, in the UK and Australian schemes certificates attest to the generation of one MWh of REE; in the New Zealand case, certificates are denominated directly as one tonne of CO<sub>2</sub> equivalent emission.. Both certificate types may be traded separately to their associated energy product. While often there may be a close equivalence in effective emission value between the certificate types (AGO, 2003/1), there is an attractive clarity and lack of ambiguity in the emission based definition. Emission based systems also integrate more readily with broader international trading schemes.

On the demand side, the UK and Australian schemes are quota schemes of the Renewable Portfolio Standard type, where governments mandate the purchase of certain quantities of renewable-based energy (Berry, 2002). The renewables standard creates a demand side for a market whereby those liable parties unable to generate their own renewable energy may purchase certificates created by others. Markets are therefore domestic in operation, and the certificates regulatory property created by the relevant government. In New Zealand's case, the demand side of the market has been created through the Kyoto Protocol. The credits issued by the New Zealand government are therefore internationally tradable with other countries which have ratified the Kyoto Protocol, offering access to broader and more liquid markets.

Importantly also, the effect on national Assigned Amounts under Kyoto differs materially. Certificate systems in England and Australia in no way affect those countries' Assigned Amounts (a hypothetical issue in Australia's case as Australia is one of the two developed countries not to have ratified the Kyoto Protocol). In New Zealand's case however the benefit granted project developers in the form of tradable credits is in fact a transfer of property rights from the nation to the individual developer. Each certificate issued under the New Zealand scheme represents therefore a reduction in New Zealand's available Assigned Amount under the Kyoto Protocol.

The decision on the type of certificate system to use is complex and undoubtedly influenced by a country's perception of their difficulty in meeting their Kyoto 'limits'. In New Zealand's case, the decision to use Kyoto-based certificates was made at a time when there was projected to be a surplus in entitlements. In Australia's case, the question was, as noted, hypothetical. In the UK, while data suggested the probability of the UK achieving its Kyoto undertakings, the government had also committed to internal goals more stringent than its Kyoto undertakings – and there was doubt over their achievement (HM Government, 2004).

All three schemes depend for their success on inducing the provision and consumption of an environmental service, the provision of renewable energy based electricity (REE). Of the three schemes, the more comprehensive UK scheme best serves to illustrate the factors impacting on that success. While several of those factors addressed the demand side of the market, most were of principal concern to potential suppliers.

Issues impacting on the demand side included

- the level of the buyout price, directly affecting purchase decisions and amplified in its effect through the recycling of buyout revenue, effectively meaning an REC might have a value in excess of the buyout price
- a further incentive component through RE exemption from the Climate Change Levy, an example of positive program synergy and
- a clear espousal of long term aims for the program, allowing both consumers and producers to develop their actions in a framework of some perceived consistency.

Such factors on the demand side were broadly positive, in contrast to a number of supply side issues less conducive to supply development. They included

- cost pressures on potential suppliers, first in the NFFO tender process, and later in the RO open market approach. While apparent cost reductions were achieved, this appeared to be at the expense of RE deployment, and, in association with excessively short development timeframes, to have contributed to adverse public reaction to concentrated development in few high-return sites.
- the lack of differentiation of treatment for alternative technologies tended, when coupled with cost pressures, to handicap those technologies of potential supply diversity and employment opportunity as it failed to internalise expected long run improvements in supply cost structure
- perceived risk to long term investment returns from a number of sources – certificate market operation, electricity market operation, and concerns over policy consistency as demonstrated by moves to other instruments such as capital subsidy funding
- a tendency for that risk to favour the participation of larger firms better able to finance development and internalise risk, thereby limiting the role of smaller and more diverse supply sources and
- the parallel operation of other policy instruments which, while of benefit on the demand side, tended to add to perceived risk to supply-side investors in terms of policy stability.

It is notable that most of these issues are not a product of the use of certificates *per se*, but of the regulatory framework within which the certificate scheme was established and operated.

Notwithstanding the seeming supply side difficulties, there was a degree of confidence in the achievement of UK REE supply objectives – albeit with the aid of additional policy instruments such as capital subsidies (Connor, 2003). Early results fell far short of target, implying a major increase in implementation rates if targets were to be achieved.

By comparison, the Australian scheme (MRET) appears likely to relatively readily meet its objective, while sharing most of the potential supply side handicaps noted above. The Australian mechanism also offers a lesser demand side incentive, with a penalty/buyout approach both lower in its direct amount, and not subject to the buyout revenue recycling of the UK system. This apparent anomaly can be largely ascribed to two complementary factors – the much lower target adopted, coupled with the ready availability and inclusion of pre-existing generation sources able to supply a substantial portion of that target. This well illustrates the extent to which the outcomes of certificate schemes may as much be affected by their surrounding regulations (their ‘policy settings’) as by the underlying nature of the certificate scheme itself. (O’Doherty et al (2003) note the same issue impacting on another attempt to establish the supply of an environmental service – the UK packaging recycling system.) It would be reasonable to expect that, were the Australian scheme objective of a larger scale, then the issues shown problematic in the UK system would have emerged there also.

New Zealand’s certificate/credit scheme by its different nature obviates a number of the issues noted above. Buyout of obligations does not arise, the implicit expectation being that generation offered to the grid will be bought, with market rules prescribing the value at which supply bids will be made (EnergyLink/MWH, 2005). That in turn may be argued as confining potential suppliers’ risk to the market for certificates, and to the risk of government policy shifts. In terms of the former, participation in larger and more liquid markets for emission certificates is likely to be of lesser risk than participation in smaller, local markets able to be affected by local circumstances and actions. The risk of the latter may be limited by execution of agreements with government by individual suppliers, as an outcome of supply tender processes. Overall risk to potential suppliers should therefore be lower than either of the other two systems. On the other hand, the issue of non-differentiation of technologies is shared with other schemes, the likely outcome being the development of near-market technologies only. The New Zealand scheme is a further example of the extent to which the overall nature of an initiative may be shaped more by regulatory definitions – in this case the nature of the certificate – than by the underlying nature of the policy instrument itself. The devil is indeed in the detail.

## **8. Concluding comment.**

The three national RE approaches discussed here differ markedly. In the UK, challenging targets have been adopted, alternative instruments tested, and mixed success achieved against those targets. Significant issues are seen to be present which are potential impediments to the development of REE supply. Those issues appear relevant in the Australian context also, in the MRET program, the only Australian RE program of significance. They have not prevented a likely achievement of national targets, which may be attributed to a combination of a modest target, and admission of existing RE generators to the supply side. While the underlying schemes are very similar, the regulatory settings associated with each have produced quite different outcomes. In New Zealand’s case, the *Projects* program was one of only two national initiatives in GHG reduction, no doubt reflecting early perceptions that New Zealand was in credit in its

Kyoto obligations. The New Zealand scheme is wholly voluntary, has no defined binding target, and relies on Kyoto allocated emission amounts and Kyoto emission trading provisions to provide a national mechanism for emission reduction. While certificate based, the scheme differs materially to both the UK and Australian systems, and has yet to be tested against commercial implementation.

The three schemes illustrate the extent to which definitional and regulatory differences between schemes similar in their basic mechanism may materially influence the manner in which schemes operate, and their expected outcomes. That in turn suggests that development of effective policy instruments depends not only on the selection of basic policy instruments, but at least as strongly on the regulations or policy settings governing the application of the instruments. Policy analysis and prescription therefore needs to be addressed at least as much at the design of implementation frameworks, as at the core principles adopted.

The IEA (2004) notes a further nine countries which adopted tradable certificate systems for RE development over the period 2000 – 2003. This suggests further assessment of those countries' schemes would be of value to gauge the extent to which the various operational settings and regulations governing the schemes have impacted on their success in RE deployment. Further, an examination of those countries which have applied pricing systems would allow the impact of regulatory settings on those schemes to be gauged. It may well be that effective program development depends at least as much on the regulatory parameters defined around the central certificate instrument, as on the choice of instrument itself.



## Appendix 1: Features of National Certificate Schemes.

Feature	UK	Aust	New Zealand
Objective ( <u>addition</u> by 2010)_ (RE as % of total generation)	10% of 2010 <sup>1</sup> level	2% of 1997 level <sup>4</sup>	6.5% of 2001 level <sup>5,6</sup>
Certificate basis	1 MWh RE based generation <sup>1</sup>	1 MWh RE based generation	1 tonne CO <sub>2</sub> e emission
Origin of certificate ‘right’	National law	National law	Kyoto agreement
Market for trades	National	National	International
Source of subsidy funds	Users through distributors <sup>2</sup>	Users through distributors	National asset transfer <sup>6</sup>
Compliance penalty/buyout price as % average 2000 electricity price	75% <sup>2,3</sup>	50% <sup>3,4</sup> <u>not tax deductible</u> <sup>7</sup>	Not applicable
Compliance penalty/buyout price inflation indexed	Yes <sup>1</sup>	No <sup>4</sup>	Not applicable
Recycling of buyout to conforming suppliers	Yes <sup>2</sup>	No	Not applicable
Existing generators included in scheme	No	Yes (with set baselines)	No
Selection of RE source	Open/approved RE	Open/approved RE	Tender process
Major existing hydro included in scheme	No	Yes	No

## Appendix 2: Units and abbreviations

Abbreviation	Unit
kWh	Kilowatt hours
tCO <sub>2</sub>	Tonnes of carbon dioxide
GDP	Gross Domestic Product
PPP	Purchasing power parity
toe	Tonnes of oil equivalent
tCO <sub>2</sub> e	Tonnes of carbon dioxide equivalent
MWh	Megawatt hours
PJ/a	Petajoules per annum
p/kWh	Pence per kilowatt hour
GWh/a	Gigawatt hours per annum

## References

- AGO (Australian Greenhouse Office), 2003. Renewable Opportunities: A review of the Operation of the *Renewable Energy (Electricity) Act 2000* (the Tambling Review) <<http://www.mretreview.gov.au/report/index.html> > Accessed 31 May 2005
- AGO (Australian Greenhouse Office), 2003/1. Electricity Marginal Emission Factors and Prices: Default Values, <<http://www.greenhouse.gov.au/ggap/round3?emission-factors.html> > Accessed 13 July 2005.
- AGO (Australian Greenhouse Office), 2004. Government Response to Tambling Mandatory Renewable Energy Target (MRET) Review Recommendations, <<http://www.greenhouse.gov.au/markets/mret/pubs/mret-response.pdf>> Accessed 31 May 2005
- AGO, 2005. Low Emissions Technology Development Fund, < <http://www.greenhouse.gov.au/demonstrationfund/statement.html> > Accessed 17 May 2005
- Aurora Energy, 2005. Electricity Organisations, <<http://www.electricity.co.nz/NZlinks.htm> > Accessed 18 May 2005.
- AusWEA (Australian Wind Energy Association), 2004. Wind Farming & the Australian Electricity System, <http://www.auswea.com.au/WIDP/assets/2ElectricitySystem.pdf> Accessed 21 May 2005
- Bailey, I., Haug, B., & O'Doherty, R., 2004. Tradable permits without legislative targets: a review of the potential for a permit scheme for sterilised clinical waste in the UK, *Waste Management & Research*, 22 202-211.
- BCSE (Business Council for Sustainable Energy), 2003. Submission to the MRET Review, <[http://www.mretreview.gov.au/pubs/mret\\_submission165.pdf](http://www.mretreview.gov.au/pubs/mret_submission165.pdf)> Accessed 20 May 2005
- Berry, D., 2002. The market for tradable renewable energy credits. *Ecological Economics* 42, 369-379.
- Bertoldi, P., & Huld T., 2006. Tradable certificates for renewable electricity and energy savings, *Energy Policy*, 34, 212 – 222.
- Blechynden, K., 2005. NZ's biggest wind farm for Makara, *Dominion Post*, 2 June 2005 <<http://www.stuff.co.nz/stuff/0,2106,3299916a7693,00.html> > Accessed 26 June 2005.
- CIA, 2005. World Factbook <<http://www.cia.gov/cia/publications/factbook/> > Accessed 20 July 2005
- Clarke, R. 2002. Trading in Pollution. *OECD Observer*, 233: 38.
- CoA (Commonwealth of Australia), 2002. Towards a Truly National and Efficient Energy Market (the Parer Report), <<http://www.efa.com.au/Library/ParerFinRpt.pdf>> Accessed 17 May 2005
- CoA (Commonwealth of Australia), 2004. Securing Australia's Energy Future, <[http://www.dpmc.gov.au/publications/energy\\_future/docs/energy.pdf](http://www.dpmc.gov.au/publications/energy_future/docs/energy.pdf) > Accessed 3 June 2005

- CoA (Commonwealth of Australia), 2005. \$500m Low Emissions Technology Fund Takes Shape, <<http://www.deh.gov.au/minister/env/2005/mr03jun05.html>> Accessed 17 June 2005
- Commonwealth of Australia, 2002. Australia's Third National Communication on Climate Change <[http://unfccc.int/national\\_reports/annex\\_i\\_natcom/submitted\\_natcom/items/1395.php](http://unfccc.int/national_reports/annex_i_natcom/submitted_natcom/items/1395.php)> Accessed 20 May 2005
- Commonwealth of Australia, 1997. Safeguarding the Future: Australia's Response to Climate Change, <[http://www.pm.gov.au/news/media\\_releases/1997/GREEN.html](http://www.pm.gov.au/news/media_releases/1997/GREEN.html)> Accessed 7 June 2005.
- Connor, P. M., 2003. UK renewable energy policy: a review. Renewable & Sustainable Energy Reviews 7: 65-82.
- DTI (Department of Trade and Industry), 1999. New and Renewable Energy: Prospects for the 21<sup>st</sup> Century March: Consultation Document <[http://www.dti.gov.uk/renewables/renew\\_2.2.3.htm](http://www.dti.gov.uk/renewables/renew_2.2.3.htm)> Accessed 23 May 2005
- Economist, 2005. Country Briefings <<http://www.economist.com/countries/>> Accessed 12 May 2005
- EECA (Energy Efficiency and Conservation Authority), 2001. National Energy Efficiency and Conservation Strategy <<http://www.eeca.govt.nz/strategy/strategy.asp>> Accessed 20 June 2005
- EECA (Energy Efficiency and Conservation Authority), 2001/1. Review of New Zealand Wind Energy Potential to 2015, <<http://www.eeca.govt.nz/publications/PublicationDetails.aspx?s=p&id=44>> Accessed 20 May 2005
- EIA, 2004. Country Analysis Brief - Australia <<http://www.eia.doe.gov/emeu/cabs/australi.html>> Accessed 19 May 2005
- EIA, 2005. Country Analysis Brief - United Kingdom <<http://www.eia.doe.gov/emeu/cabs/uk.html>> Accessed 12 May 2005
- Energy Link/MWH, 2005. Wind Energy Integration in New Zealand: Final Report, <<http://www.med.govt.nz/ers/electric/wind-energy/final/index.html>> Accessed 18 May 2005
- HM Government, 2001. The UK's Third National Communication under the United Nations Framework Convention on Climate Change <[http://unfccc.int/national\\_reports/annex\\_i\\_natcom/submitted\\_natcom/items/1395.php](http://unfccc.int/national_reports/annex_i_natcom/submitted_natcom/items/1395.php)> Accessed 20 May 2005
- HM Government, 2004. Review of the UK Climate Change Programme: Consultation Paper, <<http://www.defra.gov.uk/corporate/consult/ukccp-review/ccpreview-consult.pdf>> Accessed 20 May 2005
- Hydro Tasmania, 2005. Annual Report 2003/4, <<http://203.2.158.16/annualreports/2004/pages/internals.pdf>> Accessed 20 May 2005
- IEA, 2002. Indicators <<http://www.iea.org/Textbase/stats/index.asp>> Accessed 12 May 2005
- IEA, 2003, Dealing with Climate Change: Policies and Measures Database <<http://www.iea.org/textbase/pamsdb/search.aspx?mode=cc>> Accessed 6 January 2006.

- IEA, 2004. Renewable Energy: Market and Policy Trends in IEA Countries  
 [<http://www.iea.org/Textbase/publications/free\\_new\\_key\\_result\\_pubs.asp?keys2=4116&Submit2=Submit >](http://www.iea.org/Textbase/publications/free_new_key_result_pubs.asp?keys2=4116&Submit2=Submit) Accessed 2 February 2006.
- IEA, 2004/1. Notable Energy Developments in New Zealand: Report of Standing Group  
 [<http://www.iea.org/textbase/papers/roundtable\\_sltslt\\_nz.pdf >](http://www.iea.org/textbase/papers/roundtable_sltslt_nz.pdf)  
 Accessed 12 June 2005
- Keenan, E., 2005. National Gridlock: New Zealanders urgently need new power sources, but everything on offer seems to be a turn-off, Time International, 21 March 2005
- Kema-Xenergy, 2004. Intermittent wind generation: summary report of impacts on grid system operations: consultant report prepared for California Energy Commission, June 2004, in Energy Link/MWH, 2005, Wind Energy Integration in New Zealand: Final Report,  [<http://www.med.govt.nz/ers/electric/wind-energy/final/index.html >](http://www.med.govt.nz/ers/electric/wind-energy/final/index.html)Accessed 18 May 2005
- Kent, A., Mercer D., 2005. Australia's mandatory energy target (MRET): an assessment Energy Policy, in press at 20 July 2005.
- McLennan Magasanik Associates, 2002. Modelling the Price of Renewable Energy Certificates Under the Mandatory Renewable Energy Target: Report to Office of the Renewable Energy Regulator  [<http://www.orer.gov.au/about/modelling-mret.html >](http://www.orer.gov.au/about/modelling-mret.html) Accessed 20 May 2005
- Menanteau, P., Finon, D., & Lamy M-L., 2003, Prices versus quantities: choosing policies for promoting the development of renewable energy, Energy Policy 32 799 – 812.
- Meyer, N. I. 2003. European schemes for promoting renewables in liberalised markets. Energy Policy 31, 665-676.
- MfE (Ministry for Environment), 2001. New Zealand's Third National Communication on Climate Change  [<http://unfccc.int/national\\_reports/annex\\_i\\_natcom/submitted\\_natcom/items/1395.php >](http://unfccc.int/national_reports/annex_i_natcom/submitted_natcom/items/1395.php) Accessed 20 May 2005
- MfE (Ministry for Environment), 2005. About the Resource Management Act 1991,  [<http://www.mfe.govt.nz/laws/rma/ >](http://www.mfe.govt.nz/laws/rma/) Accessed 29 June 2005
- Mitchell, C., Connor, P.M., 2004. Renewable energy policy in the UK 1990 - 2003. Energy Policy 32: 1935 - 1947.
- Morthorst, P.E., 2000. The development of a green certificate market. Energy Policy 28 1085-1094.
- Morthorst, P.E., 2003. A green certificate market combined with a liberalised power market, Energy Policy 31 1393-1402.
- NAO (National Audit Office), 2005. Department of Trade and Industry: Renewable Energy  [<http://www.nao.org.uk/publications/nao\\_reports/04-05/0405210\\_uk\\_renewables.pdf >](http://www.nao.org.uk/publications/nao_reports/04-05/0405210_uk_renewables.pdf) Accessed 16 May 2005

- Nolles, K., I. MacGill, et al. (2002). Managing Electricity Related Greenhouse Emissions in New South Wales via Retail Licence Conditions - Projected impacts and the importance of accurate accounting. Sydney, Centre for Energy and Environmental Markets, University of New South Wales March 2002 <[http://www.ceem.unsw.edu.au/ceem\\_docs/nsw\\_retail\\_license\\_conditions.pdf](http://www.ceem.unsw.edu.au/ceem_docs/nsw_retail_license_conditions.pdf)> Acc 29 Jun 2005
- NZ Government, 2004. Annual Report on Climate Change Policy Implementation 2003/4 <<http://www.climatechange.govt.nz/resources/reports/annual-report-policy-implementation/index.html>> Accessed 10 May 2005
- NZ Government, 2004/1. Climate Change: The Outcome of the First Projects Tender Round, <<http://www.climatechange.govt.nz/resources/cabinet/index.html>> Accessed 20 June 2005
- NZ Government, 2005. Annual Report on Climate Change Policy Implementation 2004/5 <<http://www.climatechange.govt.nz/resources/reports/annual-report-05/index.html>> Accessed 10 May 2005
- NZCCO (NZ Climate Change Office), 2005. What are Projects? <<http://www.climatechange.govt.nz/policy-initiatives/projects/questions-answers.html>> Accessed 20 May 2005
- NZCCO (NZ Climate Change Office), 2004. Twenty-four climate-friendly projects awarded carbon credits, <http://www.climatechange.govt.nz/resources/media-releases/8dec04.html> Accessed 27 June 2005.
- O'Doherty, R., Bailey, I. & Collins, A., Regulatory failure via market evolution: the case of UK packaging recycling. Environment and Planning C: Government and Policy 21, 579 – 595.
- Oxera Consulting, 2005. Renewables support policies in selected countries: Report prepared for the National Audit Office, [http://www.nao.org.uk/publications/nao\\_reports/0405/0405210\\_int\\_comparisons.pdf](http://www.nao.org.uk/publications/nao_reports/0405/0405210_int_comparisons.pdf) Accessed 20 May 2005
- Pearce, D.W. & Turner R.K., 1990. Economics of Natural Resources and the Environment, Harvester Wheatsheaf, Hemel Hempstead.
- PIU (Performance and Innovation Unit), 2002. The Energy Review <<http://www.number-10.gov.uk/su/energy/9.html>> Accessed 29 Jun 2005
- Ringel, M. 2006. Fostering the use of renewable energies in the European Union: the race between feed-in tariffs and green certificates. Renewable Energy In press at 1<sup>st</sup> July 2005 1-17.
- Rossiter, D., Wass, K., 2004. Australia's Renewable Energy Certificate System. Paper to International Conference for Renewable Energies, Bonn 2004. <<http://www.orer.gov.au/about/pubs/bonn.pdf>> Accessed 20 May 2005
- Snowy Hydro, 2005. Company Background <<http://www.snowyhydro.com.au/levelTwo.asp?pageID=14&parentID=3>> Accessed 20 May 2005
- Tietenberg, T.H., 1980. Transferable Discharge Permits and the Control of Stationary Source Air Pollution, Land Economics v.5 391 – 416. Reprinted in Dorfman, R., & Dorfman N.S., Economics of the Environment, Norton, New York, 1993.

- Trittin, J., 2004. Wind energy - a pillar of global energy policy. Speech to World Wind Energy Conference, November 2004, Beijing. <[http://www.bmu.bund.de/english/renewable\\_energy/doc/6628.php](http://www.bmu.bund.de/english/renewable_energy/doc/6628.php)> Accessed 1st July 2005
- UK Electricity Association, 2000. World Electricity Prices, in Solarbuzz <<http://www.solarbuzz.com/Solarpricesworld.htm>> Accessed 7 July 2005
- UNFCCC, 2004. Emissions Trading: Background, < [http://unfccc.int/kyoto\\_mechanisms/emissions\\_trading/items/3016.php](http://unfccc.int/kyoto_mechanisms/emissions_trading/items/3016.php) > Accessed 20 May 2005
- UNFCCC, 2005. Kyoto Protocol – Status of Ratification <[http://unfccc.int/files/essential\\_background/kyoto\\_protocol/application/pdf/kpstats.pdf](http://unfccc.int/files/essential_background/kyoto_protocol/application/pdf/kpstats.pdf)> Accessed 20 July 2005
- WTO, 2005. Trade Profiles <<http://stat.wto.org/CountryProfile/WSDBCountryPFHome.aspx?Language=E> > Accessed 20 May 2005