Centre for Energy and Environmental Markets

# A Review of Market-based Schemes to Drive Energy Efficiency

Rob Passey
Iain MacGill
Muriel Watt

**January 2008**

UNSW
THE UNIVERSITY OF NEW SOUTH WALES
SYDNEY • AUSTRALIA

## About CEEM and this report

The UNSW Centre for Energy and Environmental Markets (CEEM) undertakes interdisciplinary research in the design, analysis and performance monitoring of energy and environmental markets and their associated policy frameworks. CEEM brings together UNSW researchers from the Australian School of Business, the Faculty of Engineering, the Institute of Environmental Studies, and the Faculty of Arts and Social Sciences, working alongside a growing number of international partners. Its research areas include the design of spot, ancillary and forward electricity markets, market-based environmental regulation, the integration of stochastic renewable energy technologies into the electricity network, and the broader policy context in which all these markets operate.

This report presents a review of energy efficiency certificate trading schemes, non-tradeable energy sales target schemes and tradeable energy sales target schemes, as well as more general guidance on energy efficiency policy development. This review uses a framework to assess the various design elements of these schemes, especially with respect to their impact on effectiveness, efficiency and equity. These design elements are illustrated with reference to Australian and international schemes that target energy efficiency, and likely interactions with possible emissions trading schemes in Australia are discussed. Potential impacts of selected scheme designs in NSW are estimated.

The corresponding authors for this report are:

Dr Robert Passey
r.passey@unsw.edu.au

Dr Iain MacGill
i.macgill@unsw.edu.au

This research was funded by the NSW Department of Environment and Climate Change (DECC) in the interests of contributing to the debate on climate change and energy efficiency policy. However, the views expressed in this report are those of CEEM, not of DECC.

*www.ceem.unsw.edu.au*

# Executive Summary

Energy efficiency is widely agreed to offer some of the best opportunities to reduce the costs of essential energy services, reduce our use of limited and polluting fossil fuel resources for the longer term as well as demand on stressed energy infrastructure in the shorter term, and achieve the lowest cost greenhouse emissions reductions possible.

Policy measures to promote energy efficiency can be broadly categorised into: support mechanisms such as the provision of information; control or regulatory mechanisms including minimum performance standards and license conditions; and market-based mechanisms that change the energy 'price' seen by decision makers for different energy options.

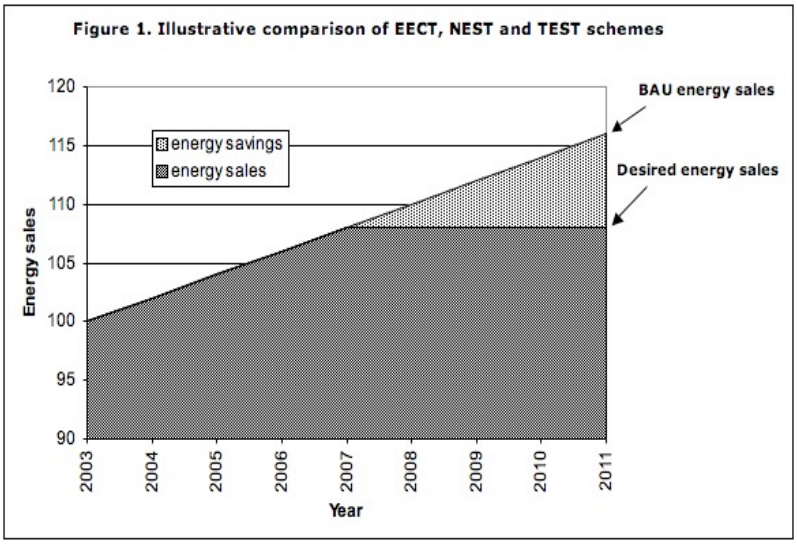
While voluntary support mechanisms can provide useful learning experiences for early mover individuals and firms, they are no substitute for mandatory control or market mechanisms in moving all decision makers towards more efficient energy choices. 'Command and control' regulatory programs have delivered some of the greatest successes in energy efficiency policy, and so it seems likely that the focus of energy efficiency policy should be on such approaches. Nevertheless, there is an important role for policies that encourage participants to choose energy efficiency options beyond minimum standards, and this is where market-based mechanisms can contribute to coherent and effective policy development.

Scheme design is critical to developing appropriate market-based mechanisms. This report focuses on three possible market-based approaches to drive improved energy efficiency, based on legislating energy efficiency or energy sales obligations on electricity retailers within competitive retail electricity markets. These approaches are:

1. **Energy Efficiency Certificate Trading (EECT)**: baseline and credit schemes, such as White Certificates, where tradeable certificates are created at the project level and correspond to an hypothecated reduction in energy use; and
2. **Non-tradable Energy Sales Target (NEST)** schemes: where there is a sales cap but no tradeable certificates or permits are used, and liable parties just have to reduce their actual energy sales; and
3. **Tradeable Energy Sales Target (TEST)**: cap and trade schemes, where either tradeable permits correspond to energy sales or where liable parties trade their targets.

Figure 1 illustrates the differences between these approaches at the scheme level (note that instead of energy sales, other relative targets could be used, such as energy sales/GDP etc). In an **EECT**, to reduce energy sales from the BAU projection to the desired level, the light shaded area corresponds to the energy savings certificates that would need to be created. In a **NEST**, total energy sales would have to track along the desired

**Figure 1. Illustrative comparison of EECT, NEST and TEST schemes**



energy sales level. In a **TEST**, energy sales permits corresponding to the darker shaded area would be distributed to retailers (unless targets can be traded in which case no permits would be used). Thus, in theory, if all three schemes operate effectively, they should have the same outcome in terms of energy use.

We use an assessment framework to formalise the comparison of different scheme designs. This includes evaluating different schemes against the criteria of effectiveness (has energy use been reduced as much as is claimed), efficiency (has this occurred at least cost, including transaction costs) and equity (were costs and benefits distributed appropriately with regards to parties working towards greater energy efficiency yet also with respect to vulnerable energy consumers).

## Energy Efficiency Certificate Trading schemes

EECT schemes generally combine certificates (typically representing one MWh of hypothetical energy savings) with market-based trading between parties having 'energy efficiency obligations' and other parties creating such 'energy savings' at the project level. EECT schemes are now being implemented in a number of countries around the world, and they are compatible with restructured competitive retail markets and focus cash flow on particular types of energy efficiency actions.

*Baselines*

EECT schemes are by necessity baseline and credit (B&C) schemes where energy 'savings' are created by specified projects. It is extremely challenging to determine whether the activities that result in the creation of a certificate reduced energy use as much as is claimed. This is because;

- the absence of energy use is not measurable and so must be estimated with respect to a projected baseline of what would have happened in the scheme's absence,
- the scheme may not account for increased energy use in unregistered projects,
- new projects established in response to increased demand for their product can create certificates while increasing energy demand,
- of the racheting effect, where projects create certificates when they go below their baselines but do not 'pay back' certificates when they go above them,
- of the rebound effect, where cost-effective reductions in energy use frees up money to be spent on other activities that then increase energy use, and in situations where energy efficiency measures increase the level of energy service rather than reduce energy use.

Many of the problems relating to a lack of physical additionality, as well as ratcheting and rebound can be overcome if savings targets are linked to consequent energy consumption ie. if the previous year's certificates resulted in energy use being decreased by less than expected, then the required number of certificates for the following year could be increased proportionately. An alternative to this is to attempt to estimate the impacts of any lack of additionality and apply derating factors to particular types of projects – however these are difficult to calculate, subject to constant revision and near impossible to assess.

*Targets*

Targets can be set for both the scheme overall as well as for liable parties. The scheme target can be a *measurable energy use* target with respect to an historical value (eg. energy use in the year before the scheme commenced), or an *estimated reduction in energy use* target with

respect to a projected BAU level of energy use, or as a percentage of a particular years' energy use or greenhouse (GH) emissions. The target's units can be set in terms of an absolute target (eg. GJ/year) or be as an intensity target (eg. GJ/per unit GDP/year). The tradeable certificates' units are generally set simply as an absolute reduction in energy use (eg. MWh).

Liable party's targets are determined by the number of certificates that must be created for the scheme target to be met. They are generally set as a proportion of the scheme's overall certificate requirement, for example in proportion to electricity sales (although as discussed below, large energy users could also be made liable parties).

Although fixed scheme targets are generally preferred to percentage targets (in order to increase certainty), they may not achieve the original stated objective. Sufficient flexibility with a variable target could be achieved through the use of a shortfall provision. Percentage targets also act as an automatic compensator – if electricity use grows faster than expected, the number of certificates required by the scheme increases.

*Timeframe*

In order to create the industry certainty required for long-term investment, the scheme should have a long timeframe. Longer-term targets must, however, be set with regard to the climate science and what it indicates about the required global rate and scale of emission reductions. One approach is to set target 'gateways' to provide longer-term guidance. Targets could be set each year or less frequently, where the latter provide liable parties more flexibility in terms of timing, and may encourage longer-term projects. However, they may also result in liable parties losing focus and leaving action until the last minute.

*Scope*

A scheme's scope can include one or more particular end-use sectors (eg. residential, commercial or industrial), and particular types of fuels. In theory, the broader the scope, the more efficient the scheme because a wider range of activities can be included, providing more opportunities for energy savings. However, increasing the range of eligible activities in a project-based scheme also increases administrative complexity and costs.

Consideration should also be given to each sector's contribution to energy use, and the opportunities and cost-effectiveness of reductions. Limiting a scheme to only one sector increases the opportunities for rebound effects in non-covered sectors, and is less likely to take account of the embodied energy of hardware. It may be necessary to have different targets in different sectors to reduce the degree to which all the lowest cost options in one sector are used to meet other sectors' targets, leaving only the higher cost options.

An EECT could target electricity, both electricity and gas or all relevant fuels. Each fuel type would need a different target, which would depend on the ease and cost of meeting targets, as well as that fuel's contribution to greenhouse emissions. Subsectoral targets for each fuel could be required.

*Activities*

In all EECT schemes, certificates are created at the project level and so some sort of accreditation process is required. This generally involves defining eligible activities and appropriate methodologies, with novel activities assessed on a case by case basis. The activities can be defined at a technology level (eg. use of a particular type of hardware) or at the system level (eg. for a particular process). Having many activities eligible to create

certificates results in a large number of complex rules, and additional risks of non-additionality. Where a particular type of project is well defined and frequently implemented (eg. CFLs), the energy savings may be deemed. This simplifies administrative tasks for all concerned but also requires longer term projections both of what the project will deliver and what would have happened if the project hadn't gone ahead.

*Motivation*

Financial motivation must be applied to liable parties in the form of a penalty set at an appropriate level to ensure compliance, and should include some form of shortfall leeway. Non-compliance should be publicly reported. Liable parties could either be prohibited from passing on the penalty costs, or may be allowed to do so since this would make them less competitive. Additional incentives can be provided through rewards for exceeding targets.

*Financing compliance*

Implementation of energy efficiency measures will incur upfront costs for liable parties. International schemes are financed through a levy per unit of electricity, which in most cases is determined by government as a broad based charge but in some cases is determined by the liable party, and sometimes as a charge based on EE projects submitted to government in action plans. Allowing liable parties such as retailers to set their own levy would in theory be fair as long as it was set as a per kWh basis and so small energy users would not be unfairly affected. This assumes a competitive retail electricity market, where customers are free to move to another retailer if the levy is too high. Retailers may need to include a component to compensate network operators for lost revenue.

*Low income households*

Although energy efficiency activities should reduce energy costs in the medium to longer term, there could be some short-term increase in costs. Existing government programs used to provide assistance with energy bills to low income households could be used to ensure that an EECT does not increase energy costs for this group. A number of international schemes also require that a certain amount of the EE activities must occur in low-income households, and sometimes that no scheme costs can be passed onto these customers. Of course this approach doesn't help all low income consumers, only those that receive the deals offered by retailers, and so the standard safety nets should remain.

*Non-tradeable EEC scheme*

It is possible to have an EEC scheme where the certificates are not tradeable, but in all other aspects is the same as an EECT scheme. Certificates in this context are used to measure performance of liable parties against their targets, rather than representing a tradeable 'energy efficiency' commodity. This can have the effect of creating a stronger link between the liable party and its customers, but may also reduce the scheme's efficiency due to lack of trading opportunities to capture low cost energy efficiency options. However, the UK EEC decided against full trading because they found that no stakeholder was able to identify a specific type or mechanism for energy savings that would be more likely to be developed under an EECT arrangement than under direct contracting with suppliers.

*Interactions with Emissions Trading Schemes*

The interactions between EECT and an emissions trading scheme need careful consideration. To the extent that EECT drives cost-effective energy efficiency (and hence abatement) within the covered sectors, EECT will reduce the costs of achieving ETS targets. Energy price rises

due to the ETS would increase the range of cost-effective energy efficiency actions and this may need to be reflected in the rules testing additionality of such actions. If the energy efficiency certificates are converted into greenhouse gas savings through some 'imputed' emissions reduction factor, more direct interactions are possible.

If the ETS supports offset projects in non-covered sectors there may be opportunities for energy efficiency certificates to be used to meet ETS targets. This opportunity would not appear to exist in current Australian ETS proposals because they cover all energy-related emissions through a mix of downstream (large emitter) and upstream (fuel supply) arrangements. It is possible to design arrangements that allow trading between an EECT and ETS even for energy efficiency actions within covered sectors. To avoid double counting, the creation of an avoided $tCO_2$ from energy efficiency in a covered sector would then require that the cap of the ETS be adjusted down by a $tCO_2$ as well. Accredited EECT abatement that was actually non-additional would therefore increase the burden of emissions reductions on other market participants – an important discipline for policy makers in determining the EECT rules. It would, however, add considerably to scheme complexity.

*Discussion*

Note that an inherent characteristic of tradeable certificate schemes (ie. both an EECT and the TEST discussed below), is that, as the number of certificates created approaches the scheme's total requirement, the certificate price will most likely become more volatile and drop quite dramatically. This is because, as soon as one more certificate is produced than is needed to meet the scheme's target, that certificate has zero value. One way of overcoming this is to create effectively ongoing demand by having a target that continues to increase towards a longer-term end-date. Sunset clauses limiting the time over which projects can create certificates and limiting the time that certificates can be banked for future use can also help.

Another inherent characteristic of tradeable certificate schemes is that the cost of certificates to liable parties is set at the marginal cost of action despite the fact that the vast majority of certificates could actually be created at less than this cost. In strict economic terms, the extra surplus (profit) to parties with very low cost efficiency options doesn't represent inefficiency at a societal level because money is not wasted, merely transferred. However, considerable 'windfall' cashflow may go to parties with very low cost activities – such as those that would have occurred regardless of the scheme.

## Non-tradeable Energy Sales Target

In a NEST, retailers would be given energy sales targets that do not involve the use of tradeable certificates or permits. For example, under such a scheme, retailers would have to reduce the energy sold per average customer by 2% per year. Much of the additionality problems with EECTs derive from the use of project baselines, and a NEST would avoid the use of baselines completely. NEST schemes therefore also avoid the need to define the activities eligible to create certificates, and likewise, no deeming, auditing, monitoring or verification would be required by government – significantly reducing administration costs. A NEST would also negate any rebound effect within the covered sector.

There does not appear to be a clear precedent for this type of scheme anywhere around the world, particularly in the context of an energy industry with competitive retail markets. Thus the discussion here should be seen as a preliminary scoping of options that are deserving of more in-depth assessment.

*Targets and Scope*

Targets for a NEST can be set in the same manner as for an EECT scheme. The scheme target could expressed as an absolute or intensity value and would probably be subdivided into different targets by sector and fuel type. Retailers' targets would be set as per-customer targets (eg. MWh per customer). Thus, as the numbers of customers changed, the per customer target could be adjusted so that the scheme's overall target was maintained. Retailer's targets can't be set with respect to anything 'external' such as GDP because in that case there would be a need to define the retailer's market share, which would itself be dependent on their sales, which is what they are meant to be reducing.

The average per customer energy use may be quite different between retailers. In the residential and commercial sectors, all retailers could have the same per customer target if the levy approach described below is used. In the industrial sector, enterprises with unusually high energy use could be targeted with separate measures (with the remainder included in the NEST), or through subsectoral targets, possibly according to best practice. Different industrial sector targets for different retailers should be avoided because the larger energy users from a retailer with a lower average energy use could move to a retailer with a higher average, potentially reducing the per customer energy use of both retailers, even though total energy use had stayed the same.

If only electricity is targeted, there may be an incentive to move customers from electricity to gas because this will reduce per customer electricity use. If both electricity and gas are targeted there will still be an incentive to move customers from electricity to gas because the electricity retailer will reduce it's per customer demand, but at least gas use will be covered by the scheme. At this stage the likelihood and GH consequences of a move from electricity to gas are not clear. As for the EECT, other fuels likely to be used could be covered by the scheme, and would likely require differential targets, again determined by the ease and cost of reductions, as well as that fuel's contribution to GH emissions.

As for an EECT, a NEST should be given a longer-term timeframe, with its targets altered over time as conditions require.

*Actors*

In the NEST schemes described here, the liable parties would be energy retailers. Other parties involved would be the end-users and possibly third party providers of energy reduction options. DNSPs may also be involved if the levy is applied through them. All energy users should be included, especially large energy users. An energy sales or customer number threshold could be used to exempt small retailers from the scheme, as they may find it more difficult to develop the required institutional capabilities.

*Motivation*

The motivation for retailers would be the same as for an EECT ie. a penalty. A 'make good provision' is automatically built into a NEST because if a retailer fails to meet its target in one year, it still has to meet the following year's original target. Retailers would have the benefits of banking because exceeding their targets in one year makes their next year's targets easier to meet.

*Financing compliance*

Financing compliance for a NEST scheme is not as straightforward as for an EECT. This is essentially because in a NEST, a retailer's liability is tied to it's own customer base, rather

than to an average liability across the scheme. Compliance costs could be borne by the customers that benefit from the EE hardware, by the retailer's entire customer base (or possibly just the appropriate sector) or by the NSW customer base, again possibly by sector. It is likely that a levy applied across the NSW customer base is the most suitable.

Use of a NSW-wide levy involves a two-step process. In the first, to cover the cost of EE actions, all retailers pay a levy to government in proportion to their customer numbers at the end of each year. The levy may be different for different sectors, depending on the costs of EE in each sector. This approach should ensure that all retailers pay an equal per-customer amount towards reducing energy use. If the levy is applied in proportion to the customer's energy use, new entrant and existing retailers could simply offer low tariffs to poach customers that have low energy use. The levy proceeds would then be redistributed to the retailers according to energy sales per average customer. Thus, retailers that have a higher average per customer energy use than other retailers will receive a greater proportion of the levy proceeds.

In the second step, retailers would recoup the cost of the levy from their customers, most probably as a per kWh charge. Applying a per customer levy as the same fixed charge to each customer's bill would have significant equity implications, with smaller customers paying a disproportionately higher cost.

Although there is an incentive for retailers to target low energy use customers because they then avoid having to undertake energy reduction measures, this should be offset by the fact that retailers with customers with a lower than average energy use would have to apply a higher per kWh levy charge to those customers. Conversely, retailers with higher than average energy use customers will be able to apply a lower per kWh customer charge, which should be some compensation for having to undertake energy reduction measures.

The levy imposed on customers should pay for or subsidise all hardware, including installation, as well as education campaigns etc. It is most likely that all hardware would be owned by whoever owns the associated infrastructure (eg. the house where a solar water has been installed), and so they would also have responsibility for maintaining that hardware. Of course, it may be in the retailer's interest to assist in maintenance.

The levy should be set at a level to ensure the use of least-cost EE options, and could be reviewed each year. Excess funds from the levy in one year could be used to supplement the levy in subsequent years. The size of the levy could be determined with reference to the levies already used in other countries, taking into account the claimed energy reductions, and should include a profit component. NSW has long had a levy on electricity which has been used for R&D, DSM and other purposes in the past. The assessments of EE potential performed for NFEE, VEET and the NSW Government could also be used. Network Service Providers may also need to be compensated for lost revenue because of decreased transmission and distribution (this would also apply to an EECT, depending on the degree to which it reduced energy use below BAU). One way to address the possibility of the levy being too low, resulting in one or more liable parties paying the penalty, is to recycle any penalty back to the liable parties. However, simply paying the penalty back to those who paid it means there would be no incentive to avoid it. Instead, liable parties that exceeded their targets should be paid back a significantly smaller proportion of the penalty than those that didn't, and the more they exceed their targets, the less they get.

*Discussion*

As above, it is not clear that an EECT would result in implementation of lower-cost EE options than a NEST. A NEST is likely to have much lower administration costs (no deeming, auditing, monitoring or verification required by government at the project level), and may provide greater certainty to providers of EE services (because their returns would not be dependent on a certificate price). A possible disadvantage on a NEST is that providers of EE services would need prior agreements with energy retailers, who in turn would require some form of reassurance that energy use would be reduced as much as the project developer claims. In the UK EEC this is generally achieved through the hardware warranty (eg. 15 years for a boiler) and so the associated energy savings are recognized only for that period. Alternatively, retailers and project developers may need to enter into long-term or forward contracts for energy efficiency measures (similar to those that occur with Energy Performance Contracting).

Although there could be instances where there is a lack of BAU or policy additionality (ie. where an EE activity would have occurred in the scheme's absence), this only matters if this occurs disproportionately with one or more retailers. With a NEST scheme, lack of BAU and policy additionality at a scheme level simply reduce the scheme's overall compliance costs. In an EECT, lack of BAU and policy additionality don't necessarily reduce the scheme's overall compliance costs (as reflected by the final cost to end users which is essentially determined by the certificate price, which represents the marginal cost of action).

As discussed above, tradeable certificate schemes can result in liable parties paying significantly more than the actual cost for particular projects because the certificate price is set at the scheme's overall marginal abatement cost. In a NEST, retailers would be in direct negotiations with the providers of EE services and so would be more likely to pay at the marginal cost of that particular project – reducing their compliance costs.

In a NEST there are no certificates or trading and so there should be no particular challenges in managing its interactions with an ETS. To the extent an NEST drives cost-effective energy efficiency actions, it would reduce the costs of achieving the ETS target.

## Tradeable Energy Sales Target

A Tradeable Energy Sales Target (TEST) combines the energy sales focus of a NEST with the trading attributes of an EECT. Again, there does not appear to be a clear precedent for this type of scheme anywhere around the world, and so the discussion here should be seen as a preliminary scoping of options that are deserving of more in-depth assessment.

A TEST could either:

1. be identical to a NEST but allow retailers to trade proportions of their sales targets, or
2. be based on a cap and trade scheme with the cap set in the same way as the energy sales target of a NEST, and where the permits correspond to a unit of energy sales, eg. MWh.

As for the NEST, both types of TEST would have:

i) an overall scheme target based on an absolute level of energy sales, with different subtargets for different sectors and fuels,

ii) retailer per customer targets based on the sectoral and fuel subtargets,

iii) the same sectoral and fuel per customer targets for each retailer,

iv) the same actors,

v) the same penalty price,

vi) the same ramp rates and excess provisions,

vii) the same very long or indefinite timeframe,

viii) no need to define the activities eligible to create permits, and likewise, no government auditing, monitoring or verification would be required at the project level, and

ix) possibly no need to have an energy sales cutoff threshold because small retailers could simply buy compliance.

**Type 1** Unlike a NEST, Type 1 would allow retailers to trade excess portions of their previous year's annual target (ie. banking is allowed). This excess could be carried over to subsequent years so could be sold at any time, or may simply be held to meet future liabilities.

**Type 2** A cap and trade (Type 2) TEST would be more complex, and would have the following characteristics:

i) Trading of permits based on a unit of energy eg. MWh for electricity and MJ for gas.

ii) Trading could occur across sectors.

iii) At the beginning of the year the retailers would know what their per customer target was for that year. Any excess permits could be traded only in the next year.

iv) In the scheme's first year both the overall target and the per customer target would be based on projected BAU energy use. The subsequent years' targets would decrease in the same way as for a NEST. Note that the per customer levy is also paid at the end of each year.

v) Banking of unused permits for use in later years but no borrowing from future years.

vi) No offsets because that would involve a baseline and credit scheme.

vii) Financing compliance: could be achieved through either the NSW-wide levy or by auctioning the permits:

a. NSW-wide levy: as for the NEST, and free permits would be given to retailers at the end of each year according to their customer numbers at that time multiplied by the per customer target for that year.

b. Auction permits: Auctioning the permits would avoid the need to determine the size of the levy. However, as for the NEST scheme, if the permits are auctioned, there would be an additional incentive for new entrant and existing retailers to poach households that have low energy use because of energy efficiency measures implemented by other retailers.

Thus, the permit essentially represents a 'right' to sell a unit of energy and the scheme would have some similarities to a downstream cap and trade emissions trading scheme (where the permits represent the right to 'emit' a $tCO_2$-e). Thus, two significant differences to the currently proposed emissions trading schemes (PM Taskforce and NETS) is that the TEST discussed here targets the downstream end of the market, and is designed to target particular

sectors. The TEST could be designed so that it should be entirely compatible with either of the proposed emissions trading schemes and should simply reduce their compliance costs, ie. reduced energy use and reduced associated emissions would reduce the permits required under a C&T emissions trading scheme.

**Governance**

All the above schemes are complex and likely to require design revisions. Revisions will also be required as circumstances change, for example as targets are updated or new sectors are incorporated. This means that not only must a scheme be designed so that it can be revised, but some form of ongoing revision process must be formally incorporated into the scheme design. EECT schemes can be separated into design, operation and assessment components. In this case, the scheme is designed at the Governance level, operated by the Administrator and assessed by the Regulator. The scheme may then be implemented through the following process: Scheme design – initial scheme operation – scheme assessment – revised scheme design and implementation – further operation – scheme assessment – revised scheme design and implementation, etc. In this process, separation of powers between the 'designer', 'operator' and 'assessor' is important to reduce conflicts of interest, especially where the assessor is publicly reporting on outcomes that are relevant to public welfare and are important to informing revision of the scheme design.

# Contents