RICARDO-AEA

International Review of Trading Schemes for Energy Savings and Carbon Emission Reductions

Report Commissioned by the World Bank

ESMAP

Report for World Bank

Ricardo-AEA/R/ED58547
Issue Number 4
Date 16/08/2013

Ea Energianalyse a/s

Customer:
World Bank

Customer reference:
China: Trading Schemes for Energy Savings and Carbon Emission Reductions INCEPTION REPORT

Confidentiality, copyright & reproduction:

Ricardo-AEA reference:
Ref: ED58547 - Issue Number 4

Contact:

Mark Johnson, Chadwick House, Birchwood Park, Warrington, Cheshire WA3 6AE

t: 0870 190 6748
e: mark.johnson@ricardo-aea.com

Ricardo-AEA is certificated to ISO9001 and ISO14001

Authors:
Mark Johnson (Ricardo-AEA), Nipunika Perera (Ricardo-AEA), Tom Beckett (Ricardo-AEA), Kirsten Dyhr-Mikkelsen (Ea Energy Analyses), Mikael Togeby (Ea Energy Analyses)

Approved By:
Mark Johnson

Date:
16 August 2013

Signed:

Table of Contents

Glossary

ARB	Air Resources Board (under the CEPA)
BEE	Bureau of Energy Efficiency
CEC	California Energy Commission
CEPA	California Environmental Protection Agency
CERC	Central Electricity Regulatory Commission
CERT	Carbon Reduction Emissions Target
Certificate	An energy saving (White Certificate), renewable energy (Green Certificate) or carbon trading unit, which is tradable between obligated parties to a scheme.
CITSS	Climate Instrument Tracking System Service
CLTEESP	California Long Term Energy Efficiency Strategic Plan
CO_2e	Carbon dioxide equivalents
CPUC	California Public Utilities Commission (regulator)
CTP	(Carbon) cap-and-trade program
DC	Designated Consumers
Directive	A piece of legislation commonly used within the EU.
DoE	US Department of Energy
EE	Energy Efficiency
EED	Energy Efficiency Directive
EEO	Energy efficiency obligation
EERS	Energy efficiency resource standards
EPA	US Environmental Protection Agency
ESCert	Energy Saving Certificates
EU ETS	European Union Emissions Trading System
GHG	Green House Gas
HVAC	Heating, Ventilation and Air Conditioning
IEX	Indian Energy Exchange
IOU	Investor-owned utility (as opposed to municipal utilities)
JNNSM	Jawaharlal Nehru National Solar Mission
kgOE	kilograms of oil equivalent
kWh	kilo Watt hour
M&V	Monitoring and verification
MMT	Million metric tons
MRV	Monitoring, Reporting and Verification
mTOE	million tons of oil equivalents
MWh	Mega Watt hour
NAPCC	National Action Plan on Climate Change
NMEEE	National Mission for Enhanced Energy Efficiency
Participant	Entity that are either obliged or volunteer to participate in the scheme
PAT	Perform, Achieve and Trade
PG&E	Pacific Gas & Electric (Northern California)

PGC	Public goods charge
POU	Publicly-owned utility
PXI	Power Exchange of India
RE	Renewable Energy
REC	Renewable Energy Certificates
RO	Renewable Obligation
RPO	Renewable Purchase Obligation
RPS	Renewable Portfolio Standard
RPS	Renewable Portfolio Standard
SCE	Southern California Edison (Southern California)
SCG	Southern California Gas (Southern California)
SERC	State Electricity Regulatory Commissions
SGE	San Diego Gas & Electric (Southern California)
SLDC	State Load Dispatch Centres
SoCal Gas	Please see SCG
tCO_2e	Tons carbon dioxide equivalents
WCI	Western Climate Initiative
White Certificate[1]	A system which has one or more of the following: • a quantitative target for energy efficiency improvement; • obligated parties that must meet the target; and • a system that: defines the energy saving activities that can be implemented to meet the target; measures, verifies, and reports the energy savings achieved through these activities; and confirms that the activities actually took place. • Enforcement mechanisms and sanctions

[1] [1] [1] Determined from Tyler et al 2011, http://www.erc.uct.ac.za/jesa/volume22/22-1jesa-tyler-etal.pdf , E Lees/World Energy Council (2007)

Executive Summary

1.1 Introduction

In support of its policy-development the Chinese Government is looking to international experience with energy saving certificate trading (also known as white certificate trading), and its interactions with other policies, to provide recommendations that are applicable in the national context. The purpose of this study is to review international experience/best practices and provide those recommendations. It contributes to the World Bank ESMAP funded technical assistance to compliment a GEF project to establish energy savings monitoring and verification systems in China.

This paper presents the results of the international review of experience with white (Energy Savings) and green (Renewable Energy) certificates trading and carbon cap and trade. The results are drawn from analysis of policies in UK, Italy, California, India and higher level assessment of policy at EU level. It also presents preliminary recommendations for policy approaches in China.

1.2 Issues to be addressed

The purpose of this work is to provide recommendations on how white certificate trading systems can co-exist with carbon trading and green certificate systems.

The Government of China (GoC) had set a mandatory target to cut energy intensity (energy consumption per unit of GDP) by 20 percent in the 11th Five-Year Plan (2006-2010) and renewed its target of 16 percent reduction during the 12th Five-Year Plan (2011-2015), The GoC also set an ambitious target to achieve 15 percent non-fossil fuel share in primary energy consumption by 2020. In addition, the GoC also made a pledge to reducing its carbon intensity by 40-45 percent from 2005 to 2020, to which energy efficiency (EE) and renewable energy (RE) are expected to make the largest contribution.

There are different agencies responsible for achieving EE, RE, and carbon targets with multiple planned trading schemes in China. The National Development and Reform Commission (NDRC) Environmental Protection and Resource Conservation Department is considering to pilot Energy Saving Certificates Trading as a market-based mechanism to achieve the 12th FYP energy intensity reduction target cost effectively. In the meantime, the NDRC Climate Change Department is piloting carbon cap and trade scheme in five cities and two provinces (Beijing, Tianjin, Shanghai, Chongqing, Shenzhen, Guangdong, and Hubei) to cost effectively achieve the 12th FYP carbon intensity reduction target. The National Energy Administration has developed RE quota system to be submitted to the State Council, and is contemplating RE trading to achieve the RE target cost-effectively. The priority and coordination of the proposed Energy Saving Certificates trading, RE trading, and carbon cap and trade are the topic of this report.

To address these issues we have focused on three key issues: (1) the rationale for a country or region adopting targets for Energy Efficiency, Renewable Energy, and Carbon reduction at the same time; (2) the rationale for adopting co-existing policy measures and trading schemes to achieve these EE, RE, and carbon targets; and (3) interactions of these policies and trading schemes to gain synergies and avoid conflicts. Our analysis of these elements is described below, followed by a preliminary recommendation for China.

1.3 Rationale for co-existence of EE, RE, and carbon targets

Many developed countries have set energy efficiency (EE), renewable energy (RE), and carbon emission targets at the same time, like China. For example, the most well-known is the EU 2020 targets that committed 20% improvement in energy efficiency, 20% energy from renewable energy, and 20% reduction in carbon emissions from 1990 level by 2020. The rationale identified behind the selected countries having targets for Energy Efficiency, Renewable Energy, and Carbon reduction at the same time, is as follows:

- Energy policy seeks to achieve multiple aims, and in support of this it is necessary to set targets for different aspects. Energy policy objectives include energy security (reducing energy supply and pricing vulnerability), reduction in costs of energy, and increasing access and affordability for the poor, as well as local and global environmental benefits from reduced use or fuel for energy supply. Together this mix of objectives has been a major driver for a mix of targets.
- The primary focus of energy policy has differed in the regions we have examined, and this has been reflected in the different emphasis on targets and therefore on the measures implemented. For instance; energy efficiency has been prioritised in California and India, whereas in the EU the primary objective has been carbon emissions, whilst renewables and energy efficiency policies have been seen as contributing to the carbon reduction objective, and broader energy policy objectives.

1.4 Rationale for co-existence of EE, RE, and carbon policy instruments and trading schemes

The study also focused on identifying the rationale for the selected countries to have white (Energy Savings), green (Renewable Energy) certificates trading and carbon cap and trade systems at the same time. In theory an overall carbon objective would be achieved at least cost by implementing only a carbon target/system. However, the use of other measures reveals how they contribute to the broader energy policy objectives mentioned above:

- Multiple policy objectives have led to the use of multiple schemes. This is because energy policies have more objectives than just reduction of carbon emissions from energy use.
- Carbon cap and trade will not tap all the energy efficiency potentials, as carbon pricing alone cannot remove all the market barriers and failures for energy efficiency, partly due to the low price elasticity at least in the short run. Use of white certificate trading focusses abatement on energy reduction, which has been seen to benefit energy security, fuel poverty, reduction of energy bills, avoiding investment in energy system expansion, and is complementary to carbon cap and trade.
- Carbon pricing alone cannot necessarily provide enough incentive for the deployment of renewable energy. Green certificates have been used to encourage the development of renewable technologies, which might initially be more expensive than other abatement routes. This can overcome the barriers to development and ultimately help reduce the long term costs of renewables, supporting a longer term transition to a low carbon economy. The development of a renewables industry also has positive benefits such as job creation and industry building, contributing to green growth and improving the diversity of the energy supply mix.
- Multiple policies are preferred so that if one fails to meet the target, the others may compensate, thereby reducing the risk of failing to meet the objectives overall.

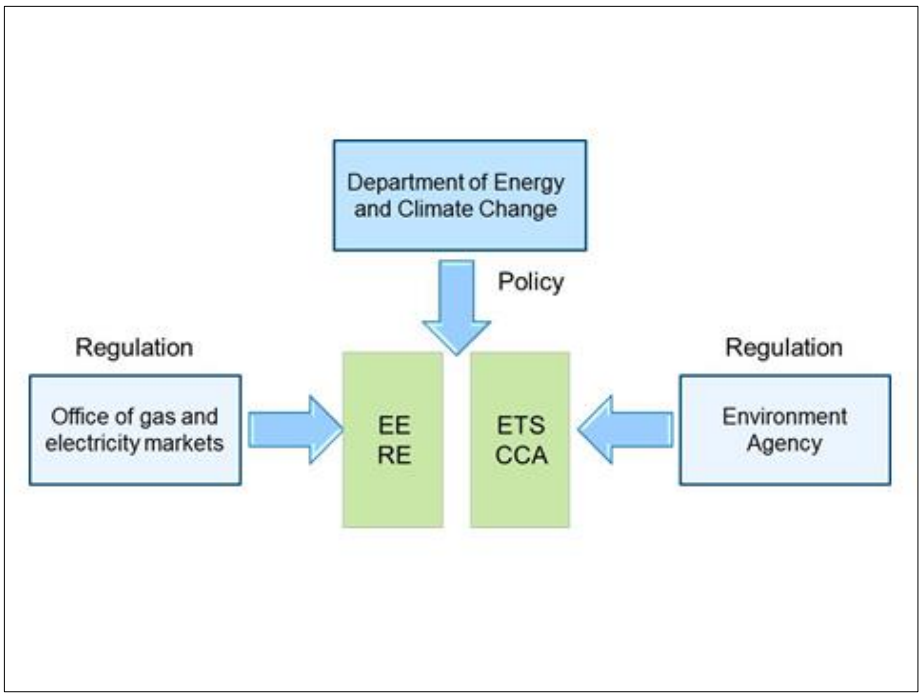
- There is evidence that energy efficiency policies have been introduced in advance of carbon trading (for example in California). We consider this in part a historical reflection of concerns over energy costs pre-dating concerted action over climate change. It is also possible that a natural hierarchy is followed, in which reducing energy demand is prioritised over action to generate it more cleanly. However, where carbon trading is then introduced, this co-exists with energy efficiency trading and does not replace them. There is no evidence of a transition from energy efficiency trading towards carbon trading.

1.5 Interactions between policies: conflicts and synergies

International experience from the UK, Italy, and California demonstrates that the EE, RE, and carbon trading schemes can co-exist and complement well with each other, with little conflict, as each trading scheme targets at different obliged parties, systems, and sectors. Whenever and whenever necessary, changes are made for the trading schemes to avoid any conflicts. For example, when the trading schemes apply to the same sectors and obligated parties, specific rules are introduced to avoid overlap of energy coverage. The key is to have institutional coordination at the top policy level for EE, RE, and carbon reduction, and each trading scheme targets at different obliged parties, sectors, or energy fuels.

Institutional arrangements. The UK is a good example where an overarching agency -- the Department of Energy and Climate Change -- sets and coordinates energy and emission reduction policies and targets at the top level, while independent regulators administer and regulate the treading schemes. The EE and RE measures that place obligations on energy suppliers are regulated by the Office of Gas and Electricity Markets (in England, Scotland and Wales), which also regulates other aspects of these energy suppliers' activities. The primarily industrial ETS and Climate Change Agreement systems, targeting energy consumers/GHG emitters, are regulated by the Environment Agency (in England), which has responsibilities for environmental protection. The regulators are appropriate to the type of regulated entity, and responsibilities for policymaking and implementation are clearly defined and separated.

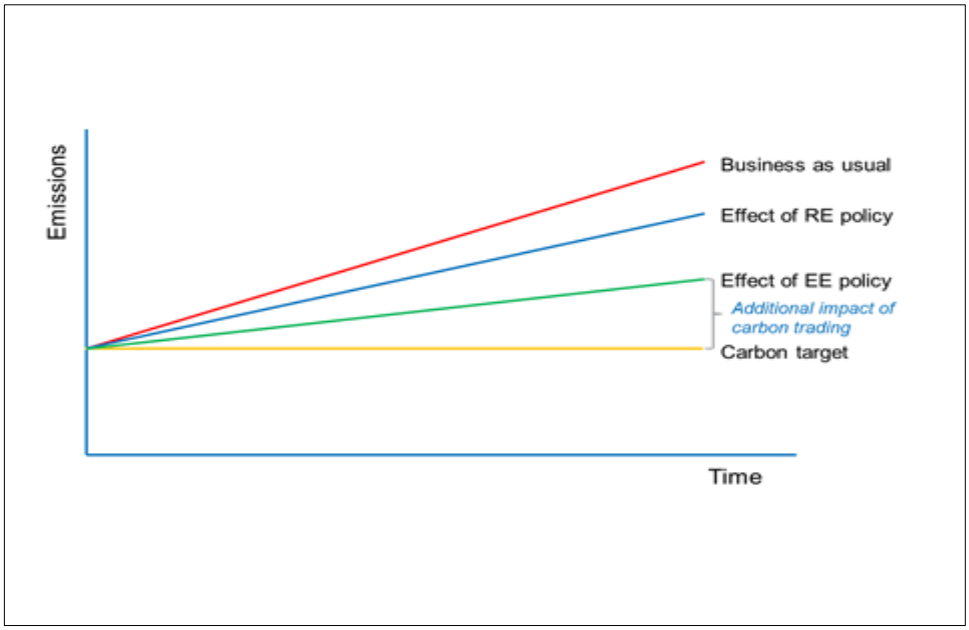
Figure 1-1 UK Institutional arrangements



System target setting. Energy Efficiency targets are often expressed as a percentage reduction in energy supply or consumption against an historic baseline. This is the case in the white certificate predecessors to the UK CERT system and India's PAT system as examples. Renewable certificate targets are often set on a similar basis – i.e. percentage of supply in a given year to be from renewable qualifying technologies. The targets in these systems, therefore, are independent of the targets set in carbon trading systems. However, where systems overlap in their coverage, such as with regards to electricity generation and supply, carbon trading targets should take account of expected performance of energy savings measures. The EU ETS provides a good illustration of how carbon targets can be set and how they relate to energy efficiency targets:

- In Phase III of the EU ETS (2013-2020) the target was set with consideration to the overall EU target for emissions reductions of 20% by 2020. The EU target covers all energy use emissions, for example those in the EU ETS but also transport, direct use of energy in households and so on. A decision was therefore required on how much of the overall target would be met from operators within the EU ETS and how much from other sources. This decision took account of the abatement potential in EU ETS compared with other sources and the expected effect of policies outside of the EU ETS. On this basis the EU ETS target reduction was 21% (i.e. slightly higher than the economy average).
- In Phases I and II, targets were set by Member States and were subject to EU central approval. Phase II for instance, aligned with the first Kyoto commitment period and national targets were set according to the level of ambition required by the EU ETs to support the achievement of the Kyoto targets. This has similarities to the EU approach to target setting for Phase III. The EU ETS was part of the overall mix of policies and the level of ambition for EU ETS needed to take account of the effect of these other measures, including the effect that they have on the EU ETS emissions (electricity savings policies reduce emission from power stations covered by EU ETs for example). This is illustrated conceptually below, in which a target for carbon trading is set taking account of the level of emission reductions expected from EE and RE policies.

Figure 1-2 Carbon cap setting accounting for effects of other measures



System coverage. In this section we examine three aspects to system coverage: (a) coverage of sectors; (b) coverage of obliged parties; and (c) coverage of energy fuels. A motivation for implementing multiple systems is that it enables focused efforts on different sectors of energy use (different consumers and fuels), where it is impracticable that these be covered by a single system, such as carbon cap and trade. This diversity of measures may to a degree be influenced by the type of energy consuming/emitting entity. Table 1-1 highlights that EE trading, RE trading, and ETS schemes oblige different entities and cover different sectors, from experience in the EU, UK, Italy, CA, and India.

Table 1-1 Coverage of Various Schemes Researched

	Renewable Energy	Energy Efficiency	Cap & Trade
European (Directives)	**Increase Deployment of Renewable Energy to a Target**	**Energy Efficiency in all sectors**	**Large Industry and Carbon Intensive Energy Production**
UK	**Increased use of Renewables across all sectors using electricity** (*Electricity suppliers obligated)*	**Domestic Sector Energy Efficiency** (*Energy suppliers obligated)* **Energy Intensive Industry** ***(energy consumers covered)***	**Large Industry and Carbon Intensive Energy Production** ***(energy consumers obligated)***
Italy	**Increased use of Renewables across all sectors using electricity** (*Electricity suppliers obligated)*	**All sector energy efficiency** (*Energy suppliers obligated)*	**Large Industry and Carbon Intensive Energy Production** ***(energy consumers obligated)***
California	**Increased use of Renewables across all sectors using electricity** (*Electricity suppliers obligated)*	**All sectors other than transport** *(Energy suppliers incentivised)*	**Large Industry and Carbon Intensive Energy Production as well as land based offset.** ***(energy consumers obligated)***
India	**Increased use of Renewables across all sectors using electricity** (*Electricity suppliers obligated)*	**Large Energy Intensive Industries**	**N/A**

Box 1: The evolution of white certificate trading in the UK

The UK introduced an energy saving obligation system in 2002, called the Energy Efficiency Commitment (EEC). EEC required electricity and gas suppliers with more than 15,000 domestic customers to achieve energy saving targets. Savings were calculated from eligible measures, which in part had to be implemented for poorer households. The second phase started in 2005, in which the threshold for obligated suppliers was raised to 50,000 customers and the target was raised. In 2008 the next phase began and the system was renamed the Carbon Emission Reduction Target (CERT). This involved the refinement of eligible measures and the conversion of the target into units of carbon saved, which was also increased over earlier years. CERT has now been superseded by the Energy Company Obligation (ECO). Common to all systems is that obligations are placed on energy suppliers, they are overseen by the energy markets regulator, the targets are set in relation to historic energy supplied and that they focus on the domestic sector. Savings could be traded with other obligated suppliers.

In 2001, shortly before the introduction of EEC, the UK introduced the Climate Change Agreements (CCAs) energy saving system (see box 2 below). CCAs differ from EEC/CERT in that it covers energy intensive industry and places the obligation on the energy consumer, not the energy supplier.

The EU Emissions Trading System (EU ETS) was introduced in 2005 and superseded the domestic UK Emissions Trading System. EU ETS covers the emissions associated with direct energy use and industrial processes. It interacts with EEC/CERT and CCAs to the extent that it covers electricity generation and these other systems include electricity consumption.

Coverage of sectors

The review of international experience has highlighted that each trading system focuses on different sectors. Carbon trading systems normally focus on industrial sectors and power generation. This is the case for instance in the EU ETS and the Cap-and-Trade Program in California. Renewable Energy Certificate systems naturally focus on the electricity suppliers. For energy efficiency systems, however, we find two different approaches:

- Systems focus on smaller energy users, especially the residential sector, while the obligation is imposed on electricity suppliers. For example, in the UK, the Energy Efficiency Commitment, and its successor the Carbon Emission Reduction Target system, were aimed at residential energy users, and especially those in fuel poverty. The Titoli di efficienza energetica (TEE) system in Italy allowed projects from all sectors, although in practice the majority of savings came from the residential sector. The Californian Energy Efficiency Obligation also allows savings in all sectors. It targets lower income customers but savings were made across all sectors.
- Systems and obligation focus on energy intensive industries. Examples of such systems are the UK Climate Change Agreements (CCAs) and the Indian Perform, Achieve, Trade system. CCAs are voluntary sectoral agreements for energy saving, and are the model for India's Perform, Achieve, Trade system (albeit PAT is mandatory). The eligibility rules of these systems ensure that these systems cover

specific sectors. A degree of certificate trading and banking of over-achieved targets is possible.

Box 2: Climate Change agreements and Perform, Achieve, Trade – examples of user obligated energy saving systems

The UK and India have both implemented energy savings systems in which the obligated entities are energy intensive industrial consumers. Both cover primary fuels and electricity consumption.

In the UK Climate Change Agreements (CCAs) are voluntary and establish targets through negotiation between industrial sectors and the government. These targets are translated to individual enterprise targets for facilities or groups of facilities. Those enterprises that meet their targets receive a partial rebate on the UK carbon tax. CCAs have been in place since 2001 and are underpinned by an audit regime. Many facilities are also included in the EU Emissions Trading System (EU ETS) and accounting rules ensure that EU ETS energy is not included in the enterprise CCA targets or reported energy. In earlier phases trading was allowed using left-over credits from the now-ceased UK Emissions Trading System. In the current phase

The Perform, Achieve, Trade system drew heavily on experience with CCAs and established energy intensity based targets for certain industrial sectors. It was introduced in March 2012 and the first target period ends in 2015. Those sectors that over-achieve their targets can trade savings certificates with those that under-achieve.

Coverage of obliged parties

The obliged parties in carbon trading systems examined in this project are the energy consumers themselves, mostly energy intensity industries and power generators, either at individual installation or enterprise level. This is not necessarily the case for white certificate trading, in which the type of obligated party depends on the type of energy consumer:

- For smaller emitting sources, an upstream approach is more suitable, and energy saving trading schemes have therefore regulated the energy suppliers, such as electricity and gas distributors, who are obliged to reduce energy demand by end-users. This is the case for the UK EEC/CERT, Italian TEE and Californian EEO systems.
- For larger emitting sources, such as energy intensive industry, it is the energy consuming enterprise that is the obligated entity. This is the case for the UK CCAs and the Indian PAT system.

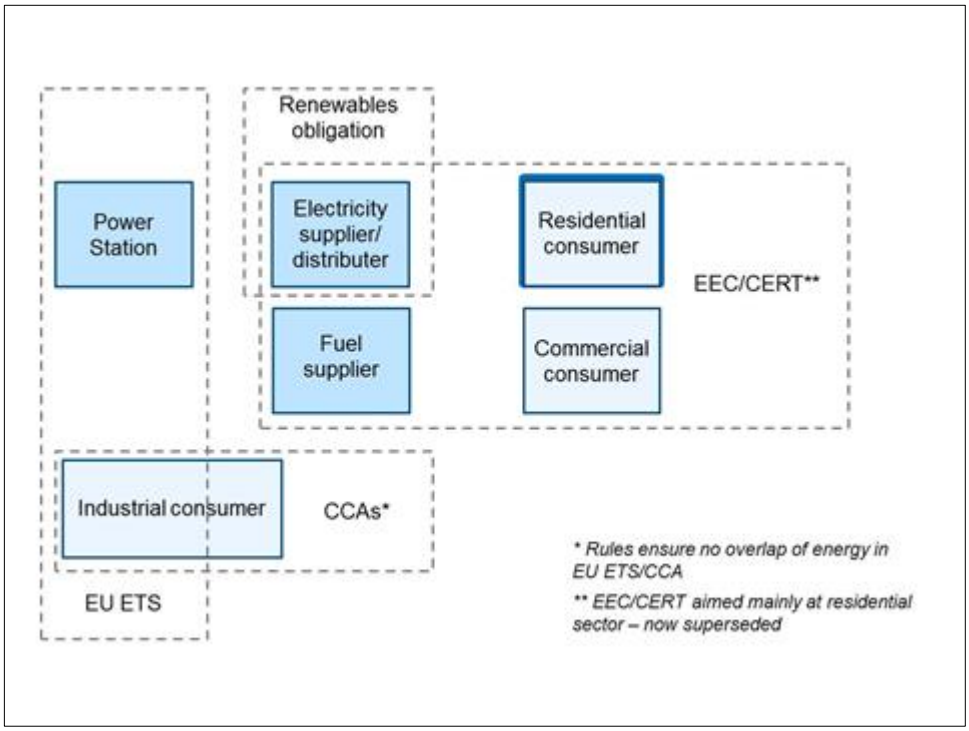
In the countries examined, there is only one example of carbon trading and energy savings measures overlapping for the same obligated entities. This is in the UK where many industrial operators in the EU Emissions Trading System (EU ETS) are also subject to energy efficiency targets under the Climate Change Agreements (CCAs). Note: CCAs are separate from the white certificate savings obligation applied to suppliers of energy to domestic and small enterprise consumers. CCAs provide an incentive for energy savings because operators that meet their target receive a rebate against the UK carbon tax. CCAs

pre-date EU ETS but the rationale for CCAs continuing to apply to EU ETS installations is that they provide an additional incentive for energy saving, support UK competitiveness by allowing a carbon tax rebate for energy intensive users.

A further consideration for obliged parties is that of vertically integrated electricity companies, for example in the UK the electricity system includes enterprises with both generation and supply businesses. They can be involved in carbon trading (EU ETS) and white certificate trading (EEC/CERT). However, the markets for generation and supply are separate and obligations fall on separate legal entities.

A summary of the UK position is presented below. The only instance of enterprises covered by multiple systems for their energy consumption is with EU ETS and CCAs, but in this case specific rules avoid any double counting of emissions/energy (as discussed later).

Figure 1-3 UK energy and carbon trading landscape



Coverage of energy fuels

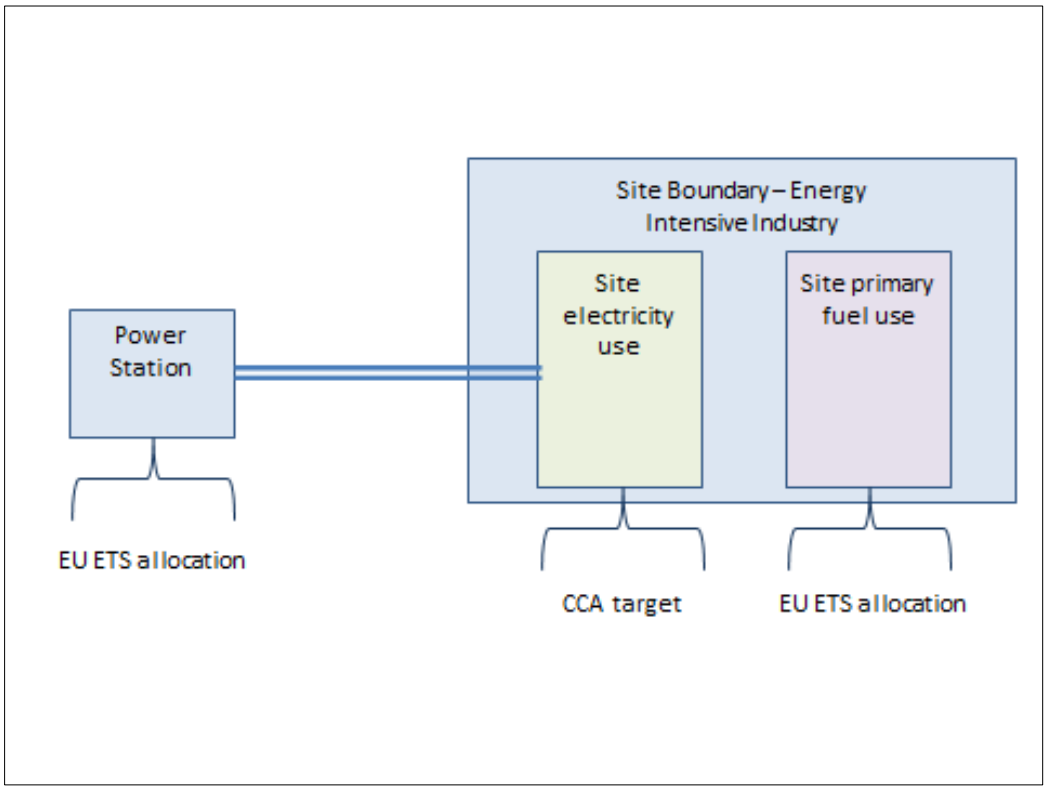
As discussed above, an important example of international experience with overlaps in obliged parties between systems is that both EU ETS and the UK Climate Change Agreement (CCAs) program put obligation on energy-intensive industries. In the UK, many CCA operators are also in the EU ETS, though there are much more CCA operators (about 10,000) than EU ETS operators (about 1,000). Wherever there is an overlap in the same obliged party, the targets under CCAs are defined as reductions in their non-EU ETS energy. In practice, the EU ETS covers emissions from primary fuel use at an installation, while the CCAs cover electricity use only. The target setting coverage is indicated in the figure on the following page.

There are two important points to note about the figure. First, it must be emphasised that the EU ETS free allocation is not an installation target, but is the level of emissions above which the installation would incur a net cost for its emissions allowances. Second, the CCA covers

electricity use, so doesn't overlap with EU ETS in which electricity generation is covered. This is discussed below.

By excluding EU ETS emissions in this way from CCA target setting it is possible to have co-existing systems in which one (EU ETS) focuses on reductions in primary combustion emissions and the other (CCAs) on reductions in electricity use at the same installations.

Figure 1-4 UK CCA and EU ETS target setting



Interaction between obligations on electricity generation and consumption

There are many instances in which electricity is covered by multiple systems, by virtue of carbon trading covering the emissions at the point of generation, and white certificate systems covering the supply or use of electricity. In Italy, California and the UK such situations exist. In the UK, generation of electricity is covered by the EU ETS and there are two instances of overlap in which electricity consumption is covered by an energy saving system; CCAs for energy intensive industry as mentioned above and; EEC/CERT for residential energy use, in which the obligation is placed on energy suppliers.

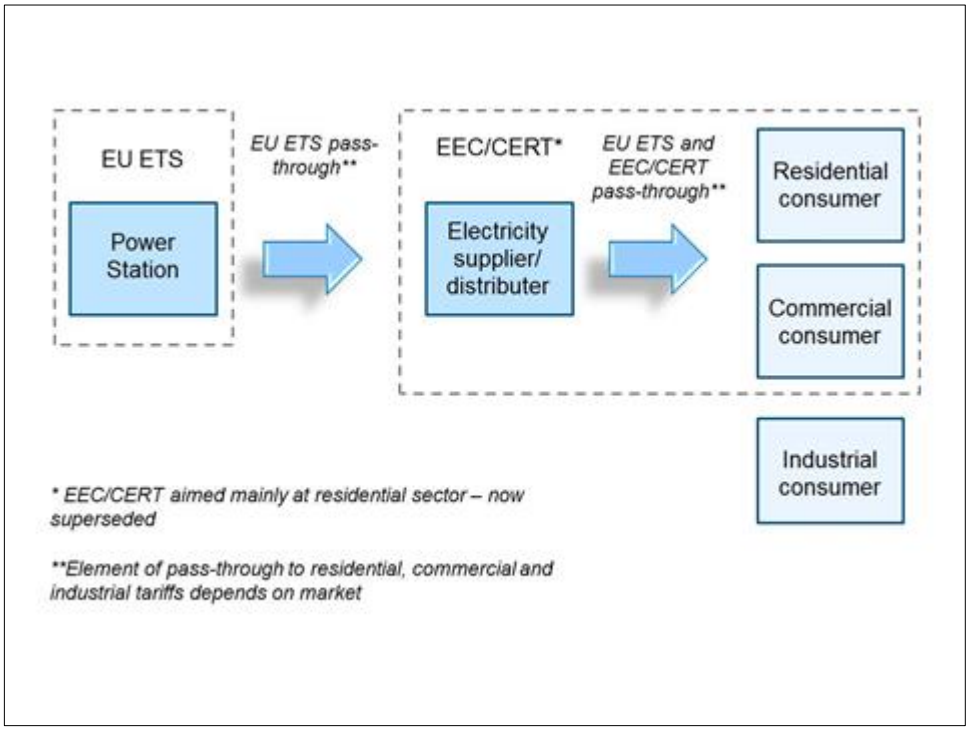
Electricity use reductions as a result of energy savings policies will, of course, reduce the need for electricity generation. If the emissions resulting from electricity generation are capped under a carbon trading system, then the energy saving policy will contribute to the achievement of the carbon cap. To achieve carbon savings that are additional to those that would be achieved as a result of the energy saving system, it would be necessary to take account of the energy saving target when setting the carbon cap. This is discussed under Target Setting below.

Incremental cost pass-through

The impact on costs relates to the nature of electricity price setting. In a liberal electricity market the cost of generation is passed through to consumers, for example as is the case in the UK. The wholesale electricity market price is driven by the cost of generation necessary to meet demand, which itself includes the marginal cost of carbon associated with electricity generation. For example, if coal plant provide the flexibility to meet demand, and they emit 0.9tCO2/MWh, then if the carbon price is €10/tCO2 the carbon cost element of the electricity price realised by these plant will be €9/MWh. Moreover, this carbon price element will be realised by all electricity generators and passed through to the retail price paid by all consumers (ignoring effects of short and medium term pricing mechanisms).

In this way, under a liberalised electricity market, the consumers will pay the cost associated with the carbon emissions from electricity generation. Electricity consumers will also pay a cost associated with energy saving/white certificate systems. In systems that place the obligation on energy suppliers (EEC/CERT, TEE, EEO), the suppliers will recover the costs of this in the retail pricing of electricity, if they are able to do so. In systems where the obligation is on the user (CCAs, PAT), then the consumers pay the cost directly, although the cost may depend on the nature of the incentive mechanism – for example, meeting a CCA target provides the operator with a benefit, as it receives a rebate against the UK carbon tax, although the overall effect is a net cost. The chart below illustrates how consumers can be exposed to the costs of carbon and white certificate trading systems.

Figure 1-5 UK carbon and white certificate cost, under a pass-through scenario



These cost pass-through arguments are important for the design of complimentary systems, in particular:

- Where the market allows it, it is possible that the cost of carbon trading on electricity generation and the cost of energy saving/white certificates fall on the same consumers. This affects the economic consequences of co-existing systems.

- In pass-through situations, there can be an incentive for electricity use savings from both carbon trading and energy saving systems. This can reinforce the price signal for electricity savings, and increase the attractiveness of electricity use savings compared with fuel switching as a means of reducing carbon emissions.
- In cases where the pass-through of the carbon cost of electricity generation is not possible, due to the nature of market regulation, the energy saving/white certificate systems offer the opportunity to incentivise electricity saving measures that may not otherwise arise.

Target allocation. As described above, the entities participating in green and white certificates generally differ from those in carbon trading. In green and white certificates targets of each entity are set on an equal percentage basis, as described above. Entity-level allocations in carbon trading systems differ. These can be based on past emissions performance, benchmarks or allocated via a sale, such as an auction. Importantly though, the carbon trading allocation is not the same as an entity level target – the actual emissions for each entity will depend on its cost effective abatement opportunities, not its level of free allocation. There is therefore no concern over consistency between systems.

Monitoring, Reporting and Verification (MRV). Carbon trading systems and white certificate systems can adopt differing MRV approaches, which has implications if they are to be linked or co-exist for the same energy. For instance:

- Our experience of the systems examined shows that carbon trading often employs full third party verification, whereas for white certificate trading there is a spectrum from full third party verification (in India) to audit and sampling (as for the UK) or ex-ante programme approval (in California). The use of full third party verification in India may be a consequence of the obligated entity being large energy consumers, for which mandated verification is more feasible. A sampling or programme approach for other systems may be favoured because the obligation is on energy suppliers to provide a large number of measures within their customer bases, for which full verification is less practicable.
- MRV may focus on the enterprise level, such as with EU ETS, PAT, or on projects or programmes of measures, such as EEC/CERT.
- Carbon trading systems either measure emissions directly, or calculate them from activity data such as fuel use – the latter method being much more common. White certificate systems determine savings from calculated impacts (such as the improved thermal performance of a building) or deemed values (the savings for replacement energy efficient lighting).
- Carbon trading systems measure emissions during an annual compliance period. White certificate systems recognise the energy savings over the lifetime of each measure implemented.

Penalties for non-compliance and legal framework. Table 1-2 lists examples of penalties for non-compliance, ranging from a high price per ton CO2 under the ETS system to a percentage of annual turnover of the obliged enterprises under the White Certificates Trading scheme. In addition, underreporting would also receive additional penalty.

Table 1-2 Example Non Compliance Regimes

Scheme	Example Non Compliance Regimes
Green Certificates	The India, California and the UK provide an option to buy out obligations per unit of energy, providing an alternative to obtaining certificates.
White Certificates	In the UK the CERT scheme had a maximum non-compliance penalty of 10% of an electricity producer's annual turnover, with obligations not being carried to a further year. A penalty of 20,000 USD is provided in the India for lack of compliance with the PAT scheme, with a further penalty for the number of units short of the target.
Carbon Cap and Trade Scheme	Penalties in Europe are €100 per tCO_2e not covered by the scheme, but obligations carry to the next year. The penalty for non-compliance to the CTP in California is charged per unit as in the EU ETS; as being four times the cost of auctioned units in that year.

For white certificates we have found evidence of tolerance to small shortfalls against target (UK) or larger differences (California) before penalties apply. Furthermore, the penalties can relate to the economic performance of the obligated entity, such as a proportion of financial turnover, rather than the environmental or energy impact of underperformance.

For carbon trading systems, an increase in emissions results in an additional cost to the operator. For white certificates, similarly, an increase in the amount of energy supplied will also incur a cost, either by requiring further savings measures or the purchase of additional certificates.

The legal basis for each type of trading system does vary, with the UK being a good example.

- EU ETS is regulated as with other environmental polluting activities. Operators are required to maintain a permit and comply with regulations. This is overseen by an environmental regulator, who has the power to issue fines, prosecute or terminate operations at an installation.
- White certificates and green certificates are overseen by the energy market regulator and enforced by conditions that are contained in the supply licences of obligated entities. The regulator has the power to issue fines and, ultimately, withdraw an energy company's supply licence. This experience, however, is less relevant for energy savings measures in which the consumer is the obligated entity.

1.6 Preliminary recommendations for China

Rationale for co-existence of targets

China is a developing country. Energy conservation is one of the highest priorities for the government, as it contributes to energy security, resource conservation, environmental sustainability, energy affordability, green growth, and competitiveness objectives. Similarly,

the main driver for RE policy in China is to build a world class RE manufacturing industry, improve energy security, and diversity energy mix to address the severe local air pollution. Therefore, the EE and RE targets are warranted and should continue.

Chinese government is committed to climate change mitigation, and set carbon intensity reduction target. In China, more than 85% of the carbon emissions come from the energy sector. Achieving the EE and RE target will lead to achievement of the carbon intensity reduction target.

However, despite a dramatic decline in carbon intensity in China over the past decade, carbon emissions more than doubled during the same time period. China is now the largest GHG emitter in the world. Therefore, it is important for China to shift from an intensity reduction target for energy and carbon emissions to total absolute energy cap and carbon emission target, whenever the political economy can accept this.

Rationale for co-existence of EE, RE, and carbon policy instruments and trading schemes

The adoption of policy measures in China should be on the basis of the overall policy objectives, and hence the targets. This may mean that multiple complimentary policies are required. For instance, carbon trading will encourage some energy efficiency improvements and fuel switching, but it alone will not lead to achieving EE, RE, and carbon targets.

The government intends to increase the use of market-based mechanisms during the 12th FYP to achieve its energy intensity reduction targets cost effectively. Currently, reaching the 12th FYP energy intensity target is running into significant obstacles – some of the targeted priority enterprises could not meet their energy saving targets and some of the provinces fear that the total energy consumption cap puts a drag on their economic growth. Some enterprises or regions (e.g. Eastern provinces) have limited energy saving potentials, and it can be difficult and costly for them to achieve their allocated targets; while other enterprises or regions (e.g. Northeast and Western provinces) have large energy saving potentials, could exceed their allocated targets, but need extra incentives for them to do so.

The stakeholders consulted during the study recognized that the key conditions for EE trading are relatively mature in China today, with the mandatory energy conservation targets at the national level and allocated to each province and 10,000 priority enterprises, the envisioned total energy consumption cap, Energy Conservation Law as a legal basis, 26 accredited 3rd party verifiers, mandatory energy reporting by the key priority enterprises, pilot on-line monitoring platform for energy savings MRV, and more than 2000 ESCOs to undertake energy conservation -- all contributing to the readiness of an EE trading in China.

Perhaps a phased approach is appropriate for China, sequencing of EE, RE, and carbon trading based on the criteria, for example, if the EE trading conditions are relatively mature, EE trading could be implemented during the 12th or 13th Five-Year Plan, while carbon trading may start after 2020, and integration of domestic carbon market with international market after 2030.

Coordination of EE, RE, and carbon trading schemes

In China, the EE program and obligations have been focusing on large energy-consuming industries, rather than electricity distribution utilities in Europe and the US States. Therefore, by default, the potential EE trading scheme would have overlaps with the ETS for the same obliged parties in the same sector, and for the same energy, including both primary energy and electricity consumption. There is no international precedent for such cases, at least not in the countries and systems reviewed under this study. This would not only run a risk for the

same obliged parties to double counting and double dipping, but also create a distorted incentive in favor of energy saving compared with carbon reduction (fuel switching).

In addition, unlike most of the developed countries with liberal power market, China's power sector does not allow cost pass-through to consumers, given the tightly regulated tariff. There also lacks legal basis for non-compliance penalty, and MRV system in China. Finally, there is no separation of policy making functions from regulation functions in China, and no an overarching coordination policy making body like in the UK to coordinate the targets and policies for EE, RE, and carbon emissions. Therefore, the coordination between ETS and EE trading schemes in China would need additional research and studies.

Further consideration should also be given to ways to avoid this overlap of energy. One option would be not to include electricity consumption in carbon trading systems, but to include it in the Energy Saving Certificate Trading systems. In this respect the UK example of CCAs is most relevant.

Other options for avoiding overlap of the same obliged parties should also be examined, including piloting EE trading in selected provinces or cities that are not covered by the ETS pilots. This approach would address the concerns regarding overlapping coverage of the two sets of systems and reduce complexity at pilot stage.

Overall, this study has highlighted many issues related to target setting and policy development to achieve multiple energy/environment policy objectives simultaneously. Detailed further work is necessary to apply the principles highlighted in this report in the development of energy saving, carbon trading and renewable certificate trading systems in China.

2 Introduction

2.1 Background

In support of its policy-development the Chinese Government is looking to international experience with energy saving certificate trading, and its interactions with other policies, to provide recommendations that are applicable in the national context. The purpose of this study is to review international experience/best practices and provide those recommendations. It contributes to the World bank ESMAP funded technical assistance to compliment a GEF project to establish energy savings monitoring and verification systems in China.

This final report provides an insight into the 4 countries carbon trading schemes, which Ricardo AEA and Ea Energy Analyses have conducted on behalf of the World Bank and makes preliminary recommendations for further work to support policy development in this area in China. It has been carried out by Ricardo-AEA as consortium lead together with EA Energy Analyses, the Institute of Policy and Management, Chinese Academy of Sciences (IPM CAS) and Beijing ZFK Energy Technology.

2.2 Introduction to International Review

Individual national reviews have been conducted by four specialists. The aim of the national review is to understand why there are different certificate trading schemes within one system, so to answer the question of whether one scheme would operate more effectively. Initially design elements of the trading schemes were considered a priority however the focus of this report is to understand the rationale, conflicts and synergies between the schemes within a single system. For this reason the analysis includes interviews with policy makers alongside research conducted by the specialists. In doing this, we aim to provide a unique understanding of the co-existence of schemes.

For the UK, Italy, California and India, this analysis has been done to cover comparable schemes in each of the countries, covering; energy efficiency, renewable energy and carbon 'cap and trade' trading schemes. As certain EU policies apply to both the UK and Italy, a brief review of EU legislation is presented prior to the national review. The analysis of the country trading systems are standardised with each providing conclusive comparisons regarding consistency, harmonisation, interaction and coordination of co-existing trading systems.

A summary of the international findings is found in Section 8 and preliminary recommendations in Section 9.

3 Europe

Since the early 1990s the EU has implemented legislation related to emissions, for example Decision 93/389/EC detailed a requirement for member states to report emissions and Decision 93/12/EC provided restrictions on the fuel that may be used in vehicles to limit emissions. The 1998 Kyoto Protocol, obliging the EU to reduce emissions by 12% by 2012 to a 1990 baseline, resulted in a large number of directives relating specifically to energy efficiency, renewable energy and carbon emissions and subsequent trading, to be introduced:

- **Renewable energy**: Directive 2001/77/EC[2] on the promotion of electricity produced from renewable energy sources in the internal electricity market obligates member states to; produce periodic reports relating to renewable energy, have assessments of their approach to subsidising schemes as well as alleviate barriers to implementing schemes (planning applications and access to grid connections). Directive 2009/28/EC[3] on the promotion of the use of energy from renewable sources, repealing previous directives, provides detail on member state requirements to meet renewable energy targets; mandatory national targets, an energy action plan and MRV systems for measuring renewable energy produced and distributed.
- **Energy efficiency**: Directive 2001/91/EC on the energy performance of buildings; sets minimum requirements for the energy performance of all new buildings and existing large buildings subject to major renovation and provides for energy certification of all buildings. Directive 2006/32/EC[4] on energy end-use efficiency and energy services, sets a 9% energy efficiency target by 2015 for member states; obliges them to incentivise suppliers of gas or electricity, imposes mechanisms to monitor these improvements and provides for legislation to limit the cost benefit associated with bulk energy purchase. Directive 2012/27/EU[5] on energy efficiency amends Directives 2009/125/EC and 2010/30/EU and repeals Directives 2004/8/EC and 2006/32/EC, it legislates that member states must produce a national energy efficiency target, incentivise building renovation and must impose monitoring mechanisms to allow for accurate reporting to the European Commission.
- **Emissions Trading:** Directive 2003/87/EC[6] named the EU Emissions Trading Scheme Directive provided the framework for the EU ETS setting methods for emissions trading, guidelines for mandatory participation as well as background on design elements to the scheme; monitoring reporting and verification (MRV), allocation and penalties. Directive 2009/29/EC repeals the 2003/87/EC directive as well as many amendments to the EU ETS by changing the method by which tradable units are allocated as well as expanding the scope of the EU ETS.[7]

Under these directives Italy and the United Kingdom are obliged to improve energy efficiency, promote renewable energy and participate in the EU emissions trading schemes. The scope of this study is to review trading systems. Italy and the UK have used national certificate trading systems to incentivise both energy efficiency and renewable energy. It is not an obligation under EU law to use certificate trading schemes, these will be explored in more depth in the country specific sections.

[2] Please see Directive 2001/77/EC at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2001:283:0033:0040:EN:PDF
[3] Directive 2009/28/EC may be found at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=Oj:L:2009:140:0016:0062:en:PDF
[4] Directive 2006/32/EC may be found at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0064:0064:en:pdf
[5] Directive 2012/27/EU may be found at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:EN:PDF
[6] Directive 2003/87/EC may be found at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:EN:PDF
[7] Details of other Directives may be found at http://ec.europa.eu/clima/policies/ets/documentation_en.htm

The EU ETS legislates that specific industries with installations above a certain output are obliged to reduce their emissions to national targets. Burden sharing allows Member State national targets to be variable, but cumulatively result in a 12% reduction in emission by 2012 to a 1990 baseline. The revision of the EU ETS stipulates a 21.45% emission to a 2005 baseline by 2020 using a benchmarking method of allocation. As the third phase of the EU ETS is just beginning, this section will focus on Phase II of the EU ETS (2007 – 2012). During this period both Italy and the UK were provided with different caps as part of the burden sharing mechanism implemented by the EU ETS; targets and results are different and will be detailed in the national analysis.

Further details about the Energy Efficiency Directive have also been researched as part of this report as there are quite clear guidelines from the EC over methods of deploying energy efficiency policy. These are relevant to the analysis and rationale related to the country analysis therefore will be included as part of this section.

As we have had access to experts, who have contributed to the policy making in Europe, this section will also detail some of the rationale for implementing multiple directives, which result in carbon reduction.

3.1 EU ETS

The EU Emissions Trading Scheme has operated, to date, in three phases: Phase 1; 2005 – 2007, Phase 2; 2008 – 2012, Phase Three; 2013 - 2020. Phase 1 was a pilot period of 'learning by doing' aimed at providing experience to the main industries as well as competent authorities of how to best manage the scheme. For Phase 1 and 2 each country in the EU had to construct its own National Allocation Plan (NAP), which had to detail the required reduction in emissions over the period, from a 1990 baseline to individual Members States targets'. The preamble of the EU ETS directive[8] details that the directive allows for other mechanisms to be used in Member States; '[the Directive] should not prevent any member state from maintaining or establishing national trading schemes other than those included in the Community scheme'; 'member states may consider the implication of regulatory, fiscal or other policies that pursue the same objectives [of emission allowance trading]'. Through Article 24 of the EU ETS[9] Member States may apply emission allowance trading to activities, installations and greenhouse gases which are not listed in Annex 1'. The legislation allowed a great degree of flexibility for Member State, because of the way the National Allocation Plans operated.

It is extremely difficult to assess the emissions reduction that has resulted from the EU ETS alone, due its interaction with policies, economics and climatic conditions. In Phase 2 the economic downturn in Europe, pushed the price of carbon down, and as business as usual projections in NAPs did not factor in the economic downturn, there was an abundance of units; therefore the carbon price fell. Evidence from interviews and literature shows policies also contribute significantly to the carbon reductions projected in NAPs.

In Phase 2, the economic decline in Europe resulted in a dramatic fall in the price of units arguably resulting in little emission reductions as business as usual predictions were inaccurate. Equally, there is evidence to suggest that during 2011 there was a reduction of emissions and a high level of compliance (<99%) whilst the economy grew.[9] An analysis of the price of units during the period will help inform the analysis of both the United Kingdom and Italy therefore this will be included in this section.

[8] Accessible from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:EN:PDF
[9] Europa Reference IP/12/477 Emissions Trading: annual compliance round-up shows declining emissions in 2011. Available from http://europa.eu/rapid/press-release_IP-12-477_en.htm

Table 3-1 Summary of the EU ETS

Element	Detail
Sector with Target	Large Industry and Carbon Intensive Energy Production
Sector with Emission Reductions	Large Industry and Carbon Intensive Energy Production
Eligible Traders	Company registered on the national registry
Emissions	CO_2 and NO
Scope (% of emission)	45% of emissions
Method to deliver scheme	Financial burden imposed by cap for every tCO_2 emitted
Verification of Compliance	100% 3rd party verification
Non-compliance regime	€100 Euro penalty for every tCO_2e above cap

3.1.1 Scope and Coverage

Member States are obliged to provide a list of the installations falling under the criteria listed in the EU ETS Directive as well as any other installation they wish to include. Phase 2 included CO_2 and nitrogen oxide emissions. Participation is mandatory for high-emitting installations in the power and heat generation industry and selected energy-intensive industrial sectors with a certain level of output:

- Energy activities (combustion installation with thermal output exceeding 20MW mineral oil refineries, coke ovens).
- Production or processing of ferrous metals (metal ore processing, production of pig iron or steel with capacity exceeding 2.5 tonnes per hour).
- Mineral industry; (cement (>500t/day), lime (>50t/day), other minerals (>50t/day), glass (>20t/day).
- Ceramics including bricks, tiles, stoneware or porcelain (75t/day or kiln capacity >4m^3).
- Other activities (pulp from timber, paper and board (>20t/day)).

The criteria for mandatory participation covers over 1,200 power plants and manufacturing installations totalling around 45% of total CO_2 emissions in Europe.

3.1.2 Targets

The European target was set at a 12% reduction by 2012 to a 1990 baseline, with each country having its own target according to its' level of development and quantity of emissions. Decision 93/389/EC, which required Members States to report on annual emissions, provided a basis of setting the 1990 baseline. This was later improved upon to detail the quantity of emissions for each country.[10] For Phase 3 a 2005 baseline was decided upon as actual emissions reported via Phase 1 of the EU ETS provided a more accurate level of emissions.

Each Member State may choose its path to the emissions reductions via a National Allocation Plan (NAP), which needs European Commission ascent. The guidance allows for Member States to have a degree of flexibility over how the NAPs allocated the European Union Allowances (EUAs) (representing tCO_2e) to installations; however allocation has to be non-discriminatory between companies or sectors. The path to the percentage reductions may also be chosen through the NAP, however reasons for not following the straight line to

[10] Commission Decision 2006/944/EC determining the respective emission levels allocated to the Community and each of its Member States under the Kyoto Protocol pursuance to Council Decision 2002/358/EC. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:358:0087:0089:EN:PDF

the Kyoto commitments had to be justified by certain criteria; requirements of development, potential to reduce emissions, cost effective investment and consistency with other legislation.

3.1.3 Monitoring, Reporting and Verification

The EU ETS requires installations to provide an annual report to their national regulator in a particular format. This document must:

- State activities.
- Determine and document sources of emissions.
- Provide source specific emission data and subsequent calculation.
- Record dates of testing and calibration of monitoring equipment.
- Provide quantities of fuels used and materials used in each source.
- Determine the level of uncertainty in the monitoring equipment and basis of calculations.

Detail is provided via legislation of methods used to calculate and report emissions. Specific detail is provided concerning:

- Combined heat and power stations; a different calculation may be used to factor in that fuel used produces electricity and heat.
- Renewable energy devices; fuel bought from this source is carbon neutral.
- Waste incineration; an emissions factor to be used across all waste.

An independent party (e.g. Environmental Consultancy) approved by the national competent authority (e.g. Department of Food and Rural Affairs), conducts an annual verification of an installations' emissions. This is carried out firstly through a desk based review of the report to be provided to the competent authority; including calculations and records used to calculate emissions. The independent party then conducts a site visit to review methods used. Lack of compliance would result in calculations being performed again and the verification process to be repeated. Once verification is complete the report is passed to the competent authority.[11]

3.1.4 Institutional Arrangements

In Phase II of the EU ETS each country held its own registry. A registry allows for an individual to hold a registry account; this account holds only units, and the registry only assists with the transfer of units not money. Any transfer of finance for units is done independently of the registry.

Any individual could hold an account in a registry, with those with a participating installation being given an account automatically. Individuals without a participating installation would predominantly be carbon traders. Each country would be provided EUAs equivalent to their cap, whereby they would issue or auctions EUAs to installations. Individuals then may trade with other participants of the EU ETS. At the end of each year the central European registry would conduct an accounting exercise to see that sufficient units were surrendered against caps within country and for each installation.[12]

Within Phase II of the EU ETS a unit issued in the previous year may be used for compliance in the present year, resulting in the use of banking. It was also possible for a unit from the forthcoming year to be borrowed for compliance in the present year. Although borrowing meant an installation may exceed its cap in the present year, the emissions excess from the present year would be removed from the installations cap in the forthcoming year, resulting in

[11] Commision Decision NO 280/2004/EC concerning the mechanism for monitoring Community Greenhouse gas emissions and for implementing the Kyoto Protocol. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:055:0057:0057:EN:PDF

[12] Within Phase 3 there is no country specific registry only a central European registry which allocates or auctions units to all individuals with installations. An individual without a participating installation may still own a registry in Phase 3.

good provision being made for the emissions caps. If installations did not have sufficient units to surrender in order to meet their cap, for each tCO_2 over the cap they would have to pay €100.

3.1.5 Price of carbon credits

Figure 3-1 shows the price of carbon during the EU ETS has fluctuated dramatically. Reasons for this occurring are multiple but are mainly caused by an abundance of units in the system pushing down price, examples of how this occurs is as follows:

- The economy (accounting for the fall in price at the end of 2008); whereby business as usual projections are inaccurate resulting in an over allocation of units.
- The impact 'hot air' whereby 1990 baseline emissions are above current emissions resulting in over allocation.
- Inaccurate 1990 baselines being used to set caps resulted in many countries having an over allocation of units.
- The impact of banking and borrowing during the scheme combined with the above, allowing for over allocation to be used in the other compliance years.

Figure 3-1 Price of EUAs during Phase II and III of the EU ETS[13]

Much of this 'price elasticity' has resulted in policy makers questioning the environmental benefits of the EU ETS. Policy makers interviewed said '*The direct price impact of the CO2 quota system to the end user is weak. The demand is in-elastic and a number of barriers reduces the impact.' 'The current ETS has collapsed.'*

When another policy maker was questioned about the cost of carbon being lower than the cost of abatement, resulting in little carbon abatement, his answer was as follows: '*The EU ETS guarantees a 21% reduction in emissions in 2020 from 2005 levels (a product of the cap) but obviously the recession will deliver much of this. There is evidence of ETS in its early phases driving behaviour change and emissions reduction. The benefit of the EU ETS is that it uses one set of rules for everyone in the EU allowing for a level playing field, whilst reducing emissions.*'[14]

Evidence indicates that the cost of carbon, through the EU ETS, is not impacting behavioural change, providing rationale for the implementation of other measures.

3.2 EU Energy Efficiency Directive

The EED introduces legally binding measures for each Member States to increase energy efficiency. Measures include the legal obligation to establish an energy efficiency obligation

[13] Source: Thomason Reuters Point Carbon
[14] Interview with Niall McKenzie, Department of Energy and Climate Change, UK.

(EEO), described in EED Article 7, or system or a specified set of alternative policy measures. The goal is to drive forward energy efficiency improvements in household, business, industry and transport sectors. The following text focuses on EED Article 7.

Table 3-2 Summary of the EU Energy Efficiency Directive

Element	Detail
Sector with Target	Energy distributors and/or retail energy sales companies, may include transport fuel distributors or retailers.
Sector with Energy Savings	All final energy use sectors can be targeted, transport may be excluded.
Energy Savings	Energy savings at energy "end-use", no limitations which final energy use sectors are to be targeted.
Target	Cumulative end-use energy savings target by ultimo 2020 of minimum 1,5 % of the annual energy sales to final customers averaged for 2010- 2012. Permitted exemptions may not reduce this target by more than 25%.
Method to deliver scheme	Designated obligated parties.
Verification of Compliance	3rd party verification of a statistically significant proportion and representative sample.
Non-compliance regime	Not specified in the EED, at Member States discretion.
Eligible Traders	Not specified in the EED, at Member States discretion.

3.2.1 Scope and Coverage

The directive requires each Member State to set up an energy efficiency obligation scheme in order to achieve a cumulative end-use energy savings target by 31 December 2020. There are no limitations to Member States as to which final energy use sectors are to be targeted. This includes also the transport sector and ETS industries even if their energy use has been excluded from the calculation of overall amount of energy savings as described in paragraph 3.2.2.

All final energy that is purchased by a natural or legal person is covered by the scheme. This includes both grid-bound (e.g. electricity, natural gas) and off-grid energy (e.g. heating oil, biomass for heating).

Member States may also allow that a limited amount of 'supply side' energy savings from energy transformation, distribution and transmission sectors, including efficient district heating and cooling infrastructure, is counted towards the target.

The obligated parties should be designated amongst the energy distributors and/or retail energy sales companies operating in the country and may include transport fuel distributors or transport fuel retailers operating in the country. The obligation, should not however be imposed on small energy distributors, small retail energy sales companies and small energy sectors to avoid disproportionate administrative burdens.

3.2.2 Targets

The EED stipulates that the EEO must advise a cumulative end-use energy savings target by 2020 at least equivalent to achieving new savings each year from 1 January 2014 to 31 December 2020 of 1.5 % of the annual energy sales to final customers of all energy distributors or all retail energy sales companies by volume, averaged for 2010, 2011 and 2012. Permitted exemptions may not reduce this target by more than 25%.

Energy used in the transport sector and industrial activities covered by the EU ETS may be partially or fully excluded from the target. The calculation of energy savings should take into account the lifetime of the savings and it is possible to count savings obtained in a given year as if instead obtained in any of the two previous or three following years. Further, savings in transformation, transmission and distribution may be included in the reported savings.

Each Member State can decide itself how to spread the effort needed to achieve the overall amount of savings over the seven-year obligation period. Allocation of targets amongst the obligated parties, and weather this is done sector wide or corporate wide, are also left to the discretion of the Member States.

3.2.3 Monitoring, Reporting and Verification

According to the EED the energy savings achieved by each obligated party, or each sub-category of obligated party, shall be published once a year. The EED emphasises that a measurement, control and verification system must be put into place to ensure that at least a statistically significant proportion and representative sample of the energy efficiency improvement measures put in place by the obligated parties is verified. Furthermore, this verification must be conducted independently of the obligated parties.

3.2.4 Institutional Arrangements

The EEO design may permit obligated parties to include certified energy savings achieved by energy service providers or other third parties in their reported energy savings. The EEO design must ensure that an approval process is in place which is clear, transparent and open to all market actors, and which aims at minimising the costs of certification.

As such the EED allows for the directive to be implemented as a white certificate scheme, where energy savings are traded on the basis of certificates. However, the EED does not make such trading obligatory. Design of potential trading platforms and trading mechanisms are left to the Member States discretion.

3.3 Rationale, Conflict and Synergies of Directives

Interviews as documented in Table 3-3 provide an overview of why multiple directives were introduced:

- The energy efficiency directive provided a social welfare and energy security benefit.
- The price elasticity of carbon on the EU ETS means other directives need to be introduced to drive carbon reduction.
- A carbon trading system would not be enough to result in the deployment of renewable energy as the price of renewable energy is higher than that of energy efficiency.

Table 3-3 Extracts from Interviews with European Directive Specialists[15]

- *'Energy policy has more goals than CO2. Security of supply and economy is also central (including less vulnerability towards price fluctuations)' 'Energy efficiency can help improving the security of supply (including fuel dependency of unstable countries)'*
- *'A CO2 trading system (like ETS) will increase the end users' energy price, but will not lead to realisation of all profitable energy efficiency projects. A number of barriers and market failures prevent this from happening. In practise the price elasticity is low. This is part of the reasons for setting separate energy efficiency goals.'*
- *'In theory a CO2 quota system would optimal, if the only goal was CO2.'*
- *'Renewable energy is the critical part. Renewable energy tends to be expensive. So overlapping goals makes renewable energy the most critical part. Energy efficiency – on the other hand – is generally very cheap.'*

[15] Further details of those interviewed is currently undisclosed. If agreement is provided by the policy maker (still awaiting), this will be included in the final report.

4 United Kingdom

4.1 Summary of Trading Systems

The United Kingdom has introduced many carbon reduction policies since 2001, and has imposed measures for energy efficiency since the late 1990s. These policies have covered different sectors with a variety of methods, and have contributed to the UK achieving over a 20% reduction greenhouse gas emission to 2012, from a 1990 baseline. A summary of some of the policies, relevant to this study, is as follows:

- **Energy efficiency in homes:** From 2002 under the Energy Efficiency Commitment (EEC) electricity and gas suppliers were required to make savings in energy supply to meet a specific target. EEC operated in two phases and was replaced in a further evolution by the Carbon Emissions Reduction Target in 2008. Under CERT the targets were expressed in units of carbon dioxide saved. In 2012 CERT was replaced by the Green Deal, which included an element in which energy suppliers are required to make savings for less well-off households (the Energy Company Obligation). See Box 1 below.
- **Carbon Taxation and Trading for Companies:** In 2001 the UK introduced the Climate Change Levy (CCL), which taxed any company consuming (not producing) coal, gas or electricity, charged at a fuel-specific rate expressed per unit of energy (kWh). Energy intensive industries could apply for a 65% reduction in the CCL if they agreed to a percentage reduction in energy or carbon. These agreements were known as Climate Change Agreements (CCAs). In addition to this the UK initiated its own emissions trading scheme in 2002 (see UK ETS below). This covered certain industrial installations and also permitted CCA participants to trade their obligations[16], by agreeing this with the regulator.
- **Carbon Trading for industry and Energy Producers:** Energy intensive industry could voluntarily participate in the UK ETS from 2002, however they were obliged to participate in the EU ETS (described below) from 2005 and UK ETS ceased in 2007.
- **Renewable Energy:** The UK implemented the Renewable Obligation (RO) in 2002 to incentivise deployment of larger scale renewable electricity generation and to meet European directives of promoting the use of Renewable Energy. The RO will eventually be replaced by a feed-in Tariff system (see box 3)

The UK analysis covers the CERT, RO and EU ETS schemes, as these are more mature systems, have coexisted and (apart from CERT which has recently been replaced) are current. CCAs are considered for some of the overview analysis because they represent a situation where the same energy is regulated by an emission trading system (EU ETS) and an energy reduction policy (CCAs). Table 4-1 provides a summary of the UK trading systems reviewed in this report.

[16] The scheme was mainly set up for energy producers; they were incentivised to participant and were known as Direct Participants. Direct Participants joined the EU ETS in the 2006.

Table 4-1 UK Trading Schemes

Element	CERT	RO	EU ETS
Year Scheme Introduced	2002 (Energy Efficiency Commitment) 2008 (CERT)	2002	2005 (Phase 1) 2008 – 2012 (Phase 2)
Period reviewing	2008 – 2012	2011-12	2008 - 2012
Ambition	Reduce energy use in households.	Market based mechanism promoting renewable energy.	Market based mechanism promoting carbon reductions from big industry, manufacture and energy production.
Sector with Target	Gas, Electric, Coal, LPG and oil domestic suppliers with over 50,000 customers (moved to 250,000 in Dec 2011).	Electricity Suppliers	Large Industry and Carbon Intensive Energy Production
Sector with Carbon Emission Reductions	Households	All electricity Users	Large Industry and Carbon Intensive Energy Production
Coverage (% of total country emissions)	Up to 47% of emissions[17]	Up to 35% of emissions[18]	52% of emissions[19]
Scheme operator/ Regulator	Office of Gas and Electricity Markets (Ofgem)	Office of Gas and Electricity Markets (Ofgem)	Environment Agency
Method to target setting	% reduction of overall tCO_2e target according the number of households supplied.	% supply of electricity from renewables	Financial incentive arising from carbon price as a result of cap imposed at scheme level. Price applies for every tCO_2e emitted
Verification of Compliance	Random audit	Transparent electricity market allow for verification to occur immediately.	100% 3rd party verification
Non-compliance regime	May be fined up to 10% of annual turn-over of the electricity supplier.	Penalty per unit not from Renewables, currently £40.71 per MW/hr.	€100 Euro penalty for every tCO_2e above cap.
Target	293 million lifetime tonnes of CO_2e ($MLtCO_2e$)	Set by the number of ROCs per MW/h. 2011/12 period was set at 0.124 ROCs per MW/h.	29.6 $MtCO_2e$ per annum[20]
Achieved	241.8 $MLtCO_2e$ (Circa 48.36 $MLtCO_2e$ per annum)	15.1$MtCO_2e$[21] 2011/12	29.6 $MtCO_2e$ per annum
Estimated Cost	£2.3 billion	£1.45 billion	Unknown

[17] A calculation is made up of the total energy supply and residential carbon emission divided by the total emission. The source used is the DECC Statistical Release of the 2011 UK Greenhouse Gas Emissions, Final Figures. (available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/180823/ghg_national_statistics_release_2011_final_results.pdf).
[18] A calculation of the total energy supply divided by the total emissions for 2011.
[19] DEFRA. UK Approved Phase II National Allocation Plan 2008 – 2012. (2007). http://webarchive.nationalarchives.gov.uk/20121025080026/http://decc.gov.uk/assets/decc/what%20we%20do/global%20climate%20change%20and%20energy/tackling%20climate%20change/emissions%20trading/eu_ets/euets_phase_2/phase_2_nap/nap-phase2.pdf
[20] The UK projected a 29.6 $MtCO_2$ below a business as usual scenario (see Phase 2 National Allocation Plan, para 1.32), taking into consideration other policies implemented. It is assumed this was achieved through burden sharing mechanisms.
[21] This is an estimated figure provided by Ofgem.

4.1.1 Scope and Coverage

As seen in Table 4-1 the RO and CERT have some overlap; both obligate the supplier of energy to meet obligations by trading certificates. However, the supplier of certificates comes from different sectors; in CERT this is from energy efficiency measure, RO this is from renewable energy suppliers. The cross-over between CERT and RO with the EU ETS is as follows; electricity producers are obligated to reduce carbon via the EU ETS, which electricity suppliers (obligated by CERT and RO) purchase. The following gives a more thorough description of the sectors covered by each scheme:

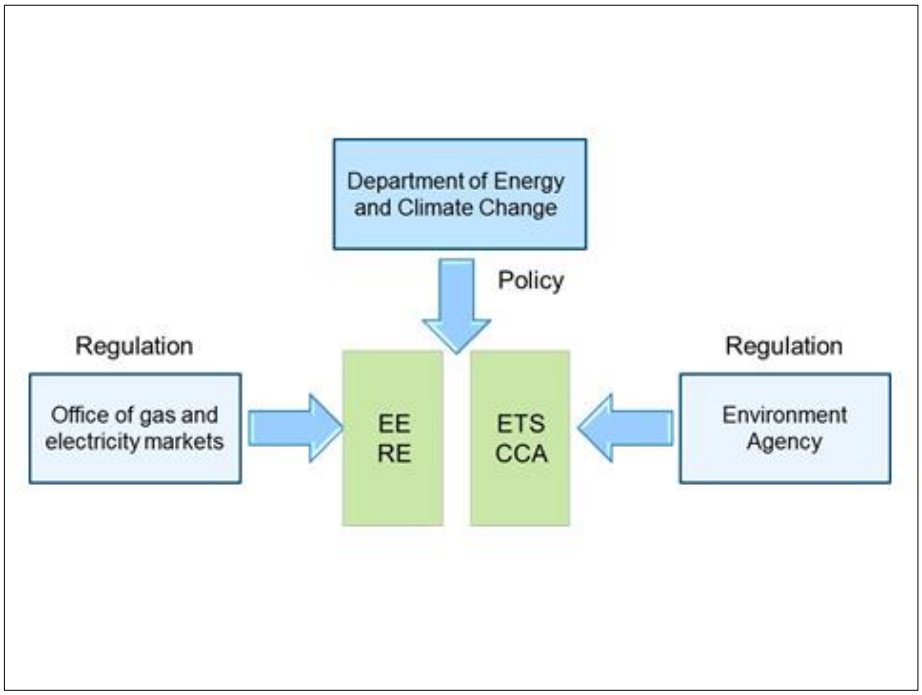
- EU ETS: As covered in section 3.1.1.
- RO: The obligation is on suppliers and is expressed as a renewables target in relation to overall level of supply. This is in MWh or ROCs. Suppliers must either acquire ROCs to meet their obligation or pay a buyout, or a mixture. The total buyout payments are recycled to those that surrendered ROCs, on a pro-rata basis. ROCS are created by being awarded to eligible renewable electricity generators in relation to the amount generated, with more expensive technologies, or those less established, receiving more ROCs/MWh than cheaper more established ones. Suppliers with an obligation acquire ROCs from generators either bilaterally or though other platforms such as privately run auctions. The Office of Gas and Electricity Markets (Ofgem) regulates the scheme by monitoring the amount of electricity sold by suppliers against the number of certificates provided for compliance each year. Accreditation of renewable schemes is done at the point of grid connection, which is regulated by Ofgem. Random audits are also conducted on renewable energy schemes benefiting from certificate trading.
- CERT: Energy suppliers who supply over 250,000 households are obliged to participate in CERT. There are 6 companies who met this criterion during the CERT period. The criterion for mandatory participation has changed during the scheme due to the small number of electricity suppliers in Britain and the cost of compliance for small companies.[22] Ofgem issues annual targets. Energy suppliers must have sold less energy per household, with evidence of this being due to the deployment of energy efficiency measures. Ofgem conduct random audits of the energy efficiency measures deployed by energy suppliers.

Ofgem manages all energy supplier obligations; therefore the CERT and RO are managed by Ofgem. These schemes are enforced through energy generation and supply licences, which are regulated by Ofgem. As electricity supply is monitored centrally the schemes are managed easily, without significant reporting mechanisms.

In the UK example below, the Department of Energy and Climate Change sets energy policy. The EE and RE measures that place obligations on energy suppliers are regulated by the Office of Gas and Electricity Markets (in England, Scotland and Wales), which also regulates other aspects of these energy suppliers' activities. The primarily industrial ETS and Climate Change Agreement systems, targeting energy consumers/GHG emitters, are regulated by the Environment Agency (in England), which has responsibilities for environmental protection. The regulators are appropriate to the type of regulated entity, and responsibilities for policymaking and implementation are clearly defined and separated.

[22] See interview with Anonymous Policy Maker. (Refer Appendix)

Figure 1-2 UK Institutional arrangements



4.1.2 Targets and Penalties

Each scheme's target had been designed so to contribute effectively to the 12.5% reduction in emissions from a 1990 baseline by 2012. The cost of carbon abatement and other political benefits are also considered in target setting for each scheme.

Methods of determining targets for CERT and RO were standardised for mandatory participants of each scheme. For each of these schemes a calculation determines the target for each participant. The CERT targets are set by using the amount of energy an electricity or gas company sells per annum divided by the total energy sold multiplied by the overall carbon reduction target. The 2011/12 target for the Renewable Obligation was 0.124 ROCs per MW/h sold, which is the same for each electricity supplier. This targets means that if one ROC was acquired for each MW/h sold by an electricity supplier then 12.4% of electricity supplied by that supplier would come from renewable energy. In practice many renewable energy sources are awarded more than 1 ROC per MW/h.

The EU ETS is more complex in the UK. In Phase 2 the National Allocation Plan (NAP) projects a business as usual emissions scenario, which includes the effects of other carbon reduction policies and strategies, in order to determine the overall cap on emissions. The method of calculating allocation to each industry is conducted in the same way, with installations, within that industry, receiving proportionate allowances (EUAs). Only the EU ETS allows for banking or borrowing of credits. None of the schemes reviewed either have a price floor or price ceiling per-say; however the RO does have a buyout option per MW/h, resulting in an effective price ceiling for the ROC.

CERT and the EU ETS have penalties for non-compliance. The EU ETS provides a more rigid structure to penalties, by providing a fixed fee per unit of carbon. The CERT scheme has a potentially extremely high penalty for non- compliance of 10% of annual turn-over of the electricity supplier; however no company has been issued with a full penalty even though some marginally missed their annual targets. Since there are only a few electricity companies Ofgem can easily manage communication with each to ensure near compliance.

Trading in order to gain compliance is also very different in the schemes reviewed. The EU ETS has multiple trading platforms for the financial exchange of units, however used country registries with registry accounts to allow for exchange of units[23]. When units are exchanged between countries the central European Transaction Log would log the exchange. Each year the central European registry accounted for all the units issued and surrendered for compliance Europe wide. ROCs are traded between renewable energy producers and electricity suppliers primarily, but then may be traded between electricity suppliers using traders. CERT allows for energy companies to take on other energy companies' obligations by agreement with Ofgem, not requiring a platform for exchange. There was limited exchange of obligations between companies during the scheme (not more than 5% of total obligations).

4.1.3 Complimentary Mechanisms

The UK and the EU have a large amount of legislation which covers the carbon reduction. One scheme which distinctly crosses over with the Renewable Obligation is the feed-in-tariff system, which provides subsidy for schemes below RO thresholds for support. Recently the Renewable Heat Obligation has been introduced in the UK to support the production of domestic heat from renewable sources, which compliments CERT.

The UK has a variety of schemes to promote energy efficiency and carbon reduction in companies. The carbon reduction commitment (CRC) is a tax for large companies using over 6,000 MW/h, half hourly electricity, per year. The Climate Change Levy (CCL) is another scheme for smaller companies, which results in a tax being placed on electricity used by the company. Climate Change Agreements (CCAs) allow companies who are obligated under the CCL to gain a significant reduction on their CCL. CCAs are established through companies providing a report of projecting emissions, helping establish a business as usual projection. CCAs result in companies agreeing to individual plans of carbon reduction; if they do not meet their target they are obligated to purchase certificates or carbon offsets. The Climate Change Act 2008, from 2013 obligates listed companies to report their scope 1 carbon emissions, making carbon use a public figure.

4.2 The Rationale for Co-Existence

The rationale collected via literature shows that all schemes have been introduced to make a contribution to the UK's legally binding target under the Kyoto Protocol (1998) and the Climate Act (2008). Interviews with policy-makers shows the main rationale for introducing different schemes are that they incentivise different sectors and methods of carbon reduction, whilst CERT also helps with issues such as fuel poverty. Box 1 shows the history of the introduction of White Certificate Schemes.

[23] From 2013, this system has been replaced by a Union Registry, which issues all EUAs and conducts compliance.

Box 1: The evolution of white certificate trading in the UK

The UK introduced an energy saving obligation system in 2002, called the Energy Efficiency Commitment (EEC). EEC required electricity and gas suppliers with more than 15,000 domestic customers to achieve energy saving targets. Savings were calculated from eligible measures, which in part had to be implemented for poorer households. The second phase started in 2005, in which the threshold for obligated suppliers was raised to 50,000 customers and the target was raised. In 2008 the next phase began and the system was renamed the Carbon Emission Reduction Target (CERT). This involved the refinement of eligible measures and the conversion of the target into units of carbon saved, which was also increased over earlier years. CERT has now been superseded by the Energy Company Obligation (ECO). Common to all systems is that obligations are placed on energy suppliers, they are overseen by the energy markets regulator, the targets are set in relation to historic energy supplied and that they focus on the domestic sector. Savings could be traded with other obligated suppliers.

In 2001, shortly before the introduction of EEC, the UK introduced the Climate Change Agreements (CCAs) energy saving system (see Box 2 below). CCAs differ from EEC/CERT in that it covers energy intensive industry and places the obligation on the energy consumer, not the energy supplier.

The EU Emissions Trading System (EU ETS) was introduced in 2005 and superseded the domestic UK Emissions Trading System. EU ETS covers the emissions associated with direct energy use and industrial processes. It interacts with EEC/CERT and CCAs to the extent that it covers electricity generation and these other systems include electricity consumption.

EU ETS emissions are reduced as a result of the policies of RO and CERT, and have generally been taken into account when setting the EU ETS cap. Policy makers interviewed highlight that the cost of carbon abatement is considered in decisions that are made. Evidence suggests most energy efficiency measures are less expensive than deploying renewable energy, whilst the EU ETS is also expected to be more cost efficient.

The rationale for introducing for design elements of the schemes also has a history, summarized below:

- **EU ETS[24]:** The idea of implementing some form of carbon pricing from industry manufacture was considered prior to an ETS. *'Stakeholder engagement with sectors showed they preferred trading as it enables industry to decide whether and when to abate or pay the tax (ie cost of allowances), whereas a tax simply has to be paid*'. It was also shown that finding the least expensive way of abating emissions through burden sharing was a priority in considering a trading system. '*Trading enables the cheapest form of abatement to be found in the economy and therefore reduces overall economic costs'. The Emissions Trading Group, consisting of industry stakeholders, was a consultation group prior to the setup of the UK ETS[25] and assisted in its design.* Passing fiscal control of carbon pricing to Europe was also part

[24] Extracts from the Interview with Niall McKenzie, DECC.
[25] The UK ETS started in 2002 as a pilot scheme with volunteer participants who would be provided incentive for their involvement, this scheme fed into the design elements currently used in the EU ETS.

of the rational for Britain's involvement in the EU ETS '*An EU wide carbon tax would compromise the fiscal sovereignty of Member States and therefore not be politically acceptable'.*

- **CERT[26]:** Energy efficiency obligations on suppliers have been part of carbon reduction policy since carbon was addressed as an issue. The scheme was initially focused on carbon reduction but later the scheme proved to have multiple benefits, and therefore changed many design elements of the policy. '*To begin with, the CERT scheme was simply an energy efficiency scheme to promote carbon reduction. It has evolved as politicians have found other benefits to such a scheme. Other benefits now heavily promoted are issues surrounding fuel poverty through our provision of energy efficiency measures to priority groups. There is little attention drawn to other issues such as energy security.*'[27]
- **RO:** Directive 2001/77/EC (as described in 4.1) legislated for renewable energy policies to be introduced into Member States. The renewable obligation provides a market based mechanism for the further deployment of renewable energy in a market where carbon rich energy production is less expensive, per MW/h. The obligation to meet the renewable energy demands was placed on the supplier, who would in turn pass costs to the customer allowing for the system to pay for it without drawing significant subsidy from the government. The proposed Feed in Tariff and Contract for a Difference (FiT, CfD) also will obligate suppliers, passing on the cost to the customer. A trading system for certificates is used to allow the market to adjust the price of renewable energy according the demand for ROCs: Once sufficient certificates have been bought to cover all suppliers renewable obligations the price paid for renewable energy will fall. Equally, when there is not sufficient renewable energy available to provide certificates to suppliers (especially at the point of compliance), the price of renewable energy will increase.

Box 3: Feed-in-Tariff / Contracts for difference in the UK

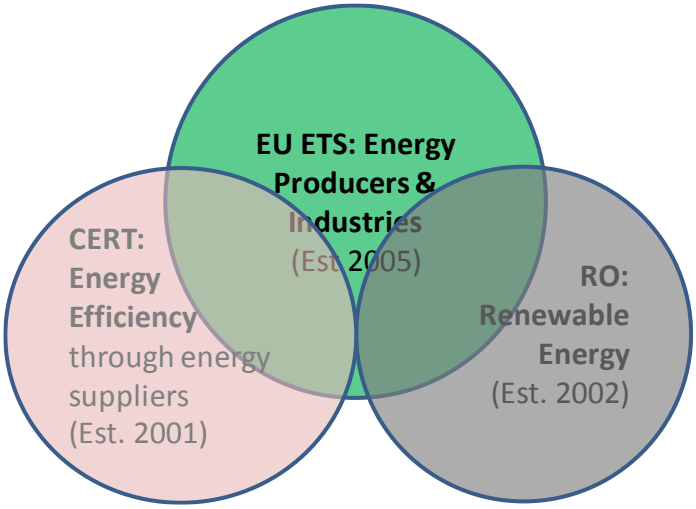
The UK is currently implementing reforms of its main electricity market, to align the market structure with the requirement for investment to meet all energy policy objectives, namely carbon emissions, energy security and energy price affordability. As part of this work it is replacing the Renewables Obligation (gradually, such that existing investments are protected) with a feed-in tariff/contract for difference (CfD) mechanism. Under this mechanism a long term contract between the Government and renewable electricity generators is set at a fixed level where variable payments are made to ensure the generator receives the agreed tariff. The FIT payment would be made in addition to the generator's revenues from selling electricity in the market. According to the Government, this approach would have the a lower impact on consumer bills than alternative mechanisms considered, because it provides revenue certainty leading to a lower cost of capital for investors, and hence a lower cost of generation borne by consumers. Also, by providing a return that adjusts to the electricity price, the approach avoids excess rents when the electricity price is high, helping to stabilise consumer bills.

[26] Extracts from interview with Anonymous Policy Maker, DECC.
[27] Anonymous Policy Maker, UK

4.3 The Conflicts and Synergies of the Schemes

The Conflicts and Synergies of the schemes are as described in Figure 4-1.

Figure 4-1 Diagram to Depict the Interaction between Certificate Trading Schemes



Each scheme has a significant crossover with the EU ETS as they contribute to carbon reduction. Equally the schemes reviewed do not cover all carbon reduction policy in the UK that interrelates with the EU ETS. The main synergy of RO, CERT and CCL with the EU ETS is that they reduce carbon. Details of their interactions are as follows:

CERT and the EU ETS:

Coverage: The EU ETS focuses on the point of emissions, whereas the CERT scheme covers suppliers, in turn resulting in a reduction in electricity use.

Caps: Energy efficiency results in less carbon being produced in the system, potentially helping electricity generators meet EU ETS obligations.

Double incentive: Electricity generators who are also energy suppliers receive a double benefit through the co-existence of schemes; they reduce energy use resulting in EUAs and CERTS that may be traded.

RO and the EU ETS:

Coverage: As many energy generators have also invested in renewable energy, there is some cross-over between the EU ETS and RO.

Caps: Renewable energy results in less carbon being produced in the system, potentially helping electricity generators meet EU ETS obligations.

Double incentive: Electricity generators may benefit from the RO by setting up renewable energy schemes, whilst reducing their supply of carbon intensive energy production. This will allow for double benefit as they produce ROCs as well as reducing their business as usual emissions helping release more EUAs for trading.

Figure 4-2 Interview responses to Synergies and Conflicts Questions

Conflicts

'There are no real conflicts as they cover different systems and we have made changes where and when necessary in the CERT scheme to accommodate any conflicts.'

'CERT covers the housing sector therefore does not conflict with the obligations of electricity producers to the EU ETS. If the CERT scheme increases energy efficiency it reduces the demand for electricity which can mean less fossil fuel burn making it easier to meet the EU

ETS cap. So no conflict.'

Synergies

'Different schemes target different behaviours by different segments of society (energy use by households and business, investment in electricity generation and industrial carbon emissions). The overarching EU ETS can readily accommodate other schemes, as there affect may be taken into consideration when setting the cap.'

'Because they [CERT and the EU ETS] *cover different areas they interact well with each other. CERT also benefits the system by remedying some social welfare issues as well as operating well with local authorities.*

'Electricity companies are effectively subsidized by the renewable obligation to invest in renewable generation whilst the EU ETS taxes them for fossil fuel burn. As the renewable obligation allows for companies to reduce their emissions there is quite a synergy between the two systems, with little or no conflict. Renewable energy targets were factored into setting the ETS cap by the European Commission resulting in no compromise of the EU ETS.'

4.4 Summary of Findings

The CERT, RO and EU ETS, seemly interact very well with each other. There is little evidence of the schemes having conflicts and policy makers were enthusiastic to show that this was this case. Conflicts identified were justified by policy makers and supporting evidence. The history of UK carbon policy shows that carbon trading and energy efficiency were considered before incentivising renewable energy. It is also clear that energy efficiency provides the least expensive form of carbon abatement.

The synergy between the schemes was the coverage of different sectors and their method of changing behaviour. The interviews with policy-makers indicated that an emissions trading scheme could incentivise energy efficiency, renewable energy and carbon reduction alone, as long as there was a significant and adaptable cap[28]. Even though an ETS should find the least expensive form of carbon abatement, a CERT policy maker highlighted that energy suppliers, in the absence of an energy efficiency scheme, would have no incentive to decrease supply.

Broadly, the following summarize findings from UK analysis:

- Having various schemes allows for awareness to be raised about the different forms of carbon reduction, helping change behaviour.
- Renewable energy, energy efficiency, white certificate and emissions trading can have synergy when the emissions trading scheme provides an overarching target.
- Different schemes can cover different sectors effectively.

[28] The policy maker identified that in the EU it is nearly impossible to change the annual cap due to the number of member state participants. Due to business as usual projections being subject to economy, climate and carbon abatement costs it would be necessary for a system without energy efficiency and renewable energy schemes to have an adaptable annual cap.

5 Italy

5.1 Summary of Trading Systems

Italy has implemented a renewable energy scheme and energy efficiency scheme, under the requirements of European Directives. They are also obligated to participate in the EU ETS. The overarching EU ETs framework is as described in Section 3.1 and is not repeated here. From 2005 White Certification energy efficiency legislation (Titoli di efficienza energetica) resulted in large electricity and gas suppliers being obligated to reduce the amount of energy used in households they supplied.

The TEE uses a system whereby certificates would be produced and traded to find the least costly form of energy efficiency. The scheme sets an annual target which would be distributed across the energy suppliers, which would be complied with by either trading certificates or meeting obligations by implementing energy efficiency schemes.

Element	TEE, Titoli di efficienza energetica	EU ETS
Year Scheme Introduced	*2005*	
Period reviewing	*2013-2016*	*2008 - 2012*
Sector with Target	*Electricity and gas* *DSO > 50,000 customers*	*Large Industry and Carbon Intensive Energy Production*
Sector with Emission Reductions	*All sectors*	*Large Industry and Carbon Intensive Energy Production*
Scope (% of total country emissions)		*45% of emissions*
Operator/Regulator	*Regulator issues certificates: AEEG* *Market place: GME*	
Method to deliver scheme	*Obligation on DSO's* *Tradable certificates*	*Financial burden imposed by cap for every tCO_2 emitted*
Verification of Compliance	*Regulator:*	*100% 3rd party verification*
Non-compliance regime		*€100 Euro penalty for every tCO_2e above cap*
Target	*2012:6 Mtoe (Electricity: 3,5 Mtoe. Natural gas: 2,5 Mtoe)* *2016: 9.51 Mtoe (Electricity: 5.23 Mtoe. Natural gas: 4.28 Mtoe)*	*8% reduction*
Achieved		*??*

5.1.1 Scope and Coverage

The Italian energy efficiency certificate scheme – *Titoli di efficienza energetica, TEE* – was first introduced in January 2005. The aim of the TEE is to contribute to fulfilling Italy's GHG commitment, increased competitiveness and employment, and security of energy supply[29] and it is intended as the primary driver for energy efficiency.

The energy efficiency scheme is focused on technical projects leading to improved energy efficiency in the use of natural gas and electricity. Projects can come from all sectors including small-scale cogeneration and photovoltaic systems, but projects from households (electricity and natural gas) dominate (70% in 2011/2012). The EU ETS which Italy is also subject to does in principle overlap with the TEE in terms of addressing end-use consumption in energy intensive industries but in reality the set-up of the TEE cost recovery

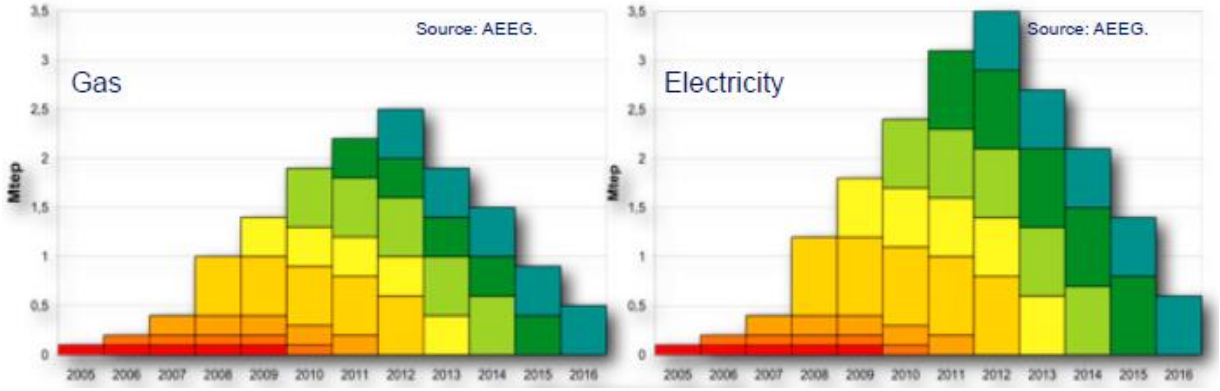
[29] Authority for Electricity and Gas (AEEG), 2009.

mechanism and certificate verification system has so far resulted in very little activity if any within this segment.

The obligated parties are the electricity and natural gas distributors that, as of 31 December of the preceding year, have more than 50,000 end-users connected to their grid. There are 14 electricity and 62 natural gas distributors obligated to meet energy saving targets. The main actor is ENEL which obligation is more than half the total obligation. Within the gas sector three companies account for more than 40% of the gas sector target.

The compliance period is only one year. Since the typical savings measure has a standardised lifetime of 5 years the targets "accumulate", as shown in the figure below.

Figure 5-1 Development in the Italian target[30].



The minimum threshold for projects to be certificated varies depending on the type of verification method and the proponent. Projects can be combined into one, also projects with different owners, but still the thresholds are a challenge to smaller companies with potential projects based on a monitoring plan approach.

Table 5-1 Minimum Thresholds (toe) for Projects[31]

Proponent	Deemed savings	Engineering estimates	Monitoring plan
Distribution system operators and companies with energy manager	25	100	200
Voluntary parties	25	50	100

5.1.2 Targets and Penalties

The TEE started in 2005 with an obligation of 0.2 Mtoe primary energy consumption[32]. In 2016 the obligation will be 9.51 Mtoe. Italy's total gross inland energy consumption made up 175.5 Mtoe in 2010 according to EuroStat[33]. The 2016 obligation thus constitutes 5% of the 2010 consumption. The target for the previous period (2008-2012) was 2.2 Mtoe cumulative in 2008 increasing to 6.0 Mtoe cumulative in 2012.

[30] The white certificate scheme: the Italian experience and proposals for improvement; D. Di Santo, D. Forni, V. Venturini, E. Biele; ECEEE 2011 Summer Study, pp. 249–260.
[31] The white certificate scheme: The Italian experience and proposals for improvement, Dario Di Santo et.al., ECEEE 2013 Summer Study Proceedings, June 2013.
[32] 1 toe corresponds to 5,350 $kWh_{electricity}$ or 14,300 $kWh_{natural\ gas}$ (1,300 Nm^3).
[33] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Consumption_of_energy

The targets assigned to each obligated party depends on the national market quota and is distributed proportional to the energy delivered to the obligated party's end-users two years before.

The system operates with four different classes of certificates – 1) Electricity, 2) natural gas, 3) all other energy not for transport, and 4) all other energy for transport. The distinction is made for reasons of cost recovery. Cost recovery via the tariffs was first opened in the end of 2008 for type 3 and not yet in 2011 opened for type 4. Certificates were valid for three obligation periods i.e. 2005-2012.

The penalty for not meeting the obligation is 25,000 to 155 million EUR assessed on a case-by-case basis. However, there is a one year grace period before the penalty is issued provided that at least 60% of the obligation has been met. The penalty does not cancel the obligation to meet the target. Banking of certificates is allowed within the period 2005-2012 while borrowing is not directly allowed – however, a one year grace period is given if at least 60% of the annual target is met.

5.1.3 Monitoring, Reporting and Verification

The TEE operates with three calculation methods for determining the achieved savings, namely deemed savings, deemed savings combined with partial on-field measurement (engineering estimates), and ex-ante combined with ex-post measurement subject to pre-approval (also referred to as "monitoring plan").

About 90% of the savings in the period 2005-2009 were delivered via projects for which simplified measurement and verification methodologies exists (mostly deemed savings)[34]. The dominating technology by far is lighting. It is worth noting that ENEL's subsidiary, ENEL Sole, owns about 1.9 million street lights.[35]

An analysis made by the Italian Federation for the Rational Use of Energy (FIRE) in 2011 shows that the ratio of the TEE remuneration (set to 90 EUR/toe) and the capital cost investment has been 3,100% for low flow shower taps in sports centres with electric boilers! This clearly indicates why the interest in monitoring plan based projects is much lower than deemed savings projects as long as the market is not saturated.

Table 5-2 Ratio of TEE remuneration and capital cost[36], shown for those deemed savings files that result in a more than 10% ratio.

Deemed savings files	Ratio
13c-bis: Low flow shower taps in sports centres with electric boilers	3,100%
13c-bis: Low flow shower taps in sports centres with gas boilers	1,800%
13b-bis: Low flow shower taps in hotels with electric boilers	577%
13b-bis: Low flow shower taps in hotels with gas boilers	342%
18: Public lighting HPS lamps substituting mercury vapour lamps	144%
24: LED lamps for cemeteries	56%
1-tris: CFLs	50%
9: Variable speed drives for industrial pumping systems	36%
25a: Anti-standby device	15%
8-bis: Solar thermal collectors for hot water substituting electric boilers	12.8%

[34] http://www.eea.europa.eu/soer/countries/it/national-and-regional-story-italy-12
[35] The role of a distributor in a white certificate system: ENEL's experience, Anna Brogi, April 2013.
[36] The white certificate scheme: the Italian experience and proposals for improvement; D. Di Santo, D. Forni, V. Venturini, E. Biele; ECEEE 2011 Summer Study, pp. 249–260.

2: Substitution of electric boilers for hot water with gas boilers	12.3%
23: LED semaphoric lamps	11%

5.1.4 Institutional Arrangements

The Italian Authority for Electricity and Gas[37] regulates and administrates the scheme and with the assistance of the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, certifies the delivered energy savings. The market is managed by Gestore Mercati Energetici[38] that also manages the Italian Power Exchange, IPEX. The Italian National Agency for New Technologies, Energy and Sustainable Economic Development is also responsible for updating guidelines and technical energy savings sheets.

Savings certificates can be generated by the obligated parties as well as accredited energy services providers. One certificate is equivalent to 1 toe.

The obligated parties may thus meet their target by directly implementing EE measures themselves, contracting ESCOs to implement the measures, or purchasing EE certificates. (Please note that a large majority of the accredited ESCOs are not ESCOs as defined by the EU but instead installers of EE measures). Large consumers that have an energy manager may be accredited to create their EE certificates but their certificates only make up a very small share of the total amount: In the period up to 2009 they represented less than 1%. Most projects are implemented by ESCOs.

The Italian TEE certificates are traded in one session per week and the price of the certificates are determined based on bids from sellers and buyers. The obligated parties can produce their own certificates, buy them on the (spot) market or buy them bilaterally (over-the-counter). Volume and prices from bilateral transactions are also made public.

Third parties, called energy service providers or ESCO's, can produce white certificates and sell these on the exchange or bilaterally for the obligated energy distributors. More than 80% of the savings have come from third parties.

The costs associated with energy efficiency improvement in relation to certificate type 1,2 and 3 are recovered through the tariff costs associated with energy efficiency improvement in transport (certificate type 4) are not eligible for cost recovery. Thus the interest is certificate type 4 has quite naturally been non-existent.

The cost recovery value set centrally by the regulator and was originally 100 EUR/certificate – a value that does not have any direct relation to the actual cost incurred[39]. Average in 2010 was about 94 EUR/toe.

Projects in general contribute to target achievement for 5 years (standardized lifetime) but building envelope improvement projects such as buildings thermal envelope, bioclimatic design, reduction of cooling needs, etc. contribute for 8 years"[40] and CHP and cogeneration for 10 years[41].

According to the 3rd annual report issued by the Authority for Electricity and Gas, energy saving measures implemented since the start of the TEE scheme can be grouped into the following three categories:

- Measures related to the residential sector with regard to electricity end-uses (e.g. installation of efficient domestic appliances, CFLs, etc.), heating needs (e.g. installation of efficient boilers, building envelope retrofits, etc.), energy production and

[37] http://www.autorita.energia.it
[38] http://www.mercatoelettrico.org/
[39] Design of white certificates: Comparing UK, Italy, France and Denmark, Ea Energy Analyses, November 2007.
[40] http://www.eea.europa.eu/soer/countries/it/national-and-regional-story-italy-12
[41] Best Practises in Designing and Implementing Energy Efficiency Obligation Schemes, The Regulatory Assistance Project, IEA DSM, June 2012.

distribution (e.g. photovoltaic installations, combined heat-and-power production, district heating, etc.);

- Public lighting system improvement (e.g. installation of highly efficient lamps, systems automatically regulating lighting level, etc.);
- Measures addressing the industrial sector.

5.1.5 Complimentary mechanisms

In addition to the TEE, "tariff funds are used to finance information campaigns from electricity and gas distributors as well as audit schemes at the local level."[42]

Furthermore, customer projects may benefit from national grant schemes such as tax reductions when energy renovation is undertaken and at the same time qualify for the TEE.

5.2 Summary of Findings

Italy has in addition to the TEE also a national renewable energy scheme and is obligated to participate in the EU ETS. There is an overlap between TEE and EU ETS but focus of the TEE has so far been very much on simple savings (CFLs, low flow shower heads, and the like).

Both the TEE and the national renewable energy scheme issue certificates that can be traded bilaterally and on a spot market. Both schemes set an annual target which is distributed across the energy suppliers, which would be complied to by either trading certificates or meeting obligations through either buying renewable energy for sale or implemented energy efficiency measures.

Please note that for the next period (2013-2016) of the TEE significant changes are expected.

[42] Best Practises in Designing and Implementing Energy Efficiency Obligation Schemes, The Regulatory Assistance Project, IEA DSM, June 2012.

6 India

6.1 Summary of Trading Systems

India is the world's third largest emitter of carbon-dioxide (CO_2) in terms of absolute emissions. The Indian Government recognises the current trends of its fast growing economy to drive up imports of fossil fuels, local pollution and greenhouse gas emissions putting the energy supply security at risk and having major impacts on the Indian economy including livelihoods, water supplies, agriculture, food production and infrastructure. India's National Action Plan on Climate Change (NAPCC) and its constituent eight missions prepared under the aegis of the Prime Minister's Council on Climate Change were developed to provide a range of key policy and regulatory drivers and by incentives for low carbon growth. Renewable energy and energy efficiency are seen as high priorities in the NAPCC.

The Renewable Energy Certificates (RECs) system and the Perform Achieve Trade mechanisms (PAT) schemes discussed and analysed in this report are designed to achieve the energy generation and energy saving targets in the country in line with the NAPCC targets (see Table 6-1).

- Renewable Energy: India has a large Renewable Energy (RE) potential; yet its vast potential remains largely underutilised. NAPCC set a Renewable Purchase Obligation (RPO) target, to produce 15% of the country's electricity with renewable energy sources by 2020. Further, under the Jawaharlal Nehru National Solar Mission (JNNSM), the Indian government aims to develop 20,000 MW of solar energy by 2022. [43] The Electricity Act 2003 stimulated RE based power generation through State Electricity Regulatory Commissions (SERC) by setting Renewable Purchase Obligation (RPO) targets for state distribution companies to purchase certain percentage of their total power requirement from renewable energy sources. The aim is to help RE generators recover their cost of renewable energy generation. Renewable Energy Certificate (REC) scheme was introduced to enable state electricity distribution companies to fulfil their RPO and reduce the mismatch between the availability of renewable sources across various states.

- Energy Efficiency and savings: The National Mission for Enhanced Energy Efficiency (NMEEE) is one of the eight national missions of NAPCC that aims to drive market-based approaches to unlock energy efficiency opportunities to ensure a sustainable growth in India. Four new initiatives are launched under the NMEEE: Perform Achieve and Trade (PAT, Market Transformation for Energy Efficiency (MTEE), Energy Efficiency Financing Platform (EEFP) and Framework for Energy Efficient Economic Development (FEEED). In this report we examine the PAT scheme, which is a market based mechanism implemented with the aim of enhancing investments in energy efficient technologies and production efficiency in large energy intensive industries in India. PAT cycle 1 from 2012 – 2015 aims to achieve an energy saving target of 6.686 million tonne of oil equivalent (toe) distributed among 478 designated consumers under 8 energy intensive industries.

[43] Falling Short: An Evaluation of the Indian Renewable Certificate Market, Climate Policy Inittiative

Table 6-1 Summary of REC and PAT Schemes

Element	REC	PAT
Year Scheme Introduced	March 2011	March 2012
Period reviewing	2011- present	2012 – present
Sector with Target	Issued to Renewable Energy Generators → Obligated to be purchased by electricity distributors/ suppliers • Distribution Licensees • Captive Consumers • Open Access users *(refer appendix 3.1.1 for definition by Electricity Act 2003)*	'Designated Consumers (DC)' of large energy intensive industries
Sector with Emission Reductions	State electricity consumption – included households, industries	'Designated Consumers (DC)' of large energy intensive industries
Scope (% of total country emissions)	Approximately 15% reduction in emissions by 2020[44]	Reduction in 26 million tonnes of carbon dioxide equivalent (CO2) by 2015
Operator/Regulator	CERC – Central Electricity Regulatory Commissions	Bureau of Energy Efficiency (BEE)
Method to deliver scheme	Renewable purchase Obligation (RPO) - % of renewable energy obligated for distribution utility in each State	Specific Energy Consumption (SEC) reduction target to be achieved by March 2015. Achievement > Target → E-Scerts Achievement<Target→ Purchase E-Scerts / Penalty
Verification of Compliance	Compliance Auditors	Designated Energy Auditors (DENA)
Non-compliance regime	Obligated entity to deposit into a separate fund to purchase the shortfall of REC at forbearance price	Base penalty of USD 20,000 plus an amount proportional to the number of units the target is short by[45]
Target	15% of the country's electricity with renewable energy sources by 2020	Estimated savings 6.6million toe at the end of 1st PAT Cycle (by 2014-15)
Achieved	40% coverage - FY 12-13 out of total 3163 MW RE generation, around 1273 MW of RE power got REC [46]	Available post 2013[46]

6.1.1 Scope and Coverage

Both REC and PAT schemes are driven by the National Action Plan on Climate Change (NAPCC) and evolve around the Electricity Act (2003) and the Energy Conservation Act (2001) respectively. They are both recently implemented by central and states governments and are identified to play a role in determining the overall success of the country's climate policy by covering the renewable energy and energy efficiency sectors.

[44] Assumption based on the 15% renewable energy generation target – EVI interview
[45] MARKET-BASED CLIMATE MITIGATION POLICIES IN EMERGING ECONOMIES
http://www.c2es.org/docUploads/market-based-climate-mitigation-policies-emerging-economies.pdf
[46] Interview with stakeholder from EVI – Refer Appendix 2.1.1

REC: RECs are regulated by the Central Electricity Regulatory Commission (CERC).

RECs are issued to RE generators with grid connected RE technologies approved by the Ministry of New and Renewable Energy (MNRE)[47] and meet with the required eligibility criteria. Following accreditation and registration of the eligible entities and in accordance with the 'Certificate of Energy Injection' issued by the State Load Dispatch Centres (SLDC), the regulator will issue the RECs and maintain a REC registry. The REC system provides for two types of RECs: solar and non-solar.

The entities mandated to purchase a defined amount of renewable energy of their overall consumption are called 'Obligated Entities'. Three types of obligated entities are identified to meet with the RPO targets set by the SERC: distribution licensees, captive consumers and open access users. Obligated entities may either purchase renewable energy or purchase RECs to meet their RPO. RECs can also be purchased by entities other than obligated entities on voluntary basis.

PAT: The regulator for the PAT scheme is the Bureau of Energy Efficiency (BEE). In terms of energy carriers PAT scheme covers all forms of energy (electricity, solid fuel, liquid fuel, gaseous fuel, by products used as fuel etc.) consumed for production of output in energy intensive industries. The PAT scheme is targeted at 'Designated Consumers (DC)' identified by the Energy Conservation Act 2001 as the largest consumers in the country. In the first cycle of PAT scheme (2012-2015), 478 plants in the following 8 energy intensive sectors are being covered: thermal power plants, Iron & Steel, cement, fertilizer, Aluminium, textile, pulp & paper, chlor-alkali. The DCs of these 8 sectors account for about 164 mtoe (million tons of oil equivalents) of energy consumption annually as per 2007-08 data which is about 54% of the total energy consumed in the country. (Refer Appendix 3.1.5) [48]

6.1.2 Targets, Allocation Mechanisms and Penalties

REC:
The Electricity Act (2003), mandate State Regulators (SERC) to set RPO targets for each state with the aim of achieving 15% of its energy requirements from RE sources by the year 2020. However, RE sources are not evenly spread across different parts of the country. The SERCs fix a certain proportion of electricity consumption (refer Appendix 3.1.2) as RPO targets for the obligated entities by taking into account the availability of resources and its impact on electricity tariffs. This resulted in resource rich states specifying higher RPO targets and resource low state specifying lower RPO targets. Following the implementation of the REC mechanism many states have made meeting RPO targets mandatory and included more realistic renewable energy addition to the RPO targets.

One REC is equivalent to 1 MWh of electricity generated and fed into the grid and is valid for 730 days[49]. Participants can purchase REC from the exchange platforms Indian Energy Exchange (IEX) and Power Exchange of India (PXI) created by the regulator. The trading will take place at the forbearance price and floor price determined by the regulator from time to time (Refer Appendix 3.1.4). In case of non-compliance, obligated entities have to pay penalties, in general, at forbearance prices, which is an upper bound for REC price at any trading platform. The RE generators under REC scheme can generate revenue from the sale of electricity component of RE generation and the revenue from the sale of environmental attributes in the form of RECs.

Stakeholder stated: *''The cost of renewable energy generation is high compared to conventional generation. Therefore, the obligated entities in the resources rich states would*

[47] Eligible Renewable Energy Generators: Wind, Solar, Small Hydro (below 25 MW of capacity), Biomass based power generation (including cogeneration), Bio-fuels and Municipal solid waste based power generation projects are eligible to apply for REC. Projects from these sectors if qualify then can accredited as an eligible entity. (source: http://greencleanguide.com/2010/12/25/renewable-energy-certificates-india/)
[48] PAT consultation document, 2010 – 2011, BEE
http://beeindia.in/NMEEE/PAT%20Consultation%20Document_10Jan2011.pdf
[49] See interview with Anonymous Policy Maker (refer appendix)

not like to procure renewable energy more than the RPO fixed. With the REC mechanism resources rich states can produce more electricity from renewables can sell RECs to obligated entities from states that so not have sufficient renewable energy resources."

Within its functioning period since 2011, REC policy makers have identified areas where it needs design improvements. The trends on the rising of REC closing balance (Refer Appendix 3.1.3) may point out the need for an energy policy for creation of more demand for certificates. In order to create this balance between demand implementation of a national RPO is in discussion by a Forum of Regulators. Furthermore strengthened penalty enforcement by the state regulators and creation of secondary and bilateral markets were highlighted as required changes to the system. [49]

PAT: Each facility under the PAT scheme has been assigned a specific energy consumption (SEC) reduction target by the regulator to be achieved by March 2015 [50,51]. Targets are statistically calculated using production and annual energy consumption data of 5 years (2005-06 to 2009-10) submitted by the DCs.

According to BEE *"the 478 designated consumer plants offer an energy saving potential of 6,686,000 ton of oil equivalent/year(6.686 million toe/year) at the end of first phase of PAT Cycle (2012- 2015)"* [52]

The DCs receive tradable, certified energy savings credits if efficiency gains beyond their SEC targets are achieved. One ESCert is received for 1 tonne of oil equivalent (toe) of energy consumption saved by the DC beyond the SEC target. If the DCs fall short of the target, they have to pay a base penalty of USD 20,000 plus an amount proportional to the number of units the target is short by[53]. A special platform for trading ESCerts is yet to be finalised by the regulator.

6.1.3 Monitoring, Reporting and Verification

Both schemes undertake monitoring and verification prior to issuing the tradable certificates. In the REC scheme the SLDC monitor and account renewable energy injected into the grid by eligible entities on monthly basis. A verification certificate called the 'Certificate of Energy Injection' will be issued which certified the generator to obtain the REC. The trading will be monitored by the regulator and reported in the REC registry.

In the PAT scheme the regulator analyses the claims submitted by the energy managers according to the PAT assessment document. Every participant has to do mandatory audit by an accredited energy auditor within 18 months of first notification. This monitoring and verification will be done by designated energy auditors (DENA) who will be notified by the regulator.

6.2 The Rational for Introducing Different Schemes

The information collated from literature and interviews with stakeholders from the respective schemes highlight several factors reasoning why India has introduced different schemes for renewable energy and energy efficiency. They are described below:

- The absence of a national mandatory CO_2 reduction target and the lack of legal provisions for carbon trading in the country makes it difficult to see carbon trading policies being implemented in short term. The REC and PAT schemes are backed by the existing Electricity Act (2003) and Energy Conservation Act (2001) of India.

[50] Perform Achieve and Trade (PAT)- Presented by Dr. Ajay Mathur (DG, BEE)
[51] Creating market support for energy efficiency: India's perform, achieve and trade scheme *CDKN, DFID 2013*
[52] Perform Achieve and Trade (PAT)- Methodology- Baseline Normalization, Energy erformance Indicators, Targets and M&V. Presented by Mr. K. K. Chakarvarti (EE, BEE) http://beeindia.in/schemes/schemes.php?id=9
[53] MARKET-BASED CLIMATE MITIGATION POLICIES IN EMERGING ECONOMIES http://www.c2es.org/docUploads/market-based-climate-mitigation-policies-emerging-economies.pdf

- The Kyoto Protocol mandated developing countries such as India and China to take Carbon reduction measures.

Stakeholder stated '' By 2012 which marked the end of Kyoto commitment, the potential for Carbon emission reductions in India were estimated to be at 16% which was mostly achieved through renewable energy commercialization and energy efficiency.''[54]

- India's rapid economic growth is placing an enormous demand on its energy resources. The gap between electricity supply and demand has been steadily growing and is seen as a great challenge for country's development and poverty reduction. Increasing renewable energy generation and energy efficiency measures seem to be most appropriate for the country as they play a crucial role in displacing fossil fuels and meeting country's energy demand while reducing CO_2 emissions. Thus each scheme is implemented with independent targets with the ultimate aim to reduce India's Carbon emissions.
Stakeholder involved in the REC scheme stated that *'' there is a peak energy deficit and around 40% of the country doesn't have access to electricity. Dependency on fossil fuel and increasing imports fuel are critical factors to consider. Importance of Energy Access and Energy security in the backdrop capacity addition has been major focus, energy efficiency along with renewable energy is the thrust areas to ensure sustainable development. Renewable Energy (RE) has now become a necessity rather than a choice in the face of the challenges posed by energy security and climate change. ''*

Similarly, stakeholder involved in the PAT scheme stated, *'' PAT scheme is an energy reduction policy. It supports Carbon reduction as an additional parameter. BEE looks at energy efficiency only and works according to the Energy Conservation Act. When energy efficiency is being covered carbon reductions are also included. But different systems are needed to achieve the individual targets and objectives of renewables and efficiency.''*

6.3 The Conflict and Synergy of the Schemes

The REC and PAT schemes in India are functioning independently, under two different regulatory bodies in order to achieve Renewable Energy and Energy Efficiency targets respectively. However out interviews with stakeholders helped to identify some synergies and conflicts between the two systems.

- The SEC target for the PAT scheme and the RPO target in the REC scheme are set independently. The SEC target is a plant specific target set with the aim of improving energy efficiency in individual plants to reduce energy consumption nationally. It was set for each plant by taking 5 years of energy consumption data from each of the 478 plants involved in the PAT first cycle. The RPO target is a state level target on electricity consumed by participants in each state with the aim of promoting renewables and improving energy security in the country.

- The PAT scheme, which is under the Energy Conservation Act, measures amount of energy saved with the use of efficient technologies. The REC scheme, which is under the Electricity Act measures its target as per electricity consumption from renewables. Hence use of energy as a PAT measure means that there is no overlap with the REC measure when it comes to electricity. If the measure for PAT were carbon then decarbonisation of electricity supply could lead to double counting in PAT, and use of energy as a measure avoids this double counting.

- The PAT scheme covers many large energy intensive industries complying with the SEC targets. These can also be large captive power producers and large open access consumers of power which are stated as participants obliged to complying with the RPO.

[54] Extract from interview with anonymous policy maker.

Therefore some industries are subjected to both renewable energy and energy efficiency targets which they can achieve by participating in REC and PAT schemes separately.

- According to the PAT regulator, in the case of renewable energy generation on site and the use of renewable energy will reduce the gate-to-gate SEC (which is measured in tonnes of oil equivalent (toe)) set for the plant. If the energy consumption reduction achieved is less than the SEC target, ESCerts can be claimed. [55] However participants (obligated entities) with RPO targets are not able to use ESCerts to demonstrate compliance with the RPO. [56] This ensures that there is a fair and clear boundary between the systems and avoid possible conflicts.

- There is a possibility for both the schemes to be traded in a similar platform. Currently REC trading takes place on the platform of Indian Energy Exchange (IEX) and Power Exchange of India (PXI). Both the exchanges came into existence with the objective of performing day a head and term a head trading of electricity. As the trading of ESCerts will take place post 2015 the trading platform for PAT is not yet finalised and BEE is currently working on developing a platform called PAT-Net which will be used for monitoring, reporting and trading activities. This is expected to perform similar to the REC Registry. [46]

- The RPO compliance has been annual, whereas SEC compliance period is three years. Trading under the PAT scheme is expected to start post 2015. There are considerations on going for annual timeframes for ESCert trading. [46] Official from BEE stated that there were administrative issues foreseen due to the difference in compliance times and was stated as a reason for not synchronising the two schemes.

Considering these synergies there are discussions on linking the two schemes. The PAT Consultation document states: *''The fungibility of ESCerts with RECs is also envisaged. It is proposed that the conversion factor for enabling such fungibility will be based on verifiable parameters such as energy consumption in kgOE (kilograms of oil equivalent)".* However according to interviews with stakeholders it confirms that these conversion factors have not yet being implemented.

6.4 Summary of Findings

Energy policy development in India at present is focused largely on improving energy security in the country. With a large proportion of the population still not having access to electricity, country's large dependency on imported fuel and economic and social impacts due to climate change has driven the country to identify renewable energy and energy efficiency as drivers for improving country's energy security. The REC scheme aims to boost energy generation from renewable sources, while the PAT mechanism promotes energy saving and technology up improvement in large energy intensive consumers. Consequently both REC and PAT contribute to CO_2 reduction in the country.

REC scheme covers renewable energy generators and state level distributors of electricity and aims to achieve NAPCC's 15% electricity generation by renewables target by 2020, while improving energy access and securing the energy market in the country. With a balanced market of RECs will help energy generators in the country recover their generation costs. The PAT scheme covers the large energy intense consumers from 8 sectors (including thermal power generation) contributing to around 54% of the energy consumption in the

[55] BEE website – FAQ sheet http://beeindia.in/content.php?page=schemes/schemes.php?id=8
[56] Climate policy and market insights, CARBON first

country. It aims to reduced country's energy consumption and increase economic growth and energy security in a sustainable manner.

As the two schemes currently coexist in the country, some synergies and conflicts were expected. Both schemes are still at very early stages with very short experience and it is difficult to make any conclusive remarks on the success or failure and outcomes of the schemes. Currently, they function independently without any conflicts. Some key highlights on how conflicts were avoided are:

- in the case of a participant being obliged to participate in both the schemes they can achieve their targets by participating the two schemes independently.

- RECs are issued to generators for the amount RE generated electricity fed in to the grid which can be traded with obligated distributors and ESCerts will be issued for amount of energy saved beyond the SEC target by the consumers and traded with consumers who cannot achieve the SEC target.

- in the case of RE generation and use of RE, PAT participants are given a reduced gate-to-gate SEC target (measured in tonnes of oil equivalent) and the ESCerts can be claimed if more than the target is achieved. However ESCerts (energy savings) cannot be used in compliance with RPO targets.

PAT system is at its earliest stages since implementation in 2012 and performance can only be evaluated after the three year compliance period ending in 2015. Stakeholder stated that *''Targeted Industries are still not very proactive in taking measures to comply with SEC targets''*.

However policymakers in India have begun to think of possible synergies (highlighted in the section above) which could ultimately lead to integrating the two systems. Whilst there are difficulties and issues related to this stakeholder interviews and literature confirms possibilities of this in the long term.

7 California (USA)

California is rich in both conventional resources (oil, natural gas) and renewable energy resources (hydro, geothermal, wind, solar). California has the highest population in USA and its total energy demand is second only to Texas. Although California is a leader in the energy-intensive chemical, forest products, glass, and petroleum industries, the State has one of the lowest per capita energy consumption rates in the country. The California State government's energy efficiency programs have contributed to the low per capita energy consumption. Driven by high demand from California's many motorists, major airports, and military bases, the transportation sector is the State's largest energy consumer.

California considers energy efficiency a resource and has established a "loading order" (i.e. priority list) that calls for first pursuing all cost-effective efficiency resources, then using cost-effective renewable resources, and only after that using conventional energy sources to meet new load.

The pursuit of renewable energy goals has resulted in California receiving more investment funding in clean technology than anywhere else in USA, and accounting for 44% of all U.S. patents in solar technologies and 37% of all U.S. patents in wind technologies. The energy-related carbon emissions 2010 reached 370 million tCO_2e with the transport sector contributing with almost 60%.

It is the ambition of California State to reduce GHG (energy and non-energy related) emissions to 1990 levels by 2020 and 80% below 1990 emissions levels by 2050. The net GHG emission[57] 1990 is estimated to approx. 425 million tCO_2e while the energy-related carbon emission alone was 363 million tCO_2 e in 1990[58].

[57] http://www.arb.ca.gov/cc/inventory/pubs/reports/staff_report_1990_level.pdf
[58] http://www.eia.gov/environment/emissions/state/state_emissions.cfm

Table 7-1 provides an overview of certificate trading scheme to help California meet its targets.

Table 7-1 Summary of Certificate Trading Schemes

California	EEO	RPS	CTP
Rationale	Reducing energy bills and avoiding investment in energy system expansion (cost-effectiveness)	Sustainability and diversification	Climate protection
Introduced	Early 1970s	2003	2013
Period reviewing	2006-2008; 2009; 2010-2012; 2013-20??	2011-2013	2013-2014; 2015-onwards
Point of regulation / obligated party	Investor owned utilities SCE, PG&E, SDG&E, SoCal Gas (and voluntarily also publicly owned utilities) within electricity and natural gas	Retail energy sellers within electricity	Sources at least 25,000 tCO_2e/year
Sector with emission reductions	In principle all except transport (98% of el savings in 2011 were in res+com, while gas savings are mainly in com+ind; technologies are primarily indoor lighting HVAC and process)	Centralised and distributed electricity generation?	Phase 1 (2013-2014): Electricity generation (incl. imports) + industry (app. 160 million tCO_2e which is app. 35% of California's total GHG emissions). Phase 2 (2015-onwards): Electricity generation (incl. imports) + industry + distributors of transportation fuel, natural gas and other fuel (app. 395 million tCO_2e which is app. 85% of California's total GHG emissions)
Scope (% of total country emissions) / potential???	Electricity and gas consumption excl. transport i.e. xxx	Primarily electricity generation i.e. xxx	Energy-related carbon emissions i.e. down to 363 million tCO_2e by 2020 and 363*0.2=73 million tCO_2e by 2050
Operator/Regulator	CPUC	CPUC	ARB
Method to deliver scheme	Annual obligation of x% reduction in retail consumption + utility programs	Annual obligation of x% of retail energy sales must be RE + market for solicitation of new RE (Renewable Auction Mechanism)	Annual allocations and off-set credits available to load providers + quarterly auction, single bid, uniform price, available to all??. Price minimum 10 USD in 2012 rising 5% annually above inflation
Cost recovery method	Tariff surcharge + state funds	Tariff surcharge	
Verification of Compliance	Third party assessment following strict protocols	CPUC via the WREGIS information system	
Non-compliance regime	Penalties are triggered if savings are below 65% of target.	The penalty for an RPS procurement deficit is 5 UScents/kWh, up to 25 million USD per year.	Four times the short fall within a period
Target	Avoided consumption, Societal cost-effectiveness, Reduced per capita consumption. CO_2 n.a. IOU annual goals for 2010-2011 are 1,014 MW, 4,601 GWh el and 98 Mtherms gas.	Renewable share of energy generation. Intermediary target for 2011-2013 is 20% of retail energy sales must be RE	Avoided carbon emissions. Targets are 1990 level by 2020 and 80% reduction relative to 1990 in 2050
Achievement	2011 results: TRC = 2.02 cost-effectiveness, 1,069 MW, 5,736 GWh el, 84 Mtherms gas	Expectations are that the intermediate target of 20% of retail energy sales being RE by 2011-2013 will be superseded.	(None yet)

7.1 Californian Energy Efficiency Obligation (EEO)

7.1.1 Scope and Coverage

California's utility-sector customer energy efficiency programs date back to the 1970s and have grown and evolved substantially over four decades. The Californian Energy Efficiency Obligation (EEO) is a state-wide energy efficiency programme targeted to low-income customers and administered by the four investor-owned utilities (SCE, PG&E, SG&E, and SCG).

The point of regulation is the investor owned utilities (IOU);[59] SCE, PG&E, SDG&E, SCG and voluntary publicly owned utilities (POU), who supply electricity and natural gas. There are 41 POUs. The Californian utilities are highly regulated entities and locally controlled (no interstate commerce) which makes them suitable as point of regulation. Investor-owned utilities (IOU) administer each of their energy efficiency programs with oversight by the California Public Utilities Commission (CPUC), which establishes key policies and guidelines, sets program goals, and approves spending levels. California's publicly owned utilities (POUs) also administer customer programs.

In principle all consumption sectors except transport are included. However, 98% of the reported electricity savings in 2011 were in the residential and commercial sector, while gas savings were mainly in the commercial and industrial sector. The main technology focus is on indoor lighting, HVAC, and processes. On-site generation (e.g. cogeneration, combined heat and power production) and micro-generation (e.g. solar hot water heaters) are not counted as energy efficiency measures.

7.1.2 Targets

The target is not specified in carbon reductions but in IOU annual goals for energy reduction; for the period 2010-2011 this is 1,014 MW, 4,601 GWh el or 98 Mtherms of natural gas. California's current targets are embedded in the approved 2010-2012 program portfolios and budgets for the state's IOUs, which calls for gross electricity savings of almost 7,000 GWh and natural gas savings of approximately 150 MMTh.

7.1.3 Monitoring, Reporting and Verification

California utilities are now operating within a 2010-2012 program portfolio period, which is predicted to produce electricity savings of almost 7,000 GWh and natural gas savings of approximately 150 MMTh (goals expressed in gross, not net savings).

The evaluation of ratepayer-funded energy efficiency programs in California relies on regulatory orders[60]. There is third party assessment of compliance following strict protocols. Evaluations are administered by both utilities and the CPUC. Evaluations are conducted state wide as well as for each of the utilities. Benefit-cost tests are required for overall portfolio screening of deemed savings. All of the five classic benefit-cost tests identified in the California Standard Practice Manual are used – Total Resource Cost (TRC), Utility/Programs Administrator (UCT), Participant (PCT), Social Cost (SCT), and Ratepayer Impact Measure (RIM).

[59] Utilities are regulated monopolies that provide energy services within a limited geographical area. The investor owned utilities include SCE, PG&E, SDG&E. They purchase electricity for their customers but also produce about 30-40% of the electricity that they sell. They also own the distribution network within their territory. The utilities will not be allowed to build new production capacity since the intention of the state is to create greater competition (in order to achieve greater cost-effectiveness). New capacity will be built by others.

[60] CPUC Decision 09-09-047

The TRC is used as primary cost-effectiveness test. Every 3 years the utilities present a portfolio of activities that they propose to undertake during the course of the next three years. The portfolios are subject to approval by the CPUC. All activities combined within the portfolio of a utility must pass the threshold value – TRC 1.25 or above – and not each activity individually. Protocols for how to calculate baselines and additionality and how to measure and verify savings are provided in the California Standard Practice Manual[61].

According to the interviewed representative from CPUC, a drawback of the current set-up of the EEO is that it is quite complex. Both ex-ante assessment and ex-post evaluation/measurement are required. This takes a lot of time and effort and causes disputes over the measuring and verification. In other words this set-up is quite costly to administrate.

7.1.4 Institutional Arrangements

A 'risk return incentive mechanism' is used to align ratepayer and shareholder interests by creating a significant reward/penalty for IOUs' success/failure. The 'risk return incentive mechanism' sets a minimum performance standard for the IOU under which incentive earnings accrue only if the IOU energy efficiency portfolio of programs achieves at least 85% of the their targets[62]. The incentive formula calls for utilities to receive 9% of net benefits if they achieve between 85-99% of savings goals, and 12% of net benefits if they meet or exceed savings goals up to the earnings caps established for each utility. In addition, utilities can earn a percentage of their incentive earnings before evaluation procedures verify their impacts.

Penalties are triggered if savings are below 65% of target. Total incentives are capped at 450 million USD and are paid in three instalments – after installation, after EMV report, and 30% after final assessment.

California's utilities fund some of their programs and initiatives through resource procurement budgets and recover their costs through rate cases brought before the CPUC. California's utilities also collect a Public Goods Charge (PGC) on customer utility bills to fund utility energy efficiency programs. Public Goods Charge is California's name for a public benefits fund established in Assembly Bill 1890 in 1996. The PGC on electricity consumption is about 0.48 UScents/kWh and covers energy efficiency, renewable energy and R&D. About 0.3 UScents of this charge support energy efficiency programs. Assembly Bill 995, which became law in 2000, extended the electric PGC through January 1st, 2012. A natural gas PGC was created by Assembly Bill 1002 in 1999 which funds cost-effective energy efficiency and other public purpose programs. The activities are financed through a public goods charge on electricity of about 0.003 USD/kWh, capped at 3% of customer's bill and a natural gas DSM charge plus additional funding on a case by case approval by CPUC.

All of the investor-owned electric and gas utilities in California have decoupling[63]. The revenue decoupling program is combined with performance incentives for meeting or exceeding energy efficiency targets. Revenue requirements are adjusted for customer growth, productivity, weather, and inflation on an annual basis with rate cases every three or four years, varying by utility.

The Database for Energy Efficient Resources (DEER)[64] is a database, sponsored by California Energy Commission (CEC) and CPUC, designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life. The users of the data are program planners, regulatory reviewers and planners, utility and regulatory forecasters, and consultants supporting utility and regulatory research and evaluation efforts.

[61] http://www.energy.ca.gov/greenbuilding/documents/background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF
[62] Decision 07-9-043 (October 2007).
[63] Decoupling is the term used for the separation of a utility's profit from its sales of electricity as a commodity. Instead, a utility's revenue is met by setting a revenue target, and then electricity rates are regularly fine-tuned to meet that target.
[64] http://www.deeresources.com/

7.2 Renewable Portfolio Standard (RPS)

7.2.1 Scope and Coverage

Established in 2002 under Senate Bill 1078, accelerated in 2006 under Senate Bill 107, and expanded in 2011 under Senate Bill 2, California's Renewables Portfolio Standard (RPS) is one of the most ambitious renewable energy standards in USA.

The RPS was introduced in 2002 as a reaction to the Californian/US energy crisis in 2000 caused by energy traders' manipulation of the energy market. This created a wish for diversification of energy resources. Other reasons for introducing the RPS was a growing concern for climate change and an interest in promoting emerging renewable energy technologies that could become marketable.

The point of regulation (i.e. obligated party) is retail energy sellers of electricity.

California's RPS is based on procurement of renewable energy (kWh) and does not set capacity targets. This is to avoid excessive expansion. A load-serving entity satisfies its RPS obligation when eligible renewable energy is generated and delivered to its customers.

7.2.2 Targets

The RPS requires investor-owned utilities, electric service providers, and community choice aggregators[65] regulated by the CPUC to procure 33% of their annual retail sales from eligible renewable sources by 2020. The RPS also requires electricity retail sellers[66] to achieve intermediate RPS targets of 20% from 2011-2013 and of 25% from 2014-2016.

All retail electricity sellers in California are subject to the RPS, except municipal utilities – these are instead directed to design programs with similar goals and report annually to the Energy Commission on their progress.

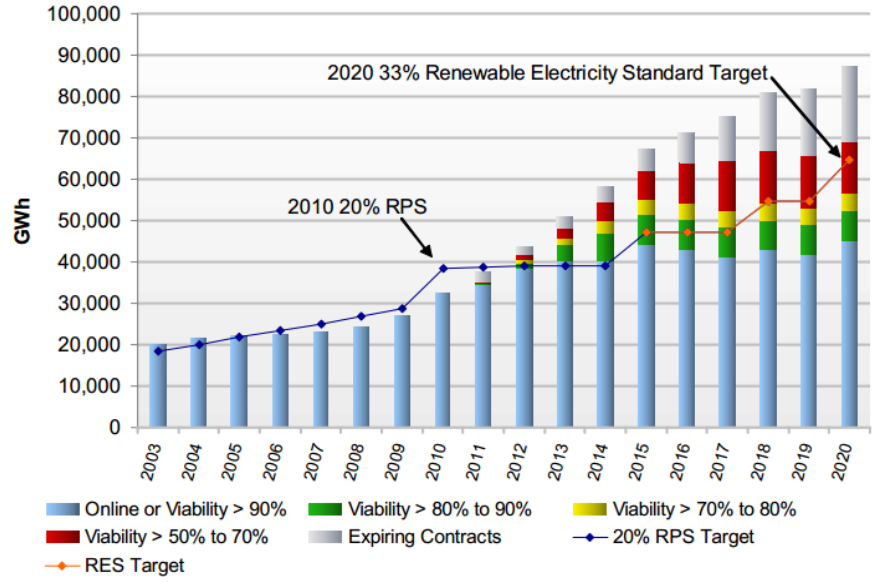
There are ongoing efforts according to the interviewed CPUC representative; to create individual targets for specific renewable energy technologies but so far no mandatory individual targets have been introduced. However, there is an ambition to promote specific technologies such as energy storage, combined heat and power production, geothermal, ground source heat pumps, and various biomass related technologies (biogas, bio-ethanol, etc.). At present some of these systems may cost more than traditional fossil fuel based technologies and traditional renewable energy technologies such as wind and solar. The reason for the interest is one of diversity of supply, so to understand cost-effective technology options.

7.2.3 Monitoring, Reporting and Verification

The CPUC progress report on the first and second quarter of 2012, shows that the electricity retail sellers have met the goal of serving 20% of their electricity with renewable energy and are already on track to far surpass that goal in 2012. More than 300 MW of new renewable capacity came online in the first two quarters of 2012, and another 2,740 MW is scheduled to come online before the end of the calendar year.[67] Since 2003, 2,871 MW new renewable capacity achieved commercial operation under the RPS (please see Fig 7-1).

[65] Community choice aggregator – Typically local government that does not own network nor production system but instead acts as retailer on behalf of the community.
[66] Retail energy seller = Energy service provider – Own no network nor production system but instead acts as retailer selling to an end-user.
[67] Published by CPUC 31st July 31, 2012, http://www.cpuc.ca.gov/PUC/energy/Renewables/RPS_Q1Q2_2012_report_to_leg.htm

Figure 7-1: Progress overview, as presented at senate oversight hearing, February 1st, 2011, by Julie Fitch, Director, Energy Division, CPUC.



According to CPUC recent RPS solicitations have been robust:

- Increased participation from larger and more experienced developers;
- Dramatic increase in number of solar photovoltaic bids;
- 2009 RPS solicitation resulted in 100 MWh of bids (very large);
- 2009 bids alone would meet half of IOUs' 33% target.

CPUC and utilities increasingly focus on tapping the wholesale distributed generation market for renewables (under 20 MW in size) to allow for faster delivery schedules and interconnection at the distribution level, without need for transmission upgrades[68].

7.2.4 Institutional Arrangements

A Renewable Energy Credit (REC) represents the environmental and renewable attributes of renewable electricity. Electric retail sellers are obliged to buy eligible renewable energy and its associated RECs to comply with the RPS requirements. The RECs can be traded in voluntary markets. The California Energy Commission (CEC) tracks the RECs, and at the end of a compliance year, verifies how many RECs each retail seller has procured for compliance with the RPS. The CEC present this in an annual verification report to the CPUC, and the CPUC then determines whether a retail seller is in compliance with the RPS.

There are three types of transactions involving RECs – "bundled", "unbundled", and "tradable". Bundled power purchase agreements are for both the RECs and energy associated with an eligible RPS facility. Unbundled REC transactions are for only the RECs. Once the RECs are unbundled from the energy, the energy is considered null electricity (non-renewable) and no green claims can be made for use of this null electricity. Tradable

[68] Progress: Senate Oversight Hearing: February 1st, 2011, http://www.cpuc.ca.gov/NR/rdonlyres/B5320B26-82A8-45EB-AD27-266FD4C09FF2/0/PresentationforOversightHearings_RPS_2111CPUC.pdf

REC transactions are also for only the RECs, but the RECs can be traded to multiple participants before ultimately used for RPS compliance.

In the voluntary market, any company (e.g. a grocery store chain) that is not regulated by the state to buy green power can buy RECs to make claims that it is powered by clean energy.

Both voluntary RECs and compliance RECs are tracked using the Western Renewable Energy Generation Information System (WREGIS)[69] which was launched in June 2007. The first WREGIS certificates were issued January 30th, 2008. The system helps ensure the credibility of the "green" value of RECs.

Facilities that serve onsite load (i.e. distributed generation) own their RECs, and these RECs are not transferred to the utility. That means that a facility owner can either make green claims (e.g. "our company is powered by solar") if it retains the RECs, or the facility owner can sell the RECs so that another entity can make green claims. The CPUC does not regulate who the facility owner sells its RECs to.

The California Energy Commission is responsible for determining the eligibility of renewable resources and certifying individual facilities as RPS eligible. All renewable sources are permitted, except for hydro power – here only facilities of 30 MW or less are allowed.

Load-serving entities (LSEs) are, without CPUC approval, allowed to carry procurement deficits less than 25% of that year's incremental procurement target (the difference between the LSE's current and prior year annual procurement targets) for up to three years. Deficits greater than 25% of that year's incremental procurement target may be carried forward without penalty if the LSE demonstrates to the CPUC an allowable reason for non-compliance, five of which are:

1. Insufficient response to the RPS solicitation.
2. Contracts already executed will provide future deliveries sufficient to satisfy current year deficits.
3. Inadequate public goods funds to cover above-market renewable contract costs.
4. Seller non-performance.
5. Inadequate transmission.

Shortfalls in excess of 25% of the incremental procurement target are also permitted upon a persuasive showing of lack of effective competition; that a deferral would promote ratepayer interests and the overall procurement objectives of the RPS program; or upon showing of good cause.

The penalty for an RPS procurement deficit is 5 UScents/kWh, up to 25 million USD per year.

7.2.5 Complementary Mechanisms

In addition to the RPS there is a separate solar water heater program for small producers and large producers. The CPUC has identified various challenges that impede the timely realization of renewable generation contracts, relating to transmission, financing, siting, permitting, integration, environmental and military objectives, technology development and commercialization, and equipment procurement.

The California Energy Commission (CEC) in its 2007 Integrated Energy Policy Report (IEPR) indicated that there are substantial barriers to generation siting, permitting and transmission that must be addressed in order to achieve the 2010 and 2020 RPS goals. The Renewable Energy Transmission Initiative (RETI) is a statewide initiative to help identify the transmission projects needed to accommodate these renewable energy goals and facilitate transmission corridor designation and transmission and generation siting and permitting.

[69] http://www.wregis.org/

7.3 Cap-and-Trade Program (CTP)

7.3.1 Scope and Coverage

California's GHG cap-and-trade program (CTP), which began on January 1st, 2013, is a central part of Assembly Bill 32 (AB 32), California's Global Warming Solutions Act. The CTP went into effect on January 1st, 2012 with the first compliance obligations beginning January 1st, 2013. The obligated parties are installations with over 25,000 tCO_2e/year, which include refineries.

In the first compliance period (2013-2014) the sectors included are electricity generation (incl. imports) plus industry. This equals to approx. 160 million tCO_2e which is approx. 35% of California's total GHG emissions including both energy-related and non-energy related emissions. In the second period (2015-onwards) distributors of transportation fuel, natural gas and other fuels are added reaching approx. 395 million tCO_2e i.e. approx. 85% of California's total GHG emissions.

The utilities are encompassed by the CTP to the extent that they produce energy.

7.3.2 Targets

The overall target is an 80% reduction of carbon by 2050 to a 1990 baseline. The energy-related carbon emission in 1990 was 363 million tCO_2e. The CTP operates with allowances (tradable permits), and offset credits[70]. Off-sets are activities that capture carbon from the air (e.g. growing trees) and thereby off-sets a part of the emissions created by other sources.

ARB allocates *allowances* in three primary ways:

1. Direct distribution to covered entities for industrial assistance, using a combination of product-based and energy-based methodologies;
2. Direct distribution to electric distribution utilities – To ensure that electricity ratepayers do not experience sudden increases in their electricity bills associated with the CTP, ARB allocates allowances for free to electrical distribution utilities on behalf of ratepayers. The electrical distribution utilities must use the value associated with these allowances for the benefit of retail ratepayers of each electrical distribution utility, consistent with the goals of AB 32. They may *not* be used for the benefit of entities or persons other than their ratepayers;
3. Selling allowances through quarterly State run auctions.

In addition, a small percentage of allowances have been set-aside for the allowance price containment reserve[71]. A 'Voluntary Renewable Electricity program' within the cap-and-trade program allows for entities that are not covered by the cap-and-trade program to apply to ARB to retire allowances on their behalf for using eligible voluntary renewable electricity. ARB will begin to retire allowances in 2014 for voluntary renewable electricity contributions in 2013. The regulation requires ½% of the annual budget for the budget years in the first compliance period, and then a ¼% for the budget years in the subsequent compliance periods, to be dedicated to a voluntary renewable electricity account from which allowances will be retired[72].

There are holding limits and auction purchase limits to prevent participants from acquiring market power. Non-utility covered entities may purchase no more than 15% of allowances sold at any auction; other entities are limited to 4%. ARB offset credits may be used by an

[70] A carbon allowance is a legal document issued by a government agency permitting the bearer to emit one tCO_2e and the total number of allowances available is pre-determined and legally binding (hence the term 'cap'), meaning that retiring one allowance reduces the maximum pollution allowed by one tCO_2e. A carbon offset credit is a certificate that equates to one tCO_2e not emitted due to an investment in a carbon reduction project.
[71] Cap-and-Trade Regulation 95870(a) and Staff Report Appendix G) and the Voluntary Renewable Electricity Program (see 95870(c).
[72] http://www.arb.ca.gov/cc/capandtrade/renewable/renewable.htm

entity to meet up to 8% of its triennial compliance obligation. Each offset credit is equal to one tCO2e and can only be quantified using an ARB approved Compliance Offset Protocol[73]. Only ARB can issue compliance offset credits for use in the CTP.

The method of allocating allowances to the electricity sector incorporates ratepayer cost burden, projected cumulative energy efficiency accomplishment and early investment in qualifying renewable resources during the period 2007-2011[74].

In order for electric utilities to receive allowances, entities must provide end-use customer load and receive payment for that load from end-use customers. Generators, marketers, and other providers of electricity that do not have a transactional relationship to end-use customers are not eligible for allowance allocation.

7.3.3 Institutional Arrangements

The scheme is operated by ARB. The cap will decline over time. Facilities subject to the cap will be able to trade permits (allowances) to emit GHGs.

The market set-up is quarterly, single bid, uniform price. The regulation includes a reserve price that limits the potential to manipulate allowance prices at auction. The reserve price (i.e. the price minimum) was set to 10 USD in 2012 rising 5% annually above inflation.

The first allowance auction was held by the Air Resources Board (ARB) on November 14th, 2012. The auction included a 'Current Auction of 2013 vintage allowances' and an 'Advance Auction of 2015 vintage allowances'. The second auction was held February 19th, 2013. The auction included a 'Current Auction of 2013 vintage allowances' and an 'Advance Auction of 2016 vintage allowances'. The 2013 auction clearing price was 13.62 USD/allowance, with 12,924,822 total '2013 allowances' sold, and the 2016 auction clearing price was 10.71 USD/allowance with 4,440,000 total '2016 allowances' sold. In case of non-compliance the penalty is four times the shortfall within a period.

The Climate Instrument Tracking System Service[75] (CITSS) is a market tracking system used to supports the implementation of GHG cap-and-trade programs for California and other jurisdictions. It provides accounts for market participants to hold and retire compliance instruments and to participate in transactions of compliance instruments with other account holders. The auction platform[76] is a separate system but registration with CITSS is required.

7.3.4 Complimentary Mechanisms

It is worth noting that ARB is working with British Columbia, Ontario, Quebec and Manitoba, through the Western Climate Initiative (WCI), to develop harmonized cap-and-trade programs that will deliver cost-effective emission reductions.[77] ARB also works with other trading programs such as the EU ETS and the US Regional Greenhouse Gas Initiative in an effort to minimize the potential for market manipulation.

7.4 Coexistence of Systems

7.4.1 Synergies

There has not been any discussion to integrate the three systems (energy efficiency obligation, renewable portfolio standard, carbon cap-and-trade). It is state policy to adhere to three systems – higher guarantee of success, more certainty in outcomes, and a reluctance to let the market achieve the goals. The three systems are considered symbiotic. Multiple

[73] http://www.arb.ca.gov/regact/2010/capandtrade10/finalrevfro.pdf, sub-article 13, page 152.
[74] http://www.arb.ca.gov/regact/2010/capandtrade10/candtappa2.pdf
[75] http://www.arb.ca.gov/citss
[76] http://www.arb.ca.gov/cc/capandtrade/auction/auction.htm
[77] See http://www.wci-inc.org/

policies are preferred so that if one fails to meet the target the other might perform ("belt and suspenders").

Energy efficiency can contribute both to a higher share of renewables and to lower carbon emissions. The price premium deriving from the RPS makes energy efficiency measures more cost-effective. The carbon cap-and-trade program internalise carbon costs and make renewable energy more competitive.

While the EEO and the RPS contribute involve the electricity and natural gas utilities, the CTP also involves other sectors of the economy and allows the electricity and natural gas sector trade credits with other sectors which provides for greater cost-effectiveness. And non-energy-related carbon not already captured by the EEO nor the RPS is thus also addressed.

It still remains more expensive to build new renewable energy capacity than traditional capacity. And energy efficiency is the most cost-effective way to achieve carbon reductions.

7.4.2 Conflicts

There is according to CPUC and CEC representatives that we spoke to no conflicting between the three systems (energy efficiency obligation, renewable portfolio standard, carbon cap-and-trade) but perhaps some overlapping that reduces the overall cost-effectiveness.

7.4.3 Linkage

The systems serve somewhat different purposes. The rationale behind the birth of the EEO introduced in the early 1970s was to limit energy bill increases and avoid investment in energy system expansion (fossil fuel prices were rising). The rationale behind RPS, introduced in 2003 is sustainability. Carbon reduction (climate protection) is now a prominent political goal and CTP was introduced in 2012.

The representative of CEC believes that seen from a cost-effectiveness perspective an improvement can be made in the interaction between the three systems. California considers energy efficiency a resource and has at present a "loading order" (i.e. order of priority) that calls for first pursuing all cost-effective efficiency resources, then using cost-effective renewable resources, and only after that using conventional energy sources to meet new load. The current loading order is arbitrarily determined. Changing the loading order to one of carbon reduction based on the cost-effectiveness of the measures, covering all sectors of the economy and all energy types would make more economic sense. Energy efficiency is the cheapest way to achieve the goal but some renewable energy technologies would be too costly compared to other renewable energy technologies or traditional fossil fuel technologies, and would thus be ranked lower.

With regard to the RPS design there are efforts ongoing to create individual targets for specific renewable energy technologies but so far no mandatory individual targets have been introduced. However, there is an ambition to promote specific technologies such as energy storage, combined heat and power production, geothermal, ground source heat pumps, and various biomass related technologies (biogas, bio-ethanol, etc.). At present these systems may cost more than traditional fossil fuel based technologies and traditional renewable energy technologies such as wind and solar. The reason for the interest is one of diversity of supply and a strive for creating a range of future cost-effective technology options.

7.5 Summary of Findings

The three policies serve different energy political goals and regulate different actors and segments. A carbon cap-and-trade program would for example not necessarily contribute to

energy efficiency and thus sustainability. A RPS furthers the shift away from fossil fuels but does not address non-energy related emissions and potential offsets.

All three systems are continuously revised as the market develops and lessons are learned and ambitions are increased. This is key to achieving targets while limiting costs.

8 Findings

In support of its policy-development the Chinese Government is looking to international experience with energy saving certificate trading (also known as white certificate trading), and its interactions with other policies, to provide recommendations that are applicable in the national context. The purpose of this study is to review international experience/best practices and provide those recommendations. It contributes to the World Bank ESMAP funded technical assistance to compliment a GEF project to establish energy savings monitoring and verification systems in China.

This paper presents the results of the international review of experience with white (Energy Savings) and green (Renewable Energy) certificates trading and carbon cap and trade. The results are drawn from analysis of policies in UK, Italy, California, India and higher level assessment of policy at EU level. It also presents preliminary recommendations for policy approaches in China.

8.1 Rationale for co-existence of EE, RE, and carbon targets

Many developed countries have set energy efficiency, renewable energy (RE), and carbon emission targets at the same time, like China. The rationale identified behind the selected countries having targets for Energy Efficiency, Renewable Energy, and Carbon reduction at the same time, is as follows:

- Energy policy seeks to achieve multiple aims, and in support of this it is necessary to set targets for different aspects. Energy policy objectives include energy security (reducing energy supply and pricing vulnerability), reduction in costs of energy, and increasing access and affordability for the poor, as well as local and global environmental benefits from reduced use or fuel for energy supply. Together this mix of objectives has been a major driver for a mix of targets.
- The primary focus of energy policy has differed in the regions we have examined, and this has been reflected in the different emphasis on targets and therefore on the measures implemented. For instance; energy efficiency has been prioritised in California and India, whereas in the EU the primary objective has been carbon emissions, whilst renewables and energy efficiency policies have been seen as contributing to the carbon reduction objective, and broader energy policy objectives.

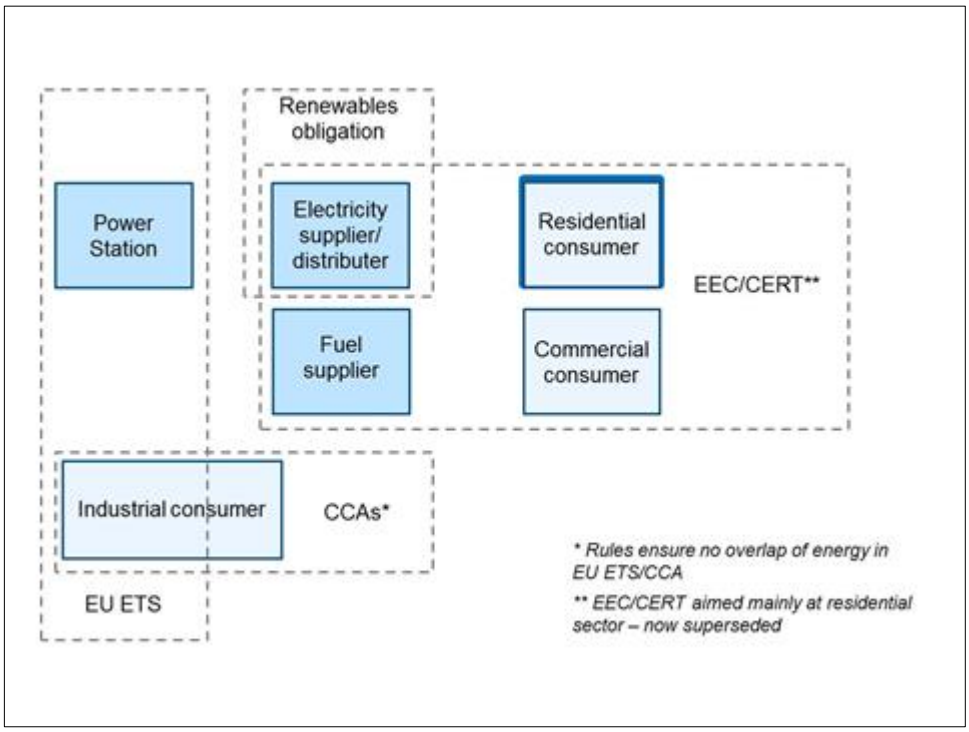
8.2 Rationale for co-existence of EE, RE, and carbon policy instruments and trading schemes

The study also focused on identifying the rationale for the selected countries to have white (Energy Savings), green (Renewable Energy) certificates trading and carbon cap and trade systems at the same time. From international experience the following reasons are identified for the existence of multiple systems:

- Multiple policy objectives have led to the use of multiple schemes. This is because energy policies have more objectives than just reduction of carbon emissions from energy use.
- Use of white certificate trading focusses abatement on energy reduction, which has been seen to benefit energy security, fuel poverty, reduction of energy bills, avoiding investment in energy system expansion, and is complementary to carbon cap and trade. Carbon cap and trade will not tap all the energy efficiency potentials, as carbon pricing alone cannot remove all the market barriers and failures for energy efficiency, partly due to the low price elasticity at least in the short run.
- Green certificates have been used to encourage the development of renewable technologies, which might initially be more expensive than other abatement routes. This can overcome the barriers to development and ultimately help reduce the long term costs of renewables, supporting a longer term transition to a low carbon economy. The development of a renewables industry also has positive benefits such as job creation and industry building, contributing to green growth and improving the diversity of the energy supply mix. Carbon trading cannot necessarily provide enough incentive for the deployment of renewable energy as the cost of carbon abatement through renewables is often much higher than that of energy efficiency.
- Multiple policies are preferred so that if one fails to meet the target, the others may compensate, thereby reducing the risk of failing to meet the objectives overall.
- There is evidence that energy efficiency policies have been introduced in advance of carbon trading (for example in California). We consider this in part a historical reflection of concerns over energy costs pre-dating concerted action over climate change. It is also possible that a natural hierarchy is followed, in which reducing energy demand is prioritised over action to generate it more cleanly. However, where carbon trading is then introduced, this co-exists with energy efficiency trading and does not replace them. There is no evidence of a transition from energy efficiency trading towards carbon trading.

8.3 Interactions between policies: conflicts and synergies

Overall, it is found that multiple systems can co-exist successfully. In general, however, systems tend to cover different obliged parties in different sectors of the energy generation or consumption spectrum. The only example in which the same enterprises are obliged under multiple systems is in the UK, in which certain industrial enterprises are covered by both the Climate Change Agreement and EU Emission Trading System regimes. In this case, specific energy accounting rules ensure that the systems do not cover the same energy. The UK is an illustration of this coexistence, as shown below



In the design of multiple co-existing systems the following experiences are relevant:

- Institutional arrangements often have an overarching agency responsible for set and coordinate policies and targets for EE, RE, and carbon emissions, with independent regulators responsible for implementation and regulation of policy measures. A coordinated approach to target setting is required, in which the effects of existing policy measures are taken into account when setting the targets of others. Regulatory bodies involved are specific to the type of entity being regulated. For example, the regulation of emissions often falls to ministries or agencies responsible for environmental protection, whereas white certificate/obligation systems may be administered by the regulator for energy supply markets.
- White certificate trading systems tend to place obligations on energy suppliers to make savings on a project basis. End user industrial energy systems are more often enterprise level in which the target is placed on the energy consumer.
- In systems that permit pass-through of the costs of energy, carbon or renewables polices the costs are borne by consumers. The effects of multiple polices can be additive and impact on domestic household energy affordability and commercial competitiveness.
- The design of MRV systems includes decision on whether to adopt full third party verification or an energy data audit approach. The MRV framework can apply to whole enterprises, sites, or to projects.
- Penalty regimes need to take into account any need for compliance shortfalls to be made up in future years. They need to be sufficient to enforce compliance, with penalties much higher than the compliance cost. The identity of offending enterprises is commonly made public.

9 Preliminary recommendations for China

Rationale for co-existence of targets

China is a developing country. Energy conservation is one of the highest priorities for the government, as it contributes to energy security, resource conservation, environmental sustainability, energy affordability, green growth, and competitiveness objectives. Similarly, the main driver for RE policy in China is to build a world class RE manufacturing industry, improve energy security, and diversity energy mix to address the severe local air pollution. Therefore, the EE and RE targets are warranted and should continue.

Chinese government is committed to climate change mitigation, and set carbon intensity reduction target. In China, more than 85% of the carbon emissions come from the energy sector. Achieving the EE and RE target will lead to achievement of the carbon intensity reduction target,

However, despite a dramatic decline in carbon intensity in China over the past decade, carbon emissions more than doubled during the same time period. China is now the largest GHG emitter in the world. Therefore, it is important for China to shift from a carbon intensity reduction target to total absolute carbon emission target, whenever the political economy can accept this.

Rationale for co-existence of EE, RE, and carbon policy instruments and trading schemes

The adoption of policy measures in China should be on the basis of the overall policy objectives, and hence the targets. This may mean that multiple complimentary policies are required. For instance, carbon trading will encourage some energy efficiency improvements and fuel switching, but it alone will not lead to achieving EE, RE, and carbon targets.

The government intends to increase the use of market-based mechanisms during the 12th FYP to achieve its energy intensity reduction targets cost effectively. Currently, reaching the 12th FYP energy intensity target is running into significant obstacles – some of the targeted priority enterprises could not meet their energy saving targets and some of the provinces fear that the total energy consumption cap puts a drag on their economic growth. Some enterprises or regions (e.g. Eastern provinces) have limited energy saving potentials, and it can be difficult and costly for them to achieve their allocated targets; while other enterprises or regions (e.g. Northeast and Western provinces) have large energy saving potentials, could exceed their allocated targets, but need extra incentives for them to do so. Since the government has allocated mandatory energy saving targets to the 17,000 priority enterprises and the energy data collection and reporting systems have been established during the 11th FYP period, the environment is relatively mature for Energy Saving Certificates Trading. Therefore, the government plans to pilot Energy Saving Certificates Trading scheme to achieve the 12th FYP target cost effectively.

The stakeholders consulted during the study recognized that the key conditions for EE trading are relatively mature in China today, with the mandatory energy conservation targets at the national level and allocated to each province and 10,000 priority enterprises, the

envisioned total energy consumption cap, Energy Conservation Law as a legal basis, 26 accredited 3rd party verifiers, mandatory energy reporting by the key priority enterprises, pilot on-line monitoring platform for energy savings MRV, and more than 2000 ESCOs to undertake energy conservation -- all contributing to the readiness of an EE trading in China.

Perhaps a phased approach is appropriate for China, sequencing of EE, RE, and carbon trading based on the criteria, for example, if the EE trading conditions are relatively mature, EE trading could be implemented during the 12th or 13th Five-Year Plan, while carbon trading may start after 2020, and integration of domestic carbon market with international market after 2030.

Coordination of EE, RE, and carbon trading schemes

In China, the EE program and obligations have been focusing on large energy-consuming industries, rather than electricity distribution utilities in Europe and the US States. Therefore, by default, the potential EE trading scheme would have overlaps with the ETS for the same obliged parties in the same sector, and for the same energy, including both primary energy and electricity consumption. There is no international precedent for such cases, at least not in the countries and systems reviewed under this study. This would not only run a risk for the same obliged parties to double counting and double dipping, but also create a distorted incentive in favor of energy saving compared with carbon reduction (fuel switching).

In addition, unlike most of the developed countries with liberal power market, China's power sector does not allow cost pass-through to consumers, given the tightly regulated tariff. There also lacks legal basis for non-compliance penalty, and MRV system in China. Finally, there is no separation of policy making functions from regulation functions in China, and no an overarching coordination policy making body like in the UK to coordinate the targets and policies for EE, RE, and carbon emissions. Therefore, the coordination between ETS and EE trading schemes in China would need additional research and studies.

Further consideration should also be given to ways to avoid this overlap of energy. One option would be not to include electricity consumption in carbon trading systems, but to include it in the Energy Saving Certificate Trading systems. In this respect the UK example of CCAs is most relevant.

Other options for avoiding overlap of the same obliged parties should also be examined, including piloting EE trading in selected provinces or cities that are not covered by the ETS pilots. This approach would address the concerns regarding overlapping coverage of the two sets of systems and reduce complexity at pilot stage.

Overall, this project has highlighted many issues related to target setting and policy development to achieve multiple energy/environment policy objectives simultaneously. Detailed further work is necessary to apply the principles highlighted in this report in the development of energy saving, carbon trading and renewable certificate trading systems in China.

RICARDO-AEA

The Gemini Building
Fermi Avenue
Harwell
Didcot
Oxfordshire
OX11 0QR

Tel: 0870 190 1900
Fax: 0870 190 6318

www.ricardo-aea.com