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52K30052.13

WHITE CERTIFICATE SYSTEMS AND THEIR APPLICABILITY TO FINLAND

Report to Ympäristöpooli at Finnish Energy Industries

May 2011

WHITE CERTIFICATE SYSTEMS AND THEIR APPLICABILITY TO FINLAND

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Pöyry Energy Consulting is Europe's leading energy consultancy providing strategic, commercial, regulatory and policy advice to Europe's energy markets. Part of Pöyry Plc, the global engineering and consulting firm, Pöyry Energy Consulting merges the expertise of ILEX Energy Consulting, ECON and Convergence Utility Consultants with the management consulting arms of Electrowatt-Ekono and Verbundplan. Our team of 250 energy specialists, located across 15 European offices in 12 countries, offers unparalleled expertise in the rapidly changing energy sector.

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ESIPUHE

Tämä White certificate systems and their applicability to Finland – Valkoisten sertifikaattien järjestelmät ja niiden soveltuvuus Suomeen -selvitystyö on Energiateollisuuden Ympäristöpoolin toimeksiantama ja rahoittama.

Työssä on tutkittu valkoisiin sertifikaatteihin perustuvien järjestelmien teoriaa ja toimintamalleja sekä niistä saatuja kansainvälisiä kokemuksia Italiasta, Ranskasta, Iso-Britanniasta ja Tanskasta. Työssä on myös analysoitu valkoisten sertifikaattien järjestelmän soveltuvuutta Suomeen.

Selvitystyö on tehty Pöyry Management Consulting Oy:n toimesta. Selvityksen projektipäällikkönä on toiminut Päivi Aaltonen ja keskeisinä asiantuntijoina Joonas Päivärinta, Arnhild Wartiainen (Pöyry Management Consulting AS, Norja), Ilkka Heikkilä (Pöyry Finland Oy) sekä Ossi Porri.

Työn toteutus perustui kirjallisuuslähteiden ja tutkimusraporttien pohjalta tehtyyn Pöyryn asiantuntija-analyysiin valkoisten sertifikaattien järjestelmistä sekä saaduista kansainvälisistä kokemuksista niiden soveltamisessa. Suomeen soveltuvuuden arvioinnissa hyödynnettiin Pöyryn kokemuksia Suomen energiatehokkuussopimus-järjestelmän toteutuksesta. Työn yhteydessä järjestettiin kaksi työpajaa, joissa tutustuttiin kansainvälisiin kokemuksiin valkoisista sertifikaateista ja keskusteltiin valkoisten sertifikaattien järjestelmän soveltuvuudesta Suomeen.

Projektin kuluessa työtä ohjasi ohjausryhmä, johon kuuluivat Pentti Puhakka työ- ja elinkeinoministeriöstä, Rami Rajala, Antti Kohopää ja Sirpa Leino Energiateollisuus ry:stä, Hannu Härkönen Fortum Electricity Solutions and Distribution yksiköstä, Rauno Tolonen Helsingin Energiasta ja Jouko Rämö Pohjolan Voimasta. Lisäksi työpajatyöskentelyyn osallistuivat Pekka Tervo työ- ja elinkeinoministeriöstä, Pertti Koski Motivasta, Mikko Vesterinen Oulun Energiasta ja Pekka Salomaa Energiateollisuus ry:stä.

Esitämme Ympäristöpoolille kiitokset mielenkiintoisesta tutkimusaiheesta sekä ohjausryhmälle ja muille osallistujille parhaat kiitokset arvokkaasta panoksesta työn ohjauksessa ja työpajoissa.

Vantaalla toukokuussa 2011

Päivi Aaltonen   Joonas Päivärinta

Arnhild Wartiainen   Ilkka Heikkilä

Ossi Porri

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Energiatehokkuuden edistäminen on yksi EU:n kolmesta ilmastopolitiikan päätavoitteesta CO_2 päästöjen vähentämisen ja uusiutuvan energian osuuden kasvattamisen lisäksi. Samalla se on ainoa näistä kolmesta tavoitteesta, jonka saavuttamiseksi ei ole asetettu jäsenvaltioita sitovia tavoitteita. Kuluvan kevään ja alkukesän aikana on odotettavissa uusia EU:n linjauksia energiatehokkuustavoitteiden sitovuudesta sekä keinoista niiden saavuttamiseksi. Euroopan komissio on esittänyt huolensa siitä, että jäsenvaltioiden nykyisillä energiatehokkuustoimenpiteillä ei näytettäisi saavutettavan vuodeksi 2020 asetettua 20% säästötavoitetta. Valkoiset sertifikaatit on mainittu yhdeksi markkinaehtoiseksi keinoksi energiatehokkuuden edistämiseksi.

Tämän selvityksen tavoitteena on tutkia valkoisten sertifikaattien järjestelmien teoriaa, saatuja kansainvälisiä kokemuksia valkoisten sertifikaattien järjestelmien toteutuksesta ja toiminnasta sekä näiden pohjalta analysoida edellytyksiä valkoisten sertifikaattien järjestelmän toteuttamiseen Suomessa.

Monet haasteet, joita tässä työssä tunnistetaan tai analysoidaan, ovat yhteisiä monille markkinaehtoisille mekanismeille, joilla pyritään edistämään energiatehokkuutta. Valkoisten sertifikaattien järjestelmää suunniteltaessa tulee huomioida ja määritellä useita tekijöitä. Tekijät voidaan ryhmitellä seuraavasti:

1. Valkoisten sertifikaattien kysyntä (velvoitteen asettaminen)

   Kysyntä sertifikaateille syntyy, kun asetetaan toimijakohtainen energiansäästövelvoite. Velvoite voidaan asettaa joko verkko-operaattoreille tai myyntiyhtiöille sähkö, lämpö ja/tai kaasumarkkinoilla. Velvoite voidaan kohdistaa toteutettavaksi valituille energialajeille tai loppukäyttäjäsektoreille. Toimenpiteiden toteuttamista ei yleensä rajoiteta toteutettavaksi yrityksen omien asiakkaiden piirissä, vaan toimia voi toteuttaa vapaasti energian käyttäjien piirissä. Säästövelvoitteen asettaminen jonkin tietyn sektorin toimijoille ei myöskään välttämättä tarkoita, että itse toimenpiteet tulisi toteuttaa samalla sektorilla.

2. Tavoitteen määrittely ja allokointi

   Viranomaisten tai poliittisten päättäjien tehtävänä on asettaa järjestelmälle säästötavoitteet sekä tavoitteiden saavuttamiselle asetettava aikajänne. Näiden tavoitteiden asettaminen liittyy myös muihin energiatehokkuusmekanismeihin. Säästötavoitteiden allokointi valituille toimijoille ei välttämättä edellytä valkoisten sertifikaattien käyttöönottamista, vaan niiden ensisijaisena tarkoituksena on dokumentoida läpinäkyvästi tehtyjen toimenpiteiden säästövaikutukset ja toissijaisesti luoda edellytykset säästötoimenpiteiden tehokkaalle hyödyntämiselle. Valkoisten sertifikaattien käyttöönottoa suunniteltaessa tulee asettaa rinnakkain niiden tuomat tehokkuushyödyt ja järjestelmän erilaisten ratkaisuiden aiheuttamat kustannukset. Kaupankäynnin mahdollistava sertifikaattijärjestelmä muodostaa energiapalveluyrityksille ylimääräisen tulonlähteen ja näin muodostaa uuden tulonlähteen sellaisten toimien rahoitukseen, jotka eivät muuten toteutuisi.

3. Energiansäästötoimenpiteiden määrittely ja sertifiointi

   Yksi keskeisimpiä tekijöitä valkoisten sertifikaattien järjestelmässä on päätös hyväksyttävien energiatehokkuustoimien ja –projektien kelpoisuudesta. Suunnittelussa tulee linjata etukäteen määriteltyjen standarditoimien ja erilliseen hakemukseen perustuvien projektien rooli järjestelmässä. Nämä hyväksymismenettelyt voivat esiintyä joko yksinään tai samanaikaisesti. Standarditoimien etuna on kevyt hyväksyttämisprosessi, kun taas hakemukseen perustuvan järjestelmän etuna on teknologianeutraalius. Säästötavoitteiden kohdistuessa erityisesti kotitaloussektoriin tai muihin pieniin käyttäjiin, muodostuu standarditoimiin perustuva järjestelmä kustannustehokkaammaksi. Hallinnointikustannusten minimointi asettunee tuolloin teknologianeutraaliudesta saatavia hyötyjä suuremmaksi. Hakemuksiin perustuva järjestelmä sen sijaan houkuttelee uusien innovatiivisten säästöprojektien toteuttamiseen, kun taas standarditoimiin perustuva järjestelmä soveltuu etukäteen tunnistettujen potentiaalisten toimien toteuttamiseen.

4. Energiansäästötoimenpiteiden monitorointi ja varmennus

   Energiatehokkuustoimien valvonta ja hyväksyttäminen eivät ole yhtä suoraviivaisesti toteutettavissa kuin esimerkiksi vihreiden sertifikaattien tapauksessa. Energiatehokkuustoimien vaikutuksia ei pystytä selkeästi todentamaan mittauksin, vaan säästövaikutukset arvioidaan vertaamalla toteutunutta kulutusta niin sanottuun baseline-kulutukseen eli kulutukseen, joka tapahtuisi ilman toimenpiteitä. Erityisesti standarditoimien yhteydessä toimenpiteiden säästövaikutusten arviointi on haastavaa ja perustuu laskennalliseen keskimääräiseen säästövaikutukseen. Standarditoimien käyttö kuitenkin helpottaa valvonnan toteuttamista ja alentaa verifioinnin kustannuksia merkittävästi.

5. Velvoitteen täyttäminen ja täytäntöönpano

   Järjestelmän uskottavuuden ja sertifikaattimarkkinan tehokkaan toiminnan turvaamiseksi järjestelmään tulee luoda riittävän tiukka mekanismi velvoitteiden täyttämisen valvonnassa. Velvoiteosapuolten tulee noudattaa valvonnasta, toimien hyväksyttämisestä sekä niiden raportoinnista asetettuja velvoitteita. Viranomainen valvoo toimijoille asetettujen säästötavoitteiden toteutumista ja asettaa tarvittaessa sakon, jos tavoitteita ei ole saavutettu. Sakko määräytyy yleensä suhteessa saavuttamatta jääneeseen energiamäärään.

6. Sertifikaattimarkkinan piirteet ja markkinapaikan ylläpito

   Valkoisten sertifikaattien järjestelmä voi perustua sertifikaattien markkinapaikan luomiseen, jolloin velvoiteosapuolilla on mahdollisuus valita velvoitteidensa täyttäminen joko toteuttamalla toimenpiteitä itse, hankkimalla sertifikaatteja kahdenvälisin sopimuksin energiapalveluyrityksiltä tai muilta velvoiteosapuolilta tai hankkimalla sertifikaatteja spot-markkinoilta. Sertifikaattimarkkinan tehokkaan toiminnan varmistamiseksi voi olla tarpeen luoda tavoitteita tukevia muita ominaisuuksia. Mahdollisuus sertifikaattien siirtoon ja lainaukseen velvoitejaksojen yli sekä sertifikaattien rekisteröinti ja niiden jäljittäminen ovat eräitä tärkeitä elementtejä sertifikaattien kauppaan perustuvissa järjestelmissä.

Selvityksen perusteella valkoisten sertifikaattien järjestelmästä on tunnistettu muun muassa seuraavia etuja ja heikkouksia.

Etuja:

- periaatteessa mahdollistaa säästötoimien toteutumisen toimenpiteiden kustannusjärjestyksessä
- tuottaa tilastotietoa toteutettujen säästötoimien vaikutuksista
- luo mekanismin, jonka puitteissa säästötoimet voidaan kohdistaa tunnistetuille sektoreille ja toimenpiteille, jotka eivät todennäköisesti muuten toteutuisi
- on markkinaehtoinen mekanismi, joka voidaan ainakin periaatteessa laajentaa EU-laajuiseksi järjestelmäksi
- lähtökohtaisesti takaa järjestelmälle asetetun energiansäästötavoitteen saavuttamisen

Heikkouksia:

- järjestelmän hallinnolliset kustannukset nousevat helposti korkeiksi, erityisesti jos sektorikenttä on laaja ja jos järjestelmä sisältää kaupankäyntimekanismin
- lisäävyyden varmistaminen edellyttää suurta panostusta energiankäytön nykytilan tutkimiseen ja dynaamista säästötoimien vaikutusten laskentaa
- soveltuu heikommin suuren mittaluokan energiansäästöinvestointien tukemiseen
- järjestelmän kokonaiskustannuksia ei voida tietää ennalta, mikä voi johtaa ylimitoitettuun kompensaatioon velvoiteosapuolille

Kansainväliset kokemukset

Selvityksessä on tutkittu valituissa EU-maissa käytössä olevien valkoisten sertifikaattien järjestelmien ominaisuuksia ja niillä saavutettuja tuloksia. Valittuja maita olivat Italia, Ranska, Iso Britannia ja Tanska.

Maissa toteutettujen valkoisten sertifikaattien järjestelmien ominaispiirteiden välillä on merkittäviä eroja. Erot juontavat juurensa erilaisiin järjestelmälle asetettuihin politiikkatavoitteisiin. Järjestelmien keskeisiä tavoitteita ovat energian loppukäytön tehostaminen ja hiilidioksidipäästöjen vähentäminen. Maat ovat asettaneet järjestelmälle lisäksi muita tavoitteita, joiden vaikutukset näkyvät niiden suunnitteluratkaisuissa. Italiassa tavoitteena on lisäksi energiaomavaraisuuden lisääminen, Ranskassa sähkö- ja kaasumarkkinoiden kilpailuun varautuminen ja Iso Britanniassa vähävaraisten ja eläkeläisten tukeminen.

Tutkitut maat ovat asettaneet eritasoisia vaatimuksia sallittujen energiatehokkuus-toimien lisäävyysvaikutukselle. Italiassa tiukoilla lisäävyyskriteerillä on keskeinen vaikutus järjestelmän toimintaan. Sen sijaan Tanskassa ja Ranskassa toimille ei aseteta tai asetetaan vain lievästi lisäävyysvaatimuksia. Kovin lievien lisäävyysvaatimusten seurauksena järjestelmä voi tuottaa kohtuuttomia hyötyjä toimien toteuttajille, sillä säästötoimet kohdistuvat todennäköisesti sellaisiin projekteihin tai investointeihin, jotka olisivat kannattavia ilman sertifikaattien tukeakin.

EU-maiden valkoisten sertifikaattien järjestelmissä niin sanotuilla standarditoimilla on keskeinen asema. Standarditoimet ovat määrämuotoisia toimia, joiden säästövaikutukset lasketaan etukäteen. Ne kohdistuvat usein rakennusten energiatehokkuuden parannuksiin sekä kotitalouksien energiatehokkaisiin laitteisiin. Säästöt arvioidaan suhteessa maan keskimääräiseen käytössä olevan teknologian kulutukseen (baseline-tasoon). Keskeiset syyt standarditoimien laajamittaiseen käyttöön ovat verifioinnin merkittävästi alhaisemmat kustannukset verrattuna projektikohtaisesti verifioitaviin toimiin. Toinen syy on riittävän tarkan ja neutraalin tiedon puute energiatehokkuuspotentiaalista järjestelmän piiriin kuuluvilla sektoreilla. Standarditoimien määrittelyä tulee kehittää säännöllisesti, jotta toimilla saavutettavien säästövaikutusten laskennassa tulee otettua huomioon keskimääräisen energiankäytön jatkuva tehostuminen sekä muun lainsäädännön vaikutukset.

Useammassa tutkitussa maassa on tunnistettu tarve kehittää energiankäyttäjille suunnattavien niin sanottujen pehmeiden toimien, kuten tiedon jakamisen ja muiden sellaisten toimien, jotka eivät vaadi investointeja, sisällyttämistä järjestelmään. Esimerkkinä pehmeistä toimista voidaan mainita Ranskan standarditoimenpiteistä taloudellisen ajotavan kurssi liikennepolttoaineen kulutuksen vähentämiseksi. Yleensä ottaen tutkittujen maiden järjestelmien hyväksytyt toimet eivät juuri sisällä pehmeitä toimia. Järjestelmän ja velvoitteiden olemassaolon on kuitenkin arvioitu edistäneen velvoiteosapuolten toimia energiatehokkuustiedon jakamisessa energiankäyttäjille, vaikka ne eivät olisi oikeutettuja valkoisten sertifikaattien lunastamiseen.

Erilaiset järjestelmäratkaisut eri maissa tekevät maiden valkoisten sertifikaattien järjestelmien tulosten vertailun erittäin haastaviksi. Järjestelmän puitteissa saavutettuja säästöjä ei voi verrata keskenään, koska niiden taustalla voi olla lähes vastakkaiset periaatteet esimerkiksi lisäävyysvaatimusten suhteen. Lisäksi järjestelmien kattavuus vaihtelee merkittävästi Italian ja Ranskan lähes kaiken energiankäytön kattavuudesta Iso Britannian järjestelmän rajaukseen ainoastaan kotitaloussektoriin. Näin ollen järjestelmän piirissä oleva tehostamispotentiaalit muodostuvat ainoastaan näistä sektoreista ja tekevät säästötulosten vertailun mahdottomaksi.

Selvityksen mukaan edellytyksiä kauppaan perustuvan valkoisten sertifikaattien (TWC, Tradable White Certificate) järjestelmän tehokkaalle toiminnalle ovat mm. seuraavat seikat:

- laaja sektorikenttä toimien toteuttamiselle,
- kaupankäyntioikeus myös muilla kuin velvoiteosapuolilla,
- toimenpiteiden toteuttajille tarjotaan riittävästi ja laadukasta tietoa eri sektoreiden ja energialajien säästöpotentiaalista,
- riittävän haastavat säästötavoitteet, jolloin sertifikaateille syntyy riittävä niukkuus,
- selkeät, läpinäkyvät ja dynaamiset periaatteet säästöprojektien verifioinnissa sekä
- selkeät ja läpinäkyvät periaatteet tavoitteen saavuttamatta jäämisestä asetettavien sakkojen määrittelyssä sekä sakon tason asettaminen niin, että se ei ole ylimitoitettu, mutta silti rankaiseva.

Pohdintaa valkoisten sertifikaattien järjestelmän soveltuvuudesta Suomeen

Valkoisten sertifikaattien järjestelmän keskeiset valinnat heijastavat sille asetettuja yleisiä, usein poliittisia tavoitteita. Järjestelmän luomisessa tulee ottaa huomioon Suomen erityispiirteet. Raportissa on analysoitu joitakin keskeisiä valintoja ja seikkoja.

Suomessa on pitkät perinteet energiansäästö- ja energiatehokkuusohjelmien toteuttamisessa. Energiapalveludirektiivin piirissä olevat toimijat ovat liittyneet laajasti vapaaehtoiseen energiatehokkuussopimusjärjestelmään ja niiden puitteissa onkin saavutettu tavoitteisiin nähden hyviä tuloksia. On kuitenkin nähtävissä, että saavutettaville säästöille asetetaan jatkossa yhä kasvavia tavoitteita. On myös sopimusaloja, joissa saavutettujen säästöjen määrä näyttäisi jäävän jälkeen asetetuista tavoitteista. Olisikin hyvä tutkia tarkemmin syitä säästötoimien toteutumatta jäämiseen ja arvioida valkoisten sertifikaattien järjestelmän soveltuvuutta näiden toimien toteuttamisen edistämiseen.

Valkoisten sertifikaattien järjestelmät voivat parantaa ESCO-toimijoiden liiketoimintaedellytyksiä. Tärkeitä tekijöitä ESCO toiminnan edistämiselle ovat riittävän laajan markkinapotentiaalin turvaaminen luomalla mahdollisimman kattava järjestelmä sekä kehittämällä mahdollisimman pitkälle standardoituja dokumentteja ja hakuprosesseja säästöprojektien hyväksyttämiseen. Tärkeä tekijä ESCO-toiminnan edistämisessä on riittävän kattavan ja ajantasaisen tiedon saanti energiatehokkuuspotentiaalista eri sektoreilla.

Selvityksen perusteella valkoiset sertifikaatit näyttäisivät soveltuvan erityisesti pienen kertaluokan, mutta laajan käyttäjäjoukon energiatehokkuustoimenpiteiden aktivoimiseen. Tällaisia ovat esimerkiksi kotitalouksissa tai palvelusektorilla toteutettavat toimenpiteet. Laajempien ja teknisesti haastavampien projektien toteuttaminen valkoisten sertifikaattien järjestelmässä vaatii työlästä hyväksyttämisprosessia, mikä nostaa järjestelmän kustannuksia niin hakijoiden kuin myös sen hallinnoinnin osalta.

Yleisesti ottaen energiatehokkuuden taso on Suomessa korkea. Energiatehokkuuden varhaisten toimien ja kansallisten markkinoiden koon johdosta Suomi voi osoittautua liian pieneksi markkinaksi valkoisten sertifikaattien markkinan luomiselle. Valkoisten sertifikaattien markkina-alueen laajentaminen yhteiseksi muiden EU-maiden kanssa toisi sekin mukanaan useita haasteita sekä lisäisi hallinnollisia kustannuksia. Yhteisten valkoisten sertifikaattien markkinoiden luomisen vaarana on, että varhaisia toimia tehneet maat päätyvät rahoittamaan muissa, energiatehokkuuden suhteen jäljessä olevissa maissa tehtäviä toimia - ellei varhaisia toimia ole riittävästi huomioitu EU:n taakanjaossa.

Pohjoismaiset energiaregulaattorit ovat asettaneet tavoitteen yhteisten sähkön vähittäismarkkinoiden luomiselle Pohjoismaihin. Tässä kehitystyössä tulee ottaa huomioon Pohjoismaiden mahdollisesti erilaiset ratkaisut energiatehokkuuden edistämisen keinoissa erityisesti sähkön vähittäismyyjille asetettujen velvoitteiden osalta. Tehokkaan ja tasapuolisen kilpailutilanteen luomiseksi vähittäismyyjien toimintaedellytykset tulee olla merkittäviltä osin yhtenevät kaikissa markkina-alueen maissa.

Mikäli Suomessa päädyttäisiin tavoittelemaan kasvavia säästötavoitteita energiatehokkuusvelvoitteeseen perustuvalla mekanismilla, yksinkertainen ja sektorikattavuudeltaan suppea järjestelmä voisi osoittautua kustannustehokkaimmaksi. Suppean järjestelmän riittävyys saavuttamaan asetetut säästötavoitteet riippuu pitkälti siitä, millä sektoreilla potentiaali on, mikä sen volyymi on ja millä kustannuksilla potentiaali saadaan toteutettua. Jatkuva säästöpotentiaalin kartoitus on tarpeen riippumatta siitä, mikä energiatehokkuusvelvoitteen toteutustapa on.

2. EXECUTIVE SUMMARY

The European Commission's Plan for Energy Efficiency from 2006 established the objective of consuming 20% less energy by 2020. The recent studies show that the current level of implementation of measures in the EU member states will only achieve energy savings of about 13% by 2020. Consequently, in the new proposals for the new Energy Efficiency Plan and Energy Services Directive there are expected to have critical evaluation of the current path in reaching for the set targets and introduction of more precise guidelines for the policy mechanisms to be applied in reaching the targets. White certificates system has been indicated as one of the potential market based mechanism in promoting energy efficiency.

The target of this study is threefold. First, to examine the theory of white certificate systems, secondly review the experiences from the European countries where white certificate systems are in use, and thirdly, to analyse the applicability of a white certificate system in Finland.

The theory of white certificate systems

A White certificate scheme is a policy measure to facilitate energy end-use efficiency improvements. The principle of white certificates is that authorities impose energy efficiency obligations on electricity and/or heat and/or gas suppliers or distributors, which can then decide whether to implement energy efficiency measures to end-users or purchase white certificates, depending on their marginal costs and the price of the white certificates. White certificates are used as a document to verify a certain amount of reduction in energy consumption. The price of the white certificates is either set in a spot-market or in bi-lateral trading.

White certificate schemes involve a number of design variables, and the choices made for these variables may have an important influence on efficiency and effectiveness of the system. The relevant choices may be grouped under six headings[1]: 1. Sources of demand for white certificates, 2. Defining and allocating targets, 3. Defining and certifying energy efficiency activities, 4. Monitoring and verifying energy saving activities, 5. Compliance procedures and enforcement; and 6. Market characteristics and operation.

1. Sources of demand for white certificates

   The choice on obliged party is essentially done between Distribution Company or Supplier in the case of electricity or gas market actors. It should be noted that imposing the obligation to certain actors does not mean that other energy carriers would be excluded from Tradable White Certificate (TWC) system. It's possible that the obliged parties are allowed to execute energy efficiency actions in all eligible energy carriers and with all eligible end-user sectors.

   Distribution companies act as natural monopolies and are thus under regulation. In that respect additional obligation could be relatively easy to implement on distribution companies. On the other hand regulation of distribution companies' right to collect costs related to TWC obligation from end users must be in line and transparent with regulation of regular distribution tariffs.

   Suppliers generally have well-established and direct relationship with the end-users. That should give suppliers incentives to promote services related to energy efficiency. Furthermore, electricity supply being a competed branch assures cost efficiency of energy efficiency measures. Competition and market concentration are

[1] NERA (2005)

however aspects that need to be addressed when imposing obligation on suppliers. TWC should not distort competition e.g. by favouring small or big companies or hindering development of international retail markets.

2. Defining and allocating targets

   The authorities have to set the size of a white certificate target. The size of the target depends on the level of ambition of the authorities. In addition, it needs to be decided what type of target is to be used, i.e. relative or absolute. In addition, a decision on whether the target should be increased over time, and on the length of the period the target is valid for, must be taken. These questions need to be addressed regardless the mechanism that is selected for increasing energy efficiency and do not, per se, relate to TWC-mechanism.

   Allocating an energy efficiency target to certain actors does not necessary require inauguration of white certificates. The purpose of the certificates is firstly to document transparently achieved energy savings and secondly create a tool to efficiently take advantage of energy efficiency potential where appropriate. The degree to which these efficiency gains are sought for should be compared to transaction costs related to widening the scope and nature of the TWC-scheme. Creating a market for TWCs can attract new energy services business and serve as source of income from actions that are triggered by such external support. ESCO activity also reduces challenges arising from (unequal) obligation sharing.

3. Defining and certifying energy efficiency activities

   A key issue in TWC schemes is the eligibility of projects that generate certificates. It also needs to be decided if approved measures should be standardized (rights-based system) or based on applications for all measures (application-based system) or a combination of those. Application-based system is a simple way to assure technology neutrality, which, in theory, should lead to lower costs and efficient outcome of the TWC-mechanism. When targeting especially small end-users, the trade-off between “mechanism accuracy” and transaction costs related to application processes become more crucial. Small savings per unit of action in e.g. household segment is a strong argument in favour of rights-based system. Minimizing administrative effort might out-weight efficiency gains from action/technology neutrality. Application-based system attracts more easily innovative solutions, whereas rights-based system can be used as a tool to selectively favour certain energy efficiency measures or sectors. Strict requirements in additionality call for regular update on baseline definitions in savings calculations relating to standard measures as well as application based calculations.

4. Monitoring and verifying energy saving activities

   The monitoring and verification of energy-saving projects within White Certificate schemes is less straightforward than for example the monitoring of renewable electricity generation within a green certificate scheme. This is because the quantity of energy ‘saved’ cannot be directly measured, but must be estimated by comparing measured or calculated energy consumption with a counterfactual baseline. Introduction of standard lists facilitate monitoring and verifying burden ex-post. Ex-ante definition of energy savings achieved from a measure that is qualified as “standard action” requires calculating an action or technology specific baseline. Standard lists are thus vulnerable to embedded favouring of selected activities and calculation based energy savings can diverge from actual energy savings achieved.

5. Compliance procedures and enforcement

   Adequate compliance and enforcement mechanisms will be necessary to ensure both the credibility of the TWC scheme and the effective operation of the certificate market. Participants must comply with the monitoring, verification and reporting protocols for projects and the trading rules for certificates, as well as meeting their individual energy saving targets. Compliance with targets may be enforced through a financial penalty that can be specified as a fine for each kWh of energy ‘not’ saved.

6. Market characteristics and operation

   Allowing trade with the certificates creates more room for market efficiency. The less active ESCO-business is, the more it is important to introduce trading possibilities. If the market for TWC functions well the question of equal obligation burden becomes less crucial. Trading can either be permitted between obliged parties or allow also third parties to enter the market. Introduction of trading possibility is more beneficial and cost effective if the scope of eligible sectors in the scheme is broad and if also non-eligible parties are allowed to trade certificates.

   Additional rules may be required on the best possible functionality of a white certificate market. The banking and borrowing of certificates and the registration and tracking of certificates are some important market design features. An Implementer is a market actor who carries out measures on the premises of an end user. The measures can be ordered and financed by the obliged party who then receives certificates corresponding to the calculated or pre-defined (standard actions) savings. The less the right to implement is limited the more room is left for new business to merge and innovations to be found. In a system where TWCs are granted on standard lists basis certain degree of monitoring or permitting is however essential for quality control purposes. In application based system it is less important to regulate implementers ex-ante, whereas the verifying process is more burdensome and more costly.

Experiences from the European countries with white certificate systems

White certificates are in theory a useful policy tool to foster additional investments and project in end-use efficiency and achieve energy savings. However, they need to be complemented (and supported) by other policy actions aimed at overcoming the obstacles to the development of a market for energy efficiency products and services, e.g., information campaigns and clearing houses, energy labelling, minimum energy efficiency requirements, market studies and statistics to help identify the technological baseline and, thus, to give incentives where they are more needed.

Coexistence of different policy tools to promote end-use energy efficiency gains and the related public benefits, require a strong policy coordination effort at the institutional level in order to avoid over-incentives and alterations of market forces and signals, the latter being a key input for fine-tuning and updating the regulatory framework.

A possible pitfall of a white certificate scheme is that the monitoring and verification procedures are rather complex, and open to cheating (through self reporting). Regulators should pay proper attention to this aspect as well as to the aspect of the ‘additionality’ factor.

The basic design and regulatory choices in determining the outcomes of a white certificates scheme is of high importance. Many design modalities reflect national policy priorities. This includes factors such as size of the saving potential in the sectors under obligation, the size and nature of the obligation, the decision between annual or lifetime saving targets, obliged parties, sector and energy coverage, and the status of market liberalisation.

White certificate schemes are shown to be well suited to end-use sectors with low unit consumption, like household and services sectors where certificates can deliver low-cost and standard energy efficiency measures. Nevertheless, they can be designed to channel efforts towards individual measures with higher upfront investment needs. This requires a more detailed validation and measuring policy of the regulator.

Administrative costs of all policy instruments are a function of the simplicity of the system and the ease of obtaining reliable information necessary for its design and enforcement. Defining standard measurement and verification methodologies reduces the transaction costs for obliged parties and project developers and thus directs the market towards types of projects or sectors, where such standard methodologies ('deemed savings') are available.

A broad scope inevitably entails high(er) administration costs for both the regulator and the various market actors; efficacy in terms of energy savings delivered calls for accurate measuring and verification rules and procedures, but this may conflict with the need to keep these rules and procedures as simple as possible in order to limit transaction costs.

Trading is expected to deliver cost efficiency gains when energy-saving targets are set sufficiently high with respect to the existing economic saving potential in the sectors covered by obligations. The more challenging the obligation is, the greater the benefit of trading, as it brings diversity in the marginal costs of compliance among trading parties. The higher the target, the more likely it is that the obliged actors can reduce compliance costs by trading and that certificate trading can actually deliver cost efficiency gains.

Analysis of the applicability of a white certificate system in Finland

The designs of white certificate schemes vary significantly between different countries. This is due to different goals that the scheme has been set for. Also the development phase of competitive energy markets has influence in the design elements. If a white certificate scheme should be implemented in Finland, the design solution of the mechanism should be carefully evaluated taking the Finnish characteristics into account. In the report some of the key issues to be considered are discussed when analysing applicability and design of white certificates system in Finland.

Finland has one of the most comprehensive energy saving programmes in Europe. Voluntary energy efficiency agreements play a vital role in implementing the EU energy service directive and its target is to save energy by 9% compared to reference period of 2001 -2005 average energy consumption.

Companies that have joined the agreement are eligible to subsidies in commissioning energy analysis and executing energy efficiency investments. Despite the subsidies, the realized savings in some sectors lack behind the set targets. An important share of final energy in Finland is consumed in industry sector, in which also important energy saving potential has been identified. The largest gap between targets and achieved savings so far, is in the municipality sector. Whether a TWC-scheme is an appropriate instrument to harness the existing saving potential, depend on the reasons why such potential still exists and savings actions have not been taken.

Market imperfections, such as lack of information, can be addressed with other measures also, but a TWC-scheme as a tool to promote ESCO-business can be as efficient. Some of the critical factors in facilitating ESCO business to emerge are sufficient volume of business potential and creating standard documents and procedures to lower the business risks and thereby lower the financing costs. If TWC-scheme is designed to correct market imperfections, the requirement of additionality can not be interpreted too strictly.

White certificates could provide an incentive to enhance energy efficiency in household sector. In order to attain cost efficiency the actions in household sector should be largely based on utilization of pre-defined standard actions.

The benefits of a TWC-scheme can be argued to have a positive correlation with the number of sectors and scope of eligible energy carriers. The wider the range for energy savings potential, the more white certificates can facilitate in finding the most cost effective means to realize energy savings. Given the early actions taken in Finland and the size of energy markets in Finland, it may appear that Finland alone forms too limited a market for TWCs. Expanding the system to cover larger geographical area brings along, though, several challenges and administrative costs.

If national target for energy savings in Finland is wanted to be achieved through energy efficiency obligations (EEO), a simple and sectorally narrow white certificate system in which certificates are only traded between obliged parties may appear most suitable. Whether such scope is sufficient to achieve national targets depends on the location, volume and costs of energy savings potential. Thorough research and continuous follow-up of such potential is thus a prerequisite for designing any form of EEO-system.

3. INTRODUCTION AND TARGETS OF THE STUDY

Energy efficiency represents one of the three 20's in EU's energy and climate package from 2008. EU has set a target to increase energy efficiency by 20% by 2020 compared to the baseline scenario for energy consumption. Unlike targets in CO_2 reduction by 20% or the target to increase the share of renewable energy sources by 20%, the target in energy efficiency is not binding for the EU member states. The present Energy Services Directive from 2006 sets an indicative 9% savings target for EU Member States to be achieved during a period of 2008 to 2016.

In the EU's Energy Efficiency Action Plan from 2006 there are introduced actions in order to achieve the set target. The European Commission's communication for the new Energy Efficiency Plan that covers years 2011-2020 has been given on 8th of March this year and it's currently being debated between member states.

The Energy Services Directive sets the framework for the national implementation for the improvement of energy efficiency. The Directive is subject to a revision as a result of the new Energy Efficiency Plan. The revision is expected to be given before Midsummer 2011. It's commonly expected that in both the new Energy Efficiency Plan and the Energy Services Directive there will be critical evaluation of the current path in reaching for the set targets and introduction of more precise guidelines for the policy mechanisms to be applied in reaching the targets. The recent studies show that the current level of implementation of measures will only achieve energy savings of about 13% by 2020[2].

One policy measure for improving energy efficiency is a white certificate system. Such systems are already in use in some European countries. White certificates are referred as one of the potential policy measures for ensuring to reach the EU targets in energy efficiency in the above mentioned EU documents.

The targets of this study are threefold. First, to examine the theory of white certificate systems, secondly review the experiences from the European countries where white certificate systems are in use, thirdly, to analyse the applicability of a white certificate system in Finland.

3.1 Energy Efficiency driven actions from the EU

The European Commission's Action Plan for Energy Efficiency from 2006 established the objective of consuming 20% less energy by 2020 compared to the base scenario, e.g. development without additional actions. The EU Commission estimated that making such energy savings would allow Europe to reduce its CO_2 emissions by 780 million tonnes and save €100 billion in fuel costs. To achieve the objective, the Action Plan identified specific EU actions in several priority areas to be implemented between 2007 and the end of 2012. Major actions taken since then include:

- Legislation on energy performance of buildings. Main policy instrument is the Energy Performance of Buildings Directive (EPBD), from 2002 and the recast agreed on in 2010.
- Introduction of Eco-design requirements for energy-using products such as televisions, refrigerators and lighting. The policy instrument is the Eco-Design Directive first introduced in 2005 and recast in 2009.

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[2] Energy Savings 2020, 2010: European Commission, "Energy efficiency: delivering the 20% target", (COM(2008) 772 final), 2008

- Energy Labeling of products and buildings as specified in the Labeling Directive and the EPBD.
- Legislation on energy services as outlined in the Energy End-Use Efficiency and Energy Services Directive from 2006. According to this Directive, member states are committed to submit national energy efficiency action plans to the EU outlining how each country mean to reach an indicative energy saving target of 9% by 2016.
- Legislation to limit the CO_2 emissions of cars.

Nevertheless, the issuing of several Directives aiming at putting Europe on track to 20% energy savings has not paid off. Projections indicate that with the rates of implementation of the current energy efficiency policies in Member States the EU is at best heading towards 13% savings. So while EU is broadly on track for the 20% target for renewable, it's a long way from achieving the objective set for energy efficiency

The NEAPs also provide important information regarding energy efficiency. EU energy consumption in 2020 is projected to be 95% of the 2005 level. National energy consumption estimates range from increases on 2005 of more than 20% in Cyprus, Lithuania and Malta to reductions of 14% in Germany and 9% in the UK[3].

The European Council of 4th February 2011 focused on the importance to strengthen the work on energy efficiency measures. One of the conclusions was that as of 1st January 2012, all Member States should include energy efficiency standards taking account of the EU headline target in public procurement for relevant public buildings and services.

The Commission communication about a new Energy Efficiency Plan has set out in more detail a series of policies and measures across the full energy supply chain. The Commission will review the implementation of the EU energy efficiency target by 2013 and consider the need for further measures. In the new Energy Efficiency Plan there are indications towards possible national binding energy efficiency targets after 2013 and promotion of energy savings with the use of market based support mechanisms, like white certificates. In fact, there is a statement that "The Commission will propose that all Member States establish a national energy saving obligation scheme appropriate for their circumstances".

[3] Renewable Energy: Progressing towards the 2020 target, COM(2011) 31 final

4. RATIONALE FOR IMPLEMENTING A WHITE CERTIFICATE SCHEME/ ENERGY EFFICIENCY MEASURES

Improvements in energy efficiency are motivated by a whole series of objectives. Many look at measures intended to improve energy efficiency as an objective in itself. In many countries, power production is also closely associated with greenhouse gas emissions; and even renewable power production may have negative effects on the environment. In addition, reduced energy consumption can contribute to improved security of supply in a more effective way than the development of more production or transmission capacity. Within the EU, energy efficiency targets tend to be closely associated with reduction of greenhouse gas emissions and security of supply.

4.1 Definitions

This report will be based on the definitions from the Directive on energy end-use efficiency and energy services (ESD directive). The main definitions are[4]:

> *Energy efficiency:*
>
> *A ratio between an output of performance, service, goods or energy, and an input of energy*
>
> *Energy efficiency improvement:*
>
> *An increase in energy end-use efficiency as a result of technological, behavioral and/or economic changes*
>
> *Energy savings:*
>
> *An amount of saved energy determined by measuring and/or estimating consumption before and after implementation of one or more energy efficiency improvement measures, whilst ensuring normalization for external conditions that affect energy consumption*

The above definition of energy efficiency improvements implies that improvements in energy efficiency are relative, not absolute since energy use remains constant while output increases. This stands in contrast to a definition where total energy consumption is supposed to be reduced, something which entails that overall output will go down.

One example of energy efficiency improvements according to this first definition would be that room temperature is maintained constant with a lower level of energy consumption, or that the same level of consumption results in increased comfort. Examples of potential measures could be the insulation of old construction, installation of heat recovering units or heat pumps, replacement of devices and machines – or operational measures that reduce energy consumption without additional investments and without any financial or economic consequences.

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[4] DIRECTIVE 2006/32/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 April 2006 on energy end-use efficiency and energy services

4.2 The relation of energy efficiency measures to policy instruments targeting greenhouse gas emissions and production of renewable energy

White certificates are an instrument designed to help achieve energy end-use efficiency improvements. At the same time, energy and greenhouse gas emissions are closely connected in most countries, since production and use of energy to a large degree entails the use of fossil fuels (coal, gas, oil, gasoline, oil-shale and peat).

One potential effect of energy efficiency improvements are lower energy prices as a consequence of reduced consumption, which again can entail increased energy use as energy has become cheaper. This can neutralize parts of or all of the savings achieved through higher energy efficiency. In addition, over time energy consumption will depend on economic growth, wealth and changes in the population.

Implementation of energy efficiency improvements will generally affect greenhouse gas emissions and make it less costly to realize any climate targets that have been set. In various studies of the necessary measures to achieve global climate targets, energy efficiency improvements constitute a considerable share of the measures that will have to be executed. Efforts to implement energy efficiency improvements will also help to reduce the need for new renewable energy in connection with the reduction of greenhouse gas emissions. Measures for energy efficiency improvements are therefore often at least partially motivated by climate targets. The same applies to new renewable energy.

However, as far as energy efficiency in connection with power consumption and the production of new renewable power are concerned, power production is one of the sectors covered by the EU's quota system for CO_2 – ETS. It is the quota market that is meant to be the main instrument for the reduction of greenhouse gas emissions within the sectors it covers, amongst other measures by making renewable energy and energy efficiency improvements more profitable by ensuring that energy from polluting sources becomes more expensive. The introduction of additional instruments targeted at energy efficiency and new renewable energy motivated by climate targets therefore means the introduction of yet more instruments aimed at the same objective. Introduction of national energy efficiency measures in the ETS sectors would rather shift the emissions than contribute to overall reduction of CO_2–emissions. Experiences of white certificate system show that overlapping and linking of CO_2 or renewable instruments is hardly desirable.

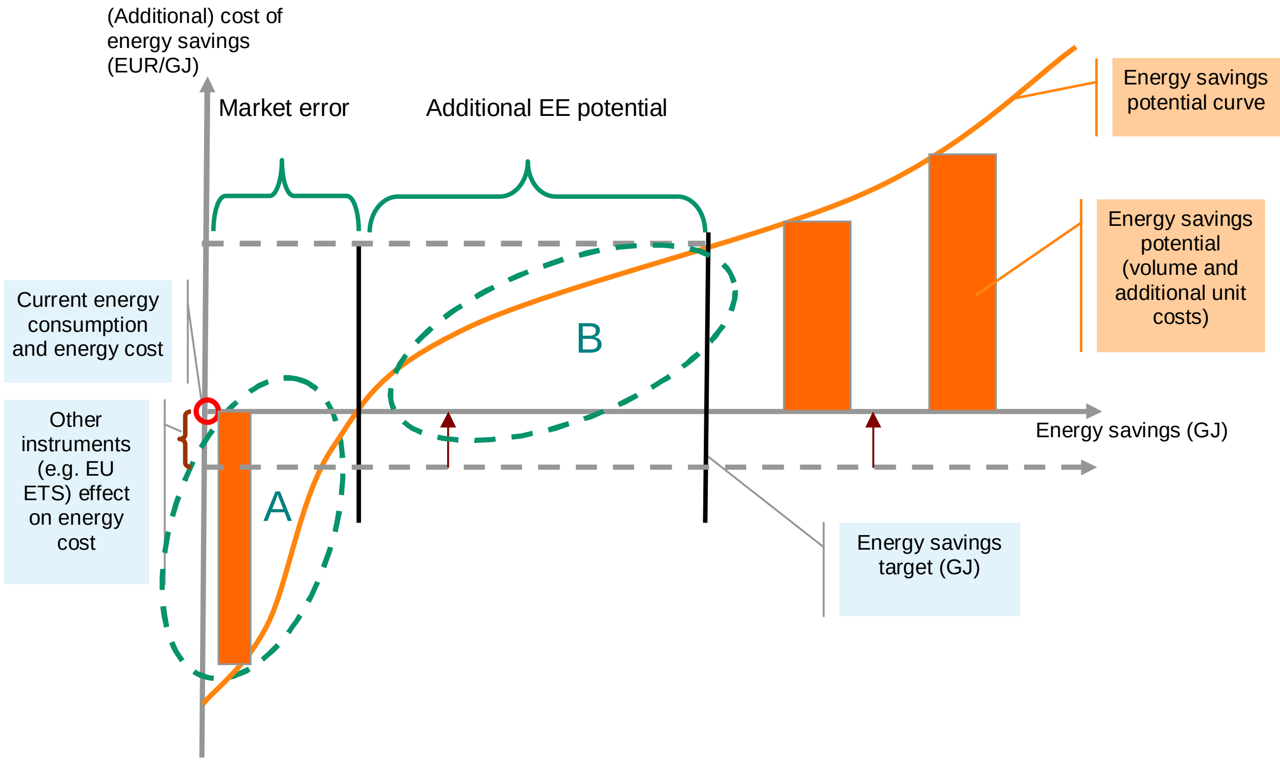
4.2.1 The scope and design of energy efficiency instrument in the energy market context

There are several instruments aiming at reducing energy consumption and/or consumption of fossil fuels. These instruments, such as EU ETS and national energy taxes, affect the cost of energy and thus make energy efficiency investments more profitable than what would be the case in the absence of the instruments. In the Figure 1 below, the vertical transition of the gray break-even line of energy savings investments illustrate the effect of existing instruments. The higher the cost of energy the more there is potential to profitably reduce energy consumption.

Figure 1 aims at illustrating the challenges related to TWC implementation in a world of overlapping political guidance and a world of uncertainties.

Regardless the mechanism, the efficiency of a political instrument depends on the accuracy of premises and assumptions made regarding the problem at hand. In order to select the right tool knowledge of existing energy savings potential is crucial. The orange curve in the figure illustrates what the accumulated energy savings potential might look like. The energy saving potential below the gray break-even line consists of such measures that would be profitable without additional support. The further we move to the right, the more additional support is required.

Figure 1 Illustration of energy savings potential: volume and costs



After having constructed the energy saving potential curve, the next step is to identify the reasons why such energy saving potential still exists, i.e. find reasons why certain energy savings investments have not been made. The appropriate tools for addressing the potential should correct the failure or reason why the investments have not been realized.

The circle "A" consists of potential which for a reason or another have not been realized even if it were economically profitable. It can be down to several market failures, such as lack of information or moral hazard. If investments in such potential were attracted with additional support in the form of TWC for example, the total costs would increase to inefficiently high level and very high profits can be gained. In such case justification for implementing a TWC-scheme can not be economic efficiency.

The circle "B" consists of energy saving potential that require additional support in order to be realized. The more uniform the potential is, the simpler it is to implement a single mechanism to support realization of these potential. If the area "B" consists of identified potential in various energy carriers, and various sectors, a uniform system's transaction costs could increase steeply. Worries of increasing "mechanism maintenance costs" may lead to situation where some of the low-cost energy saving potential in area "B" needs to be left out due to difficult measurability or verification. Selective out-ruling shifts the effective potential curve upwards. Increased transaction costs in TWC-system design have similar increasing effect on total costs.

A TWC-scheme is best suited for supporting potential in the area "B". Whether a TWC-scheme is superior to other mechanisms depends on the nature and composition of energy saving potential curve and of uncertainties related to ex-ante assumptions of costs and benefits of implementing and maintaining such scheme.

4.3 Summary of TWC and ETS compatibility

Studies in economic theory shows the following effect of introducing a white certificate scheme:

Table 1 Price and quantity effects of introducing a white certificate scheme in a country participating in the EU ETS[5]

Variable	EU ETS	EU ETS and TWC scheme	Additional impact of introducing the TWC scheme
Wholesale electricity price	Increased	Likely increased	Lower price than with EU ETS alone
Retail electricity price	Increased	Likely increased	Retail price reduced by lower demand, but increased by cost recovery. Likely increased price if supply is insensitive to price.
Electricity demand	Reduced	Reduced	Lower demand than with EU ETS alone
National non-green generation	Reduced	Reduced	Lower generation than with EU ETS alone due to lower demand.
National green generation	Likely increased	Likely increased	Existing renewables have low short run marginal cost and should take preference in merit order. Generation therefore is unlikely to be affected by reduced demand.
National CO_2 emissions	Reduced	Reduced	Ambiguous. Lower emissions from national electricity generators. But whether national emissions are lower depends upon who purchases and uses the surplus EU ETS allowances.
EU CO_2 emissions	Reduced	Reduced	Unaffected by TWC scheme. With EU ETS in place, TWC scheme has n impact on EU CO_2 emissions within a given EU ETS Phase.
Investment in end-use efficiency	Increased	Increased	Increased investment due to TWC subsidies. Offset by ambiguous incentive from retail prices – but latter also likely to increase
Investment in renewable energy	Increased	Likely increased	Lower incentive to invest due to lower wholesale electricity prices
EU ETS allowance price	-	-	Lower, due to displacement of CO_2 emissions from generation. Abatement paid for by consumers through TWC scheme

Notes: Columns 2 and 3 compare the effects of the policies to a situation where there is no regulation. Column 4 outlines the incremental effect of adding a TWC scheme—i.e., it compares the effects in column 3 to those in column 2.

This is not a complete analysis of the costs and benefits of the instrument combination, since market failures and effects in secondary markets are ignored. If these were taken into account and quantified, the instruments could lead to positive benefits for society as a whole. Nevertheless, the analysis does illustrate which groups are likely to benefit directly from the instruments and which are likely to incur additional costs.

[5] NERA(2005)

5. ANALYSIS OF THE DESIGN ELEMENTS IN A WHITE CERTIFICATE SYSTEM

A white certificate scheme is a policy measure to facilitate energy end-use efficiency improvements. The principle of white certificates is that authorities impose energy efficiency obligations on electricity and/or heat and/or gas suppliers or distributors, which can then decide whether to implement energy efficiency measures to end-users or purchase white certificates, depending on their marginal costs and the price of the white certificates. White certificate are used as a document to verify a certain amount of reduction in energy consumption.

5.1 Basic design features of a white certificate scheme

White certificate schemes involve a similar number of design variables, and the choices made for these variables may have an important influence on efficiency and effectiveness. The relevant choices may usefully be grouped under six headings[6]. These will be further elaborated below:

1. Sources of demand for certificates
2. Defining and allocating targets
3. Defining and certifying energy efficiency activities
4. Monitoring and verifying energy activities
5. Compliance procedures and enforcement; and
6. Market characteristics and operation

5.1.1 Sources of demand for certificates

A key decision in the development of a Tradable White Certificate (TWC) scheme is the choice of *an obliged party:* that is, the organisations on whom the obligation to achieve the energy savings is imposed. In most schemes, it is the end user who is responsible for achieving energy savings, and paying for the cost of any measures – either through the transfer of costs through the purchase of certificates, or through charges. At the same time, it is not very expedient for the authorities to have to relate to millions of end users; therefore, it is usual to designate one actor who can take the role of obliged party on behalf of a whole group of customers. The situation might be different in the case of large end-users.

The role of the obliged party is mainly to ”collect” money from their customers, either by transferring the cost of acquiring certificates to the customers as a share of the electricity/heat or distribution price or by collecting charges/duties.

The authorities can for example determine a quota of 10 percent. This entails that the obliged party needs to buy certificates corresponding to 10 percent of deliveries in their customer portfolio or in their license area. Certificates can be bought from an implementer who carries out energy efficiency measures (see chapter 5.1.8).

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[6] NERA (2005)

Obligation on Distribution company or Supplier?

The choice on obliged party is essentially between distribution company or supplier in the case of electricity or gas market actors. It should be noted that imposing the obligation to certain actors does not mean that other energy carriers would be excluded from TWC system.

Distribution companies act as natural monopolies and are thus under regulation. In that respect additional obligation could be relatively easily implemented on distribution companies. On the other hand regulation of distribution companies' right to collect costs related to TWC obligation from end users must be in line and transparent with regulation of regular distribution tariffs.

Suppliers generally have established and direct relationship with the end-users. That should give suppliers incentives to promote services related to energy efficiency. Furthermore, electricity supply, being a competed branch, assures cost efficiency of energy efficiency measures. Competition and market concentration are however aspects that need to be addressed when imposing obligation on suppliers. TWC should not distort competition e.g. by favouring small or big companies or hindering development of international retail markets.

5.1.2 Defining and allocating targets

The authorities have to set the size of a white certificate target. The size of the target depends on the level of ambition of the authorities. In addition, it needs to be decided what type of target is to be used, i.e. absolute or relative. The first option implies that the target is expressed as for example a given number of TWh, the second entails that the target is formulated as a saving of a certain percentage of energy use, such as a decrease of 2 percent. There also needs to be a decision on whether the target should be increased over time, and on the length of the period the target is valid for. These questions need to be addressed regardless the mechanism that is selected for increasing energy efficiency and do not, per se, relate to TWC-mechanism.

The current white certificate schemes specify a target in terms of total kWh energy savings, and make no reference to baselines for aggregate consumption by a consumer group. Instead, the targets refer to the total energy savings required from investment in individual energy saving projects, such as the installation of cavity wall insulation in a certain number of households. Each individual project leads to a corresponding quantity of kWh energy savings that is either estimated using standard factors or measured against a project-specific counterfactual baseline. The specification of a required quantity of energy savings effectively translates into a required quantity of investment in energy saving projects – but with flexibility regarding what these projects are and where they can be located[7].

5.1.2.1 White certificate quota obligation

A white certificate quota obligation can take the form of a certain share of the energy an actor is responsible for, and the quota obligation can for example be increased yearly in order to achieve a certain target.

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[7] NERA(2005)

A quota system with white certificates can be organized in different ways, but it is usual to set up trading solutions either via bilateral trading between the obliged actors and other actors that have the right to receive certificates, or through an exchange.

In addition, it is possible to set up a quota system for energy efficiency improvements without using white certificates, but with the help of other methods of documenting energy savings. The last mentioned is the case in Denmark and the UK, which we will discuss in more detail later, but the underlying principle is still the same. One difference can be that the use of white certificates to document target achievement is easier to relate to, at least if intensive trading activity is desired and where more actors than just those that are obliged parties are supposed to have the right to act as implementers.

If a scheme for white certificates is to be established as an instrument for energy efficiency improvements with a quota obligation for the obliged parties, there are several aspects the authorities need to take a stand on. Some of these aspects are more general and associated to which targets are set for energy efficiency improvements and which sectors and energy carriers the scheme is aimed at. The other aspects are more model-specific, and mainly decide the final design of the quota scheme.

First step: allocating the obligation

Allocating an energy efficiency target to certain actors does not necessary require inauguration of white certificates. The purpose of the certificates is firstly to document transparently achieved energy savings and secondly create a tool to efficiently take advantage of energy efficiency potential where appropriate. The degree to which these efficiency gains are sought for should be compared to transaction costs related to widening the scope and nature of the TWC-scheme. Creating a market for TWCs can attract new Energy Service business and serve as source of income from actions that are triggered by such external support. ESCO activity also reduces challenges arising from (unequal) obligation sharing.

5.1.3 *Defining and certifying energy efficiency activities*

A key issue in TWC schemes is the eligibility of projects that generate certificates. In principle, a wide definition of eligibility should maximize the opportunity for cost saving and thus minimize the costs to energy retailers and consumers. At the same time, it may conflict with some of the broader objectives of the TWC scheme, such as requirement of additionality, and may increase the administrative costs associated with monitoring and verification[8].

Which measures will lead to a right to certificates or target achievement is a central question. It also needs to be decided if approved measures should be standardized (**rights-based support**) or based on applications for all measures (**application-based support)** or a combination of those. An example of rights-based support is a guaranteed lump sum of support as long as you implement a pre-defined measure. Whereas an application based system means that each planned measure is subject to an evaluation on an individual basis before support is granted.

Rights-based or application-based system?

Application-based system is a simple way to assure technology neutrality, which, in theory, should lead to lower costs and efficient outcome of the TWC-mechanism. When targeting end-user segment, and especially small end-users, the trade-off between “mechanism accuracy” and transaction costs related to application processes become

[8] NERA(2005)

more and more crucial. Small savings per unit of action in e.g. household segment is a strong argument in favor of rights-based system. Minimizing administrative effort might out-weight efficiency gains from action/technology neutrality. Application-based system attracts more easily innovative solutions, whereas rights-based mechanism can be used as a tool to selectively favor certain energy efficiency measures or sectors.

It is also important that the measures lead to actual savings, and it needs to be decided if additionality is a requirement (i.e., where only measures that need support in order to be implemented should be approved). Which measures entail a right to certificates and maybe also how many certificates the different measures merit decides whether the scheme is going to be technology neutral.

To determine the energy savings resulting from an energy efficiency activity, the eventual energy consumption has to be compared to a baseline (reference situation) without additional saving efforts. Additionality refers to certification of genuine and durable increases in the level of energy efficiency beyond what would have occurred in the absence of the energy efficiency intervention, for instance, only due to technical and market development trends and policies in place. Core criteria for determining additionality can be based on[9]:

- Increase of turnover for obliged entities;
- Innovation;
- Present market structure;
- Average performance of components (e.g., insulations);Existing standards and regulations;
- Monitoring mechanisms;
- Duration of energy savings;
- Rebound effects, i.e., unexpected grater consumes deriving from chances of increased comfort (e.g., turning up the heating) produced by some energy saving projects (e.g. cavity wall insulation) without additional fuel costs for the residential use.

Additionality

Additionality is a standard requirement for energy efficiency measures to be supported e.g. by TWCs. In theory overlapping support instruments result in inefficiency. Stringent interpretation of additionality may however limit the applicability of support for energy efficiency if an important part of energy efficiency potential is not realized due to “market imperfections”. In such case e.g. TWC scheme as an additional support could trigger actions that effectively should have been done already.

Strict requirements in additionality call for regular update on baseline definitions in savings calculations.

It is usual for such schemes that a list of standard measures which give a claim to certificates is drawn up. Such measures can for example consist in the purchase of a fridge, freezer or washing machine of energy class A or above or a heat pump. The value of each standard measure is calculated based on the consumption of the

[9] Energy Charter Secretariat (2010)

average-on-the-market appliance, not the consumption of the replaced appliance. In such cases, it might make sense that the seller receives these certificates, so that it becomes more profitable to purchase energy efficient equipment.

The advantage of standardized measures is that the risk for the actor implementing the measure is reduced and administrative costs are lower, but since the saving is calculated it might differ from the actual energy saving achieved. This might potentially also put a damper on innovation, i.e. further improvements to technology and/or solutions. At the same time, it is common that schemes also open up for the possibility of getting more complex energy efficiency improvement measures approved on application.

The supply of certificates

Again, the more branches and energy carriers are qualified for white certificates, the more efficiently energy savings potential is used. Setting the target level must be in line with realistically achievable potential, but also ambitious enough, within the selected sectors. If wide range of sectors is included the comparison of energy savings in different energy sources (electricity, heat, etc.) may become difficult. Furthermore, some sectors are more affected by other schemes, such as ETS, than others. Selection of targeted sectors to be included in the TWC-scheme requires thus good understanding of where the best energy savings potential is and what might be the costs related to it. Acknowledging difficulties related to comparability of different types of energy efficiency actions, it may be worth investigating how to also include immeasurable “soft actions” in the scheme.

5.1.4 Monitoring and verifying energy saving activities

The monitoring and verification of energy-saving projects within white certificate schemes is much less straightforward than for example the monitoring of renewable electricity generation within a green certificate scheme. This is because the quantity of energy ‘saved’ cannot be directly measured, but must be estimated by comparing measured or calculated energy consumption with a counterfactual baseline. The credibility and success of the scheme depends upon how these baselines are calculated for different types of projects. The regulator will wish to ensure that qualifying projects achieve energy savings that are additional to those that would have been achieved in the absence of the TWC scheme. This additionality criterion is analogous to that used within DSM programs and project-based emissions trading schemes, but presents a number of methodological difficulties[10]. Introduction of standard lists facilitate monitoring and verifying burden ex-post. Ex-ante definition of energy savings achieved from a measure that is qualified as “standard action” requires calculating an action or technology specific baseline. Standard lists are thus vulnerable to embedded favoring of selected activities and calculation based energy savings can diverge from actual energy savings achieved. In an international context a unified baseline may further create wrong incentives if the starting point differs from a region to the other. In order to achieve sufficient additionality in standard measures, the standard lists and savings calculations must be regularly updated.

5.1.5 Compliance procedures and enforcement

Adequate compliance and enforcement mechanisms will be necessary to ensure both the credibility of the TWC scheme and the effective operation of the certificate market.

[10] NERA(2005)

Participants must comply with the monitoring, verification and reporting protocols for projects and the trading rules for certificates, as well as meeting their individual energy saving targets.

Compliance with targets may be enforced through a financial penalty that can be specified as a fine for each kWh of energy 'not' saved. This penalty may be fixed, or it may be linked to the market price of certificates or a combination of the two. A fixed fee effectively creates a ceiling on certificate prices, which translates to a ceiling on the cost of the scheme for energy consumers[11] and rules out more expensive actions.

5.1.6 Market characteristics and operation

Additional rules may be required on the best possible functionality of a white certificate market. The banking and borrowing of certificates and the registration and tracking of certificates are some important market design features. These are analogous to the mechanisms within green certificate markets and emissions trading schemes.

5.1.7 Implementer

An Implementer is a market actor who carries out measures on the premises of an end user. Those can be various energy efficiency improvement measures, for example installation of a heat pump or heat exchanger, isolation of the dwelling, exchange of windows, equipment for day/night set-back etc. The measures can be ordered and financed by the obliged party who then receives certificates corresponding to the calculated or pre-defined (with standard actions) savings.

An end user will also be able to directly contact an Implementer and order measures to be carried out, as long as these measures are listed as approved and the scheme allows for this solution. End user or Implementer will in this case receive certificates from the authorities corresponding to the measures that have been carried out and approved depending on what has been agreed.

Who can actually implement an energy efficiency measure?

The less the right to implement is limited the more room is left for new business to merge and innovations to be found. In a system where TWCs are granted on standard lists basis certain degree of monitoring or permitting is however essential for quality control purposes. In application based system it is less important to regulate implementers ex-ante, whereas the verifying process is more burdensome and thus more costly.

5.1.8 Different organization of the market actors

Being an Obliged party or an Implementer can be seen as roles that can be assigned to one or several actors. There is no reason why one and the same company should not be able to act as both Obliged Party and Implementer, but the authorities can require that these roles are organized in separate departments or companies/subsidiaries, so that it becomes possible to monitor that measures are carried out in the most efficient way and the most cost-efficient manner.

[11] NERA(2005)

Energy Service Company (ESCO)

ESCO take on behalf of their customer, the economical and technical risk related to the action or service to increase energy efficiency. ESCO directly pays the investment cost upfront, and receives income from issued certificates. The certificates can be the only source of income, or additional to the charge of the service itself. How much risk ESCO needs to bear depends on the design of the TWC: discounted lifetime savings embedded in the certificate at once, or certificates issued over the lifetime of the investments. Creating enough incentives for ESCOs to merge is essential to develop liquidity in the market, if that is desired. ESCOs are important facilitators in finding the potential and taking the measures in cost effective manner especially in larger and technically challenging projects.

5.1.9 Trade

It is important to distinguish between certification of energy savings and trading of white certificates. Trading is not a precondition for certification: in itself a certificate is an instrument that provides a guarantee that savings have been achieved due to a specific project. A certificate can be used as an accounting tool to verify compliance with energy-saving targets or with other obligations, or to qualify for e.g. state support (subsidies) or preferential taxation[12].

There are different trading options: horizontal trading between obliged parties (possible in Italy and France with certificate trade and in the UK and Denmark with obligation or project trade), vertical trading whereby obliged parties purchase certified savings or projects from third parties (possible in Italy, France, the UK and Denmark), and temporal trading, most notably banking, whereby in case of over-compliance participant carry over part of their savings to the next compliance period (possible in Italy, UK, France and Denmark). Apart from these dimensions, trading can occur on a spot market or bilaterally (over-the-counter, OTC)[13].

Tradability and banking/borrowing

Allowing trade with the certificates creates more room for market efficiency. The less active ESCO-business is, the more it is important to introduce trading possibilities. If the market for TWC functions well the question of equal obligation burden becomes less crucial. Trading can either be permitted between obliged parties or allow also third parties to enter the market. Introduction of trading possibility is more beneficial and cost effective if the scope of eligible sectors in the scheme is broad and if also non-eligible parties are allowed to trade certificates.

Ambitious long-term energy efficiency targets may speak in favor of borrowing and banking. Flexibility in the system creates stability in the long-run. Furthermore larger energy efficiency projects are better incentivized if banking is allowed.

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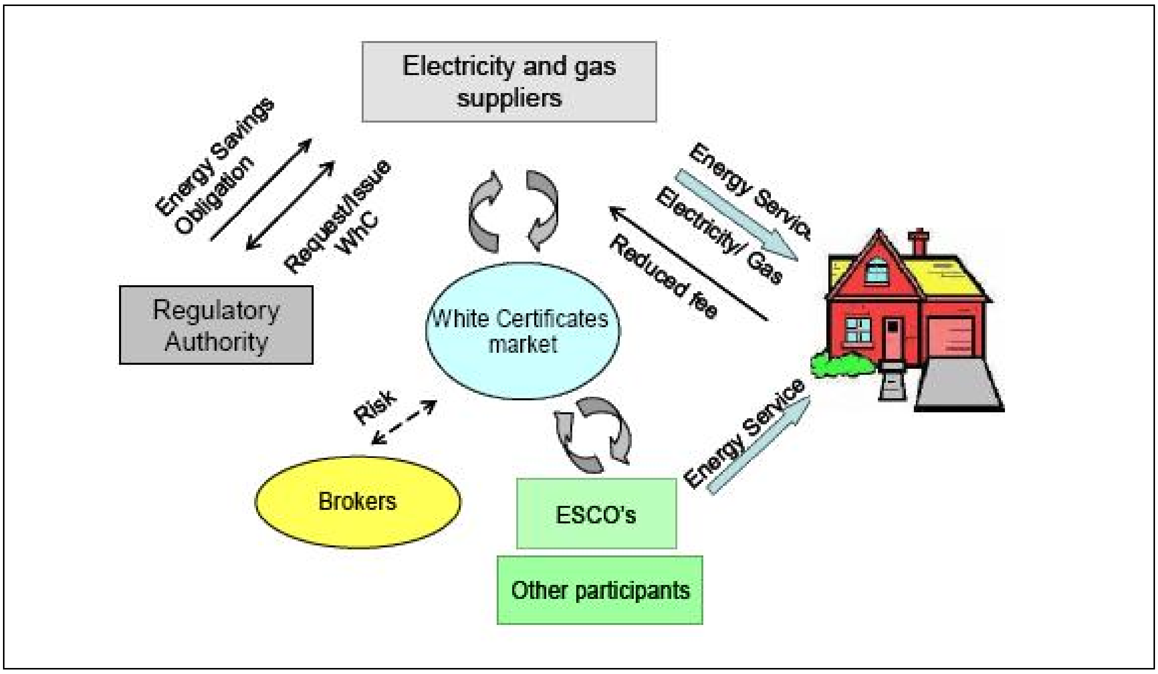
[12] Bertoldi et al. (2010)

[13] Bertoldi et al.(2010)

5.2 Market participants in a white certificate market

The following Figure 2 illustrates the roles of different stakeholders in a generic TWC-market. The mechanism for income and benefit can vary depending on the design of the market.

Figure 2 Illustration of market participants in a generic white certificate market



Source: Oikonomou (2010).

The figure above illustrates the participants of a generic white certificate market[14]:

1. Regulatory authority
   - The regulatory authority plays the principal role in distributing the obligations among the participants and issuing the certificates.
   - It's usually the regulator's task to control that obliged parties reach their targets and set the penalty fee when necessary.
   - Depending on the level of additionality requirements in the system, the regulator may have rather burdensome tasks in order to guarantee that the dynamic evolution of the baseline consumption is taken into account in the savings calculations. This may require yearly evaluation of eligible standard actions and calculation rules.
2. Suppliers and/or distributors of gas and electricity
   - The suppliers and distributors of gas and electricity can request and trade white certificates. These market participants have an obligation, set by the regulatory authority, to save a certain amount of energy within a specified period. They have to promote specific energy efficiency projects to the end-consumers. In return they receive white certificates and can trade them on the market.

[14] Oikonomou, 2004

- Obligation to obtain white certificates means an additional cost factor for electric utilities. To cover these costs utilities have to raise electricity price / distribution tariff or collect some separate surcharges. In case of a distribution company this requires changes in regulation to allow inclusion of these costs in the tariff structure.

3. Energy service companies (ESCO's)

   - ESCO's are companies that may offer to reduce a client's energy cost, often by taking a share of such reduced costs as repayment for installing the energy efficiency measure and financing its upgrades. They will not have an obligation set by the regulatory authority. ESCO's can participate the scheme after achieving energy savings and receiving white certificates by selling them to the obliged parties (OTC trade) or by participating to the certificate spot market.

4. End users

   - It is up to the end users to decide which measures they wish to implement. End users typically pay for the measures to implementers like obliged parties or ESCO's. Costs of the implemented measures will be discounted by the market value of the white certificates. Achieved lower consumption leads to lower energy bills in the future, but that benefit may be partly offset by increasing energy prices / distribution tariffs / surcharges as a consequence of fulfilling the saving targets.

   - Through increased prices all energy users would contribute to covering the costs of the scheme, but only part of the customers would get the benefits. Inclusion of end users' early actions enhances the fairness of the scheme.

5. Brokers / Other participants

   - There may be other participants/entities in the white certificate market with no obligation, but a possibility to purchase and sell white certificates. Examples for such entities are brokers and financing institutions. These participants will provide liquidity in the market, facilitate transactions and reduce the risk of the investments. The eligibility and the role of these entities differ among the existing white certificate schemes. These entities are included in the UK and French white certificate scheme.

6. WHITE CERTIFICATE SCHEMES IN SELECTED EUROPEAN COUNTRIES

White certificates schemes has been tested in a number of European countries, and which in the experience of several of these countries has proven effective in helping to achieve quantifiable energy savings. The schemes that are in operation vary in form, and each country has a scheme that is tailored to its own market.

Italy, France, Denmark and the UK are those countries in Europe that have progressed furthest with developing a market for white certificates. In some regards, they have chosen very different approaches with relation to their choice of obliged party and the way the individual solutions are organized.

Only Italy and France have systems for white certificates in a pure form, in that they use white certificates to register energy efficiency improvement measures and to prove the achievement of quota obligations, but the schemes in the UK and Denmark are still generally described as white certificate schemes.

The following description will focus on charting what type of solution those countries have chosen in regard to the different elements of a white certificate scheme as discussed above, and look at the experiences and assessments from the individual countries.

Table 2 Overall objective of the European systems for white certificates

Country	Policy objectives
Denmark	Reduce energy consumption
France	More efficiency in consumption Reduce carbon emissions Energy security
Italy	Reduce carbon emissions Reduce dependence on energy imports Develop a market for energy efficient products and services
UK	Reduce of carbon emissions Reduce energy costs for low incomes and pensioners

Source: Swedish Energy Authority (2010)

6.1 Italy

Italy set up its system for white certificates in 2005. To start with, the target was an energy efficiency improvement of 2.9 million toe for the period from 2005-2009. In 2007, the system was adjusted and the target set to 3.2 million toe for the period from 2005-2012 and the size-threshold for obliged companies was downgraded in addition to other changes. The major drivers for the changes were: lack of targets and a clear political commitment for post-2009 period, gap between the allocated savings targets and the national gross target due to dynamics in the electricity and gas market, lack of information on the expected savings from approved measures compared to future targets and lack of confidence on the penalty mechanism.

The following description is based on the system as it is today.

System design

In the Italian system, the electricity grid companies and the gas grid companies are obliged to achieve a certain amount of energy savings every year. The yearly savings targets for each energy carrier add up to the total target for Italy. Only those electricity and gas grid companies with more than 50,000 customers are obliged parties, almost 80 companies in total. The obligation for each company is determined according to their market share. The size limit was originally 100 000 customers. The reason for implementing the size-threshold is to limit the administrative costs of the mechanism.

Measures can be carried out within all end-user sectors and energy carriers. Every saved toe corresponds to one white certificate, and normally a measure gives a claim to one white certificate per year for a five-year period. In case of projects in heating or air conditioning, the crediting period is eight years. The savings are calculated on an ex post basis, meaning that the savings are accredited only after they have been delivered.

In Italy, distributors, energy service companies and certain end users (which have to have a designated "energy manager") receive certificates for energy efficiency improvement actions that have been implemented. In addition, certificates are tradable both bilaterally and on an exchange, so that distributors can fulfill their obligations by implementing measures themselves, having others implement measures for them, or purchasing white certificates bilaterally or on the exchange.

For each certificate that the obliged distributor hands in to the authorities, he receives a compensation of EUR 100 per toe, independently of the actual cost of the measures. This is financed through a designated tariff on network charges. There is a provision for a penalty mechanism in case distributors do not fulfill their obligations, but this does not consist of a certain fixed sum, but is to be decided by the regulator in such a way that it is at least equal to the cost of fulfilling the remaining obligation.

The market regulator (AEEG) has developed a rigorous monitoring and verification system. The electricity market operator registers the white certificates and (since recently) over the counter bilateral contracts. In 2008, for example, almost 40% and in 2007 one third of the volume of obligations was traded (up from 17% in 2006), of which 70% bilateral. Trading may therefore be called significant[15]. There are three different verification methods in place: predefined standard actions (deemed savings, see annex 1), technical evaluation based on some metering (engineering methods), technical evaluation based on case specific follow-up plan with metering before and after the project (complete monitoring plans). All three methods are regularly updated by the regulator in order to follow the development in technological baseline.

Results

For the period from 2005-2008, Italy over-fulfilled its target by 0.4 million toe, with a total saving of 3.7 million toe. Of this total, 77 percent came from electricity, 19 percent from gas and 4 percent from other fuels. In addition to this, 90 percent of all measures were based on standard actions. Over 80 percent of all measures were directed at households, while 10 percent were targeted at industry. Trading activity for certificates has been significant and mainly bilateral, although the share of certificates traded on the exchange is increasing.

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[15] P.A. Boot (2009) Energy efficiency obligations in the Netherlands. A role for white certificates? http://www.ecn.nl/docs/library/report/2009/e09045.pdf

In Italy a significant share (80% in the period 2005-2008) of actions has been implemented by ESCO companies[16]. One of the reasons behind this is that in Italy the policy has been to loose the direct relationship between the distribution company and end-customers. This has made it challenging to distribution companies to effectively promote energy efficiency measures at the end-users. The DSO's are prohibited to perform any actions beyond the meter[17]. This has lead to a situation where the DSO's are forced to buy white certificates from ESCO's or act via separate companies controlled by them. Another reason for such a high share for ESCO's is that the definition of ESCOs is wider than for example in Finland. It includes basic energy service providers and consequently only a few per cent are also suppliers of energy as well as energy efficiency measures.

The scheme has gradually promoted the entry of new companies within energy efficiency improvement. Totally 577 new energy service companies were established during 2004-2006. In addition, there have emerged new forms of cooperation between different market actors and an increasing number of information campaigns and training programmes. The scheme is generally regarded as well-functioning and attracts energy efficiency improvements in a cost-efficient way. It is though pointed out that certain areas of regulation, like the design of the cost recovery mechanism with obliged parties, pose a challenge. In addition, some see a need for the introduction of additional instruments. According to a press release by Italian Energy Authority the 6th September 2010, Italy has seen particularly positive achievements by avoiding consumption of 6.7 million toe and reduced emissions by about 18 million tonnes of CO2. These values are in excess of the national target for the five years from 2005 to 2009.

The Italian Energy Authority has approved 215 million euros portion of financing for the promotion of energy efficiency through the white certificate mechanism. Incentives paid from the effective date of the mechanism (January 2005) to date of the press release amount to 531 million euros in aggregate, which resulted in benefits 5 to 10 times higher than costs, according to the Authority[18]

Future

On the 20th December 2010, the Italian Energy Regulatory Authority published a consultation document on promotion of higher energy savings[19]. The consultation document suggests further improvements in the white certificate mechanism by promoting investments in more structural technologies, i.e. technologies implying savings on bills for many years; to support –within the integrated energy-service sector – more efficient business models; and to prevent speculative behavior in the white-certificate market.

The set of proposals made by the Authority is based on the encouraging experience gained in its regulatory activity and management of the first five years of functioning of the white certificate mechanism and take account of the recent evolution in legislation, although the Government still has to determine national objectives for the years after 2012.

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[16] Marcella Pavan (Italian Regulatory Authority for Electricity and Gas (AEEG) 2009) White Certificates in Italy http://www.wupperinst.org/uploads/tx_wiprojekt/Pavan_BMU_10122009.pdf

[17] International Energy Agency DSM programme, Market Mechanisms for White Certificates Trading, Task XIV Final Report, 2006

[18] http://www.autorita.energia.it/it/inglese/press_releases/10/100906.htm

[19] Autorità per l'energia elettrica e il gas: Press release 20 December 2010. http://www.autorita.energia.it/alegati/com_stampa/10/101220_ingl.pdf

6.2 France

France introduced a white certificate scheme in 2006, with a target of 54 TWh valid for the period of July 2006 to July 2009. The scheme will continue and new terms were agreed 30th December 2010. Our description is based on the scheme as it was applied during the period that just ended, and a comment on the next period is added at the end.

In France, it is the suppliers of electricity, gas, LPG and oil, plus heat and refrigeration/ cooling, mainly over a certain size, which are the obliged actors in the scheme. The obligations are determined firstly in relation to the energy carriers' market share and then in relation to the individual actor's market share within the energy source in question. The number of obliged parties is very high, more than 2 000.

The obliged actors are basically free to carry out measures within all sectors (customer groups), energy carriers and types of measures. All types of measures are allowed, but there are exceptions for measures in installations that are covered by a quota obligation, measures which only constitute a switch from one fossil energy carrier to another, and measures that are implemented in order to comply with a law. In addition, a comprehensive list of standard measures within the individual sectors has been drawn up, 170 in total, see annex 1. Certificates are referred to as "cumac". "Cumac" stands for accumulated and discounted, and refers to kWh saved over the technical lifetime of a measure, discounted by 4 percent. Certificates are issued on application by local authority representatives.

In addition to the obliged actors, public authorities and other companies can also carry out energy efficiency improvement measures and receive certificates under certain circumstances, which can then be sold on to the obliged actors. There is no dedicated exchange for trade in certificates, but provisions have been made for non-organized bilateral trade in certificates on the register's homepage.

The scheme is financed in such a way that the suppliers pass on the costs for achieving their obligation to their customer via the end-user price. If the actors do not fulfill their obligation, they incur a penalty charge of 2 cent per kWh.

Results

During the first period of the scheme, France over-fulfilled the target by 6 TWh, a total saving of 60 TWh. Statistical data from January 2009 show that 88 percent of all measures were carried out in the housing sector, 77 percent within heat and 18 percent within isolation. 10 standard measures stood for over 70 percent of all savings. At that point, target achievement was considerably lower than by the end of the period half a year later. The intense focus on households has to do with a tax credit introduced at the same time, so that a series of measures targeted at households also result in a tax credit for them. Some hold the view that the two instruments should be seen as complementary to each other, at least during this first period of the system's existence.

One effect of the scheme is that energy suppliers have developed energy-related counseling and management services as one way of contributing to the achievement of their obligations. There has been little trade in certificates, by January 2009 only 4 percent of issued volume had been traded, i.e. 1.4 TWh. The reason for this has been that there has been little need to purchase certificates in order to fulfill obligations, i.e., the actors have wished to carry out measures themselves.

Future

The 30th December 2010, the French government launched a new stage of the white certificate scheme[20]. The new period will last for the period 1 January 2011 to 31 December 2013.

According to the French Government, the white certificates scheme is now entering a mature phase and the ambitions are increased. The new target is 345 TWh cumac in 3 years, compared to 54 TWh cumac from the previous period.

6.3 UK

The UK was the first European country with a white certificate system. The system for white certificates was introduced in 2002 and has now entered its third period of obligations. In this third period, the target has been changed from a reduction in energy consumption equaling a certain number of TWh to a target related to reduction in CO2-emissions. The name of the scheme has correspondingly been changed from "Energy Efficiency Commitment" (EEC) to "Carbon Emission Reduction Target" (CERT). Regardless of this, the scheme has also earlier had a certain focus on CO2 due to the calculation method used to credit savings. The current target is 185 million tons of CO2 from 2008 to 2011.

The obliged parties in the UK are electricity and gas suppliers with a minimum of 50 000 customers. The minimum size requirement was introduced in order to avoid creating obstacles to the market entry of new suppliers, and has been raised somewhat in comparison to the earlier years of the scheme. The total obligation is divided between the actors according to their market share in the household sector.

In the UK, measures can only be implemented in the household sector, and it is a requirement that a minimum of these measures shall be implemented in low-income households and with the elderly. Actors can also carry out measures for customers that are not their own. Also this scheme uses a list of standard measures, see annex 1, but all types of measures within all energy carriers in the household sector are allowed. For the sake of simplicity, all standard measures have been categorized within six areas: isolation, lighting, devices, heat, micro-generation, demonstration measures and customer behavior. In addition, the actors can claim a bonus for the implementation of innovative solutions.

Savings are calculated in relation to the CO_2-intensity of the energy source to which efficiency improvements are made, and are based on the lifetime saving generated by the measure. It is a requirement that the measure would not have been carried out without the contribution of the actors, and the actors have to inform Ofgem to get the measure approved and registered.

The obliged actors have the option of cooperating with others in order to achieve their targets, but must in this case document that the measures carried out together with a third party would not have been implemented without financing from the obliged party. A third party is, however, not allowed to carry out an activity and then sell it to the obliged party. On the other hand, the obliged actors are free to sell part of their obligation to other obliged actors, or purchase savings achieved by other obliged parties. Actors need to apply to Ofgem for permission to do this.

The costs incurred by the individual actors in order to fulfill their obligations will be passed on to their end-customers in the household market. These customers have the possibility of changing suppliers, which results in pressure for cost-efficiency on the

[20] Press Release Ministère de l'Écologie, du Développement durable, des Transports et du Logement 30.Dec. 2010

side of the obliged actors. Apart from this, there is little transparency regarding costs for the individual actors.

Results

The experiences with CERT in the first year of the obligation period are positive. The obligation parties have already fulfilled half of the total obligation quota, in addition to the requirement regarding low-income households and the elderly. A large part of this is due to savings that have been transferred from an earlier obligation period, as much as 46 percent. The suppliers choose to work both directly towards their own household customers and with different partners, but since as a rule the supplier itself needs to be involved in any measures, there has not been any cooperation with energy efficiency service companies, i.e., no such companies have been established. The main share of the measures that were implemented during the first year was within insulation (56 percent) and lighting (38 percent).

The experience from the second obligation period from 2005-2008, while the scheme still went under the name of EEC, was over-fulfillment of the target by 44 percent, and the main share of measures were carried out within isolation also in this period (60 percent). The over-fulfillment of the target has to be seen in the light of the fact that the obliged parties knew that under certain conditions they would be able to transfer part of this to CERT. There was little indication of increased energy efficiency awareness in the end-users as a consequence of EEC, and little market pull, even though there were some signs of improvement. This is one of the reasons why CERT also contains measures targeted at customer behavior. There have also been changes in the way savings from the individual measures are calculated, and some measures have been removed and new ones included. As mentioned above, the actors can theoretically transfer obligations between each other, but this has not happened. This is due both to competitive reasons (not wanting to show the costs they incur) and the fact that any over-fulfillment can be transferred to later implementation periods.

The British system is designed with the intention of keeping the administrative and transmission costs of fulfilling the energy saving obligation to a minimum. This appears to have been successful in the case of administration, but it is more difficult to assess the cost effectiveness of the obligated parties as they are not obliged to reveal costs incurred. It has been estimated that the administration, monitoring and verification costs could be <1% of total energy supplier expenditure. It is, however, assumed that the costs incurred by private companies will be as low as possible.

In order to achieve the goal of low administrative costs the scheme does sacrifice a certain amount of precision and certainty with regards to the extent in which actual energy savings are achieved. Heavy reliance on standard measures and long lifetimes, along with very limited monitoring requirements, reduce the opportunity for accurately determining the real effect on energy consumption in households.

The administrative costs of the supervisory body, Ofgem, are low: some 600,000 to 1 million GBP yearly. These costs are recovered through licensing fees for suppliers. This is due to the standardized features of the system, and the lack of trading which would need a separate market mechanism[21].

Future

On 8 December 2010, the UK Government introduced the Energy Bill 2010/2011 to the Parliament where it's currently debated.

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[21] P.A. Boot (2009) Energy efficiency obligations in the Netherlands. A role for white certificates? http://www.ecn.nl/docs/library/report/2009/e09045.pdf

The Energy Bill has three principal objectives[22]: Tackling barriers to investment in energy efficiency; enhancing energy security; and enabling investment in low carbon energy supplies. The UK Government will introduce specific regulations under each objective.

With regards to energy efficiency, the Bill introduces the "Green Deal". The UK Government suggests creating a new legal mechanism allowing the obligation to repay the costs of energy efficiency measures to attach to the energy bill at a property, rather than to an individual. The obligation to pay will pass to the new occupier or bill payer should the applicant (of the Green Deal) move away.

The scheme intend to let householders, private landlords and businesses enjoy the benefits of energy efficiency measures and the energy bill savings they can bring, without the need for up-front finance from the customer. Payments will be collected through energy bills.

The Energy Bill will create powers allowing any tenant asking for reasonable energy efficiency improvements to receive them from 2015 onwards. It will also allow local authorities, to insist that landlords improve the worst performing homes.

The Green Deal aims to provide finance to fund fixed improvements to the energy efficiency of domestic and non-domestic properties, which will provide savings for the bill payer.

The Green Deal will include a financial framework that enables energy saving measures to be paid for in installments via energy bills. The core principle is "The Golden Rule", meaning that the installment payment for the energy saving measures should not exceed the projected associated cost savings on an average bill for the duration of the Green Deal Finance arrangement, which could be for as long as 25 years.

A new Energy Company Obligation (ECO) is introduced as part of the Green Deal. This will take over from the existing CERT obligation on companies which finishes in December 2012. The new obligation will underpin the Green Deal and focus particularly on those householders (e.g. the poorest and most vulnerable) and those types of domestic property (e.g. the hard to treat) which cannot achieve financial savings without a measure of additional support on top of the Green Deal finance.

The new obligation will not kick in until the current schemes expire at the end of 2012. The Energy Bill propose broad powers, the details will be set out in secondary legislation following a public consultation on the detail of the new arrangements envisaged in late 2011.

6.4 Denmark

Denmark has recently ratified a new agreement for white certificates, called " Energy Companies' Savings Effort", a scheme that is mainly based on voluntariness between industry actors and authorities. The scheme is based on a more general agreement regarding energy efficiency improvement in Denmark that is supposed to secure a reduction of 4 percent in gross energy consumption in 2020.

The main validity period of the agreement spans the years from 2010 to 2020, but certain parts of the agreement will be evaluated and reviewed after three years. The target contained in the agreement is an average energy efficiency improvement of 6.1 PJ per year, divided between the different industries. This is, however, one of the parts of the agreement that is due for re-evaluation on the way. In addition, part of this target

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[22] http://www.decc.gov.uk/en/content/cms/legislation/energy_bill/energy_bill.aspx

is supposed to be achieved through the establishment of a joint centre for energy savings, which will work on general tasks in connection with campaigns, market stimulation etc., and help the obliged companies achieve their targets.

The obliged actors in Denmark are the grid and distribution companies within electricity, gas, district heat and oil. With the exception of the oil distributing companies, the distribution of the total obligation for each industry to each individual company is supposed to be regulated by agreement between the companies in the respective industries. For companies that do not wish to be a part of the industry agreement, the Ministry will determine the target for the company. For the oil distributing companies, the target obligation will be determined according to their market share.

Energy savings can be implemented in all end user sectors with the exception of transport, and also in the actors' own distribution grids. The obliged actors have large freedom to identify measures and methods to achieve their obligation. In addition, they can carry out measures outside of their own respective supply area and their own form of energy (with the exception of information and counseling). A list of standard measures, see annex 1, has been drawn up, but it is possible to apply for approval for all kinds of measures. The approved saving is based on the saving achieved during the first year, but adjusted by a prioritization factor that takes into account the lifetime of the measure, the gross energy consumption connected to the saving, and the expected CO_2-effect of the measure. There is no requirement of additionality is not a requirement, i.e., that the measure would not have been carried out without support.

Implementation of the actual measures beyond counseling and information can not be carried out by the obliged companies, but the grid and distribution companies are allowed to own companies that manage the actual implementation. This does not apply to measures within the companies' own grid, where the grid and distribution companies are free to carry out measures themselves. At the same time, there is a requirement regarding involvement, and the obliged actors cannot get measures approved where they do not themselves or via an agreement with a third party contribute to the realization of energy efficiency improvements. The obliged parties need to be involved already before the measure is implemented. At the same time, the agreement contains a passage stipulating that external actors should be more actively involved, and companies within the grid and distribution companies' own corporations are not defined as external actors. This will be documented in connection with the evaluation in 2012.

The opportunities for trade in obligations are limited to the transfer of realized savings from one actor to another, potentially also via an intermediary. In addition, it is possible for an obliged actor to transfer an over- or underfulfillment of his own obligation between the individual years, with certain limitations.

For the electricity and gas grid companies, the scheme is financed via the financing regulation of the grid company(income cap), while the district heat companies are allowed to include the costs for the scheme in their end-user tariffs. Only the actual costs are supposed to be covered, and there are requirements regarding cost efficiency. Once accounts figures are available after the first year of the obligation period finishes in 2011, a benchmarking of the individual companies will be carried out and the results will be publicized. In 2012, a model to regulate the companies' costs that will contain further incentives to achieve cost-efficiency will be decided on, based on the actual costs for the two previous years. For the time being, the financing regulation of the grid company (income cap) for the electricity and grid companies has been increased by 50 øre/kWh.

Results

In 2006, the grid and distribution companies concluded the first agreement regarding further energy efficiency improvements with the authorities. They had, however, also previously done a considerable amount of work related to energy efficiency improvements, mostly related to advisory activities for their own customers and within their own energy type. The evaluation under is based on the experiences from the agreement concluded in 2006. Some changes have been made in the period from 2006 until the new agreement was concluded in 2010; those have not been analyzed more closely, but do include the adoption of the prioritization factor in the calculation of savings.

The agreement concluded in 2006 brought about a change of focus for the actors, since it opened up for the possibility to carry out a much broader range of energy saving measures targeted at all customer groups and energy types. For the electricity grid companies in particular, this meant a change of focus towards energy efficiency improvements within natural gas. An additional effect of the agreement was increased competition in the area of advisory activities to industry customers. For 2006 and 2007, 97 percent of the target obligation was fulfilled, which indicates that in general, targets are achieved. However, experience also shows that district heat companies tend to struggle more with fulfilling their obligations. To a larger degree than other companies, they have focused their effort within their own energy type, and some companies say that they do not have capacity within their own organization to handle the requirements. Under the earlier agreement, the district heat companies were obliged to fulfill certain targets, while our understanding of the new agreement of 2010 is that they have joined this on a voluntary basis.

During 2006, 2007 and the first half of 2008, 42 percent of all measures were targeted at households, while 50 percent were aimed at business and industry. Approximately half of the measures that were carried out could be classified as measures that would have been implemented anyway. Despite this, the scheme is seen as economically and financially profitable during this period. Only 38 percent of all measures were so-called standard measures. The obliged actors were generally satisfied with the scheme, especially with being given the opportunity for activities beyond their own customer base and energy type, something they claim has also led to more cost-efficiency and better customer service. The total experience is therefore seen as positive.

6.5 Prices of white certificates

In Italy, initially only 20% of white certificates were traded on the market and most white certificates were done as bilateral or subcontract arrangements between the energy distributors and energy efficiency installers. There was also considerable deviation from the cost recovery figure of €100/certificate, that the obliged parties are allowed to charge through their tariffs, and the market prices of the certificates. By 2007 white certificate prices averaged around €40 for electricity, €77 for gas and €22 for other fuels (see Figure 3), being significantly lower than the tariff contribution that the distribution companies received.

During 2007 there were made some changes to the system in order to stabilize the market. The time frame of the scheme was extended to 2012 and the savings target was upgraded, also the size threshold for obliged parties was lowered. Since the end of 2007, the market for white certificates has operated more actively. From mid-2008 both quantities and prices of bilateral deals (i.e. over the counter trades) have to be registered. The obligation to register bilateral prices has been introduced by the Italian regulator (AEEG) in order to increase the transparency of trading, to the advantage both of market operators and of the Regulator. Market signals, if not distorted, monitor the costs incurred by the system to meet its energy efficiency goals, and they are one of the possible reference parameters for updating the tariff contribution and defining the penalty for non- compliant parties.

Between June 2007 and May 2008 Italy saw buoyant trading (mostly bilateral, but an increasing share of spot market trades). Indeed in 2007, 304,932 certificates were traded on the spot market and 556,742 certificates were traded bilaterally against an actual saving target of 633,382 certificates. More than 80% of the certificates were issued for energy efficiency projects implemented by non obligated parties.[23]

The following Figure 3 illustrates the price movement of white certificate for electricity and for gas in Italy from March 2006 to June 2008. It has been analysed that the reasons behind the price drop during 2007 in type I (electricity) certificates were following[24]:

- supply surplus and market operator's expectations that the surplus situation would be long-term,
- lack of banking possibility for certificates,
- lack of targets and political commitment for the post-2009 period,
- possible market power on the demand side – mainly result of the structure of two reference markets (electricity and gas) and
- lack of confidence on the penalty mechanism – complexity and lack of pre-defined penalty.

Figure 3 Price of Italian white certificates from March 2006 to June 2008. Type 1 refers to electricity, type 2 refers to gas and OTC refers to bi-lateral or over the counter trades as disclosed to AEEG by legal requirements in April 08. (Source AAEG)

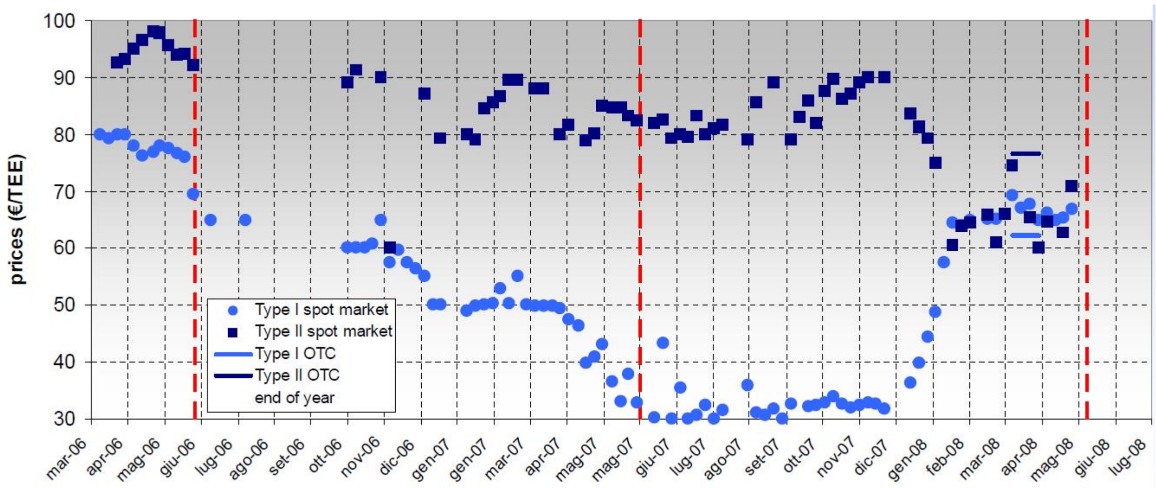
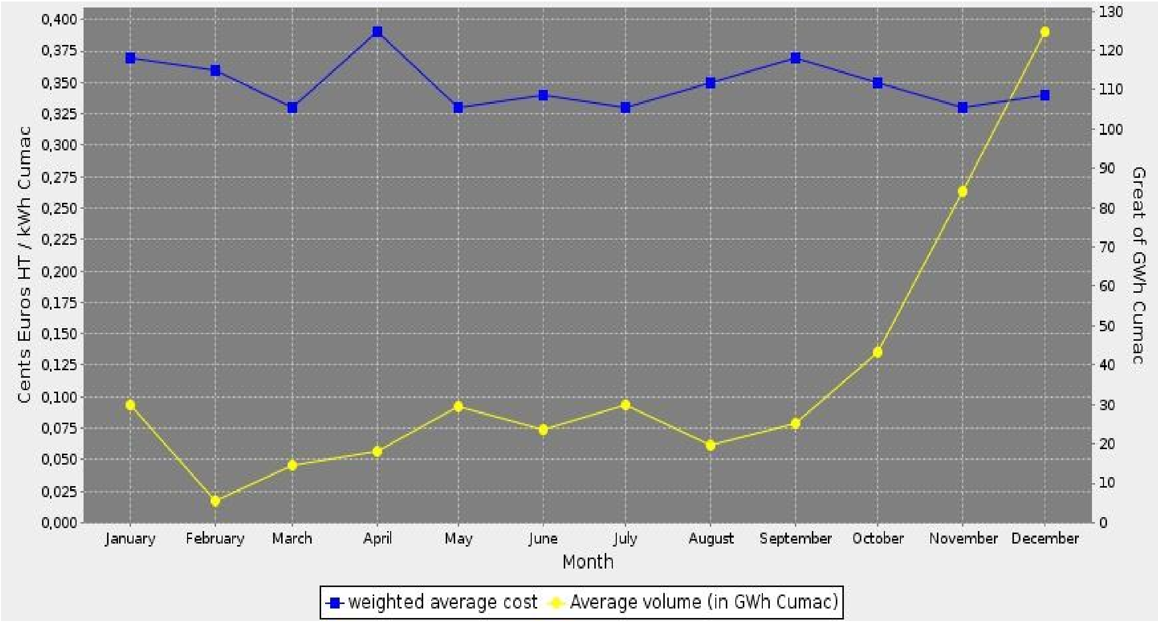


Figure 4 shows the development of white certificate prices and traded volumes in France in 2010.

[23] Eoin Lees; European and South American Experience of White Certificates. WEC-ADEME Case study on Energy Efficiency Measures and Policies. 2010

[24] Pavan: Tradable energy efficiency certificates: the Italian experience, published in *Energy Efficiency* (2008) 1:257-266

Figure 4 Average prices of issued WC and traded volume of French WC in 2010



Source: www.emmy.fr

The average price of traded white certificates in France is not currently available. In the first trading period the price is limited by the non-compliance penalty of 2 eurocents/kWh.

6.6 Summary of country description

The table below provides a short summary of important aspects in the different countries that have introduced a white certificate scheme:

Table 3 Summary of white certificate schemes in selected countries

	UK	France	Italy	Denmark
Target	Savings in CO_2	Lifetime delivered energy, kWh	Cumulative primary energy, toe	Lifetime delivered energy, PJ
Target, % of annual demand[25]	1% average in 2005-2008	1% average in 2006-2008	0,5% average in 2005-2009	1,7% (end year) in 2006-2013
Sectors	Households	Non-ETS sectors	All end users	End users excl. transport, plus own network
Obliged party	Energy suppliers with > 50 000 customers	Energy suppliers[26]	Grid companies with > 50 000 customers	Grid companies[27]
Target set by	Government	Government	Government	Government
Administrator	Energy regulator	Government	Energy regulator	Energy regulator
Penalty	Relate to size of miss	charge of 2 cent per kWh	Related to non-compliance	
Most important implementer	Energy suppliers	Energy suppliers	Energy service companies	Energy service companies
Financing	Electricity price	Electricity price	Separate charge on grid tariff	Grid tariff
Who can trade certificates	Only electricity suppliers	Energy suppliers, certain end users and public sector	All	Only grid companies
Trading solution	Bilateral	Bilateral, some provisions made	Bilateral and exchange	Bilateral

Source: Pöyry Management Consulting

The table below provides a short summary of the sectors the different schemes have delivered saving distributed as a percentage of total savings.

[25] White Certificates: concept and market experiences, Euro WhiteCert Project

[26] In addition district heating companies and suppliers of LPG and heating oil

[27] In addition district heating companies and suppliers of heating oil

Table 4 Summary of achieved energy savings in different sectors (%)

Countries	Sectors				
	Residential (electricity and heat)	Commercial buildings (electricity and heat)	Industrial	Transportation	Other
Italy 2005 - 2007	59 percent electricity use in buildings 21 percent heat use in buildings		6%	0%	14%
France 2006 - 2009	86.7%	4.3%	7.4%	0.4%	1.3% (District heating)
UK 2005 - 2008	100%	N/A	N/A	N/A	N/A
Denmark	42%	8% public sector	50% Trade and Industry	N/A	N/A

Source: Bertoldi et al (2010)

6.7 Observations and discussion

Due to the fact that only limited number of countries has adopted some sort of white certificate schemes, country-specific institutional factors can confuse available results. For such reasons far-reaching conclusions of the systems should be avoided.

The design of white certificate schemes across Europe varies considerably and their performance is heavily influenced by initial policy targets, market structure and institutional conditions as well as policy traditions in each national context. Under all white certificate schemes in the EU obliged parties have achieved and exceeded their energy-saving targets.

In such, France where they have positive experiences of white certificates operating results depend on the certificates reinforced the effectiveness of other existing instruments. White certificates often serve multiple objectives. Target image varies between countries. For example, in the UK reducing "energy poverty" is an important goal, while in France preparing energy companies face a liberalization of energy markets is an important goal behind introducing white certificates. It may therefore well be that the white certificates are a great solution for these countries, given their starting points.

Among the schemes that target more than one end-use sector, the Italian and French schemes have delivered the largest amount of energy savings in the residential sector, while the Danish obligation has focused efforts on trade and industrial sectors[28].

[28] Bertoldi et al (2010)

Over compliance with targets has been a feature of all the major schemes in the EU. According to Bertoldi et al (2010) the Italian regulator certified approximately 904 ktoe of energy savings in the period 1 June 2007–1 June 2008. However, due to the existence of certificates issued in 2005 and 2006 and not yet redeemed, as of 1 June 2008 there were almost 1.34 million certificates in circulation[29] equal to 210% of the 2007 target. Energy efficient measures implemented in the period 2001–2004 account for 13% of the total amount of white certificates issued so far and of the total savings generated in the period 2005–2007 by all energy efficiency measures implemented. In 2007 only the tradable white certificates issued and available for demonstrating compliance over the ensuing 5 years amounted to 143% of the 2007 apportioned target.

In the UK suppliers exceeded their EEC-2 targets by 44% delivering 184 fuel-standardised TWh (lifetime-discounted savings excluding comfort) and the French suppliers exceeded their targets by more than 20% delivering 65.2 TWh cumac by the end of the first compliance period on the 30th of June 2009.

Even if these national implementations are conceptually similar, the exact design of their major elements brings some market implementation differences. The choice of primary or final energy influences the balance between savings of gas and electricity: for example in Italy, where obligations are in primary energy, most savings have occurred in electricity.

According to Bertoldi et al (2010), 61% of the target distributed in Italy was targeting electricity distributors, while 78% of the savings actually came from electricity in the period 2005–2007. In the period 2001–2007 almost 21 million energy saving light bulbs (CFLs) were delivered to comply with the obligations for the period 2005–2007. This confirms the interest in electricity savings in the Italian scheme, driven by the focus on primary energy and short measure lifetimes that discourage thermal envelope measures in buildings delivering savings in gas or other primary energy sources.

In the UK electricity savings accounted for 27% of all delivered energy savings to meet the EEC-2 target. In terms of the energy savings in fuel standardised units, 41% of the total savings to meet the EEC-2 target came from electricity; this is reduced from the corresponding figure in EEC-1 of 54% due to increasing dominance of insulation measures in EEC-2 which mainly save gas[30].

In contrast in Denmark, natural gas accounts for a larger amount of savings than initially indicated in target distribution. This is likely to be due to the pre-dominance of interventions in the industrial sector in Denmark. Data on savings breakdown by fuel type are not available for France and almost impossible to estimate because the two main actions – boilers and insulation – have no fuel specification and are not fuel specific[31].

Long lifetimes for certain measures may influence the compliance choices towards such projects, with the exception of the Danish obligation, European schemes are dominated by measures with standardized saving factors, particularly in the residential sector. A scheme limited in terms of scope and energy sectors covered is more likely to use this valuation method because there may be widespread similar measures used in the sectors with large end-use customer numbers (e.g. residential, small businesses or organisations) and it may hence greatly reduce the transaction costs. There is a trade-

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[29] Out of these there was 77.7% electricity (type I), 18.7% gas (type II) and 3.6% other primary energy (type III).

[30] Bertoldi et al (2010)

[31] Bertoldi et al. (2010)

off between simplicity and accuracy in proving additionality with standardized actions. Strict requirements in additionality require for constant follow up and updating of savings calculations. This is the case in Italy where the scheme is governed by a strong additionality criterion.

Trading appears beneficial in a system with a wide scope in terms of sectoral coverage and project types where also non-obliged parties are allowed to trade. This is the case of Italy where trading is an important element. In contrast, despite the rather wide scope of the French scheme suppliers have chosen to do projects themselves or via partnerships, positioning them in the energy services market and promoting their own brand. The role of trading in a scheme that is limited in scope (e.g. residential sector only as in the UK) is more ambiguous: the additional administration cost of establishing and operating a trading regime may not justify the cost efficiency gains of trading for obliged parties and society. Preconditions for well functioning TWC market is the availability of accurate and update information on the savings potential in all eligible sectors.

White certificate systems are usually seen as an attractive scheme from Governments point of view as the cost of the obligations is not met by the Government. The costs of the system are typically around the 1-3% of end-users energy bills.

7. PROS AND CONS OF WHITE CERTIFICATES

As a summary of the discussion above, the pros and cons for implementing a white certificate scheme can be summarized as in Table 5.

Table 5: Pros and cons of white certificates

Pros	Cons
Simplified calculation of energy savings	Possible free rider effect, if targets are not challenging enough
Limited reporting documentation to be provided	The measure targets only efficiency increases, not overall reduction of energy consumption
Simplified control and certification procedures	It could involve large transaction costs for some parties
Guarantees to meet the agreed target within the scope of the white certificate system	Do not easily trigger more complex energy efficiency actions due to high verification and administration costs or uncertain revenue stream
Tradability aims at least cost achievement of targets - broad coverage of eligible sectors provided	Problems to follow dynamic evolution in energy use and prove additionality effect
It can stimulate the market for ESCOs	Increasing distribution tariffs or electricity prices
It could unlock energy saving potentials and actors that are currently not unlocked by other instruments	Total costs are not known ex-ante – can lead to oversized compensation to obliged parties

8. ANALYSIS OF WHITE CERTIFICATE SYSTEM APPLICABILITY TO FINLAND

8.1 Current measures in promoting energy efficiency in Finland

8.1.1 Background

Finland has one of the most comprehensive energy saving programme in Europe. Energy saving activities started officially in 1997 when first energy conservation programme was launched. Like today, the programme was a volunteer scheme but it was not as extensive as it is today. In 1997 the programme covered four sectors and in 2005 when programme was originally due to end it was extended to eight sectors: industry, electricity generation, district heating, electricity transmission and distribution, municipalities, property and building sector, buses and coaches, and housing properties. After two years extension, the first programme term expired.

New energy efficiency agreement period began in 2008 when industrial, municipal, and oil sectors signed contracts for the period 2008-2016. In addition to these transport sector and farm industry have agreed own sectoral agreements. They are also valid until 2016.

Energy efficiency agreements have an important role in promoting and improving energy efficiency in the Finnish society. Agreements are in a center in national energy and climate strategy which in turn provides response to international climate change commitments.

Energy efficiency agreements play a vital role in implementing the EU energy service directive. Its target is to save energy by 9% by 2016 compared to reference period of 2001 -2005 average energy consumption. Energy service directive covers sectors outside emission trading scheme ie households, transportation, non ETS industries, service sector, agriculture and forestry, and construction and machinery.

Energy intensive industries and energy production which are under emission trading scheme have their own agreements. Curbing carbon emissions as well as energy savings are seen as driving forces for joining the programme.

The summary of Finnish energy efficiency agreements are shown on a table below.

Table 6 Energy saving agreements in Finland

Programme	Driving mechanism	Duration
Energy efficiency scheme for industries		2008-2016
• energy intensive industry	Emission trading scheme	
• energy production	Emission trading scheme	
• medium-sized energy users	Energy service directive	
o industries		
o private service sector		
• energy services	Energy service directive	
o electricity transmission, distribution, retail		
o district heating and cooling		

Municipal sector • large cities, municipalities and joint municipalities • small cities, municipalities, and joint municipalities	Energy service directive Energy service directive	2008-2016
Höylä III oil-heated properties and heating and transport fuel distribution	Energy service directive	2008-2016
Transport	Energy service directive	2008-2016
The farm energy programme		2010-2016

Purpose of the agreements is to promote energy efficiency in Finland. Agreements play a vital role in implementing national climate and energy strategy and also in implementing international and EU level climate change initiatives.

On a company level, carrying out energy analyses and implementing energy efficiency management system are crucial agreement elements in order to identify energy saving measures. However, the identified potential is realized once measures are implemented.

8.1.2 Results of the Finnish energy efficiency agreements

During the first two years the realized savings are presented on the table below. Realized savings include also other measures which have implications to energy consumption. Indentified savings include those measures which are under consideration at the end of 2009. Realized savings typically represent 0,5 – 1,5% of the annual energy consumption. Figures in parenthesis present other measures which are not directly energy saving measures but have an impact on energy consumption.

Table 7 Realized and identified savings

Programme	Realized savings 2009 (GWh)		Cumulative savings 2008-9 (GWh)		Indentified savings (GWh)	
	Electricity	Heat & fuels	Electricity	Heat & fuels	Electricity	Heat & fuels
Energy intensive industries	112 (7)	569 (7)	247 (49)	1171 (103)	378 (129)	2295 (530)
Food industry	1,2	20,3 2,1)	3,4	36,8 (2,1)	5,8	59,0
Chemical industry	0,1 (-0,2)	8,3 (1,4)	0,1 (-0,2)	8,3 (1,4)	0,8	54,8
Technology	21,0 (0,1)	8,3 (2,0)	25,6 (0,1)	18,2 (2,0)	8,4	29,8
Plastics	0,8	1,1	1,4	3,7	5,7	8,3
Wood products	0,7	5,4	1,1	13,9	5,3	19,3
Energy generation	122	82*	154,5	373	373	260
Energy	2,1	2,1	4,9 (44,8)	9,3 (6)	10,2	0,3

services						
Services	0,5 (5,4)	0,5	0,8 (25,2)	0,6 (0,2)	0,9 (3,2)	4,7 (3,1)
Municipalities	1,8	4,4	4,2	9,3	9,9	29,6
Transport	-	-	-	-	-	-
Farm	-	-	-	-	-	-
Höylä III	-	-	-	-	-	-
Total	262,2 (12,3)	701,4 (12,5)	443 (118,9)	1634,8 (114,7)	798 (132,2)	2760,8(533,1)

*primary energy consumption

Table 8 Achieved and identified but unrealised savings

Programme	Achieved savings by 2009	Identified but unrealized saving potential
Energy intensive industries	No saving target set	-
Food industry	19% (cumulative target of 213 GWh set by the companies joined the programme)	30%
Chemical industry	9% (cumulative target of 104 GWh set by the companies joined the programme)	53%
Technology	24% (cumulative target of 185 GWh set by the companies joined the programme)	21%
Plastics	12% (cumulative target of 42 GWh set by the companies joined the programme)	33%
Wood products	7% (cumulative target of 227 GWh set by the companies joined the programme)	11%
Energy generation	15% in electricity / 37% in primary energy, savings target of 1000 GWh in electricity and use of primary energy	37% / 26% (electricity / primary energy)
Energy services	33% in electricity / 10% in heat and fuel, savings target of 150 GWh in electricity and heat	7% / 0%
Services	15% (cumulative target of 184 GWh set by the companies joined the programme, retail and hotels, restaurants and catering sectors)	6%
Municipalities	2% (cumulative target of 544 GWh set by the municipalities joined the programme by 2016)	7%
Farm	-	-
Höylä III	-	-
Transport	-	-

By the end of 2009, companies which have joined energy efficiency agreement programme and are under EU ESD have committed to energy savings of approximately 1800 GWh. On aggregate roughly 10% of the target was reached by the end of 2009 and approximately 14% of the committed target has been identified but unutilized.

It should be noted that for this analysis information from the first two years were available and only some rough conclusions can be made. Furthermore, it should be noted that the calculations are based on the information that was downloaded to Motiva database and was available. Also, it should be noted that sectoral coverage is up to some 95% (in terms of energy consumption) so in any case some of the energy saving initiatives are not included in the figures above.

8.2 Savings targets for energy efficiency agreements in NEEAP

Finnish energy efficiency action plan sets targets for energy efficiency programmes for companies, municipalities and households under ESD. The main targets are described in a following chapter.

On industrial sectors the savings of 1400 – 2600 GWh is targeted to be reached with current energy efficiency agreement scheme. For municipal sector an energy saving target of 400 – 600 GWh is set. For the service sector a savings estimate of 800 – 1200 GWh should be reached with current energy efficiency agreement programme. For energy sector no target was set. These saving targets are set for the period 2008-2016 and are to be valid once ESD expires.

8.3 Energy efficiency committee

In 2008, Ministry of Employment and the Economy set a committee to prepare new measures for energy saving and energy efficiency. Committee's task was to evaluate needed measures that energy end use could be lowered by 37 TWh compared to the scenario that no measures would be initiated. The main focus was on non-ETS sectors. Totally, 125 measures were proposed on the following sectors:

- Buildings (also urban structure)
- Households
- Agriculture
- Industry and service sector

For all measures energy saving impact could not be assessed but the most effective measures were

- new vehicle technology (saving estimate 8,5 TWh)
- new building code for new buildings and rehabilitation (saving estimate 4,9 TWh)
- more extensive challenging energy efficiency agreements (saving estimate 2,8 TWh)
- energy efficiency requirements for appliances (saving estimate 2,1 TWh)

With these measures approximately half of the savings target would be met. The other half would be covered with over 100 other saving initiatives. White certificates are mentioned as one option in every sector but no detailed suggestions were made where certificates could be used.

8.4 Energy efficiency agreements on energy sector

Energy sector has two separate agreements. Energy generation sector has own action and energy service sector has another one. The main focus on this report is on energy service sector action plan. Action plans are part of the framework agreement on promotion on energy efficiency between Ministry of Employment and the Economy, Confederation of Finnish Industries EK, and Finnish Energy Industries (ET).

Companies joined the energy service sector action plan have set up own indicative minimum 5% energy saving target (in real values) in their own energy consumption compared to reference year 2005. Energy savings are to be valid in 2016 when agreement term expires. Also, the energy consumption which is avoided due to energy efficiency measures can be included. It should be noticed that the saving target is directed to companies' own energy consumption, e.g seggragated heat production and distribution losses in heat and electricity networks. There is no target set for savings among the energy suppliers' or network operators' customer end. Action plan sets responsibilities for contract parties. Joined companies set target for improving own energy consumption and their clients' consumption. Branch organisation encourages companies to join the programme, takes part in annual reporting and development programmes as well as guidance, and manages different registers. Ministry's obligation is to provide financial subsidies, takes part in development projects, and allocates resources to Motiva.

Companies which have joined Energy sector's Energy service action plan are committed to provide services that target to improve end users' energy efficiency. These services can include:

- Organizing and planning
  - Recognition of energy saving opportunities at end users' operations
  - Preparation of plan for provision of energy services and energy efficiency measures
  - Mapping of early energy efficiency actions since 1995
  - Regular update of plan
- Actions that improve end users' energy efficiency in consumption
- Provision of energy efficiency information dissemination to end users
  - energy saving guidance
  - real consumption based reporting and invoicing
  - development and implementation of new services
    - promotion of procurement of energy efficient equipment
    - cooperation between different interest groups; land lords, service companies, consultants, contractors etc.
    - participation in energy saving campaigns
    - development of energy auditing
    - promotion of district heating

8.4.1 *Typical saving measures done by companies within energy service sector action plan*

Companies have provided different type of end user services in fulfilling their agreement obligations. Below are listed typical services provided during the first two years of the agreement period.

It's important to notice that the conditions for energy companies to offer well-informed energy efficiency services for their customers will improve significantly by the end of 2013 due to roll-out of smart meters practically to all consumption sites in Finland. Already now many companies offer household customers hourly consumption reporting and related services via internet portal.

1. Guidance
    - Energy saving guidance over telephone, internet and seminars
    - Client and interest group events
    - Training events
    - Borrowing of consumption meter
2. Communication
    - Energy saving competitions
    - Preparation and distribution of energy saving material to clients and schools
    - Energy efficiency seminars, articles, events and lectures
    - Energy efficiency promotion campaigns on TV and radio
    - Internet portal
3. Consumption reporting
    - Regular consumption reporting by mail or over internet
    - Remote reading
    - Online metering
4. Invoicing
    - Invoicing based on real consumption
5. Other services
    - Energy audits and analyses, do-it-yourself home energy audit model
    - Engineering services for energy efficient electrical heating
    - Condition surveys for households
    - Control and operating services for clients
    - Preparation of energy performance certificates

The roll-out of smart meters will contribute in removing information gap of energy consumption in individual households. Detailed metering data can be utilised to design efficient and accurately targeted energy saving services. Activation of such services offering may need additional boosting e.g. by promoting information channels from energy providers to end-users.

8.5 Key aspects of white certificate system design from Finnish perspective

Some of the key issues to be considered when analysing applicability and design of a white certificate system in Finland are discussed in the following chapters.

8.5.1 Selection of eligible energy carriers

Finland is an energy intensive country due to industrial structure and cold climate. Due to high level of heat consumption a great deal of energy savings potential can be found in the heat sector. Furthermore, district heating has a strong position in urban areas. At the same time for instance end-use of natural gas is limited to a small geographical area.

The potential in energy efficiency in different energy carrier is a key factor in the design of a TWC-scheme. The international experiences show that inclusion of all the main energy carriers is seen as a preferred solution. In Italy there are set separate targets for different energy carriers. This requires a sufficiently accurate estimation of the savings potential in each energy carrier.

8.5.2 Selection of obliged parties

8.5.2.1 Electricity supplier

Implementing the obligation on electricity suppliers bring many benefits that strengthen the efficiency of a TWC-scheme. Competitive nature of supply business ensures competition among energy service providers and supply companies already have an established relationship with end-users. There are however at least three aspects that need to be addressed in Finland:

1. Competition
   In Finland there are more than 70 retail suppliers and their sizes differ quite significantly. Some suppliers are focussed on local markets as the larger ones operate in the whole country. Introduction of a TWC system should not create unbalance between suppliers. Even minor additional cost factors may lead to significant effects in supplier's position in the market. Thus, the obligation should be equally allocated to all suppliers that participate in the same market.
2. Supplier switching
   Energy services provided to consumers may ask for longer relationship and continuous following of achieved energy savings. Establishment of such relationship should not hinder customers from switching energy provider and thus potentially lead to less competition in retail market.
3. Nordic retail market integration
   Nordic energy regulators have set a target for creation of a common Nordic retail market for electricity. Integration process, slow that it may be, is going forward. Implementation of a TWC must be carefully mirrored against future international retail market. In order to create an efficient and fair environment for competition, the requirements set for retailers should be consistent.

8.5.2.2 Distribution company

Distribution companies act as natural monopolies in their network region and thus they face a specific regulation that sets the framework for operative costs and return on capital. Therefore the regulation should include a cost recovery mechanism that would allow distributors to cover the costs that arise from reaching the set targets.

8.5.3 Competitive position between different energy carriers

Especially in heating sector there are several alternative forms of heat energy. There are already regulation and policies in place directly or indirectly affecting competitive position of different energy carriers for heat. TWC-scheme should be as neutral to competing heating alternatives as possible especially in terms of financing/collecting funds for the system. It's worth noticing that leaving for example district heat companies out of the group of obliged parties doesn't mean that energy efficiency actions in heat sector would be excluded as eligible actions. In most countries with TWC- scheme the actions may be taken in all energy carriers irrespective of the business scope of the obliged parties.

8.5.4 Transition from existing mechanisms to TWC

Designing of a TWC-scheme should acknowledge the existence of the comprehensive energy saving programme in place in Finland. Experience of energy savings potential has been gathered within the current scheme. Overlapping mechanisms is not desirable, but many aspects can potentially be carried forward to TWC, such as inclusion of "soft measures" namely energy audits and services related to smarter energy consumption. In addition the possible actions for developing the present agreement system into more binding direction may necessitate creating new features that resemble white certificate systems.

8.5.5 Selection of eligible sectors

An important share of final energy in Finland is consumed in industry sector, in which also important energy saving potential has been identified. The largest gap between targets and achieved savings so far, is in the municipality sector (see chapter 8.1.2). Whether a TWC-scheme is the most appropriate instrument to harness the existing savings potential, depend on the reasons why such potential still exists and savings actions have not been taken. Market imperfections, such as lack of information, can be addressed with other measures also, but a TWC-scheme as a tool to promote ESCO-business can be as efficient. In case TWC-scheme is designed to correct market imperfections, the requirement of additionality can not be interpreted too strictly.

In building sector there potentially exists moral hazard. Heat billing does not reflect households' own energy consumption, but the whole building's, and in rental houses heating costs are often included in the rent. This leads to a situation where no-one has incentive to invest in energy efficiency. Again, a third party, ESCO, could with appropriate earnings potential benefit of such energy saving potential. Smarter metering and more transparent billing partially remove market imperfection of moral hazard.

8.5.6 Financing of energy efficiency scheme

Currently available subsidies for energy savings investments are financed through annual state budget. Effectiveness of such investments is controlled by setting conditions to investments repayment period. The lower limit of two years of repayment period aims at ruling out profitable investments (cf. additionality), while upper limit aims at ruling out unprofitable investments.

In the case of investment support the total energy savings are hardly foreseeable ex-ante, but the public costs are limited by the dedicated budget. A white certificate scheme would shift the financial burden from the state more directly to end-users. At the same time the total energy savings are controlled by the defined target, whereas the total costs of the TWC-scheme carried by the end-users are variable and dependent on the relation between energy savings potential, ambition level and transaction costs.

Direct cost burden on end-users is more transparent, but the total efficiency of TWC in comparison to e.g. investment support depends on various design aspects of energy efficiency schemes.

8.5.7 Energy service companies (ESCOs)

Long tradition of energy efficiency agreements in Finland has contributed to merging of energy services businesses. Currently there is no direct and transparent way for profiting from investments. In addition, risks and administrative burden for sharing of profits from achieved energy savings generate additional costs for ESCOs and thus are a barrier for further developing ESCO-sector. Generally ESCOs operate most efficiently in large and demanding energy efficiency projects. In terms of TWC system design, this would require good conditions for application based project verification.

TWC is one option to lower the risks and create stability for ESCOs to expand energy services. The volume for new business potential though should be relatively large in creating sufficient incentives for new ESCO business. There are some doubts weather the market potential in Finland is large enough to fulfil the business potential targets.

Based on the experiences from Italy, certain TWC system design factors have significant influence on boosting ESCO business. Such factors are: allowing also non-obliged parties (ESCOs) participate certificate trading; broad selection of eligible sectors – to create large enough business potential; provide sufficiently accurate and update information about energy efficiency potential in each eligible sector – to bring equal competition conditions and bring stability to the market.

It should be noted that in Italy the concept of ESCO is understood widely. The positive results of TWC-system in promoting ESCO business in Italy can thus be inflated.

The characteristics of the typical energy efficiency services vary between different countries due to differences in climate, use of energy sources and industrial structure. This implies that the requirements for the expertise of ESCOs also vary between different countries. This may hinder ESCOs to benefit from larger EE service markets.

8.6 Could white certificates system be a potential solution for Finland?

For the time being, implementation of saving measures has been seen as one of the bottlenecks in the Finnish energy conservation scheme. Currently, investment subsidies are available for energy saving investments but still the realized savings in some sector lack behind the target set. White certificates could be seen as a complementary tool in implementation of the existing energy efficiency initiatives. In order to be successful, reduction target setting and allocation to different energy carriers should be based on accurate information on the energy saving potential.

One of the first tasks in TWC system planning is to set the overall objectives for it. Based on the experiences from the analyzed countries, the overall objectives of the schemes have significant influence in system design factors. The main target naturally is reduction in energy end-use. In order to define and allocate meaningful and realistic targets the decision-makers should possess detailed understanding of energy efficiency potential in Finland.

One of the important targets in Finland might be boosting ESCO business. A limited scope and low ambition target for the white certificate system would probably fail to trigger new energy service business due to low volume in business potential.

If there are identified specific sectors or actions with significant potential in energy efficiency that is hard to reach with the present measures, a system with emphasis on pre-defined standard actions would be efficient. The limited scope combined with the market design of utilizing pre-defined standard actions would, according to the experiences from UK, keep the administrative costs low and guarantee energy efficiency development in the predetermined target sectors.

White certificates could be applied basically to every sector where standardized or possibly standardized saving actions could be found. Typically, during the energy audits similar saving actions can be identified irrespective of the audit target. Those actions could include lighting modernizations, HVAC improvements, heating, heat recovery and cooling system investments, and investments in building automation systems. On industrial and energy sectors also savings in motors and motor systems, compressed air systems can be found. Also, proposed saving actions typically include pump, fan and compressor investments. Additionally, white certificates could cover also those private and public sector companies and communities which have not joined voluntary energy efficiency agreements.

White certificates could provide an incentive to enhance energy efficiency in household sector which perhaps is the most challenging sector to reach by the energy efficiency agreement system. White certificates could provide a direct and transparent incentive for households to for example prioritize procurement of energy efficient appliances, invest in additional roof insulation or investing in a smart home device to optimize in-house energy consumption. In order to attain cost efficiency the actions in household sector should be largely based on utilization of pre-defined standard actions.

Current energy efficiency agreement system promotes and encourages companies to mainly continuously improve their own operations as can be seen from the most typical energy conservation measures described on chapter 8.4.1. Majority of the savings are mainly related to information dissemination and guidance and less, for example, on implementation of new energy efficient equipment. White certificate system might be tailored to provide incentive for this.

Currently, despite sectors have their own energy efficiency agreements, the system encourages cooperation between parties within the agreement and other agreement participants. Agreements for example in energy sectors set requirements for energy companies to promote energy savings in their clients' operations both quantitative and qualitative. Energy efficiency promotion campaigns, seminars and energy saving information dissemination projects are few examples of cooperative actions between parties. However, many of the cooperation projects can be applied to several sectors but their actual results are difficult to quantify. White certificates could provide another cooperation aspect to energy efficiency agreement programme and its participants.

8.7 Areas for further research in Finland, recommendations

This report focuses on presenting typical characteristics of white certificate schemes in the light of energy efficiency branch in Finland. In order to understand the true potential of a white certificate scheme in Finland the energy efficiency potential and cost structure should be studied in a great detail. Furthermore, analysis of the reasons for economically feasible potential remaining unharnessed would contribute in finding the most efficient mechanism to promote energy efficiency.

There is already available numerous studies where feasibility of selected standardized actions in other European countries are analyzed. It might be useful to study further the savings potential by these actions in Finland.

A rigorous comparative analysis of the cost effectiveness of different policy mechanisms in energy efficiency and analysis of a possible coexistence of different mechanisms is an important step before developing political steering for energy efficiency. Some studies suggest that energy taxes and public subsidies are alternative mechanisms for a white certificate system, as voluntary agreements could exist in conjunction with a white certificate system[32]. Therefore, a comparative study of cost-effectiveness of energy efficiency agreement system and white certificate system as well as analysis of the possibilities for coexistence of these measures would be useful in preparation of further actions in Finland.

[32] World Energy: Market Instruments based on White Certificates: A review of international experiences, A.Capozza, W.Crattieri (CESI RICERCA, Italy)

ANNEX 1 – LISTS OF STANDARD MEASURES IN SELECTED COUNTRIES

Summary of savings delivered in France, Italy and UK.

Savings delivered by type of technology.

Italy 2005–2007			
		Savings (toe)[a]	No. of installations [b]
1	CFL[c]	1,036,360	20,761,940
2	Low-flow shower heads (residential)	195,404	9,474,586
3	Substitution of mercury vapour lamps with high-pressure sodium lamps in public lighting	116,412	422,621 lamps
4	DH systems [d]	73,767	
5	Low-flow faucets in residential	66,303	16,215,760
6	Solar collectors	54,855	229,419 m^2
7	Domestic appliances class A [e]	21,190	839,169
8	Double glazing	12,272	221,441 m^2
9	Luminosity regulators in public lighting	11,140	22,888,678 W of lamps regulated
10	Small-scale cogeneration	8150	
UK 2005–2008 (total activity in the period)			
		Savings (fuel-standardised GWh)	No. of installations
1	Cavity wall insulation	76,654	1,760,828
2	Loft insulation (virgin)	31,267	493,515
3	CFL	21,911	101,876,023
4	Loft insulation (top-up)	18,824	1,286,787
5	DIY loft insulation	9073	799,573
6	All boilers	7837	2,082,812
7	Fuel switching	4462	78,010
8	iDTV	3471	9,450,182
9	Solid wall insulation	2250	41,410
10	Standby savers	2005	2,943,384
France 2006–2009			
		Savings (GWh cumac) [f]	No. of installations [g]
1	Individual condensing boiler	14,670	137,000
2	Individual high performance boiler	8346	180,000
3	Collective heating condensing boiler	4629	43,000
4	Air–air heat pump	4499	43,000
5	Roof insulation	3782	2,842,000
6	Acotherm labeled windows or equivalent	2999	1,363,000
7	Air–water heat pump	2608	20,000
8	Variable speed drive	2152	*Not estimated*
9	Collective heating high performance boiler	1760	37,000
10	Detached firewood heating appliance	1695	32,000

[a] Total savings generated 2005–2007.
[b] Total installations 2001–2007.
[c] Tradable white certificates issued on the basis of gift tokens distributed to end-users for CFL purchase are not included. The regulator assumes that 50% of these will end as CFL installations; yet the regulator has verified that the percentage of tokens determining CFL installations is well below 50% for 30 projects submitted for certification and is currently (August 2009) following the issue.
[d] The application of engineering estimates for the evaluation of savings due to DH and small-scale CHP has been suspended as of June 2007 because of a decision of the Lombardia Regional Administrative Court. The savings reported related to projects with metered baseline evaluation. It has been estimated that DH and CHP projects whose evaluation has been suspended may determine the issuance of 100 000 TWC (100 Mtoe) for 2007. Energy-saving engineering estimates will be revised and certificates issued once the Court sentence motivations are announced.
[e] Energy-saving estimates for class A domestic appliances are being revised. Class A refrigerators, dish washers and washing machines are likely to be considered as baseline for the new deemed estimates compiled by the regulator.
[f] Official data as of 30th of June 2009.
[g] Estimates of number of installations in general or m^2 for roof insulation and windows.

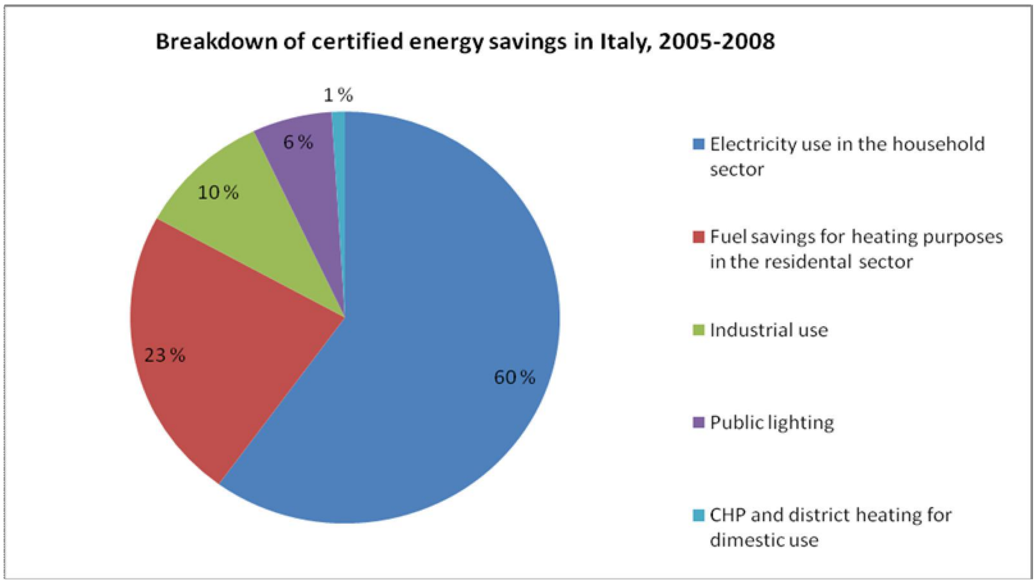
Source: Bertoldi et al (2010)

1. Italy

To illustrate the Italian scheme, some of the eligible measures developed by the Government, including measures for which deemed savings values were set by the regulator are listed below:

• Electric motors and their applications
• Lighting systems
• Reduction of stand-by power
• Reduction of electricity consumption in thermal uses
• Reduction of air conditioning electricity consumption
• Promotion of high efficiency electric appliances in offices and homes
• Substitution of electricity to other energy sources with reduction of primary energy consumption
• Heating/cooling and heat recovery in buildings supplied with non-renewable fuels
• Development of renewable energy sources at users' premises
• Promotion of electric and natural gas vehicles
• Campaigns for education, information, and promotion of energy efficiency

A breakdown of certified energy savings in the period 2005-2008 is given below:



Source: Marcella Pavan (AEEG, 2009) White Certificates in Italy.

Only investments in energy efficiency technologies, which are referred to as "hard measures" are included in Italy's system. "Soft measures," such as behavioral changes, are not eligible.

Public information campaigns are eligible only if they are connected to specific hard measures.[33]

2. France

So far 170 types of standardised actions are defined and validated covering all sectors (industry, residential, transport and tertiary) and many end-uses or technologies (insulation, efficient boilers, etc.).
As an illustration, here's a list of possible actions:

- installation of heating control mechanisms
- replacement of boilers or water heaters by more efficient equipment or thermal renewable energy
- replacement of domestic appliances with more efficient equipment equipments
- creation of wood-fired heating systems for district heating or in industry
- fitting of insulating jackets to water heaters
- boiler maintenance
- substitution with low energy light bulbs
- loft insulation
- use of double glazing

Each of the standardised measures grant a predefined number of credits (i.e. cumac), which cover the discounted energy efficiency improvement for the whole lifecycle.

The table below shows the 10 standardised actions that are applied/used most often.

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[33] Hamrin, Vine & Sharick: The Potential for Energy Savings Certificates (ESC) as a Major Tool in Greenhouse Gas Reduction Programs. Center for Resource Solutions (2007)

Référence	Intitulé de l'opération standardisée	% kWh cumac
BAR-TH-06	Chaudière individuelle de type condensation	17,66 %
BAR-TH-08	Chaudière individuelle de type basse température	8,72 %
BAR-TH-07	Chaudière collective de type condensation	7,21 %
BAR-EN-01	Isolation de combles ou de toitures	5,89 %
BAR-EN-04	Fenêtre ou porte-fenêtre complète avec vitrage isolant	5,51 %
BAR-TH-12	Appareil indépendant de chauffage au bois	5,32 %
BAR-TH-04	Pompe à chaleur de type air/eau	4,90 %
BAR-TH-29	Pompe à chaleur de type air/air	4,34 %
IND-UT-02	Système de variation électronique de vitesse sur un moteur asynchrone	3,78 %
BAR-TH-07-SE	Chaudière collective de type condensation avec contrat assurant le maintien du rendement énergétique de la chaudière	3,51 %
BAR-TH-09	Chaudière collective de type basse température	2,70 %
BAR-EN-02	Isolation des murs	2,51 %

3. Denmark

Examples of standard measures in Denmark[34]:

Insulation

Heating

Windows

Heat pumps

Solar heat systems and Solar cells

Energy counselling

4. UK

In the UK system, energy suppliers submit in advance of carrying out the project an outline of what they intend to do and the energy savings they are likely to claim. This has benefits both for the Regulator and the energy company in minimising later disputes in terms of energy savings achieved.[35]

INSULATION

Loft insulation
Cavity wall insulation
Solid wall insulation
Insulating plaster
Draught-proofing
Flat roof insulation

HEATING

Shower regulator

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[34] http://energisparesiden.dk/privat/save.aspx

[35] Eoin Lees; European and South American Experience of White Certificates. WEC-ADEME Case study on Energy Efficiency Measures and Policies. 2010

Fireplace heat saver
Zenex gas saver
Raven heat energy catcher

APPLIANCES

Standby savers
Circulating pumps
Energy efficient kettles
Real time displays (RTDs)

MICROGENERATION

Air Source Heat Pumps

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