Funding DSM Projects with Revenue from Carbon Trading

Research Report No 4
Task XVIII of the International Energy Agency
Demand Side Management Programme

Final revised version
19 November 2010

Operating Agent:
DR DAVID CROSSLEY, ENERGY FUTURES AUSTRALIA PTY LTD, AUSTRALIA

Undertaken with participation and support from:
AUSTRALIA (SUSTAINABILITY VICTORIA)
FRANCE (AGENCE DE L'ENVIRONNEMENT ET DE LA MAITRISE DE L'ÉNERGIE)
INDIA (BUREAU OF ENERGY EFFICIENCY, MINISTRY OF POWER)
SPAIN (RED ELECTRICA DE ESPAÑA)

DISCLAIMER

Final revised version
19 November 2010

Publisher: Energy Futures Australia Pty Ltd
11 Binya Close
Hornsby Heights NSW 2077
Australia
Telephone: + 61 2 9477 7885
Facsimile: + 61 2 9477 7503
Email: efa@efa.com.au
Website: http://www.efa.com.au

Principal Investigator: Dr David Crossley
Energy Futures Australia Pty Ltd

IEA DSM Secretariat: Anne Bengtson
IEA DSM Executive Secretary
PO Box 47096
S-100 74 Stockholm
Sweden
Telephone: + 46 8 5105 0830
Facsimile: + 46 8 5105 0830
Email: anne.bengtson@telia.com
Website: http://www.ieadsm.org/

CONTENTS

LIST OF FIGURES

LIST OF TABLES

THE IEA DEMAND SIDE MANAGEMENT PROGRAMME

The International Energy Agency (IEA) was established in 1974 as an autonomous agency within the framework of the Economic Cooperation and Development (OECD) to carry out a comprehensive program of energy cooperation among its 25 Member countries and the Commission of the European Communities.

An important part of the Agency's program involves collaboration in the research, development and demonstration of new energy technologies to reduce excessive reliance on imported oil, increase long-term energy security and reduce greenhouse gas emissions. The IEA's R&D activities are headed by the Committee on Energy Research and Technology (CERT) and supported by a small Secretariat staff, headquartered in Paris. In addition, three Working Parties are charged with monitoring the various collaborative energy agreements, identifying new areas for cooperation and advising the CERT on policy matters.

Collaborative programs in the various energy technology areas are conducted under Implementing Agreements, which are signed by contracting parties (government agencies or entities designated by them). There are currently over 40 Implementing Agreements, including the IEA Demand-Side Management Programme. Since 1993, the following 20 member countries have been working to clarify and promote opportunities for DSM.

Australia	France	New Zealand
Austria	Greece	Norway
Belgium	Italy	Spain
Canada	India	Sweden
Denmark	Japan (Sponsor)	Switzerland
European Commission	Republic of Korea	United Kingdom
Finland	Netherlands	United States

A total of 22 Tasks (multi-national collaborative research projects) have been initiated by the IEA DSM Programme, 15 of which have been completed. Each Task is managed by an Operating Agent (Project Director) from one of the participating countries. The Operating Agent is responsible for overall project management including project deliverables, milestones, schedule, budget and communications. Overall control of the program rests with an Executive Committee comprised of one representative from each contracting party to the Implementing Agreement. In addition, a number of special ad hoc activities–conferences and workshops–have been organized.

The actual research work for a Task is carried out by a combination of the Operating Agent and a group of Country Experts, depending on the nature of the work to be carried out. Each country which is participating in a Task nominates one or more persons as its Country Expert. Each Expert is responsible for carrying out any research work within his/her country which is required for the Task All the Experts meet regularly to review and assess the progress of the work completed by the Operating Agent and by the group of Experts. Experts meetings are usually held between two and four times a year.

The IEA DSM Programme has undertaken the following Tasks to date:

Task I*	International Database on Demand-Side Management
Task II*	Communications Technologies for Demand-Side Management
Task III*	Cooperative Procurement of Innovative Technologies for Demand-Side Management
Task IV*	Development of Improved Methods for Integrating Demand-Side Management
Task V*	Investigation of Techniques for Implementation of Demand-Side Management Technology in the Marketplace
Task VI*	Mechanisms for Promoting DSM and Energy Efficiency in Changing Electricity Businesses
Task VII*	International Collaboration on Market Transformation
Task VIII*	Demand Side Bidding in a Competitive Electricity Market
Task IX*	The Role of Municipalities in a Liberalized System
Task X*	Performance Contracting
Task XI*	Time of Use Pricing and Energy Use for Demand Management Delivery
Task XII*	Cooperation on Energy Standards (not proceeded with)
Task XIII*	Demand Response Resources
Task XIV*	Market Mechanisms for White Certificates Trading
Task XV*	Network-Driven Demand Side Management
Task XVI	Competitive Energy Services
Task XVII	Integration of Demand Side Management, Energy Efficiency, Distributed Generation and Renewable Energy Sources
Task XVIII	Demand Side Management and Climate Change
Task XIX	Micro Demand Response and Energy Saving
Task XX	Branding of Energy Efficiency
Task XXI	Standardisation of Energy Savings Calculations
Task XXII	Energy Efficiency Portfolio Standards

* Completed Task

For additional information contact:

Anne Bengtson
IEA DSM Executive Secretary
PO Box 47096
S-100 74 Stockholm
Sweden
Telephone: + 46 8 5105 0830
Facsimile: + 46 8 5105 0830
Email: anne.bengtson@telia.com

Also, visit our web site at: http://www.ieadsm.org/.

FOREWORD

This report is a result of work which was completed within Task XVIII of the International Energy Agency Demand-Side Management Programme. The title of Task XVIII is "DSM and Climate Change." Task XVIII is a multinational collaborative research project which is investigating circumstances in which DSM can contribute to mitigating greenhouse gas emissions and emissions mitigation measures can achieve benefits for electricity systems.

Task XVIII is organised into six subtasks as follows:

- **Subtask 1:** Interactions between DSM and Climate Change;
- **Subtask 2:** Principles for Assessing Emissions Reductions from DSM Measures;
- **Subtask 3:** Mitigating Emissions and Delivering Electricity System Benefits;
- **Subtask 4:** Fungibility of DSM and Emissions Trading;
- **Subtask 5:** TOU Pricing and Emissions Mitigation;
- **Subtask 6:** Communicating Information about DSM and Climate Change.

This report summarises the results from Subtask 4.

The Operating Agent (Project Director) for Task XVIII is Energy Futures Australia Pty Ltd, based in Sydney, Australia.

The work of Task XVIII is supported (through cost and task sharing) by the four participating countries: Australia, France, India and Spain. Participants provided one or more Country Experts who were responsible for contributing to the work of the Task and for reviewing work as it was completed.

Information for this report was collected, and the document was reviewed by, Country Experts and representatives from the organisations listed in the Table on page vi.

The Principal Investigator for, and main author of, this report is Dr David Crossley who also provides Operating Agent services for Task XVIII through his consultancy company Energy Futures Australia.

Any errors and omissions are the responsibility of Dr Crossley.

Country Experts and Representatives Participating in Task XVIII		
Name	**Organisation**	**Country**
“Ian McNicol	Sustainability Victoria	Australia
*Eric Vidalenc	Agence de l'Environnement et de la Maîtrise de l'Énergie (ADEME)	France
Jean-Marie Bouchereau	Agence de l'Environnement et de la Maîtrise de l'Énergie (ADEME)	France
*Balawant Joshi	ABPS Infrastructure Pvt Ltd	India
*Miguel Ordiales Botija	Red Eléctrica de España	Spain
Javier Argueso Montero	Everis	Spain
* Country Expert		

EXECUTIVE SUMMARY

The purpose of this report is to investigate options for funding DSM projects with revenue from carbon trading. The possibility of funding DSM projects in this way is based on the ability of such projects to reduce energy consumption and therefore achieve GHG emissions reductions. Once these reductions have been measured and verified, it is possible to earn revenue from trading the reductions in carbon markets. This revenue can then be used to fund the implementation of further DSM projects.

International carbon trading is now a large and rapidly growing activity. Carbon trading is carried out in a range of carbon markets across the world:

- **regulatory carbon markets** occur when governments impose emissions caps or other mechanisms to limit GHG emissions;
- **the voluntary carbon market** applies to companies, individuals, and other entities not subject to regulatory limitations that voluntarily wish to offset GHG emissions.

There are two basic types of legal instruments traded in carbon markets: *allowances* (or permits to emit) and *project-based carbon credits*. Each *allowance* represents the right to emit a specified quantity of GHG emissions. Each *carbon credit* represents a specified quantity of emissions that has been verified as abated. Emissions reductions from DSM projects may be traded as carbon credits. Regulatory carbon markets may include trading in both allowances and carbon credits. The voluntary market trades mostly in carbon credits.

Access to carbon markets is a crucial factor that determines whether it is possible to trade emissions reductions resulting from DSM projects. All carbon markets have rules about who may trade in the market and what may be sold.

Emissions reductions from DSM projects must be subject to accreditation, measurement and verification (AM&V) processes before they can be traded as carbon credits in carbon markets. The purpose of AM&V processes in carbon markets is to establish and protect the integrity of the instruments that are being traded.

There are a number of questions that developers of DSM projects should ask when investigating the possibility of using carbon financing to fund a specific project. These questions include:

- Will the DSM project produce emissions reductions?
- Can the emissions reductions be measured and verified with confidence and credibility?
- Is there a carbon market that the DSM project can access?
- Is the project large enough to warrant paying the market participation costs?
- Are personnel (staff and/or consultants) available who can manage the market participation process?

DSM project developers should also take into account the risks involved in participating in carbon markets, including the possibilities of delays, the volatility of prices for carbon credits, and the possibility of instability in carbon markets.

1. INTRODUCTION

1.1 Demand-side Management

In the electricity industry, the term 'demand-side management' (DSM) is used to refer to actions which change the electrical demand on the system.

Task XVIII takes a broad view of demand-side management and includes the following measures within the definition of DSM:

- distributed generation, including standby generation and cogeneration;
- energy efficiency;
- fuel substitution;
- load management, including interruptible loads, direct load control, and demand response;
- power factor correction;
- pricing initiatives, including time of use and demand-based tariffs.

1.2 Purpose of Task XVIII

The purpose of Task XVIII is to investigate the potential contribution to mitigating greenhouse gas (GHG) emissions that can be made by DSM measures and the extent to which emission mitigation measures can achieve benefits for electricity systems.

Currently, DSM and emission mitigation measures are implemented quite independently:

- DSM measures are implemented primarily to assist and improve the operation of electricity systems. Any impacts (positive or negative) of DSM measures on climate change are only a minor consideration, if they are considered at all;
- efforts to mitigate GHG emissions from electricity production have focussed on improving the efficiency of both electricity generation and end-use. However, emission mitigation measures focussed on increasing end-use efficiency have usually not considered any benefits to the electricity system (eg peak load reduction) that might be gained through implementing the measures.

The overall aim of Task XVIII is to reconcile these two different approaches so as to identify circumstances in which DSM can contribute to mitigating GHG emissions and emission mitigation measures can achieve benefits for electricity systems. Task XVIII then determines what is required to maximise the emissions reductions and electricity system benefits from these two types of measures.

1.3 Purpose of this Report

The purpose of this report is to investigate options for funding DSM projects with revenue from carbon trading. The possibility of funding such projects in this way is based on the ability of DSM projects to reduce energy consumption and therefore achieve GHG emissions reductions. Once these reductions have been measured and verified, it is possible to earn revenue from trading the reductions in carbon markets. This revenue can then be used to fund the implementation of further DSM projects.

The report is structured as follows: section 2 outlines the basics of carbon financing, including the different types of carbon markets and how they operate; section 3 investigates the access to carbon markets that may be available to DSM projects; section 4 describes processes for accreditation of emission reduction projects, and measurement and verification of emissions reductions achieved by these projects; section 5 discusses the viability of carbon financing for DSM projects; and section 6 provides some conclusions.

2. CARBON TRADING

International carbon trading is now a large and rapidly growing activity. Carbon trading is motivated by the requirements of the Kyoto Protocol[1] and regional emissions trading schemes, and by voluntary initiatives.

Governments, private companies, and individuals have collectively committed billions of dollars to carbon trading (USD 144 billion in 2009[2]). International carbon markets have resulted in new capital flows that are supporting low carbon energy production and use and other climate protection activities. Consequently, there are significant opportunities for trading GHG emissions reductions that result from DSM programs.

2.1 Carbon Markets

Carbon trading is carried out in a range of carbon markets across the world:

- **regulatory carbon markets** occur when governments impose emissions caps or other mechanisms to limit GHG emissions;
- **the voluntary carbon market** applies to companies, individuals, and other entities not subject to regulatory limitations that voluntarily wish to offset GHG emissions.

The voluntary market is very small compared to regulatory markets. In 2009, the value of trades in the voluntary market was only USD 338 million, compared with the USD 144 billion total value of all carbon trades[3].

There are two basic types of legal instruments traded in carbon markets:

- allowances; and
- project-based carbon credits.

Each tradeable instrument is worth a specified quantity of GHG emissions, usually one metric tonne of carbon dioxide equivalent.

Regulatory carbon markets may include trading in both allowances and carbon credits, whereas the voluntary market trades mostly in carbon credits.

---

1 Under the Kyoto Protocol first commitment period, 38 countries are subject to GHG emissions reduction commitments, comprising an overall reduction of 5.2% from 1990 emissions levels. This corresponds to emissions reductions of 30% - 40% below business as usual forecasts over the period 2008 – 2012.

2 Kossoy, A. and Ambrosi, P. (2010). *State and Trends of the Carbon Market 2010*. Washington, DC, The World Bank.

3 *Ibid*.

Allowances (or permits to emit) are usually allocated, auctioned, or issued through a combination of both methods, by a government under an emissions trading scheme established by legislation[4]. Each allowance represents the right to emit a specified quantity of GHG emissions. Obligated parties may trade excess allowances when they reduce their emissions below the quota they have been allocated under the emissions trading scheme.

Carbon credits are created when emissions reductions are achieved by implementing a specific emissions reduction project. Each carbon credit represents a specified quantity of emissions that has been verified as abated. In most regulatory project-based markets both obligated parties and non-obligated parties may carry out emissions reductions projects and create carbon credits. Some form of accreditation may be applied to either parties or projects, or both, before credits can be created.

2.2 Trading of Allowances

Trading of allowances was originally established under the International Emissions Trading (IET) mechanism established by the Kyoto Protocol[5] to the United Nations Framework Convention on Climate Change (UNFCCC). The IET mechanism involves transactions between Annex I Parties to the UNFCCC[6]. Under Article 17 of the Kyoto Protocol, Annex I Parties are allocated a fixed number of allowances known as Assigned Amount Units (AAUs) up to the quantity of greenhouse gases they can emit in accordance with the Protocol. Article 17 also authorises trading in AAUs. Countries that have shortfalls in their emission commitments under the Protocol may purchase AAUs from countries with surplus allowances.

Allowance-based carbon markets have also been established either to complement the IET mechanism under the Kyoto Protocol or without any linkage to the Protocol. These markets are usually implemented as emissions trading schemes under a cap-and-trade design in which governments set the overall emissions cap and also determine how emissions quotas will be allocated.

Figure 1 (page 4) is a simplified diagram showing how trading of allowances works under a cap-and-trade design. The cap establishes a mandatory limit on total greenhouse gases released into the atmosphere by obligated parties located within the jurisdictions to which the cap applies. Each obligated party is allocated a quota under the cap which determines the quantity of emissions that the party is authorised to release. Parties that reduce emissions below their quota can sell excess allowances to those parties that exceed their quotas. In the first few years of a cap-and-trade scheme, the cap is usually set just below where emissions are at the commencement of the scheme. Over time the cap is lowered, stimulating the development and implementation of low-carbon infrastructure.

---

4 Except for the Chicago Climate Exchange and the Voluntary Emissions Trading Scheme in Japan in which market participants voluntarily agree to meet GHG emissions targets.

5 United Nations (1998). *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. Washington, DC, United Nations.

6 Annex1 includes 40 industrialised countries consisting of the 24 original member states of the OECD, countries undergoing the process of transition to a market economy, and the European Economic Community.

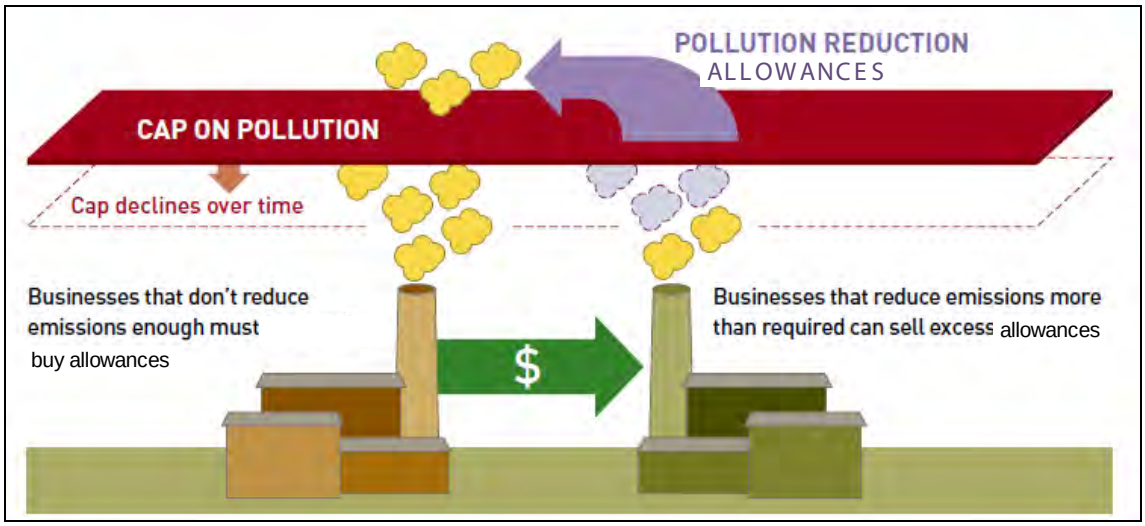

Figure 1. Trading of Allowances Under a Cap-and Trade Design[7]

Existing allowance-based markets include:

- the European Union Emissions Trading Scheme (**EU ETS**) – the largest cap-and-trade regulatory emissions reduction scheme that commenced in 2005;
- the Regional Greenhouse Gas Initiative (**RGGI**) – a cap-and-trade regulatory emissions reduction scheme operating in 10 North-eastern and Mid-Atlantic states in the US that commenced in 2009;
- the Chicago Climate Exchange (**CCX**) – emitting members of CCX make a voluntary but legally binding commitment to meet annual GHG emissions reduction targets;
- the Voluntary Emissions Trading Scheme in Japan – participating corporations set their own emissions reduction targets and there are no penalties; trading can be in "domestic credits" from verified emission reductions in Japan or in credits from international schemes.

Allowance-based markets currently being developed include:

- the Western Climate Initiative, a cap-and-trade regulatory emissions reduction scheme scheduled to commence in 10 western US States and Canadian Provinces in 2012;
- national cap-and-trade regulatory emissions reduction schemes in Canada and New Zealand and (possibly) Australia and the United States;
- direct trading by governments under the Kyoto Protocol IET mechanism of Assigned Amount Units (AAUs) that are issued to Annex I countries.

2.3 Trading of Project-based Carbon Credits

Figure 2 (page 5) summarises how trading of project-based carbon credits works. The project host is an entity that implements a project that achieves GHG emissions reductions. Once these reductions are measured and verified, carbon credits will be issued to the total value of the emission reductions achieved.

[7] Environmental Defense Fund (2008). *Cap and Trade 101*. New York, EDF.

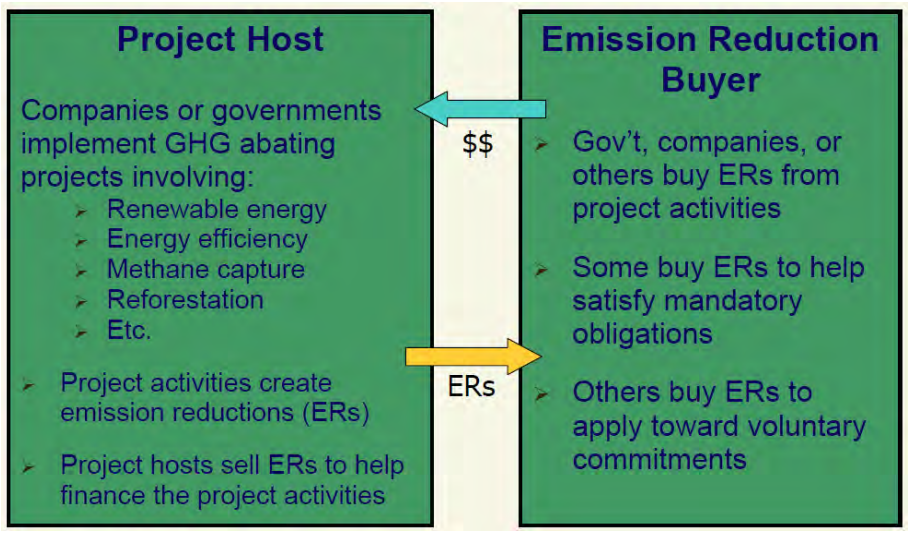

Figure 2. Trading of Project-based Carbon Credits [8]

The credits may be purchased by governments or parties who are obligated to reduce emissions under a regulatory scheme. Credits may also be purchased by parties who are not obligated to reduce emissions but who wish to apply the emissions reductions toward voluntary commitments they have made, or who simply want to reduce their carbon footprints. Consequently, trading of carbon credits can take place in either regulatory markets or the voluntary market.

Trading of project-based carbon credits was originally established under two Kyoto Protocol mechanisms:

- under the **Joint Implementation** mechanism (JI) a developed (Annex I) country with relatively high costs of domestic GHG emissions reduction can set up an emissions reduction project in another developed country with lower costs – most JI projects are in Russia and the Ukraine;
- under the **Clean Development Mechanism** (CDM) a developed (Annex I) country can 'sponsor' a GHG emissions reduction project in a developing (non-Annex I) country where the costs of such projects are usually much lower.

Currently, the Clean Development Mechanism is the largest project-based market, while the Joint Implementation market is very small.

Figure 3 (page 6) shows how the Clean Development Mechanism operates. Entity X is a country that is included in Annex I of the UNFCCC. Entity X can provide funds and technical knowledge to Entity Y in a non-Annex I country (ie a developing country) to enable that entity to implement a project that reduces GHG emissions. When the emissions reductions have been measured and verified, carbon credits will be issued. Entity X can then receive the credits in return for the funds and technical knowledge it has already provided to Entity Y or it can purchase the credits with additional funds. Entity X can apply the credits to reduce its mandatory emission reduction obligations or to voluntarily reduce its carbon footprint.

---

[8] Green Markets International Inc. (2007). *The Voluntary Carbon Market: Status & Potential to Advance Sustainable Energy Activities*. Arlington, MA, Green Markets International.

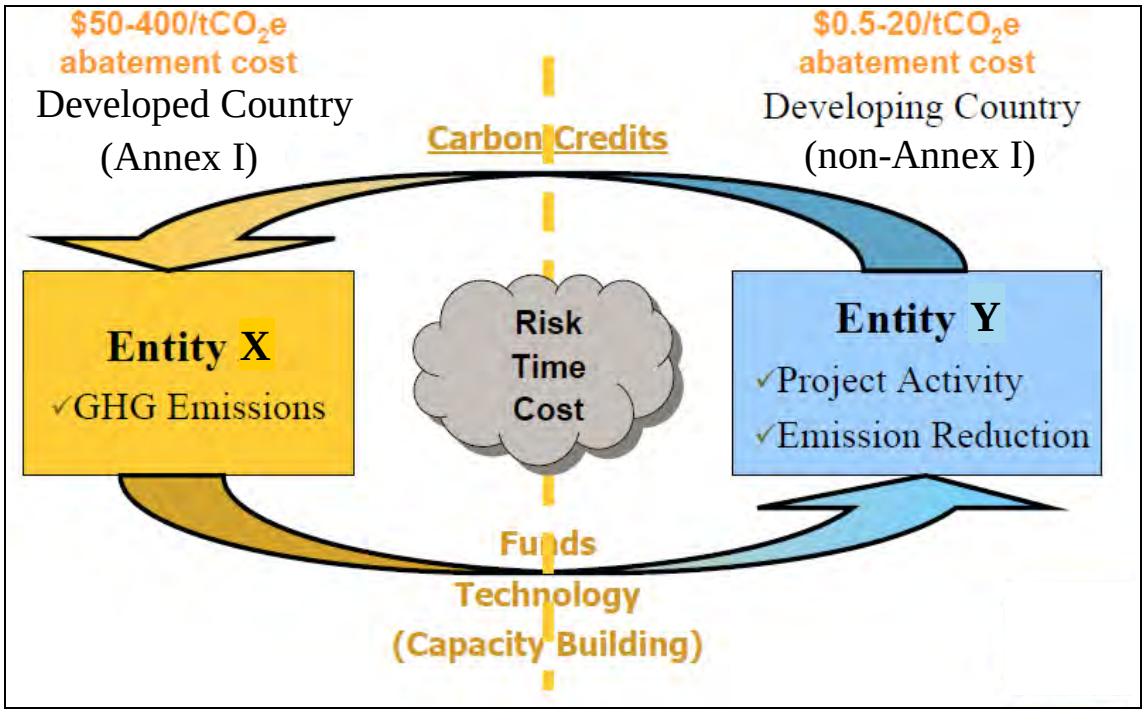

Figure 3. Operation of the Clean Development Mechanism[9]

Several regulatory markets for project-based carbon credits not linked to the Kyoto Protocol have been established in Australia:

- the New South Wales Greenhouse Gas Reduction Scheme (GGAS) that commenced in 2003[10]; and
- energy efficiency certificate trading schemes in three Australian States that commenced in 2009[11].

The California Climate Action Reserve is one example of a voluntary market for project-based carbon credits. The Reserve is a non-profit organisation originally formed with the co-operation of a group of private-sector CEOs and the State of California in 2001. The purpose behind creating the Reserve was to enable entities to take voluntary steps to reduce their emissions in a measureable, verifiable and transparent manner. The Reserve largely sets the rules governing the development and verification of emissions reduction projects, while the California Action Registry tracks and registers the projects.

---

9 Kubo, T. (2008). Overview of the carbon market and project-based credits. *Asian Development Bank Philippines CDM Project Development Workshop*, Manila, 16 April.

10 Crossley, D.J. (2008). Tradeable energy efficiency certificates in Australia. *Energy Efficiency* **1**, 267–281.

11 Crossley, D. J. (2009). *Preliminary Study of Emissions Trading Schemes in the United Kingdom and Australia*. International Energy Agency Demand Side Management Programme, Task XVIII Working Paper No 2. Hornsby Heights, NSW, Australia, Energy Futures Australia Pty Ltd.

2.4 Volumes and Locations of Carbon Trading

There are a large number of different legal instruments available for trading in carbon markets[12]. Most of these tradeable instruments represent one metric tonne of CO_2-equivalent. Some of these instruments are listed in Table 1.

2.4.1 Trading Instruments

Table 1. Trading Instruments in Carbon Markets	
REGULATORY MARKETS	
Assigned Amount Unit (**AAU)**	A permit to emit under the Kyoto Protocol, originally distributed to each Annex I Party at the start of each trading period.
European Union Allowance (**EUA**)	A permit to emit allocated by the government of a European Union Member State under the EU Emissions Trading Scheme. The EU ETS converts each Member State's AAUs into EUAs which are then tradeable within the EU ETS market. AAUs from outside the EU cannot be traded in the EU ETS market.
RGGI Emission Allowance	A permit to emit under the Regional Greenhouse Gas Initiative (RGGI) in the United States. The RGGI states sell nearly all emissions allowances through auctions and invest the proceeds in consumer benefits: energy efficiency, renewable energy, and other clean energy technologies.
Certified Emission Reduction (**CER**)	A carbon credit from a registered Clean Development Mechanism project under the Kyoto Protocol.
Emission Reduction Unit (**ERU**)	A carbon credit from a registered Joint Implementation project under the Kyoto Protocol.
Removal Unit (**RMU**)	A carbon credit from a project under the Kyoto Protocol that reduces GHG emissions or increases the absorption of greenhouse gases through direct human-induced land use, land use change and forestry activities (LULUCF).
NSW Greenhouse Abatement Certificate (**NGAC**)	A carbon credit from an emissions reduction project accredited by the New South Wales Greenhouse Gas Reduction Scheme in Australia.
VOLUNTARY MARKETS	
Voluntary or Verified Emission Reduction (**VER**)	A carbon credit from an emissions reduction project not subject to the Kyoto Protocol that conforms to one of several VER standards.
Gold Standard Voluntary Emission Reduction (**GS VER**)	A carbon credit issued under the Voluntary Gold Standard system.
Voluntary Carbon Unit (**VCU**)	A carbon credit issued under the Voluntary Carbon Standard system.
Climate Reserve Ton (**CRT**)	A carbon credit from an emissions reduction project registered by the California Climate Action Registry.

[12] Gutbrod, M., Sitnikov, S. and Pike-Biegunska, E. (2009). *Trading in Air: Mitigating Climate Change through the Carbon Markets*. Moscow, Infotropic Media.

2.4.2 Volumes of Carbon Traded

Figure 4 shows the volumes of carbon traded during 2009 in the various carbon markets. The European Union Emissions Trading Scheme dominates carbon trading with 75 per cent by volume of the total of 8,700 $MtCO_2e$ traded.

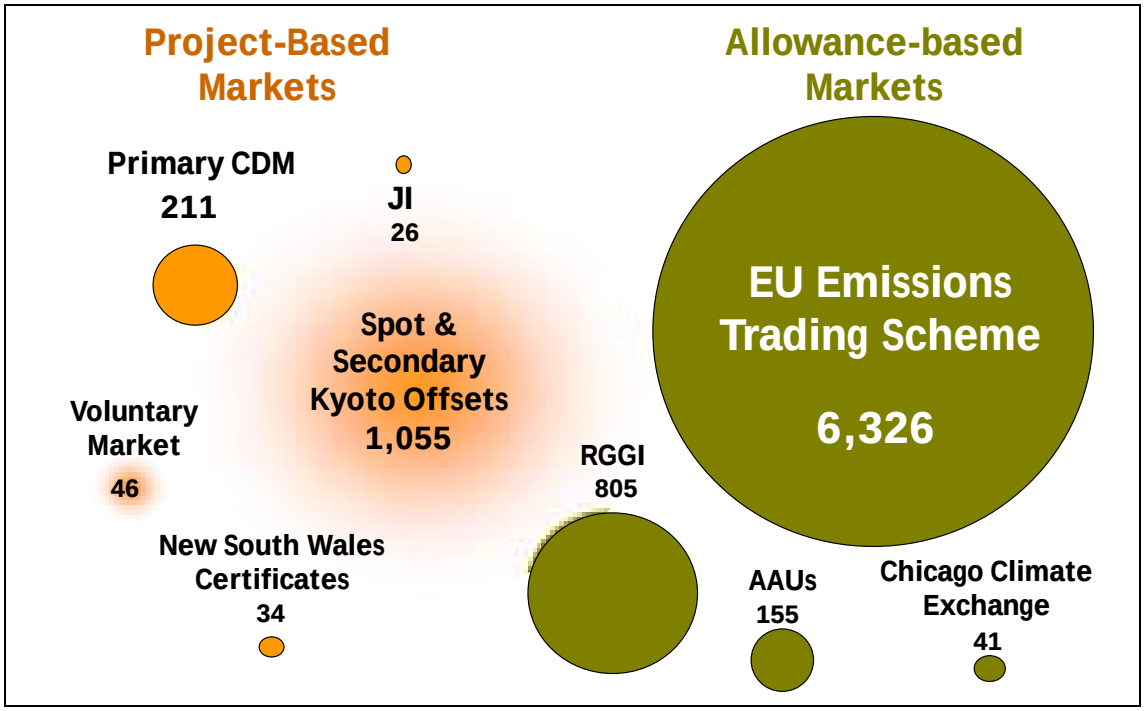

Figure 4. Volumes of Carbon Traded During 2009 in $MtCO_2e$[13]

2.4.3 Locations of Carbon Markets

Figure 5 (page 9) shows the locations of the various carbon markets currently in existence around the world.

Note that in Figure 5, Arizona is shown as participating in the Western Regional Climate Initiative. However, in February 2010, Arizona withdrew from the Initiative.

[13] Kossoy, A. and Ambrosi, P. (2010). *Op.cit.*

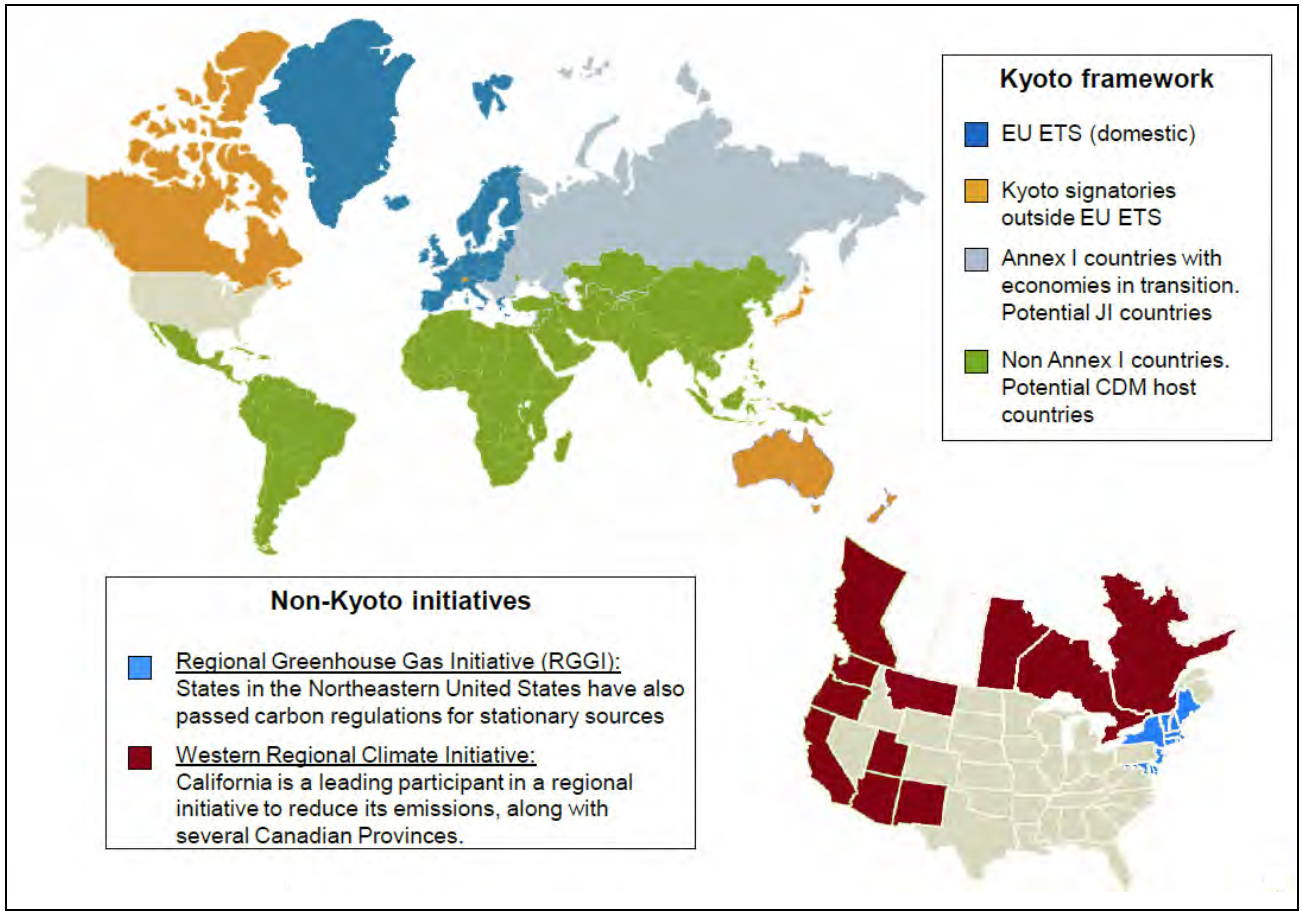

Figure 5. Worldwide Locations of Carbon Markets[14]

[14] Kossoy, A. (2008). State and trends of the carbon market. *Latin American Carbon Forum*. Santiago, Chile, 4 November.

3. ACCESS TO CARBON MARKETS

Access to carbon markets is a crucial factor that determines whether it is possible to trade emissions reductions resulting from DSM projects.

3.1 Market Rules

All carbon markets have rules about who may trade in the market and what may be sold.

The most basic rule applied in most carbon markets is that only tradeable instruments may be sold[15]. The particular criteria and procedures used to create tradeable instruments vary considerably between different regulatory markets and within the voluntary market.

In a regulatory market, the instrument that may be traded (and also surrendered to meet the emissions reduction obligations of obligated parties) is defined by the regulatory authority. This authority also usually controls the creation, registration and tracking of the tradeable instrument (though registration and tracking may be contracted out to a specialist service provider). Most regulatory markets only allow trading and surrender of instruments created in that market. However, there has been some discussion about making tradeable instruments fungible, ie allowing trading and surrender of instruments created in other carbon markets, including instruments created in the voluntary market.

In the voluntary market, creation, registration and tracking of tradeable instruments are in the hands of a range of specialist service providers. The criteria for creating tradeable instruments in the voluntary market usually focus on ensuring that claimed emissions reductions are measureable and verifiable, though the details of how this is done vary.

In all markets, the purchase of tradeable instruments usually takes place by way of legal agreements or contracts between two or more parties. The terms of an agreement may be decided upon by the parties but rules in a regulatory market may also require that certain terms be included in the agreement.

3.2 Allowance-based Markets

In allowance-based markets, the tradeable instrument is an allowance (ie a permit to emit), rather than a carbon credit linked to a measured and verified emissions reduction. Consequently, it is difficult to sell carbon credits from DSM projects in allowance-based markets. To enable such sales to occur, the market rules must allow carbon credits to be surrendered to offset some of the emissions attributed to an obligated party, thereby releasing allowances that can be traded in the market.

Most allowance-based markets based on cap-and-trade emissions trading schemes do not accept carbon credits from emissions reduction activities (such as DSM projects) as offsets because of a double counting problem. When direct emissions from the electricity sector are capped, any emissions reductions from DSM projects that reduce electricity consumption are automatically included in the measurements of the actual emissions

[15] The exception is the voluntary carbon market where private arrangements may be made between sellers and buyers to trade directly in emissions reductions without creating tradeable carbon credits.

attributed to obligated parties. Consequently, calculations of the number of allowances required to be surrendered by obligated parties will already take account of the emissions reductions from DSM projects. Therefore, allowing carbon credits linked to these emissions reductions to be surrendered in lieu of allowances would actually count the emissions reductions twice.

This double-counting issue is a general problem in regulatory allowance-based markets because it effectively means that emissions reduction activities undertaken voluntarily by firms and individuals cannot be recognised as contributing to a jurisdiction's emissions reduction targets. While this problem has been recognised in some countries, methods to overcome the problem have not yet been implemented.

The Regional Greenhouse Gas Initiative (RGGI) in the United States has pioneered a mechanism that generates a funding source that could be used for DSM projects, though it does not directly address the double-counting issue. Under RGGI, allowances are auctioned, with the bulk of auction revenues being applied to achieve "consumer benefits" – mostly through energy efficiency projects.

3.3 Project-based Markets

It is much easier to trade carbon credits from DSM projects in project-based markets. Whether this can be done in a particular market depends on the rules that determine how carbon credits that are eligible to be traded in the market are created from measured and verified emissions reductions achieved through DSM projects.

Each market has a unique set of rules for creating carbon credits. The rules that predominantly apply to limit market access are:

- Clean Development Mechanism – the DSM project must be located in a developing country that is not listed in Annex I of the United Nations Framework Convention on Climate Change (UNFCCC);
- Joint Implementation – the DSM project must be located in a developed country which is listed in Annex I of the UNFCCC; projects are generally undertaken in economies in transition where the availability of low cost emissions reductions makes the projects financially viable;
- regional project-based markets – generally the DSM project must be located in the relevant region;
- the voluntary market – depends on the purchaser, but generally the measurement and verification of the emissions reductions underlying the carbon credits must be robust.

4. ACCREDITATION, MEASUREMENT AND VERIFICATION

4.1 Requirements for Carbon Trading

Emissions reductions from DSM projects must be subject to accreditation, measurement and verification (AM&V) processes before they can be traded in carbon markets. The purpose of AM&V processes in carbon markets is to establish and protect the integrity of the instruments that are being traded.

In allowance-based markets, extensive regulatory involvement and effort are required during the initial design phase of the market to define the scope and nature of allowances and the market cap, and how the market will operate. In contrast, in project-based markets less initial market design effort is required on inception, but the emissions reductions must be determined on an individual basis for each project implemented. Consequently, a project-based market depends on a project-by-project analysis, whereas an allowance-based market depends on an analysis of the emissions inventories of obligated parties[16].

In practice, AM&V processes are required mainly in project-based markets. Most project-based carbon markets require various AM&V processes to be completed before tradeable carbon credits can be created. Consequently, a DSM project must be submitted to these AM&V processes before carbon credits can be created from the emission reductions achieved by the project.

Some project-based carbon markets require, as a first step, the accreditation of an emissions reduction project or the project proponent, or both. The purpose of accreditation is to filter out projects that are unlikely to result in the creation of carbon credits eligible for trading.

Most project-based carbon markets require that the emissions reductions underlying carbon credits undergo measurement and verification, sometimes by an independent third party, to ascertain the exact amount of the reduction and to prove that the emissions reductions actually occurred.

Also, because the Kyoto Protocol requires real and measureable reductions in GHG emissions that are additional to any that would occur in the absence of a certified project activity (a concept known as "additionality"), project-based carbon markets established under the Protocol require that emissions reductions underlying carbon credits must be reductions that would not have occurred without the project.

4.2 AM&V Processes

Each carbon market has specific processes in relation to AM&V of emissions reductions:

- Clean Development Mechanism – each project proposal must be approved by the host country and registered by the CDM Executive Board and must include an M&V methodology;
- Joint Implementation – the Kyoto Protocol included no guidelines for measuring and verifying the emissions reductions achieved by JI projects; the specification for AM&V processes for a particular project are negotiated between the host country and the investor country;
- regional project-based markets – each market establishes its own specification for AM&V processes;

[16] Stronzik, M. and Bräuer, W. (2001). *Accreditation, Verification & Monitoring of Joint Implementation*. WG4 Position Paper, Joint Implementation for International Emissions Reductions through Electricity Companies in the European Union (EU) and in the Central and Eastern European Countries ("JOINT"). Mannheim, The Centre for European Economic Research.

- the voluntary market – essentially, the specification for the AM&V processes to be used in a particular transaction depends on the purchaser; however, several organisations have established standards for the verification of emissions reductions and purchasers are increasingly requiring carbon credits to conform to one of these standards.

4.3 Examples of AM&V Methodologies

4.3.1 Clean Development Mechanism

The CDM Executive Board has approved and published a large number of individual measurement and verification methodologies applicable to different types of emissions reductions projects. Methodologies for "programmatic CDM"[17] have been specifically designed for DSM projects involving multiple installations of similar energy efficiency measures, eg compact fluorescent lamp replacement projects. These methodologies make it possible to bundle small projects, which alone would not be financially viable, making it possible to implement smaller-scale distributed DSM measures. Generally, the Board accepts average emission coefficients for grid-connected electricity projects, without requiring the identification of marginal power stations, which is known to be a not particularly accurate method for estimating actual emission reductions from projects[18].

The CDM Executive Board is also particularly keen to assess whether the emissions reductions achieved by projects are additional. Whether a project achieves additional abatement can be determined by assessing criteria that define four dimensions of additionality[19]:

- **abatement additionality**, where emissions are actually reduced compared with the situation before the project was implemented;
- **policy additionality**, where the emission abatement is in excess of any other policy, regulatory or legal requirements to reduce emissions;
- **business as usual additionality**, where the project is in excess of what could reasonably be expected to occur in the relevant sector(s); and
- **financial additionality**, where the project would not have taken place if revenue from carbon trading were not available.

---

[17] Figueres, C., and Philips, M. (2007). *Scaling Up Demand–Side Energy Efficiency Improvements through Programmatic CDM*. ESMAP Technical Paper 120/07. Washington, DC, The World Bank.

[18] Crossley, D. J and Pujari, A. (2010). *Principles for Assessing Emissions Reductions from DSM Measures.* International Energy Agency Demand Side Management Programme, Task XVIII Research Report No 2. Hornsby Heights, NSW, Australia, Energy Futures Australia Pty Ltd.

[19] Crossley, D.J. (2008). *Op. cit.*

4.3.2 Joint Implementation

While the Kyoto Protocol included no guidelines for measuring and verifying the reductions achieved by Joint Implementation projects, the Marrakesh Accords (which were agreed in 2001 and are binding on parties to the Protocol) set forth guidelines for JI project approval[20]. JI projects may be undertaken under "Track 1" or "Track 2." Track 1 projects can only be implemented where the host and investing country both fulfil a number of criteria, including having in place a national system for the estimation of GHG emissions. Under Track 1, the host country sets the rules for issuing Emission Reduction Units. Under Track 2, project developers must provide a project design document (PDD) that includes, among other things, proof of additionality. Project oversight and verification of emissions reductions is conducted by an "Accredited Independent Entity", and a specially formed body – the Joint Implementation Supervisory Council (JISC) must finally approve Track 2 projects.

4.3.3 Regional Project-based Markets

Under the New South Wales Greenhouse Gas Reduction Scheme (GGAS) in Australia, before a project proponent can create carbon credits, it must apply to the Scheme Administrator for accreditation as an Abatement Certificate Provider in respect of its abatement project. The Abatement Certificate Provider is the entity actually accredited, but the accreditation process also includes an assessment of the project submitted by the provider. The Scheme Administrator assesses the application to validate that the project meets the eligibility requirements and that the project proponent can calculate abatement appropriately. If the project does not meet the scheme eligibility criteria, the provider is not accredited for that project. The assessment by the Scheme Administrator may include commissioning a pre-accreditation validation audit[21].

Under GGAS, the accreditation process concludes with the Scheme Administrator stating the number of certificates (carbon credits) that may be created from the submitted emissions reduction project over a specified time frame. The Abatement Certificate Provider can then proceed to create certificates as the project is implemented. The Scheme Administrator may require verification audits to be carried out to determine whether the emissions reductions that have actually been achieved correspond to the numbers of certificates created.

4.3.4 The Voluntary Market

In the voluntary market, the main issue is the credibility of the emissions reductions being offered for sale. Various standards, certification processes, and emissions registry services exist, but there is no universally accepted standard. Several organisations have established standards for the certification and verification of emissions, including[22]:

- the Gold Standard;
- the Voluntary Carbon Standard; and
- the California Climate Action Registry.

---

[20] Gutbrod, M., Sitnikov, S. and Pike-Biegunska, E. (2009). *Op. cit.*

[21] Crossley, D.J. (2008). *Op. cit.*

[22] Gutbrod, M., Sitnikov, S. and Pike-Biegunska, E. (2009). *Op. cit.*

The Gold Standard was established by a group of NGOs led by the World Wildlife Fund, South South North and Helio International. Although the Gold Standard was originally designed as a supplement to Kyoto offset projects, it has now been expanded to verify carbon credits from voluntary emissions reduction projects.

The Gold Standard focuses its efforts to ensure project quality through exacting additionality and sustainability requirements. The rigorous additionality assessment uses a conservative baseline to ensure that Gold Standard projects credit only those emissions reductions that would definitely not have occurred without the project. Project developers must provide a number of supporting documents to prove that a proposed project will promote sustainable development.

5. VIABILITY OF CARBON FINANCING

The viability of carbon financing for DSM projects depends on:

- the costs involved in participating in a particular carbon market;
- the revenue likely to be generated from the sale of carbon credits; and
- the risks involved in participating in the carbon market.

5.1 Market Participation Costs

Figure 6 shows the estimated costs, in US dollars and as at May 2007, of participating in two project-based carbon markets: the Clean Development Mechanism and the voluntary market with a project certified and verified by the Gold Standard system.

Activity	Estimated Example Cost - $US		
	Full Scale CDM Project	Small Scale CDM Project	Voluntary Gold Standard*
Project Design Document Preparation	45,000	20,000	7,500
Stakeholder Consultation & Host Country Approval	10,000	5,000	2,500
Validation	30,000	12,500	5,000
Registration Fee	30,000	5,000	NA
Transaction Negotiation & Contracting	20,000	10,000	5,000
Project Monitoring (Periodic)	varies	varies	varies
Initial Verification	15,000	7,500	2,500
Periodic Verification (Cost Per Verification)	10,000	5,000	2,500
Approximate Total:	**>160,000**	**>65,000**	**>25,000**

Note: Actual costs will vary considerably depending on several factors.
*This illustration is for a "micro-scale" project <5,000 tCO_2/Yr. The costs for larger-scale projects would tend to be substantially higher.

Figure 6. Estimated Costs of Participating in Project-based Carbon Markets[23]

[23] Green Markets International Inc. (2007). *Op. cit.*

These costs are substantial. Consequently, participation costs may comprise a significant barrier to the viability of carbon financing for smaller scale DSM projects.

5.2 Revenue from Carbon Credits

Figure 7 shows the average prices in carbon markets during 2009 in US dollars per tCO_2e. The Figure also illustrates the relative sizes of the volumes of carbon traded in each of the markets during 2009.

There is a wide variation in carbon prices across the different markets. There is significant price variation even among project-based markets which are most accessible to DSM projects. The highest prices available in project-based markets are in markets associated with the Kyoto Protocol mechanisms CDM and JI. Consequently, carbon financing is likely to be most viable for DSM projects located in countries that qualify for one of these two mechanisms.

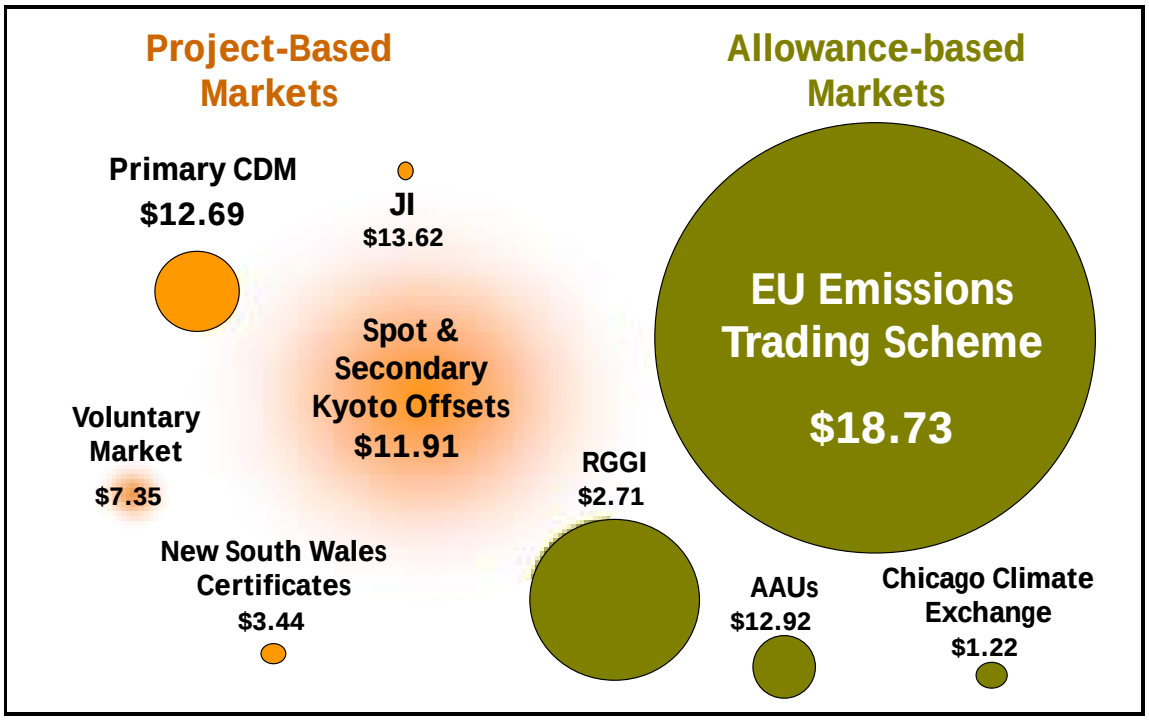

Figure 7. Average Prices in Carbon Markets During 2009 in US Dollars/tCO_2e[24]

[24] Kossoy, A. and Ambrosi, P. (2010). *Op. cit.*

5.3 Carbon Market Risks

There are a range of risks that DSM projects would face in relying on carbon financing. These include:

- delays involved in participating in carbon markets:
  - ♦ accreditation delays, eg the lengthy period required to achieve registration of emissions reduction projects by the CDM Executive Board;
  - ♦ delays in completing measurement and verification processes for carbon credits from emissions reduction projects;
- volatility of prices for carbon credits – all carbon markets have experienced price volatility, mainly because of political uncertainty and sovereign risk related to questions about actions governments may or may not take in relation to climate change;
- stability of carbon markets, eg currently there is considerable doubt about whether the CDM and JI mechanisms will continue after the first Kyoto Protocol commitment period ends in 2012.

6. CONCLUSION

Participation in a carbon market can provide new resources to enable DSM project developers to overcome financial and other barriers by:

- providing a source of revenue;
- improving project economics (increasing IRR); and
- enhancing project viability in other ways (eg an agreement with a creditworthy buyer to purchase carbon credits from a DSM project can increase confidence in the underlying project financing).

However, there are a number of questions that developers of DSM projects should ask when investigating the possibility of using carbon financing to fund a specific project. These questions include:

- Will the DSM project produce emissions reductions?
- Can the emissions reductions be measured and verified with confidence and credibility?
- Is there a carbon market that the DSM project can access?
- Is the project large enough to warrant paying the market participation costs?
- Are personnel (staff and/or consultants) available who can manage the market participation process?

DSM project developers should also take into account the risks involved in participating in carbon markets, including the possibilities of delays, the volatility of prices for carbon credits, and the possibility of instability in carbon markets.

REFERENCES

Crossley, D.J. (2008). Tradeable energy efficiency certificates in Australia. *Energy Efficiency* **1**, 267–281. Available at: http://www.efa.com.au/Library/David/Refereed%20Published%20Papers/2008/TradeableEECertificatesinAus.pdf

Crossley, D. J. (2009). *Preliminary Study of Emissions Trading Schemes in the United Kingdom and Australia*. International Energy Agency Demand Side Management Programme, Task XVIII Working Paper No 2. Hornsby Heights, NSW, Australia, Energy Futures Australia Pty Ltd.

Crossley, D. J. and Pujari, A. (2010). *Principles for Assessing Emissions Reductions from DSM Measures.* International Energy Agency Demand Side Management Programme, Task XVIII Research Report No 2. Hornsby Heights, NSW, Australia, Energy Futures Australia Pty Ltd.

Environmental Defense Fund (2008). *Cap and Trade 101*. New York, EDF. Available at: http://www.edf.org/documents/7953_captrade101_052708.pdf

Figueres, C., and Philips, M. (2007). *Scaling Up Demand–Side Energy Efficiency Improvements through Programmatic CDM*. ESMAP Technical Paper 120/07. Washington, DC, The World Bank. Available at: http://esmap.org/filez/pubs/11212007125014_ScalingUpDemandSideEE.pdf

Green Markets International Inc. (2007). *The Voluntary Carbon Market: Status & Potential to Advance Sustainable Energy Activities*. Arlington, MA, Green Markets International. Available at: http://www.green-markets.org/Downloads/vCarbon.pdf

Gutbrod, M., Sitnikov, S. and Pike-Biegunska, E. (2009). *Trading in Air: Mitigating Climate Change through the Carbon Markets*. Moscow, Infotropic Media.

Kossoy, A. (2008). State and trends of the carbon market. *Latin American Carbon Forum*. Santiago, Chile, 4 November. Available at: http://wbcarbonfinance.org/docs/State___Trend__Chile_10-08.pps

Kossoy, A. and Ambrosi, P. (2010). *State and Trends of the Carbon Market 2010*. Washington, DC, The World Bank. Available at: http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf

Kubo, T. (2008). Overview of the carbon market and project-based credits. *Asian Development Bank Philippines CDM Project Development Workshop*, Manila, 16 April. Available at: http://www.adb.org/Documents/Events/2008/CDM-Project-Development-Workshop/Carbon-Market-Toru-Kubo.pdf

Stronzik, M. and Bräuer, W. (2001). *Accreditation, Verification & Monitoring of Joint Implementation*. WG4 Position Paper, Joint Implementation for International Emissions Reductions through Electricity Companies in the European Union (EU) and in the Central and Eastern European Countries ("JOINT"). Mannheim, The Centre for European Economic Research. Available at: http://joint.energyprojects.net/documents/WG4_AVM%20Paper.pdf

United Nations (1998). *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. Washington, DC, United Nations. Available at: http://unfccc.int/resource/docs/convkp/kpeng.pdf