

www.defra.gov.uk

An analysis of the technical feasibility and potential cost of a personal carbon trading scheme

February 2008

Department for Environment, Food and Rural Affairs
Nobel House
17 Smith Square
London SW1P 3JR

Tel: 020 7238 6000

Website: www.defra.gov.uk

© Queen's Printer and Controller of HMSO 2008

This publication is value added. If you wish to re-use this material, please apply for a Click-Use Licence for value added material at:

<http://www.opsi.gov.uk/click-use/value-added-licence-information/index.htm>

Alternatively applications can be sent to:

Office of Public Sector Information

Information Policy Team

St Clements House

2-16 Colegate

Norwich NR3 1BQ

Fax: +44 (0)1603 723000

email: hmsolicensing@cabinet-office.x.gsi.gov.uk

Information about this publication is available from:

Domestic Climate Change and Energy Directorate

Defra

4D Ergon House

c/o Nobel House, 17 Smith Square

London SW1P 3JR

This document is available on the Defra website and has been produced by Accenture with the Centre for Sustainable Energy

Published by the Department for Environment, Food and Rural Affairs

An analysis of the technical feasibility and potential cost of a personal carbon trading scheme

Final Report to the Department for Environment Food and Rural Affairs

29 February 2008

Suggested citation for this report:

Chris Lane, Bob Harris, Simon Roberts (2008). *An analysis of the technical feasibility and potential cost of a personal carbon trading scheme: A report to the Department for Environment, Food and Rural Affairs*. Accenture, with the Centre for Sustainable Energy (CSE). Defra, London.

This research was commissioned and funded by Defra. The views expressed reflect the research findings and the authors' interpretation; they do not necessarily reflect Defra policy or opinions.

Accenture
Indra Morris | Chris Lane | Bob Harris
20 Old Bailey
London, EC4M 7AN
020 7844 4000

Centre for Sustainable Energy
Simon Roberts | Joshua Thumim
3 St.Peter's Court
Bedminster Parade
Bristol
BS3 4AQ
0117 934 1400



TABLE OF CONTENTS

1	Executive Summary	5
1.1	Scope of the pre feasibility study	5
1.2	Headline findings on technical feasibility	5
1.3	Headline findings on set up and running costs	6
1.4	Next steps	6
2	Overview of the type of Personal Carbon Trading scheme considered.....	8
2.1	Defra introduction to Personal Carbon Trading	8
2.2	Description of Personal Carbon Trading scheme focussed on in this study..	9
3	Components of the Personal Carbon Trading scheme.....	10
3.1	Overview of functions in the proposed Personal Carbon Trading scheme ..	10
3.2	Enrolment, ID verification and allocation	11
3.3	Carbon Credit accounts	16
3.4	Transactions and transfers	18
3.5	Auctioning of Carbon Credits	24
3.6	Trading of Carbon Credits	24
3.7	Compliance and enforcement.....	25
4	Scale of set up and running costs of a Personal Carbon Trading scheme	30
4.1	What scale of costs could be attributed to setting up a Personal Carbon Trading scheme and how does this compare to an upstream trading system?	30
4.2	What scale of costs could be attributed to running a Personal Carbon Trading scheme and how does this compare to an upstream trading scheme?	32
4.3	Over what timescale a Personal Carbon Trading scheme of this type might be implemented?	34
5	Next steps	35
	Annex A - Assumptions.....	38
	Annex B - Complications to be considered in future feasibility study	42
	Annex C - Frequently Asked Questions	44

1 Executive Summary

Defra commissioned Accenture to undertake an initial analysis of the technical feasibility and potential cost of a Personal Carbon Trading scheme. This Executive Summary outlines the scope of work we have undertaken and our headline findings on the technical feasibility and cost of the Personal Carbon Trading scheme.

1.1 Scope of the pre feasibility study

- Defra has commissioned four streams of work to inform its assessment of Personal Carbon Trading as a mechanism for meeting emissions targets against other available options. The streams include analysis of technical feasibility and cost, economic value and its strategic fit, its equity and distributional impacts, and its acceptability to the public.
- The study has been completed over an eight week period by Accenture, with additional expert advice provided by the Centre for Sustainable Energy. We agreed with Defra the most effective way to complete the study in this timeframe was to work with Accenture experts in: banking and trading systems, transaction processing, card technologies, utility company billing and payment systems, and government Information System infrastructures. We agreed with Defra that external consultation would not form part of our programme of work; this includes consultation with other Government departments such as DWP. In addition, we worked with Defra on a number of simplifying assumptions around the design and delivery of a Personal Carbon Trading scheme to enable the completion of a focussed analysis in a limited time period.
- Section 2 gives an overview of the type of Personal Carbon Trading scheme considered in this study and the components required to deliver this are described in Section 3, which also addresses a number of specific questions posed by Defra. Section 4 then focuses on the scale of set up and running costs for a Personal Carbon Trading scheme in comparison to upstream alternatives.

1.2 Headline findings on technical feasibility

- We have not identified an insurmountable technical obstacle for the implementation of this type of Personal Carbon Trading scheme from this initial analysis. It appears that the majority of functions could be fulfilled by modifying and / or adding capacity to existing systems. However, scale of change should not be underestimated with significant increases in capacity required across a range of systems in the public and private sectors to deal with the data and transaction processing of c.50 million carbon credit users. The increased pressure this creates is evident in the enrolment and allocation of credits (increasing the capacity and functionality of an existing government database), in the more than 1 billion transactions a year involving the entire UK banking system and all carbon retailers, through to the final surrender of credits back to government.
- Managing the impact of Personal Carbon Trading on these systems as they are modified and set up to process the transactions of the c. 50 million participants will also be a significant challenge and would need to be factored into any risk assessment and implementation plan. In terms of implementation timeline for this type and scale of scheme our experience suggests a transformation programme of

this scale would take in the region of 6 - 8 years to consult with industry on commercial viability, procure, design and implement.

1.3 Headline findings on set up and running costs

- We estimate the cost for setting up the Personal Carbon Trading scheme could be between £700 million - £2 billion and estimated running costs between £1 billion - £2 billion per annum. The broad range is reflective of analysis conducted at a very early stage of feasibility testing and the multiplication factor of 50 million participants for some of the key unit costs. In addition there are a number of other key cost drivers including the volume of transactions across the scheme and the number of channels through which these transactions can be executed. For example, the number of citizens eligible for carbon credit allocations affects the number of enrolments that need to be completed, which has a significant cost implication.
- The cost of setting up and operating a Personal Carbon Trading scheme is likely to be very much larger than the cost of an upstream trading system. We estimate set up costs of the latter could be between £50 million - £100 million, with estimated running costs in the region of £50 million per annum. Again the number of participants is a key driver in the differing cost estimates. The cost of enrolling 50 million participants (estimated at 3,000 man years if each ID verification could be completed in 5 minutes) would be far greater than enrolling up to 5,000 organisations in an upstream system. Likewise the cost of running 50 million carbon credits accounts (estimated at £1 billion per annum) would be significantly greater than running 5,000 organisations' carbon accounts.
- It is important to provide some context on the scale of these figures. The Identity Card Act contained a cost estimate for the set up and running of the National ID scheme, over a 10 year period, of £5.4 billion.¹ The estimated cost of administering £16.6 billion worth of Housing Benefit and Council Tax Benefit per annum to four million households is estimated by DWP to be in the region of £800m - £1bn per annum.² Whilst there are limitations to such comparisons, they demonstrate the scale of investment involved in implementing programmes that involve enrolment, ID verification and allocation a significant number of UK citizens.

1.4 Next steps

The findings in this study provide a basis for further investigation into the feasibility and cost of this type of Personal Carbon Trading scheme and the opportunity to consider alternatives with this information in mind. This report highlights some of the next steps Defra might take if either of these paths were pursued, they include:

- *Further analysis of key cost drivers as part of the economic analysis of the Personal Carbon Trading scheme.* We recommend a next step of undertaking further on the key cost drivers, in the context of the overall economic case for the Personal Carbon Trading scheme. This would be a key next step towards making a decision on whether to invest in a more detailed feasibility study.

¹ This figure is taken from the *ID Cards Act 2006, Section 37* on the likely costs of the ID Cards scheme. However, there is some debate on the scale of costs with the LSEs "*The Identity Project: an assessment of the UK Identity Cards Bill and its implications*" putting the figure in the region of £10.6 billion - £19.2 billion over 10 years.

² Research report No332, DWP

- *Direct consultation across affected industries should a more detailed feasibility study be commissioned.* If it is decided the feasibility of a Personal Carbon Trading scheme should be tested further, we recommend this is done with extensive consultation across the public and private sectors. The study would need to complete a further investigation into scheme costs and cover areas such as commercial viability and implementation risks.
- *An informed consideration of alternatives to this type of Personal Carbon Trading scheme.* Our findings on cost and technical feasibility could provide a basis for developing and assessing alternatives to the Personal Carbon Trading scheme looked at in this report.

2 Overview of the type of Personal Carbon Trading scheme considered

2.1 Defra introduction to Personal Carbon Trading

The UK is committed to reducing its level of greenhouse gas emissions and the Climate Change Bill³ proposes a target of a reduction in carbon dioxide emissions of at least 60% by 2050 (against a 1990 baseline). Individuals are responsible for around 40% of the UK's carbon dioxide emissions (largely from heating homes and water, and leisure travel), and in order to meet our longer-term emissions targets, emissions from individuals must be reduced as well as those from business and industry.

One potential measure is personal carbon trading. This is an emissions trading scheme where equal rights to emit are allocated to individuals in the economy as emission allowances (or 'carbon credits'), which must be surrendered when purchasing goods or services that cause emissions (e.g. paying their gas bill, or refuelling their car). Anyone with surplus carbon credits could sell these to individuals who require extra (where it is cheaper to buy extra, than to reduce their emissions).

In 2006, Defra commissioned the Centre for Sustainable Energy to assess the ideas and issues involved in the concept of individual carbon trading, and a report was produced: "A rough guide to Individual Carbon Trading"⁴. The Government has since conducted a pre-feasibility study to explore key high-level issues highlighted by the CSE report: effectiveness and strategic fit; equity and distributional impacts; public acceptability; and technical feasibility and cost.

There are different types of personal carbon trading that vary depending on the emissions covered, who participates and how it might be implemented. For the purposes of this study, a Domestic Tradable Quota model has been assumed:

- A mandatory scheme involving individuals and organisations, where 40% of carbon credits are allocated free to each adult and the remaining 60% are auctioned – traders and large organisations would make up the majority of buyers.
- 'Credits' would be surrendered to cover the carbon content of electricity and gas use in the home and for personal transport fuel purchases, with airlines covered and treated just as other fuel consumers.
- All individuals and organisations would have access to the market to trade their carbon credits.
- A 'pay as you go' option would allow individuals to pay the price of the carbon credits at the point of purchase, leaving the vendor to buy and surrender sufficient allowances for that sale.

A start date range of 2013 – 2020 has been assumed, with 2013 representing the earliest possible introduction date.

³ At the time of publication the Climate Change Bill is continuing its progress through Parliament. These details are therefore subject to the outcome of the Parliamentary process:

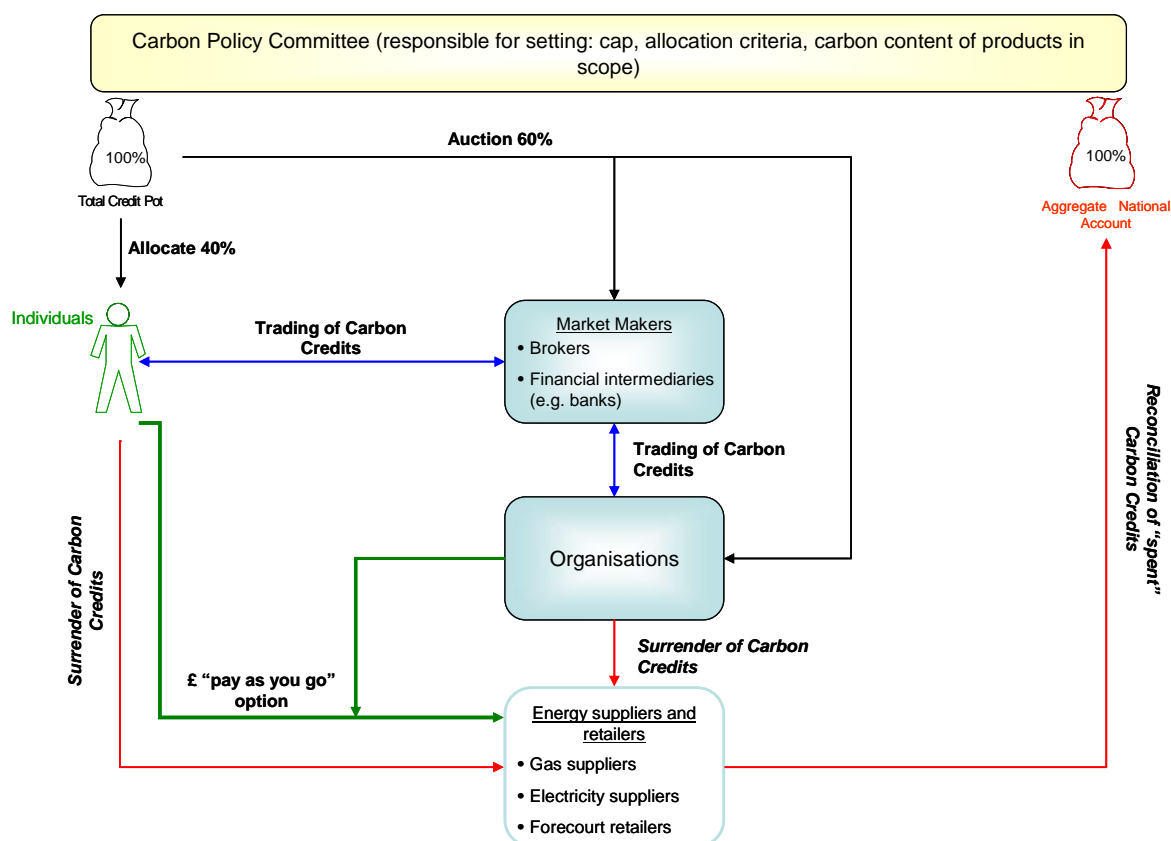
<http://www.defra.gov.uk/environment/climatechange/uk/legislation/index.htm>

⁴ <http://www.defra.gov.uk/Environment/climatechange/uk/individual/pca/pdf/pca-scopingstudy.pdf>

2.2 Description of Personal Carbon Trading scheme focussed on in this study

There are different types of Personal Carbon Trading that vary depending on the emissions covered, who participates and how it might be implemented. Defra asked that our analysis assume a Personal Carbon Trading scheme based on Domestic Tradeable Quotas (DTQs) described in the previous section. An overview of how this type of Personal Carbon Trading scheme might work is provided in Figure 1 below.

Figure 1: Proposed DTQ system (adapted from the Centre for Sustainable Energy's "A rough guide to Personal Carbon Trading", 2007.), which draws on the work completed by Fleming on Tradable Energy Quotas.



The focus of our analysis is on how the Personal Carbon Trading scheme operates alongside the c.50 million individuals that would be affected by it. Figure 1 also illustrates that the scheme specified by Defra would create a single market of carbon credits (with wholesale and retail trading taking place in this), covering organisations as well as individuals with 40% of credits being allocated on a per capita basis and 60% being auctioned to market makers on an ongoing basis. For the purposes of our analysis, our working assumption is that most businesses would not need to acquire Carbon Credits or record their usage of Carbon Credits, although they will be able to do so if they wish. They will instead pay an enhanced price to the carbon seller (energy suppliers and retailers in Figure 1) to reflect the carbon content of the purchases. These carbon sellers would purchase additional Carbon Credits from the market, to add to those received from customers, to match the required number of Carbon Credits they need to be surrendered

A full log of assumptions regarding the design of the scheme is provided in Annex A.

3 Components of the Personal Carbon Trading scheme

This section outlines the provisional operating framework for a specific type of Personal Carbon Trading scheme (see Sections 2) that provides the basis for our analysis of the key factors relating to technical feasibility and cost. Defra's key questions could not be tackled until we understood:

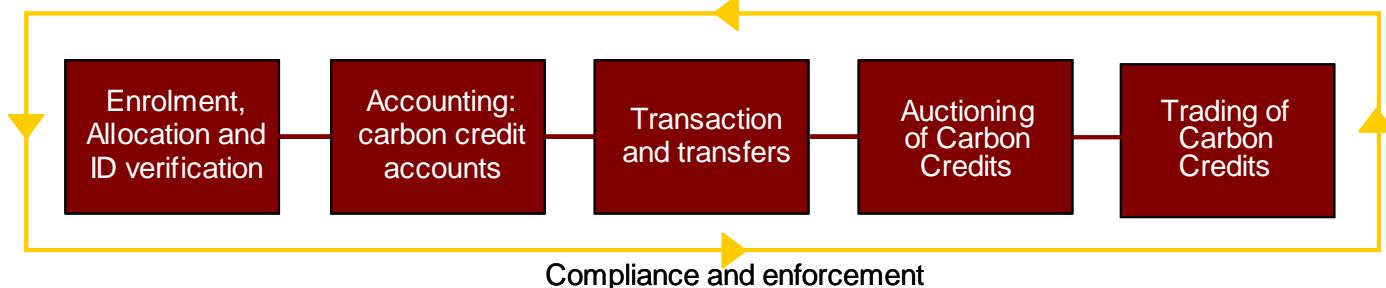
- The functionality of the scheme: the “functions” referred to in this section are the activities that need to be completed to enable the scheme to meet its objectives as set out in Section 1.3.
- The components of the scheme: “components” within this section refer to the technical instruments that enable the Personal Carbon Trading scheme functions to be completed.

In this section we describe the components we have identified as enablers of the scheme. Section 4 then uses these components as the basis for estimating the scale of cost for the set up and running of a Personal Carbon Trading scheme.

3.1 Overview of functions in the proposed Personal Carbon Trading scheme

The key functions identified in the proposed framework fall into the categories illustrated in Figure 2:

Figure 2: Main functionality required from the Personal Carbon Trading scheme



1. *Enrolment, ID verification and allocation:* The scheme needs to allocate the right number of carbon credits to the right people at the right time. This will involve the capture and verification of details on all UK adults, the maintenance and updating of the enrolment database, and the allocation of Carbon Credits to enrolled adults.
2. *Accounting:* The proposed scheme needs participants to have a means for the receipt, payment and recording of Carbon Credits. All adults will need a Carbon Credit bank account to work in tandem with their existing £sterling current account.
3. *Transactions and transfers:* Individuals will need to have the opportunity to exchange their Carbon Credits for carbon including fuel for private transport and for electricity, gas and oil for domestic energy use via multiple channels. The ability to transfer Carbon Credits from one account to another is also a required function of this scheme.

4. *Auctioning of Carbon Credits:* A scheme needs to auction 60% of Carbon Credits to primary producers and market makers in a simple, transparent way.
5. *Trading of Carbon Credits:* The scheme will need a vehicle for the trading of Carbon Credits by individuals or organisations.
6. *Compliance and enforcement:* A regulatory framework and audit system would need to be put in place to maintain the integrity of the scheme in question.

The components that would be needed to enable these functions are described in further detail in the remainder of this section.

3.2 Enrolment, ID verification and allocation

The purpose of the enrolment, ID verification and allocation components are to ensure that the right people get the right number of credits allocated to their accounts at the right time. They are the foundations for the scheme's integrity and effectiveness. Our findings in this section are based on the DWP's Customer Information System being used as a possible vehicle for the allocation of Carbon Credit. It should be noted that DWP has not been consulted as part of the study.

Figure 3 below shows the linkages between the enrolment, ID verification and allocation functions. We have agreed a working assumption with Defra that delivery of these functions would be the responsibility of a government organisation, which we refer to below as the Carbon Agency (this is for the sake of reference, rather than an explicit recommendation).

Figure 3: Enrolment & Allocation High Level Process Flow

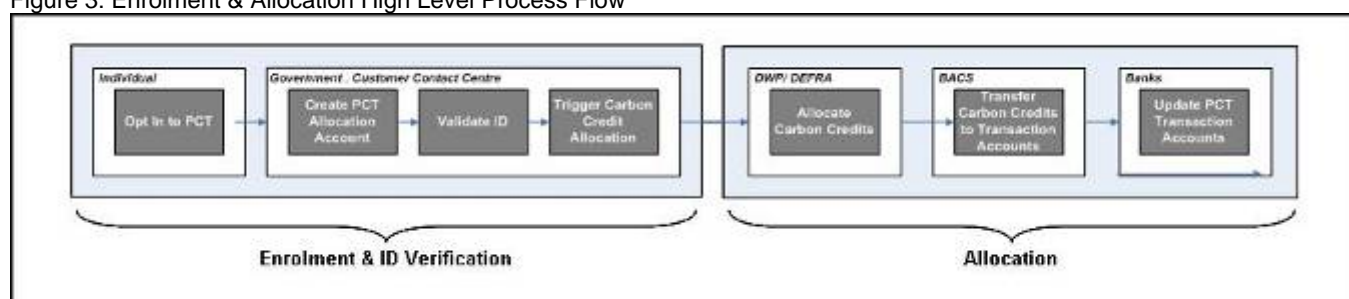


Figure 3 illustrates the step by step process by which a citizen could enroll in the Personal Carbon Trading scheme and receive their allocation of Carbon Credits into their accounts:

- **Active enrolment:** Within this scheme, individuals will be responsible for contacting the Carbon Agency to enrol. Whilst the Personal Carbon Trading scheme is intended to be mandatory, individuals will need to actively enrol to provide the Carbon Agency with the necessary information relating to the accounts created to hold their carbon credits (see Section 3.3 for detail on Carbon Credit accounts) . Without this information, the Carbon Agency will not be able to allocate carbon credits to individuals.
- In line with existing government schemes, individuals should be able to contact the Carbon Agency via a number of different channels (e.g. telephone, online, postal etc). If individuals do not enrol in the scheme the design assumption is that their credits would be made available for auction – the policy implications of this assumption are outside the scope of this study and will require further consideration

- **Passive enrolment:** where the Carbon Agency would be responsible for creating a Carbon Credit account for each eligible individual - has been discounted for the purposes of this report due to the additional expense such an option could entail. Government has only patchy information on people's bank accounts (primarily for those who are in receipt of social security benefits) and obviously will have none at all on their carbon credit accounts, so this option would require some form of central carbon bank being set up with 50 million account holders. The cost of setting up a new bank which could cope with 50m customers would be much larger than the estimated costs of existing banks amending their current systems. For similar reasons, the Government rejected the idea of establishing a "Universal Bank" in favour of persuading the banking industry to offer "basic bank accounts" to benefit claimants who did not have a bank account. Additional information on this design assumption can be found in Annex C.
- **Create Personal Carbon Trading Allocation Record:** Individuals will need to enrol in the scheme since government currently holds only patchy information on citizen bank accounts and will have no details on carbon credit accounts. It is this information (as well as updates on address and continued UK residence) that has to be captured during the enrolment process. Citizens would need to provide all the necessary information to enrol in the Personal Carbon Trading scheme including: Personal Details (name/ address/ DOB/ NINO), and Carbon Credit (CC) Account details (see section 3.3)
- **Verify ID:** An individual's ID will be verified prior to the completion of the enrolment process based on key elements of personal data i.e. name/ address/ DOB/ NINO.
- **Trigger Carbon Credit Allocation:** This trigger will be sent automatically once an individual has successfully completed the Enrolment and ID Verification processes.
- **Allocate Carbon Credits to CC Account:** In response to the above trigger, Carbon Credits will be transferred from the National Aggregate Carbon Credit Account to an individual's Carbon Credit Account through existing payment processing systems.

There are also a number of ongoing additional processes that would need to be implemented, these include:

- **Annual Reissue of Carbon Credits:** Batch process as per the initial transfer of Carbon Credits from the National Aggregate Account to Carbon Credit Accounts via Credit Payment System and VOCA (formerly BACS) .
- **Data Updates:** Processes related to maintaining Personal Carbon Trading data e.g. Carbon Credit Account information.
- **Exceptions Processing:** Processes for identifying and addressing any exceptions that occur during the end to end allocation process.

In our discussions over the last 8 weeks we have identified a number of components that need to be in place to deliver these processes, they are:

- **Personal Carbon Trading Allocation Records:** these are records created as part of the Personal Carbon Trading enrolment process. The creation of this record will flag an individual's entitlement to an allocation of Carbon Credits and trigger the actual allocation to an individual's Carbon Credit account. These records could be created by extending an individual's record on an existing government database e.g. Customer Information System (CIS) to include key Personal Carbon Trading

information e.g. Carbon Credit Account information, Allocation Entitlement Flag, Allocation Start Date, Allocation Reissue Date. .

- **National Aggregate Carbon Credit Account:** this would be a central database holding information relating to total amount of Carbon Credits within the system. It may also be used to capture management information on overall use of Carbon Credits. Allocations of credits to individuals will be deducted from the total central 'pot' of Carbon Credits.
- **Carbon Credit Allocation Mechanism:** this is a two stage process we think will be required to transfer Carbon Credits from the National Aggregate Carbon Credit Account into individual CC Accounts using the Credit Payment System and VOCA (as child benefits are currently allocated).
- **Customer Relationship Management System:** A system to manage the contact between individuals and the government on Personal Carbon Trading which will need to cover all potential contact channels. This should provide workflow support and contact tracking for all key Personal Carbon Trading processes e.g. account set up, ID verification, allocations, data updates. For the purposes of this study, we have assumed that the government would need to create its own customer contact capability. Further analysis is required to determine whether this requirement can be supported by any existing government functions. This is outside the scope of this study

How could people's ID be verified?

Effective ID verification will play an important role in maintaining the integrity of the scheme – making sure that the right individuals are getting the right allocation of Carbon Credits. We are working on the assumption that the level of ID verification would mirror that required in the allocation of state benefits– that is verification of personal data such as name, address, date of birth, NINO etc. Section 3.1 provides an overview of how we view ID verification fitting into the allocation process.

Findings on how peoples' ID would be verified

ID verification should be no more complex than that required to claim benefit, and existing levels of verification used within CIS might be applied to enrolment in Personal Carbon Trading. Citizens could claim their Carbon Credit entitlement in a similar way by enrolling either:

- Online
- By telephone to a Personal Carbon Trading Customer Contact Centre
- By post to the Personal Carbon Trading Customer Contact Centre (although this would be out of sync with government's plans for improved more cost effective service delivery).

The citizen would provide biographic information and a CC Account number into which Carbon Credits would be deposited.

Other options

More stringent ID verification checks e.g. checking original documentation such as passports or birth certificates, whilst reducing the likelihood of fraud, would significantly increase the cost of the ID verification activities in terms of the time taken to process each enrolment request and, therefore, the number of employees required to support the initial enrolment process. There are additional complications with these more stringent checks – for example, not everyone in the population has a passport. As the Personal Carbon Trading scheme is being designed in more detail, it will be necessary to consider acceptable costs for the enrolment process against acceptable levels of fraud (for example, there might be an option

for lower levels of ID verification more in line with enrolment to supermarket loyalty schemes – however, this would be likely to increase levels of fraud and cloning of Carbon Credit cards).

A guiding principle we are applying is that the level and type of ID verification applied generally varies according to the value of the commodity being allocated. If Carbon Credits were deemed extremely valuable one might consider additional verification steps at enrolment, which could include more extensive biographical or even biometric checks. Given the assumed value for Carbon Credits and the fact an existing, workable ID verification exists within DWP's Customer Information System, we decided to explore options more closely linked with these existing DWP checks. If necessary, additional checks could be added e.g. automated checking to ensure a match between the enrolled citizen and the account owner of the Carbon Credit account, thus providing an additional level of ID verification.

How long would it take to verify and issue allowances?

This will depend on the resource allocated to the enrolment task. Based on work that Accenture has carried out previously for a major government department dealing with claims processing, in order to process all enrolment applications i.e. to create allocation records, verify IDs and to deal with exceptions and general questions within 12 months, the Personal Carbon Trading Customer Contact Centre would need to employ between 7,500 and 16,000 people full time depending on the level of ID verification required. This assumes an average customer interaction of 10 – 12 minutes (across 3 main interaction channels i.e. telephone, post and online with a basic level of ID verification). This assumption is based on Accenture's experience of working with government clients on systems to capture information and verify ID.

A vital component of the scheme is a central database that has the capability to flag an individual's entitlement to an allocation of Carbon Credits and trigger the allocation of these credits to an individual's Carbon Credit bank account. The database must also have the capacity to deal with the c. 50 million adults covered by the scheme. We have agreed a working assumption with Defra that the database would be the responsibility of a government organisation. The government database handling enrolment and allocation of credits would run in parallel with multiple private sector organisations (i.e. banks and building societies) managing Carbon Credit accounts creating a two tier system.

Our analysis suggests it is technically possible to use an existing government database for allocation. Of those options investigated, DWP's Customer Information System (CIS) seems to be the best fit. The CIS database has a number of advantages that lends itself to being a vehicle for the allocation of Carbon Credits, these include:

- Good quality and accurate data held for the majority (though not all) of the 50 million adults who fall within the boundaries of the scheme. The CIS Data Model holds 86 million personal records (includes records of the deceased) – no other government database in the world is known to cover this many accounts.
- Regular updates of database records whenever a person interacts with HMRC, DVLA, Local Authorities, benefit and pension systems.
- A central point for identity validation, identity fraud detection and a central point of contact model for customers supported by multiple channels.
- A mature, proven and scaleable IT platform that is flexibly designed to adapt to business needs. The addition of a limited number of new fields to the existing Data Model to accommodate Carbon Credits is relatively straight forward within this database.

Despite our initial view that CIS is the most suitable existing database, there are factors that would need further consideration and require direct consultation with DWP (we have not spoken with DWP in developing this analysis) including:

- The impact on CIS of integrating Personal Carbon Trading requirements – additional users/ functionality/ transaction volumes. What risks are there for the CIS – what impact would this have on the performance of CIS?
- Although the data is comprehensive it is still not complete – for example, there is no data on workers who are not eligible for National Insurance.
- A clear governance structure and processes would be required as the database would run across both DWP and Defra. Clear communication would be required on Service Level Agreements upgrade plans and the charging mechanism required between Defra and DWP.

Other options considered

Other databases were considered in our discussions with Accenture experts. These include:

- *A Defra specific copy of the CIS database.* This would involve taking a copy of the CIS database, with Defra adding the required components to execute the required Carbon Credit processes. The disadvantages of such a system include the significant additional costs of building a Defra specific database. Defra would also need to manage and maintain their CIS instance on an ongoing basis – a complex level of synchronisation would be needed with DWP CIS at a significant extra cost.
- *National Insurance Recording System (NIRS).* This option was discounted due to the limitations of the database both in terms of its limited coverage (no pensioners or children are included) and the fact it is based on older technology than CIS, which means it would be more difficult and more expensive.
- *National Identity Register (NIR).* The NIR when / if it is implemented will provide an upgrade to CIS. However, our initial view is that a similar set of changes would still need to be made to the database (at a similar cost) to accommodate the allocation of Carbon Credits. We have also taken into consideration the political uncertainty around National Identity programmes and elected to focus on a database that exists today.

Would costs be affected by a high frequency of allocations (e.g. once a month) compared to once / twice a year?

The enrolment and allocation process we have described in Section 3.1 is based on the assumption that Carbon Credits would be allocated in annual lots on a staggered basis (i.e. not everyone would receive their entitlement on the same day). This staggering of allocations may go some way to mitigate against acute market fluctuations – for example, if all 50 million individuals within the scheme sell their excess credits in the final two weeks of the year.

The cost of allocating carbon credits is linked directly to the transaction cost associated with transferring carbon credits from the National Aggregate Carbon Credit Account to c50 million individual CC accounts. Costs would therefore be significantly affected by the frequency of allocations as it is the number of transactions rather than the number of credits within each transaction that determines the total cost.

The relative advantages and disadvantages of more frequent allocations are considered in the table below:

	Pros	Cons
Single Annual Allocation	<ul style="list-style-type: none"> - Lower Total Cost - Allows individuals to budget over the long term and to allow for periods of increased carbon emissions e.g. periods of unseasonably cold weather without having to buy additional credits from the market at a potentially higher price. - Fewer customer queries e.g. following up on a single allocation rather than 12 monthly allocations 	<ul style="list-style-type: none"> - May be difficult for some individuals to budget across a year
Frequent Allocations (e.g. monthly)	<ul style="list-style-type: none"> - Limited ability of individuals to respond to unplanned demands for CCs e.g. cold snap. - Potentially easier for some individuals to administer 	<ul style="list-style-type: none"> - Higher Total Cost - Additional Processing Requirements (minimal) - Additional customer queries e.g. following up on monthly allocations - Potential need to allocate different amounts of CCs per month i.e. more in winter

3.3 Carbon Credit accounts

A Personal Carbon Trading scheme of this type would require all participants to have a means for the receipt, payment and recording of Carbon Credits.

The Carbon Credit Account would require the following features to be in place:

- Banks would provide normal current account services including credit and debit transactions, internet banking, inter-account transfer, monthly statements and customer help services;
- There would be no overdraft facility;
- Joint CC accounts would be acceptable alongside joint current accounts;
- Account set-up could be automatic and triggered by the issue of new Carbon Credit cards.

Our view is that the most cost-effective way of delivering this is to build on existing banking infrastructure whereby each adult has a “Carbon Credit (CC) Account” sitting alongside their existing (£ sterling) bank current account.

The ease with which the banking sector can run the scheme alongside financial bank accounts is dependent on how analogous Carbon Credits are to a currency (i.e. they are a non perishable means of exchange). We have worked on the assumption that the Carbon Credit would have many of the same features as normal current account services, although there would be no overdraft facility. We have also agreed the assumption with Defra that there would be no “expiry date” on individual Carbon Credits – we do not view the expiration of credits as a viable option as it would require more fundamental changes across banking systems (e.g. each credit would have to be marked with an expiry date and electronically “terminated” on this date), since it could no longer be treated as analogous to a currency.

The major banks (but not all building societies) have the capability and capacity to run Foreign Currency current accounts in parallel with sterling current accounts. If Carbon Credits are treated as a form of foreign currency then the scheme could run easily alongside financial bank accounts, enabling quick exchanges between the two if necessary. However, it is important to emphasise that “easily” does not mean “cheaply” and Section 4 shows there are some significant costs associated with doing this.

Other options

We considered whether a new “Government Carbon Bank” with CC accounts for every UK adult would be a feasible solution. While, in principle, this could be established, it would:

- Require a much more extensive and time consuming process to capture personal details on every adult in order to set up 50m new accounts.
- Cost significantly more to run than CC accounts alongside existing current accounts due to the new banking infrastructure that would need to be in place.

A key prerequisite for this solution to work is that all UK clearing banks and building societies offering current accounts are prepared to offer this service, possibly via a third party organisation for the smaller building societies. This is a significant assumption that would need to be explored further with banks as part of a full feasibility study.

Is there a precedent for this mix of public and private sector delivery of the scheme?

There are many examples of where government schemes are managed across government and private databases:

- An employer holds NI and PAYE contributions for their employees in their HR system, where NI and PAYE are government schemes.
- A Pensions provider receives pension contribution data for individuals from NIRS/HMRC, even though the concept of pension contributions is a government scheme.
- DWP pays money to claimants into their bank accounts, but that money is part of a government scheme such as Income Support or JSA.

And in fact nearly all government departments outsource some part of their IT operation to a private sector organisation, with government controlling /regulating how their operator should manage their data. Consequently, within this scheme Personal Carbon Trading accounts held in banks should not be considered as privately held databases of *government* data. The data collected by the bank on the individual to set up such an account would be provided by the individual in the full knowledge of the Data Protection Act rules the bank would be bound by. The private part of the solution does not deal with the verification of individuals’ identity, or the award of allowances which the public may view as more sensitive areas to keep control of.

3.4 Transactions and transfers

A key function within the scheme is the ability for individuals to exchange their Carbon Credits for the carbon products in scope, these include:

- Fuel for private transport (i.e. petrol);
- Electricity, gas and oil for domestic energy use.

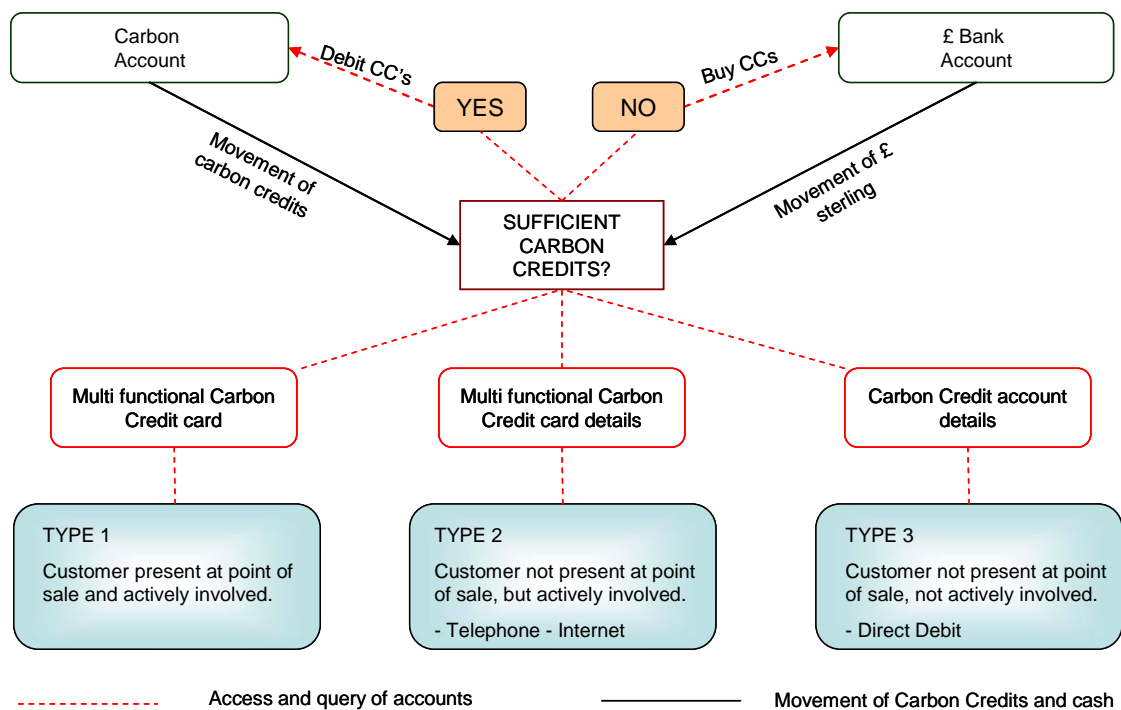
Public transport and aviation are covered indirectly through the organisations responsible for fuel purchases (in this section we also consider alternatives and complexities for extending Personal Carbon Trading to include aviation in a more “downstream” model).

There are three “types” of transaction that the scheme needs to facilitate for it to be effective in terms of enabling transactions and minimising the “hassle factor” for citizens, these are:

- Customer present at the point of sale and actively involved
- Customer not present at the point of sale, but actively involved
- Customer not present at the point of sale, not actively involved

These different payment types are illustrated in Figure 4 below.

Figure 4: Overview of different transaction types the Personal Carbon Trading will need to accommodate to cover the full range of consumer experiences with gas and electricity suppliers, and fuel retailers.



Our view is that the movement of Carbon Credits would mirror the movement of existing financial transactions. This means that for fuel purchases customers will be able to surrender Carbon Credits at the point of sale. The payment of utility bills might be done through a payment over the telephone or internet where Carbon Credit card details are passed on to the vendor, or through payment via a direct debit where the Carbon Credit account details are registered with the gas and electricity suppliers and debited automatically. Transfers of Carbon Credits between individuals would be supported by these changes to the internet

and direct debit payment systems, mirroring the way in which money is transferred through the BACS systems from one person to another.

An additional function within the system is the ability for customers to “pay as you go” – this would be an option for UK citizens who do not have a Carbon Credit card at the point of sale or for visitors to the UK. Part of the transaction process would involve a live check to calculate if there are sufficient Carbon Credits in a customer’s account to complete the purchase. If there are insufficient credits the additional cost (may vary between retailers) of the outstanding Carbon Credits will be added to the customers’ bill.

In order for this system to function we suggest a number of changes would need to be made to existing billing and payment infrastructures:

- **Payment scheme infrastructures.** Organisations such as VISA, Mastercard, and AMEX will need to adapt their existing systems to handle this new unit – the Carbon Credit. The same type and level of change would need to be made to VOCA (previously BACS) infrastructures, which currently support the processing of the majority of direct debit transactions in the UK.
- **Billing and payment systems.** The way in which customers are billed will need to be adapted to include a calculation of the number of Carbon Credits the customer needs to surrender with each purchase. This will involve “Level 1 – Point of sale” changes that include a software upgrade for each point of sale terminal that allows the Carbon Credit calculation to take place. It will also include “Level 2 changes to the EMV (Europay, Mastercard and Visa)” operating systems that will require a software upgrade to handle the surrender of Carbon Credits and support the processing of checks on Carbon Credit accounts.
- Our early view is that the Level 1 and Level 2 changes would need to be rolled out to all carbon vendors within the scope of this scheme. They would also need to be applied to systems supporting internet / telephone, and direct debit transactions.
- **Smart cards.** In order to facilitate Carbon Credit transactions some form of personal card is necessary through which vendors can access a customer’s Carbon Credit account. Section 3.4.3 below sets out the debate around the various types of cards that might be used for this purpose. Our initial view is that a Contact Smartcard would be the most effective delivery method.

Smart metering – an important enabler of an effective Personal Carbon Trading scheme for domestic energy use?

A Personal Carbon Trading scheme could work without Smart metering being rolled out nationally – for this reason we have not included the cost of installing Smart meters in all UK households in this study.

However, our initial view is that the absence of Smart metering would certainly influence the effectiveness of the scheme. Existing utility company billing systems within the UK are based on estimates, infrequently verified and often require significant readjustments. If this lack of accurate and timely information around energy use remains in 2013 it poses a significant risk to Personal Carbon Trading effectiveness.

We have explored the “best” delivery method for the Personal Carbon Trading scheme against two main criteria – firstly, the ability for it to enable the required functions of the scheme and secondly, how attractive the method is for every day use by citizens (i.e. how much additional hassle will it cause the citizen on a day to day level). We have identified some high level pros and cons associated with each of the delivery methods Defra has suggested for investigation. There are three options for physical delivery investigated here:

- Separate Carbon Credit card – a stand alone Carbon Credit card.
- Contactless Smartcard – a card automatically read when in close proximity to card reader (i.e. same functionality as an Oyster Card).
- Multi functional Contact Smartcard – as used by most banks and credit card companies at present. The option considered here is to add functionality to existing credit / debit cards to allow Carbon Credit transactions.

Our findings suggest that a Contact Smartcard (a card with a microprocessor embedded that can facilitate transaction from multiple accounts) is the only option that allows for national coverage of carbon retailers and has the functionality to allow transactions (both at point of sale and remote) from multiple account types on a single card, which we consider to be a key factor in being “user friendly”. The pros and cons of the various delivery options are outlined below.

Option 1: Separate Carbon Credit card

Pros

- Requires relatively straight forward card technology – one card accessing one account.
- Strong identity; a distinct “carbon card” could increase awareness of the carbon agenda. This option probably delivers the greatest level of visibility.

Cons

- “Hassle factor” for customers at fuel retailers – with a separate carbon card, customers would be making two separate transactions, having to get two separate cards out of their wallets (possibly three if retailer loyalty cards are included).
- Required transaction processing for the “pay as you go” option is further complicated with a separate carbon card. The carbon card would need to be processed first to calculate whether there are sufficient Carbon Credits to complete the transaction. Then the bank card would need to be processed for the transaction process.
- The additional cost of producing and distributing 50 million carbon cards – none of which could be offset against expiring current account credit or debit cards.

Option 2: One touch cards or Contactless Smart cards

A one touch card or “contactless Smart card” contains a chip that communicates with a card reader when it comes into proximity of the reader’s antenna (for example, scanning an Oyster Card over a TfL sensor). In most cases the Smart cards hold data on the cards themselves and transactions do not therefore require network connectivity to link up with a host account.

Pros

- Simple, easy and quick for citizens to use. For example, filling up at the forecourt the customer might simply run the “Carbon One Touch” card over a sensor, with any “excess” left to pay calculated at the point of sale.

- Specific physical action for the transaction of Carbon Credits – this could have a contributing affect on behavioural change (raising awareness etc)

Cons

- An additional action, which could further hassle the consumer.
- Does not have the functionality to deal with transactions where the customer is not present at the point of sale.
- Security on these cards is minimal; data is stored on card and no verification is usually required to spend the stored value.
- Additional cost of “one touch” card readers being installed in all petrol forecourts across the UK.

Option 3: Multifunctional Contact Smart cards

Smart cards contain a micro processor (unlike earlier generation credit cards of magnetic stripe cards) which enables the card to have stronger ID verification processes and to carry out many different kinds of transactions. Existing Smart cards allow customers to make purchases from a credit account, debit or another account of stored value (e.g. a Carbon Credit account).

Pros

- Allows Carbon Credits to be integrated onto existing customer cards,
- Reducing the hassle factor for customers – only need to take out one card at a time,
- Chip and pin level security,
- Provides the opportunity for banks to be associated with a “green initiative”; potential for increased buy in from across the industry,
- Can be read by existing readers, with slight software modifications to process transactions in Carbon Credits.

Cons

- Could prove difficult to implement for those participants in scheme who do not have existing bank accounts.
- Probably provides the least visibility of the three options.

An additional option of merging a “Contact” and “Contactless” Smart cards was briefly considered. This would have the potential to allow a citizen to use both one touch at petrol stations, and the conventional payment method for internet, phone and direct debit transactions. However, it was not pursued in any detail due to the additional costs of embedding this new technology into c.50 million cards and in installing readers in all UK petrol forecourts.

Could Carbon Credit cards be set up and implemented in the same way as Loyalty Card schemes?

Loyalty cards are essentially marketing tools that reward loyal buying behaviour. By presenting the card the purchaser is usually entitled to a discount or an allotment of points that can be used in future purchases. To receive a loyalty card (e.g. the Sainsbury’s Nectar Card) a customer provides registration details, which are entered onto a central database against which purchasing history is collected and analysed. The cards have the facility to issue credits to customers in the form of discounts on immediate shopping or vouchers for future use.

An initial analysis of loyalty cards being the basis of a Personal Carbon Trading scheme suggests there are some limitations to their applicability:

- Loyalty cards are generally proprietary schemes which are linked with the retail systems of different retailers or retail groups. There is no universal infrastructure for acceptance – for example, we cannot use Sainsbury's reward points at Tesco. The Personal Carbon Trading scheme requires the card to be accepted at all carbon retailers both at the point of sale and for remote transactions (e.g. direct debit).
- Consequently, a central proprietor of the Carbon Card "loyalty card" would need to be in place to set up and run the required systems. Many of the arguments against a central Carbon Bank (see Section 3.3.2 and Annex C) are applicable to this.
- The functionality of loyalty cards is typically limited in comparison to the requirements of the Personal Carbon Trading scheme. Points collected on cards are usually not transferable to another person's account. There is no option to set up direct debits for remote payments (e.g. for utility bills). There is no option to buy more points or sell points from the account.
- Enrolment for retailer loyalty cards typically requires a low level of identity verification – it is not unusual for an individual to have more than one loyalty card for a single store. For such retailers this is not a significant problem as the customer only receives points in reward for purchase. With the Personal Carbon Trading scheme citizens will be allocated a set number of credits free of charge, so a greater level of ID verification is required.
- The value of points held on loyalty cards is also usually less than the projected value of the annual carbon credit allocation. One of the UK's largest retailers issues approximately £200 million of vouchers to its 10 million card holders per annum – an average of £20 per card holder. The assumption in this study is that an annual allocation of carbon credits will be valued at £80 with the potential to rise depending on market conditions. Consequently, the simple magnetic stripe identification used to redeem points at supermarkets offers little protection against theft / cloning and consequent misuse of the card.

The limited functionality of loyalty cards means they are less expensive systems to set up and run than the credit / debit card systems linked to sterling current accounts. However, they are by no means cheap. Industry experts suggest that even in a mature loyalty scheme market such as supermarkets, the implementation costs are typically between 1% - 1.5% of total revenue – the UK's largest supermarket chain has annual revenues in the region of £45 billion, the scheme they implemented has over 13 million card holders. Retailers would need to be approached directly to develop estimates of the running costs of such schemes, which was beyond the scope of this study. However, publicly available information cites one large UK retailer with revenues of c. £15 billion a year not proceeding with a loyalty card programme due to projected high annual running costs estimated in the region of £60 million per annum.⁵

The ability for operators to make money from the scheme will have a bearing on its overall viability. The increased capacity and changes in components we have identified in Section 3.3 for dealing with Carbon Credit transactions and transfers will come at a cost that will need to be recovered (see Section 4).

The principal operators will be the banks, but several thousand other businesses concerned with the sale of fuel, utilities and air travel will also be involved. Unlike with £sterling current

⁵ "Brand Republic" article on store cards: <http://www.brandrepublic.com/login/News/601543/> – 31st October 2006_

3.5 Auctioning of Carbon Credits

A system is required to auction 60% of Carbon Credits to primary producers and market makers in a simple, transparent way. We are working on the assumption that the auction system considered here (in terms of cost) will be similar to the preferred option outlined in Defra consultation on proposed UK auction design for use in the EU Emissions Trading Scheme Phase II (2008-2012).

How this might work

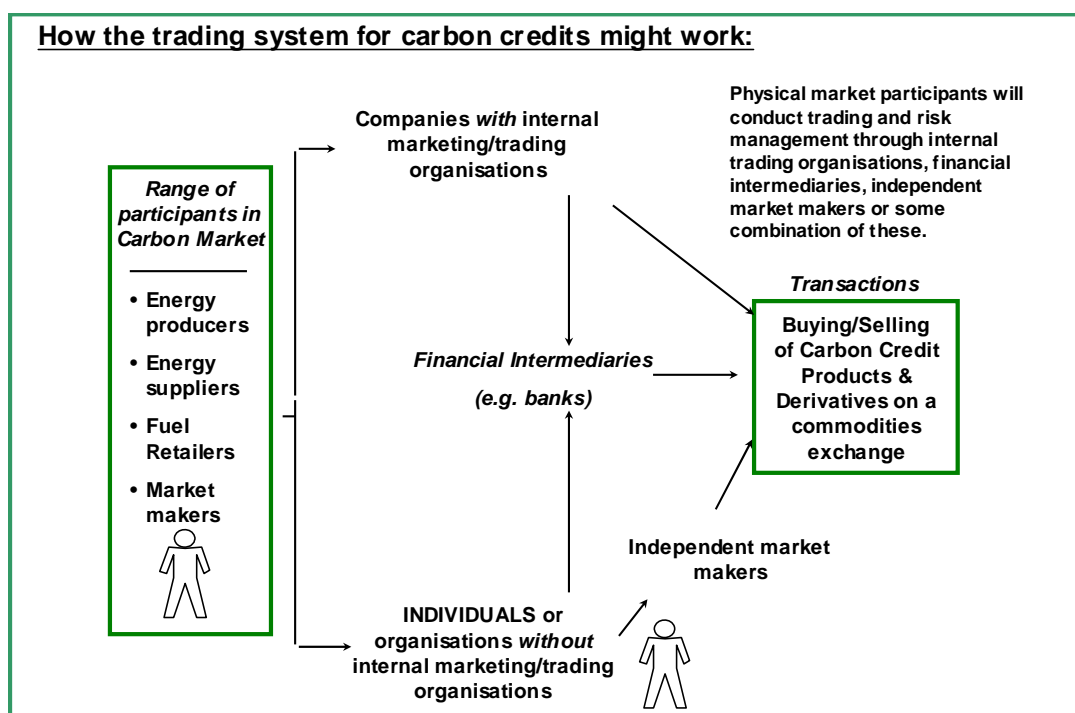
A simple static auction design would see bidders submit the number of allowances they wish to buy at a series of prices before the auction begins. A uniform pricing rule would see all winning bidders pay the same price for allowances. Access to the auction would be open to all registered account holders, which may require Government to ask for full or partial pre-payment to mitigate the risk of default. The auction would interact directly with a number of intermediaries – appointed by the UK Debt Management Office (DMO) using a transparent process – who would take bids from clients and submit them on their behalf. This model would mirror the DMO’s existing auction design for Government Debt.

3.6 Trading of Carbon Credits

A trading platform or exchange is the mechanism that will allow Carbon Credits to be traded by individuals or organisations – it will facilitate the market.

Our view is that Carbon Credits, though treated like a currency within carbon accounts, will be traded as a commodity on an existing commodities exchange (for example, Intercontinental Exchange). As with existing shares / commodities individuals will not access the exchange directly, direct access would be limited to those with registered “seats” who would partake in wholesale trading. Individuals would play a full part in the Carbon Credit market at the retail level, by placing trades through brokers or financial intermediaries (e.g. banks) in the same way individuals access existing commodity markets or buy and sell foreign currency.

Figure 6 – How the trading system for Carbon Credits might work



The main building blocks that need to be put in place to enable Carbon Credits to be traded on an exchange in this way would be:

- The addition of a new commodity on the exchange. Initial investigation suggests adding a commodity to an exchange should be relatively straight forward in terms of changes required to the Information System infrastructure and have little incremental cost.
- The level of trading on the exchange is difficult to predict as it is based on assumptions on the level of speculation and the number of traders in the market. If carbon credits are placed on an established exchange (for example, London International Futures Exchange) there should be sufficient capacity to handle the increased level of trading. The exchange would cover its costs and make money by levying a charge per trade as would the London Clearing House for processing the trades.
- Financial intermediaries and independent market makers might also need to make internal changes to their businesses to trade in carbon. This could range from employing new staff to trade in a new commodity (though increasingly, banks and brokers are trading in the existing carbon markets) and in changing their Information System infrastructures to trade in this new commodity.

3.7 Compliance and enforcement

Compliance and enforcement will play a vital role in maintaining the integrity of the personal carbon trading scheme. Setting the right regulatory framework and getting the right systems and people in place to enforce it will be key to tackling the main compliance risks associated with the scheme. This section explores what the main compliance challenges could be and a possible framework for addressing them.

The main compliance challenges associated with this type of Personal Carbon Trading scheme are:

- Failure to match carbon credits with carbon sales: All UK sales of carbon-related goods and services (as covered by the scheme) in a given period must be no more than the number of Carbon Credits redeemed (i.e. given back to the responsible carbon accounting body) in that period.
- Fraudulent creation of credits: There must not be more credits in the system than have been allocated (i.e. credits are not being created outside the allocation system).

The compliance regulatory framework must also ensure that the Personal Carbon Trading scheme is genuinely 'downstream', enabling individuals to use Carbon Credits at point of purchase to 'pay' for the carbon associated with their transaction. This requires that all organisations selling carbon-related goods and services (i.e. electricity, gas, other fossil fuels, road transport fuel) must give individuals the option of surrendering carbon credits when they buy (rather than just buying credits at point of purchase). Without this requirement, retailers might choose to avoid the cost of setting up new systems and simply buy credits themselves from the market and charge the consumer the extra cost. This would undermine perhaps the central feature of personal carbon trading (cf upstream); individuals can 'connect' with their carbon emissions by handling Carbon Credits rather than simply paying a carbon price.

The compliance and enforcement system needs to be based on a legal framework which sets out procedural and reporting requirements on the carbon 'retail' processes, including:

- The types of transaction covered by the scheme.
- The methodology and responsibilities for determining the 'carbon content' (i.e. the number of Carbon Credits) of any transaction (eg a unit of electricity from a particular supplier etc).
- A requirement on retailers (above a threshold size) of such transactions to provide an option of surrendering Carbon Credits from an account rather than paying for them at point of purchase.
- A requirement on the same 'carbon retailers' to collect the correct number of Carbon Credits from their customers to match their carbon sales and to report on these and redeem the Carbon Credits on a routine and regular basis with a central carbon accounting body.
- A set of pre-defined constraints on the types of transactions between carbon accounts for banks to incorporate into their systems (to prevent the creation of Carbon Credits).
- A reporting requirement on banks to provide aggregate totals of Carbon Credits held in individual and corporate carbon accounts to enable the central carbon accounting body to reconcile Carbon Credits allocated with those redeemed and those 'held' in accounts.
- A continuing requirement on 'upstream' energy suppliers, power generators, road fuel suppliers and airlines to provide government agencies and regulators (and now the central carbon accounting body) with details of fuel purchases, sales volumes, own use etc.
- An audit, inspection and regulated disclosure power for the central carbon accounting body.

It should be noted that this compliance framework does not require each individual carbon transaction to be reported upon or held on a central database. Compliance can be focused on aggregate sales and aggregate Carbon Credits for each retailer since these are sufficient to be assured that sales match credits. Routine compliance inspections could be used to check that carbon retailers are treating each transaction appropriately. This has an analogy in VAT compliance and reporting. Sales are reported by VAT registered companies in the aggregate but HMRC's risk-based inspection regime audits company records to review each transaction contributing to that aggregate.

The approach outlined above points to a compliance system comprising:

- A central carbon accounting body.
- A register of 'carbon retailers' which is maintained by the central carbon accounting body.
- A routine reporting regime for these registered retailers to declare to the central carbon accounting body their qualifying carbon-related sales and to redeem the requisite number of Carbon Credits.
- A routine compliance inspection regime for auditing detailed carbon retailer records (note that these need are not needed as part of routine reporting) and checking banking systems for compliance with carbon account rules.
- An enforcement regime for pursuing and prosecuting errant retailers and banks.

In terms of functions, those of the central carbon accounting body closely align with functions currently being undertaken by HMRC (eg road fuel duty, passenger flight duty, VAT etc)

Risk based inspection

As with tax collection and other enforcement processes, it makes sense to operate a 'risk-based' inspection regime. This focuses resources on those operators considered most likely to be the source of compliance infringements. However, as detailed below in Figure 7, with such a small number (20) of very significant carbon retailers, routine inspections could be relatively frequent (e.g. annual for the 20, biennial for all others) without having a significant cost implication.

Figure 7 below details the likely numbers of registered carbon retailers. We estimate the total number to be in the region of 1,000, with the estimate dependent on the precise number of independent forecourt operators which have no company relationship with a road fuel wholesaler. As Figure 7 shows, about 220 of these are responsible for 82% of UK (non-aviation) carbon emissions in 2005 (and 89% of UK carbon emissions without non-power generating EU ETS emissions). While a detailed breakdown has not been identified in the course of this study, it can be estimated that no more than 20 carbon retailers (the 6 'big' energy suppliers, and the main supermarkets and oil-major forecourt operators) account for perhaps 70 – 75% of all non-aviation carbon emissions and a far higher percentage of 'individual' direct carbon emissions.

All registered retailers could be legally required to:

- Register with the central carbon accounting body
- Report monthly (or possibly quarterly) on carbon sales and redeem the requisite number of Carbon Credits at the central carbon accounting body
- Maintain records and audit trails to facilitate compliance inspections
- Adjust accounting systems to accommodate this additional requirement

Electricity and gas suppliers must already be licensed, ensuring that Ofgem has comprehensive details on all of these operating in the UK. Road fuel retailers are already heavily regulated with respect to road fuel sales, though much of this is focused on the 110 wholesalers registered with HMRC for road fuel excise duty purposes. Most of the forecourts operated in the UK are associated with such a wholesaler, with some 'independents' outside this. Bottled gas, LPG and heating oil are also heavily regulated industries (principally for health and safety reasons), ensuring that there are existing regimes seeking to ensure safety and legitimacy in the supply of these fuels.

Coal as a heating fuel is now a very minor component of the UK fuel mix (beyond EU ETS sites). There are approximately 30 wholesalers. Coal remains widely available through retail outlets such as corner shops and petrol forecourts, typically in 25kg sacks for 'open fires' rather than principal heating uses. It would not be reasonable to insist that all such outlets 'register' as carbon retailers. A workable approach (for such a minor source of carbon emissions) would be for wholesalers to 'register' and treat any non-registered customer (e.g. corner shops etc) as a 'business end user'. This would require them to collect or buy sufficient Carbon Credits for each transaction, ensuring that any sale to an 'end user' includes the cost of these credits. In this way coal would be handled with an "upstream" system where customers would be directed by a price signal only.

Figure 7: Carbon retailers, carbon emissions and compliance

Fuel	Numbers	Source	% carbon emissions domestic	% carbon emissions other	Compliance approach
Electricity	66	Ofgem (does not include unlicensed on site supply)	11% (99% from big 6)	20%	All to register as carbon retailers
Gas	100	Ofgem	13% (99% from big 6)	11%	All to register as carbon retailers
Road fuel	110	HMRC register of road fuel wholesalers		27%	Road fuel wholesalers already registered and heavily regulated for fuel duty. Any 'independent' forecourt operators would need to provide credits to wholesalers for redemption
Heating Oil	600	Oil supplier listings by nation/devolved administration (so may duplicate UK companies)	< 2%	3%	All to register as carbon retailers
LPG / Bottle Gas	200	Supplier listings	< 0.1%	Negligible	All to register as carbon retailers
Coal	30	Coal wholesalers list	< 1%	< 1%	Occasional sale of 25kg sacks at corner shops would not justify them registering. So wholesalers to treat shops as 'business end user' and charge them for credits to match sales (so corner shop prices include cost of carbon)

What compliance / enforcement issues might occur? Would the enforcement of the scheme for certain fuel types be more problematic?

Most of the compliance and enforcement issues identified during this study are already experienced and mitigated against in day to day financial transactions such as the billing and payment for goods and trading on existing commodity markets (or even auction sites such as e-bay). The relatively small number of carbon retailers (compared, for example, with VAT registered companies) all operate in markets which are already highly regulated and inspected. The issues facing a compliance and inspection regime for carbon retailing are therefore relatively straightforward.

The study identified some issues associated with small-scale retailers of coal, such as corner shops selling 25 kg bags of coal. This is less a compliance issue but a cost issue. For such outlets, the set-up and on-going costs for registering and reporting as a carbon retailers are likely to be disproportionate to their sales volumes. They could be required to register but this would seem onerous and ultimately unnecessary in terms of ensuring all coal sales are captured within the scheme carbon cap.

We have therefore suggested that the registration and reporting requirement sits with coal wholesalers. This will ensure that all coal sales include the 'carbon credit price' (since it would have been paid to the wholesaler to cover the cost of the Carbon Credits they have to redeem). It should be noted that domestic coal sales contributed 0.68% of UK non-aviation carbon emissions in 2005.

Other fuels, such as bottled gas, LPG and heating oil should not present similar problems since the current inspection and regulatory regimes around these fuels is sufficiently onerous (principally for health and safety reasons) as to ensure that there is almost no casual retail in the way there is with coal. It is therefore reasonable to require all retailers of such products to register and collect carbon credits as described in this section.

4 Scale of set up and running costs of a Personal Carbon Trading scheme

4.1 What scale of costs could be attributed to setting up a Personal Carbon Trading scheme and how does this compare to an upstream trading system?

Our work around the scale of costs attributed to setting up a Personal Carbon Trading scheme is based on the components described in Section 3. The table below identifies the main elements and principal tasks involved in setting up a Personal Carbon Trading scheme as described in the previous section of this report. They include estimates of costs incurred by government and organisations involved in the operation of the Personal Carbon Trading scheme, but no estimates have been made of the time or costs incurred by individual or business consumers.

We agreed with Defra at the outset that the cost ranges we estimate are based on Accenture experience and not on detailed costing exercises. Therefore they should be treated as indicative and not definitive. Estimates should not be cited without this caveat.

Table 1 – Estimated costs of main components and tasks involved in setting up a Personal Carbon Trading scheme

Elements of Personal Carbon Trading scheme	Cost	UTS
Design and implementation		
Design of complete business and technical architecture, including compliance	£50m - £100m	Less than £10m
Overall programme management of implementation	£50m - £100m	Less than £10m
Enrolment, ID verification and allocation		
Marketing and publicity of Personal Carbon Trading scheme	£50m - £100m	
IT changes: customer database, customer interface and payment systems	£50m - £100m	
Data capture and ID verification	£200m - £500m	Less than £10m
Accounting and transactions		
Banks & Building Societies IS changes	£20m - £100m	
Banks & Building Societies set-up of accounts and issue of Smartcards	£200m - £500m	
Fuel retailers Information System changes for payments and accounting	£20m - £100m	
Fuel retailers Point of Sale equipment – tills and card readers	£10m - £100m	
Utilities IS changes for billing and accounting	Less than £10m	
Utilities data capture of CC account details (for direct debits)	£10m - £100m	
Changes to payment processing schemes – e.g. Visa, Mastercard, VOCA	Less than £10m	

Auction and trading

Establish auction infrastructure	Less than £10m	Less than £10m
Register new CC commodity on exchange(s)	Less than £10m	Less than £10m
Market participants registration on exchange(s) and necessary internal changes	£10m - £100m	Less than £10m

Compliance and enforcement

Registration of licensed carbon retailers	Less than £10m	
Development of compliance systems and enforcement mechanisms	Less than £10m	Less than £10m
Development of CC surrender database	Less than £10m	Less than £10m

Our estimates for the total set up costs of a Personal Carbon Trading scheme of this type are between £700 million - £2 billion. Early estimates suggest the set up of an upstream scheme with 5,000 participants could be between £50 million - £100 million.

As can be seen from the table above, the cost of setting up a Personal Carbon Trading scheme is likely to be very much larger than the cost of setting up an upstream trading system. The key functions for the latter form a relatively inexpensive subset of the functions required for a Personal Carbon Trading scheme, and the main impact on individuals would be via a (variable) increased price for relevant carbon purchases (fuel, household energy and air travel), which would anyway need to be incorporated for the Pay As You Go element of the Personal Carbon Trading scheme.

Key cost drivers and assumptions

- The estimated costs depend on a number of cost drivers, essentially based around the volume and complexity of requisite transactions. For example, enrolment of all UK adults will require the capture and verification of data on 50m people – some of this information such as carbon account details obviously cannot be collected by the existing systems. This will require modification of the CRM database to support on-line and telephone enrolment (principal costs to do this would be Information System development and operational costs) and the costs of staff engaged in customer contact and related enrolment processes. Even if enrolment and ID verification could be undertaken in an average of 10 minutes (Accenture estimate) this would require 6,000 man years of effort at a cost of c.£200m – this is included in table 1 under line item “Data capture and ID verification.”
- The set up of carbon credit accounts and issue of Smartcards is the other major cost (£100m - £500m) in the table. This is based on the assumption the incremental cost to a bank of approximately £2 to set up each carbon credit account (Accenture estimate) automatically in parallel with an existing current account. This estimate is based on a minimum level of communication from the bank to the customer (informing them of carbon account details), as well as the electronic set up of the account. The incremental cost of the smartcards set up for the exchange of Carbon Credits is dependent upon the degree to which their introduction can be synchronised with the natural expiry of existing bank smartcards (e.g. debit or credit cards) We have estimated that each Smartcard could cost between £2 – 3 to

produce (this is in addition to the set up costs of the account detailed above), to which must be added the cost of secure distribution.

- The Information System changes identified across financial services, fuel retailers and utilities are based on the judgment of Accenture experts who have experience of working with these types of systems. The ranges are also informed by the number of organisations in each of these industries:
- Banks and building societies: there are 330 banks registered with the FSA in the UK. The “Big 5” high street banks have approximately 80% share of the current account market, with 5 of the larger ex building societies being the most significant current account providers outside of this group. Outside of the banks there are approximately 5 building societies with numbers of current account holders that make up the majority of their c.5% market share of current accounts. In this study we have based the scale of costs on the 5 most significant current account providers changing their IS systems, rather than all 330 banks and 60 building societies.⁷
- Fuel retailers: in terms of point of sale system changes there are approximately 9,300 filling stations in the UK. Approximately 50% of these are owned and operated by supermarkets, oil companies and chains of independent forecourt dealers. The remaining 50% are owned by independent retailers – though this number is decreasing by the year as supermarket share grows. Each retailer would need to make changes to their point of sale systems to enable the calculation of the number of carbon credits a customer needs to surrender and the “pay as you go” cost for purchases. Retailers will also need to have card readers in place that will read and trigger the processing of the Carbon Credit contact smartcard (we assume here this will be provided by the Merchant Acquirer).⁸
- Utilities: there are 66 electricity providers and 100 gas providers that would need to adapt their billing systems to include a carbon credit charge.

4.2 What scale of costs could be attributed to running a Personal Carbon Trading scheme and how does this compare to an upstream trading scheme?

The table below identifies the main elements and principal tasks involved in operating a Personal Carbon Trading scheme as described in Section 3. They include estimates of costs incurred by government and organisations involved in the operation of the Personal Carbon Trading scheme, but no estimates have been made of the time or costs incurred by individual or business consumers.

We agreed with Defra at the outset that the cost ranges we estimate are based on Accenture experience and not on detailed costing exercises. Therefore they should be treated as indicative and not definitive. Estimates should not be cited without this caveat.

The final column indicates those elements and tasks required for an upstream trading system (UTS) and an indicative cost range.

⁷ Figures taken from the Financial Services Authority, Annual Report 2006/07

⁸ Figures taken from UKPIA Statistical Review 2007

Table 2– Estimated costs of main elements and tasks involved in operating a Personal Carbon Trading scheme

Elements of Personal Carbon Trading scheme	Cost pa	UTS
Overall management		
Policy oversight and administration of scheme	Less than £10m	Less than £10m pa
Enrolment, ID verification and allocation		
Operation and maintenance of IT systems	£40m - £100m	
Periodic allocations	£20m - £100m	
Management of leavers, joiners and changes of circumstances	£40m - £100m	
Accounting and transactions		
Maintenance of CC bank accounts	£750m - £1bn	
Vehicle fuel purchases	£50m - £100m	
Utility billing transactions	£20 – £50m	
Inter-personal transfers of CC	£10m - £100m	
Purchase or sale of CC	£10m - £100m	
Auction and trading		
Quarterly auctions	Less than £10m pa	Less than £10m pa
Wholesale trading transactions	Less than £10m pa	Less than £10m pa
Compliance and enforcement		
Operation of CC surrender process	Less than £10m pa	Less than £10m pa
Compliance monitoring and audit	£10m - £100m	Less than £10m pa

Our estimates for the total running costs of a Personal Carbon Trading scheme of this type are between £1 billion - £2 billion per annum, and the cost of running an upstream scheme with 5,000 participants could be in the region of £50 million per annum.

Key cost drivers and assumptions

The primary cost driver here is the annual cost of operating an additional 50m current accounts for Carbon Credits. Current accounts are priced in a way in which reflects total costs but does not reflect the underlying costs of any one account. However, a European benchmark used by some banking experts is an annual, incremental cost of €40-50 for maintaining a current account. Given that a Carbon Credit account would be twinned with a £sterling current account, and that it would have fewer features (e.g. no overdraft facility so

fewer exceptions handling) we have provisionally used a figure of £15 - £20 per annum. This estimate covers a range of costs including:

- administration of the account (e.g. account reporting, communications to customers by email and regular mail),
- ongoing provision of customer service via a number of channels (e.g. the system and personnel costs of supporting branch, telephone, internet access),
- maintenance of access channels to the Carbon Credit account (the system and personnel costs of providing branch, telephone, and internet access).

The pressure of incorporating an additional 50 million accounts into the existing banking infrastructure will require a considerable incremental increase in the capacity of the systems and people that underpin it.

The transaction costs in the table are based on the assumption that it costs approximately 7 - 8p to process a transaction through existing payment schemes⁹. The volumes driving these estimates are based on some rudimentary calculations. For example, transaction costs for private vehicle fuel assumes 25 million vehicles refuel weekly¹⁰, so 1.25bn transactions per year. For the purchase of energy for domestic households we have assumed 25m households paying via a mixture of direct debit (monthly), invoiced (quarterly) and on-line (quarterly), for each of electricity and gas/oil/coal so 200m-600m transactions per year.

4.3 Over what timescale a Personal Carbon Trading scheme of this type might be implemented?

If a decision to give further consideration to the implementation of a Personal Carbon Trading scheme were to be made by Ministers, it would in our view require some 6-8 years before such a scheme could become operational. The following are the main elements in this timescale:

- Full feasibility study (9-12 months): to cover detailed policy options, technical and operational design, capacity planning, detailed assessment of costs and benefits. This would involve extensive consultation with the banking, retail and other industry sectors likely to be involved in the scheme. Part of this consultation might include discussions on commercial viability and building industry “buy in” to the scheme – the experience around proposals for Universal Banking provides evidence of how challenging and sensitive this can be.
- Legislative proposals (12-18 months): perhaps including a White Paper before the necessary legislation is put in place.
- Design, development and implementation of the IT system changes needed in government, banking, retailing and other sectors (18-24 months): this would require work to be undertaken by a minimum of 50 organisations and possibly many more, depending on the scheme design.
- Issue of new multi-functional smartcards (12-36 months): a shorter period than 36 months could in principle be possible, but would mean that less of the cost could be shared with the normal renewal cycle for smartcards.

⁹ Based on an industry standard used by subject matter experts in the sector for the cost of processing end to end transactions.

¹⁰ Estimate based on figures for private car ownership taken from Department for Transport statistics and based on assumption that each car will be refuelled once a week.

- Enrolment of adults into the Personal Carbon Trading scheme (9-15 months): this can only take place after people have been informed of their carbon credit bank account. A shorter period would mean a much greater peak of work for government.

While some of these tasks could be overlapped to a limited extent, there is also a significant risk that the above indicative timescales could be exceeded due to implementation difficulties and/or changes in requirements as the policy landscape evolves. We do not consider it likely that every task could be completed in the minimum timescale, so realistically a period of 6-8 years would be required for implementation of a Personal Carbon Trading scheme.

5 Next steps

The findings in this study provide a basis for further investigation into the feasibility and cost of this type of Personal Carbon Trading scheme *and* the opportunity to consider alternatives with this information in mind. This section highlights some of the next steps Defra might take if either of these paths were pursued, they are:

- ***Further analysis on key cost drivers as part of the economic analysis of the Personal Carbon Trading scheme.*** The findings of this report will be considered alongside the other three work streams commissioned by Defra, forming a key part of the overall economic analysis of the Personal Carbon Trading scheme option. We recommend a next step of applying a sensitivity analysis to the key cost drivers and hence the cost ranges we have provided. For example, the key assumptions outlined in section 4.1 and 4.2 around the set up and running costs of Carbon Credit accounts, and the processing time for enrolling 50 million participants are significant drivers of cost. A further analysis of these drivers would be required before a rigorous sensitivity analysis could be completed, which would be a key next step towards making a decision on whether to invest in a more detailed feasibility study.
- ***Direct consultation across affected industries should a more detailed feasibility study be commissioned.*** If Ministers decide the feasibility of a Personal Carbon Trading scheme should be tested further, we recommend this is done with extensive consultation across the public and private sectors. Areas for focus in these discussions might cover:
 - *Detailed investigation into scheme costs.* The set up and operating cost centres identified in this study would need to be investigated in more detail. In particular, more analysis would be required on significant costs such as the running cost of Carbon Credit accounts within the existing banking infrastructure, and the enrolment of individuals in the scheme and allocation of credits from the CIS database.
 - *Commercial viability and “buy in” for operating the Personal Carbon Trading scheme.* This study has referenced a number of ways in which operators could make money from the scheme. However, the banking and utilities industries, along with forecourt operators, need to be consulted directly to understand levels of “buy in” and their willingness to take this on. The Universal Banking example (see section 3.2.1) provides evidence of how challenging and sensitive negotiation on this type of government sponsored initiative can be.

- *Assessment of implementation risks.* It would be important to establish the risk to existing systems of absorbing the additional 50 million accounts and their related transactions. The systems proposed in this study as the foundations of the scheme play a fundamental role in the lives of UK citizens – for example, benefits processing by the CIS database, and transaction processing into and out of sterling current accounts.

Annex B highlights some of the complications and additional questions that have arisen during the course of this work, which would also need to be addressed in a full feasibility study.

- ***An informed consideration of alternatives to this type of Personal Carbon Trading scheme.*** The findings in this report could provide a basis for developing and assessing alternatives to the Personal Carbon Trading scheme looked at here. Our work has identified a number of key assumptions that have a significant influence on the cost of the scheme, these include:
 - A mandatory format: leading to c.50 million participants.
 - The need for each eligible individual to hold a Carbon Account.
 - Its application to a range of carbon products: the scope of the scheme includes domestic energy purchases and fuel for private transport.
 - Delivery through multiple channels: for example, customer service provided online, by telephone, face to face or by post.

This report provides a starting point for the consideration of alternative schemes in the context of these major cost drivers. Any analysis of this kind would also need to address how changing such fundamentals would alter the nature of the Personal Carbon Trading scheme and its overall impact.

Annex

Annex A - Assumptions

A1. Personal Carbon Trading project: assumptions crib sheet

This section of the Annex sets out the original assumptions provided by Defra on the type of PCT scheme to be focussed on in this study.

Background

The Government is looking into the potential value of personal carbon trading (PCT). This is just one of a number of potential long-term options being explored for making individuals better informed about, and involved in, tackling climate change. We are now carrying out a pre-feasibility study to assess whether personal carbon trading might be a practical and feasible policy option, compared with other measures for constraining emissions. This work programme complements the research and academic work being undertaken by researchers and academics such as The Tyndall Centre for Climate Change, the Environmental Change Institute and the Royal Society for Arts.

PCT Project

The PCT work programme as a whole incorporates four workstreams (listed below). The outcomes of this work will be brought together to provide a summary of the key findings and recommendations on whether further work is necessary, and if so, in which areas.

- Economic value of PCT and its strategic fit;
- Equity and distributional impacts;
- Public acceptability;
- Technical & cost issues (allocation and subsequent management)

Context/ Purpose of the assumptions crib sheet

Due to time and budget constraints it is necessary to provide a broad description of a PCT scheme, including assumptions about preferred scheme design and treatment of a number of factors, e.g. inclusion of children, industry, etc. This is to ensure the four workstreams are compatible and can be brought together in a synthesis report. Although analysis should be on the basis of this particular description of a PCT scheme, we welcome (and indeed encourage) consideration of these assumptions as variables within the analysis - time and cost permitting.

Note! This does by no means indicate a preference for any particular scheme design, nor does it signify the Government's views on any specific elements of scheme design (e.g. inclusion/ exclusion of children). It is merely a baseline upon which the project can be based.

Assumed scheme design and implications

We have opted to examine PCT on the basis of the most downstream, radical design proposal – Domestic Tradeable Quotas (DTQs) (formally Tradeable Energy Quotas (TEQs)). It should be noted that this proposal would make very strong assumptions about the nature of the policy landscape into which PCT is introduced. Though these assumptions may not be met in practice, by considering the DTQ scheme we will provide a best case benchmark against which the real circumstances into which a PCT scheme is introduced could be compared. It will provide the best insight into the merits or otherwise of downstream emissions trading from a strategic perspective. A key assumption of this design proposal is that PCT can work alongside the EU Emissions Trading Scheme (EU ETS). It would also require that the design of the Supplier Obligation did not place a cap on domestic energy suppliers.

Description of DTQ model

An economy-wide system involving all individuals and organisations, where 40% of the economy's allowable carbon emissions are allocated to adults only free of charge on an equal per capita basis, and 60% is auctioned off to 'primary dealers' who then sell on to organisations in a secondary market. 'Credits' would be surrendered to cover the carbon content of electricity, and heating (e.g. gas, oil) and personal transport fuel purchases, with public transport and aviation covered (dependent on its status internationally) indirectly through the organisations responsible for fuel purchases¹¹. All individuals and organisations have access to the market to trade their credits. It is anticipated that individuals would also be able to opt-out of trading by selling their credits immediately upon allocation to an intermediary for cash, and that smaller organisations would similarly be able to refrain from direct trading by paying the carbon cost of energy/ fuel on purchase.

Summary of assumptions

- 1) Economy-wide system with 40% free allocation to individuals and 60% allowances auctioned. No explicit interaction with the EU ETS or Supplier Obligation.
- 2) A mandatory scheme.
- 3) Sectors included are household energy use, private road transport and flights.
- 4) 50 million individuals will participate in the scheme (meaning children are exempt)
- 5) An allowance unit of kg
- 6) An equal allocation of 4 tonnes CO₂ to every participant (4000 allowances of 1kg each). There would initially be allowances to cover 500 million tonnes, with a total of 200 million tonnes of allowances being allocated to individuals.
- 7) We must look at the equity impacts of PCT in the context of how it might impact today, as analysis will be based on current energy use and emissions. However, the public acceptability workstream will need to set the scene of a PCT scheme in a post-2012 landscape where abatement options are limited (as many of the easier abatement options have already been taken up)¹². [N.B. Any scheme start date is still very much unknown, other than 'no earlier than 2013, but could well be later.]
- 8) That household energy efficiency will improve evenly across income and geographical groups in the future, as well as demand for energy services (there will be an equal percentage increase in demand for energy services across all income groups). Though a strong assumption, this will allow inferences to be made from the data produced in the equity workstream
- 9) A PCT scheme would be owned by Government, but sub-contracted to the private sector for day-to-day management.
- 10) The allowances will be issued in denominations to the nearest Kg. Rounding issues will be settled within the cash transaction (so if they use 10.5kg of carbon, will use 11 kg of allowances, and the additional 0.5kg will be 'sold' to the market at the point of sale at current market price).
- 11) Central prediction for the market price of allowances will be £20/t. For sensitivity analysis, a range of £10/t to £30/t should be used. That is a price of 2p for each allowance of 1 kg.
- 12) PCT data would need to be managed within the UK, however, the development of such a system could be led outside the UK.
- 13) Visitors to the UK (and those without the facility to surrender allowances at the point of purchase) would purchase allowances from the market at the market price (rather like a tax).

¹¹ Note that this would make the incorporation of non-carbon aviation emissions difficult and would most likely require the additional use of taxation and/or regulation to ensure that the external cost of such emissions were taken into account.

¹² Further discussion will be required for this workstream on the detailed assumptions relating to easier abatement options having been taken up.

- 14) Trading volumes - 60% would be auctioned and of the 40% allocated for free. It is assumed that 10% of all allowances will be traded on the secondary market.

A2. Assumption log for the technical feasibility and cost study

During the course of the study it was necessary to make some additional assumptions to those provided by Defra. The table below shows these in full along with the initial set.

Number Scheme design assumptions

1. Economy-wide system with 40% free allocation to individuals and 60% allowances auctioned to primary producers.
2. No EU ETS or Supplier Obligation.
3. A mandatory scheme.
4. Account set up will be on an "opt-in" basis . The PCT system is mandatory in that everyone will feel the effects of the system and not that everyone needs to have a PCT account
5. The management information Government will receive on the level of carbon credit movement will be at an aggregated, rather than individual level (i.e. government will not be receiving individual profiles for each individual).
6. Sectors included are household energy use, private road transport and flights (in the context of this type of scheme flights will be covered indirectly through the organisations responsible for fuel purchases).
7. 50 million individuals will participate in the scheme (meaning children are exempt)
8. An allowance unit of kg.
9. Visitors to the UK (and those without the facility to surrender allowances at the point of purchase) would purchase allowances from the market at the market price (rather like a tax).
10. An equal allocation of 4 tonnes CO₂ to every participant (4000 allowances of 1kg each). There would initially be allowances to cover 500 million tonnes, with a total of 200 million tonnes of allowances being allocated to individuals.

Enrolment and allocation

11. Carbon will be allocated in annual blocks and the timing of the allocation will be staggered across the population (i.e. 1/12 of population receive allocation in January, 1/12 in February and so on)
12. Individuals will be responsible for the setup of their PCT Carbon Credit Accounts prior to enrolment (unless opting for pay as you go). This requires "active" engagement with the scheme. A "passive" approach would involve allocation records and Carbon Credit accounts being automatically created for eligible citizens, which would be more expensive.
13. Allocations will be made on an individual, rolling annual basis based on a person's opt in date
14. In terms of designing the allocation database the assumption is that data needs to be available 24/7.
15. Allocations to people who die / leave the country part way through an allocation period, will not be clawed back
16. Individuals will be able to carry over a defined number of carbon credits per year. Should the number of credits in their account exceed this threshold, they will automatically be "cashed up" at the market rate.
17. The components of the PCT scheme could be owned and administered by a mixture of public and private sector organisations.
18. PCT data would need to be managed within the UK, however, the development of such a system could be led outside the UK.
19. The allowances will be issued in denominations to the nearest Kg. Denominations of carbon will be rounded to three decimal points.
20. After an agreed time period "unclaimed credits" (i.e. that should have been allocated to individuals) will be transferred to the auction "pot".

ID verification

21. ID set up and administration functionality will be based on standard CIS processes. Carbon Credits will not require any additional ID verification than requested of claimants for DWP distributed benefits.

Transactions and transfers

22. Central prediction for the market price of allowances will be £20/t. For sensitivity analysis, a range of £10/t to £30/t should be used. That is a price of 2p for each allowance of 1 kg.
23. Individual carbon credits will not have an “expiry date” – they will be a non perishable commodity,
24. Existing “pin and chip” readers offer the requisite level of security
25. The transaction ratios – e.g. the number of carbon credits that to be surrendered per litre of fuel used will be decided by a separate unit (e.g. informed by Treasury, BERR, Defra etc). This unit is not being modelled in the technical feasibility study.
26. By 2013 payment scheme infrastructures will be supporting “live” checks of carbon credit accounts, thus enabling the surrender and pay as you go options for consumers. At present, the “live” checking of accounts is not universal for all transactions though consultations with experts suggest this will be the case by 2013.
27. In this scheme the c.2 million organisations that exist in the UK will not be exchanging carbon credits, but will be driven by the pricing mechanism (affected by the results of upstream trading of primary producers).

Auction and trading

28. Trading volumes - 60% would be auctioned and of the 40% allocated for free. It is assumed that 10% of all allowances will be traded on the secondary market.
29. Auction system for 60% of carbon credits will be the same as the preferred option in the Defra consultation paper on EU ETS Phase II auction systems.

Annex B - Complications to be considered in future feasibility study

This annex outlines some of the questions / complications that have arisen during the pre feasibility study, which might be considered in a more detailed feasibility study. This is not an exhaustive list and is included to give a flavour of the technical questions that would need to be addressed as thinking about a PCT scheme moves forward.

- Fuel is purchased before use (albeit once it is in the tank), household energy after use (in most cases), and air travel (should this be included in any future scheme) before use. This has issues for matching time periods for allocation, and perhaps also for the behavioural impact of running low on Carbon Credits.
- How would refunds be managed? Would this need to be built into the system - how would this work given the price of carbon is likely to fluctuate over time?
- Is an annual Carbon Credits entitlement subject to “repayment” if the person dies or emigrates?
- When does an immigrant become entitled to Carbon Credits?
- What about individuals leaving the country for extended periods of time? Does their entitlement cease? How does one find out?
- How would residents in institutions be covered by the scheme? Several different situations:
 - Resident pays for accommodation, e.g. student in hall of residence
 - Resident does not pay for accommodation, e.g. hospital or nursing home. Would there be a threshold e.g. short stays ignored, long stays entitlement ceases?
 - Mixed situations, e.g. elderly care homes where resident pays top-up fee but part of cost met by local authority
 - Armed forces in barracks, or married quarters
 - Prisoners and others in custody
 - Aside from the entitlement question, there are big problems of tracking movements in-out of such institutions.
- Complications / exceptions of enrolling individuals on the CIS database and allocating credits:
 - Individuals with no CIS record
 - Individuals with a CIS record and no bank account requiring a PCT account/ individuals whose banks will not offer Carbon Credit Accounts.
 - What implications if individuals opting out > pay as you go with a bank account?

- What implications if individuals opting out > pay as you go without a bank account?
 - Death of people with allocation accounts
- Where would the national aggregate database best sit across government's Information System infrastructure?
- Implications for customer service across the scheme: the introduction of chip and pin required a re education of the customer and of vendor service staff. This time needs to be considered in the full feasibility study (As an opportunity cost?)
- What are the potential implications for the market of holding frequent auctions for 60% of carbon credits and annual allocations for the 40% of allowances to individuals?
- There are approximately twice as many current accounts open in the UK as there are people. How would the opening of Carbon Credit accounts be managed to ensure the banking industry is not opening unnecessary changes to its systems (i.e. opening up Carbon Credit accounts that would not be used).

Annex C - Frequently Asked Questions

This annex addresses a number of questions which have been posed by commentators on our work during this review. Although several of them are directly or indirectly addressed in the main report, we have brought them together in this annex to help the reader.

FAQ1: Could the proposed National Identity Register be used as the basis for a PCT scheme?

If the National Identity Register (the database that would be used to support ID cards) were to be implemented, it would provide a database of UK residents which would contain more up-to-date and more tightly verified information than the CIS database which we have proposed as a basis. It could therefore be used as the basis for a PCT scheme, and the extent of ID validation checks could potentially be much reduced. However, the NIR would not contain details of bank current accounts and carbon accounts, which would need to be captured for all 50m adults during the enrolment process. The cost and timescale for this enrolment process would be similar to that for a scheme based on CIS. Please refer to Section 3.2 for more detail on how the enrolment, allocation and ID verification functions might be delivered.

FAQ2: Why are separate systems required for enrolment / allocation and for transactions?

In order to receive an allocation of carbon credits, each individual will require an allocation record which links their carbon credit account to their personal details (name, address, date of birth etc). This allocation record will trigger transfers of carbon credits on an agreed frequency, and maintain a record of these transfers. (This is similar to the DWP system for paying State Retirement Pension). When an individual makes a carbon purchase, details of this transaction will be transmitted through the banking system to debit the person's carbon credit account. The carbon credit account thus needs to be able to deal with a range of transaction types, as well as supporting online transfers between accounts, and the production of online and hard copy statements. (This would be similar to a bank account into which Pensions are paid). Any single transaction system would also need to handle 50m accounts and billions of transactions per year – significantly larger than any known system in existence today. From a technical perspective, it would be prudent to design this as a separate system from that used for allocation. See also FAQ4.

FAQ3: Why do people need to enrol?

Government has only patchy information on people's bank accounts (primarily for those who are in receipt of social security benefits) and obviously will have none at all on their carbon credit accounts. It is this information (as well as updates on address and continued UK residence) that has to be captured during the enrolment process. See also FAQ4.

FAQ4: Could the Government set up a "Carbon Bank" which would handle all carbon credit transactions?

In principle, this is an option although such a bank would have several times more customers than any existing UK bank. We did not examine it in detail for the following reasons:

- The cost of setting up a new bank which could cope with 50m customers would be much larger than the estimated costs of existing banks amending their current systems. For similar reasons, the Government rejected the idea of establishing a

“Universal Bank” in favour of persuading the banking industry to offer “basic bank accounts” to benefit claimants who did not have a bank account (approximately 2 – 3 million people).

- The annual running costs per carbon account would also be greater than those we have estimated for the banking industry because there would not be any “twinned” current account to absorb some of the running costs.

We also note that concerns have been expressed about Government having details of every carbon purchase made by every adult in the UK.

FAQ5: Could the PCT scheme be administered entirely online?

The scheme that we have described in this report is largely online, in that we have assumed that all participants would have a multifunctional smartcard which would be used for “customer present” transactions and that the related sterling current accounts and Carbon Credit accounts would be debited via direct debit and other “customer remote” transactions (Even so, there are still c2 - 3 million UK adults without a bank account who will need to be considered in a full feasibility study). However, only a minority of the adult population currently uses internet banking services, so it would be imprudent to assume that there is no requirement to provide access to services via a branch network (eg to trade carbon credits, or to transfer credits to another person), or to eliminate hard copy statements of carbon credit usage.

For the initial enrolment stage, we believe that a mixture of online, telephone and possibly postal or face-to-face channels will be required. Limiting enrolment only to an online channel would certainly provide a significant barrier to many UK adults.

FAQ6: Could loyalty card schemes provide a basis for a PCT scheme? Why are loyalty card schemes so much cheaper to operate than bank current accounts?

Loyalty card schemes are generally proprietary schemes which are linked with the retail systems of different retailers or retail groups, and they are not usually supported by national payment infrastructures such as VISA, Mastercard and BACS. Hence they could not support financial transactions via the banking system. Their coverage is limited to shoppers who have registered and they only cover a minority of the population. Their running costs are lower than bank accounts because they are usually based on magnetic stripe rather than the more secure chip and pin technology, they support fewer transaction types, and they have no separate branch infrastructure to support.

Please refer to section 3.4.3 for more details on loyalty cards.

FAQ7: Why can't contact smartcards similar to Oyster be used as the delivery mechanism for a PCT scheme?

It would be possible in principle for a “stored value” smartcard to be used to pay for carbon credits at “customer present” carbon purchases such as vehicle fuel. However, this would not be able to support “customer remote” purchases such as payment of utility bills, for which a carbon account is necessary. A stored value card would also need additional infrastructure nationally to allow people to transfer carbon credits to / from their card, and in all retail outlets accepting this form of payment. This option is also the least secure of the three options looked at in this study – see section 3.4.3 for more details on this.

FAQ8: What impact would more complex allocation criteria have for a PCT scheme?

We have assumed an equal per capita allocation of carbon credits. A more complex allocation formula would have two impacts:

- Additional information would have to be collected, maintained and verified. There would be an increased risk of fraud or incorrect allocations, particularly for data that is subject to frequent change such as residential location
- The requisite changes to the CIS database will increase, potentially to the point where it no longer provides a suitable basis for a PCT scheme. For example, if allocation criteria were to be based on households rather than individuals, it is unlikely that the CIS database would support the PCT scheme without wholesale redesign.

FAQ9: Would the price of carbon credits purchased on a “pay as you go” basis be the same throughout the country?

No. Carbon credits would be traded through one or more markets with the price varying accordingly. Individual consumers would not trade on the carbon market directly, but would obtain carbon credits either via a retailer (e.g. a forecourt operator or a utility) or via a wholesaler such as a bank. Since retailers and banks would be taking a commercial risk on the price at which they could obtain carbon credits from the market, it is likely that they will sell / buy carbon credits based on a price spread (this is analogous to the way in which foreign currency is traded). The price charged by a supplier for carbon credits will form part of its competitive positioning for pay-as-you-go individuals and business customers.

FAQ10: What would the implications be for the cost of the scheme if 100% of Carbon Credits were allocated to individuals on a per capita basis?

We understand that there are a number of ways such a scheme might be delivered – each of which would need to be explored in more detail before an answer could be provided to this question. At a very basic level, if such a scheme was delivered in the same format as the PCT scheme considered here, the cost implications could be small – with the auction system being the only component that would not be required in the 100% allocation. However, the major caveat to this response is that there might be additional technical components required to effectively implement the scheme, which are not needed for the PCT scheme considered in this study.

**Nobel House
17 Smith Square
LONDON SW1P 3 JR**

www.defra.gov.uk