

BARRIERS TO MARKET FORMATION

Competitive Paper

Representing multiplicity in markets- multiple representations of markets

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Gareth Veal, Stefanos Mouzas

Lancaster University Management School, Lancaster LA1 4YW, United Kingdom

(E-mail: S.Mouzas@lancaster.ac.uk) Tel: +44 (0) 1524 593908

Abstract:

In this paper we propose a typology of barriers to market formation. Our research gives a case study describing a manufacturer's preparations ahead of the launch of a new market for CO₂ within the United Kingdom. We propose four categories of barriers to market formation, a) normative barriers, b) representational barriers, c) market exchange barriers and d) catalytic barriers that underpin or multiply the strength of other barriers. Our contribution is in the development of a typology of barriers to market formation.

Key Words: Market formation, Interaction, Rules, Barriers to markets, CO₂

INTRODUCTION

This paper examines market formation within the empirical context of the launch of a new market for CO₂. We give a case study describing a manufacturer's preparations ahead of the launch of the United Kingdom's Carbon Reduction Commitment. Based upon a theoretical review and our empirical findings, we propose a typology of barriers to market formation.

Markets are institutional structures that facilitate exchange processes among different actors. In this way, markets are governed by a set of implicit or explicit rules that guide business interaction (Lewis, 1967; Mouzas & Ford, 2009; North, 1990). This set of rules defines how actors can relate to each other and how cost or price information is gathered, represented or disseminated among those who wish to participate in exchange processes (Casson, 1982; Helgesson & Kjellberg, 2005; Kjellberg, 2001; Kjellberg, Aspenberg, & Andersson, 2005; Lachmann, 1986; Loasby, 2000; Mouzas & Ford, 2009; Slater, 2002). To capture these dynamics, we have developed a typology of barriers to market formation which contains four categories. We propose barriers relating to the normative, representational, or exchange market practices put forward by Kjellberg & Helgesson (2007), plus a fourth set of 'catalytic barriers' which underpin or multiply the strength of the first three barriers.

In our case study we describe the interactions between the regulator, manufacturer and supporting service providers, illustrating how this new market is only partially integrated within the manufacturer's decision making. The first set of barriers identified refers to normative barriers. These barriers impede the creation of norms that guide business interactions. Normative barriers maybe removed by the introduction of generally accepted

rules or norms. For example, in the new market for CO₂ these new rules include the governmental creation and sale of CO₂ permits and the websites and protocols which facilitate the exchange of these permits. Secondly, representational barriers impede depiction of the markets and how they work. It appears that there are large disparities between the government representations of markets for CO₂ and those developed by businesses. Governments tend to represent CO₂ markets as a capital efficient method to incentivise CO₂ emission reductions at the least cost opportunities available to industry. However, businesses tend to represent CO₂ markets as ‘compliance schemes’ similar to other environmental regulations. As such, businesses simply respond in a fashion designed to guarantee compliance, effectively reducing the market to something closer to a tax or mandate. Third, normalising barriers impede the introduction of guidelines for how a market should work. Regarding the emerging CO₂ market, we have explored its influence upon the business models of the market participants and their energy providers, bill checking companies and specialist carbon consultancies. We have also seen that businesses respond from the perspective that CO₂ credits are not yet costly enough to drive decision making. Furthermore, company policies prohibiting speculation often short-circuit the make / buy decision that is at the heart of the proposed CO₂ market. Finally, a number of catalytic barriers are proposed as underpinning or multiplying the affects of barriers; these are technical considerations, time constraints and uncertainty.

Our research objective is to identify barriers to market formation. Therefore we formulated the following research questions:

1. Who are the actors responsible for ‘performing’ the new CO₂ market?
2. How do these actors understand and develop their representations of the market?
3. What exchanges are taking place in the market and how are they realised?
4. What makes the market stable and sustainable?
5. Can we identify barriers to market formation that explain the partial failure of this new market for CO₂?

In the following sections we start by examining previous research, we detail our research methodology, and then give a case study of a manufacturer’s response to the new CO₂ market of the United Kingdom’s Carbon Reduction Commitment. Finally, we analyse the case study using the typology of barriers to market formation proposed in the literature review.

PREVIOUS RESEARCH

Within the business marketing literature, the term ‘market’ is often used quite loosely. Challenging this raises ontological questions about the nature of what we call the ‘market’ (Araujo, Kjellberg, & Spencer, 2008). Before examining ‘barriers to market formation’, it is essential to attempt to clarify what we mean when we speak of the ‘market’.

A starting point in this ontological examination of markets is to argue that markets are institutional arrangements which facilitate the exchange of goods (North 1990). However, this definition talks more to the purpose of a market than giving a description of its substance. To identify barriers, a grittier examination of the substance of markets is required. Previous research has conceptualised business markets as webs of exchange relationships which are regulated by a ‘network constitution’ that comprises of beliefs, norms, rules and other conventions which help actors understand network interactions (Mouzas & Ford, 2009). This helps to focus the search for barriers to market formation, by emphasising the importance of these beliefs, norms, rules and other conventions. We argue that these constitute the

substance of the market and that barriers to market formation are anything which impedes the formation of these beliefs, norms, rules and other conventions.

This gives us a starting point on the search for barriers to market formation. However it is important to acknowledge that the 'network constitution' is one of a number of conceptualisations of the substance of markets. We now give some related examples and select one of these to take forwards in the development of a typology of barriers to market formation. Firstly, the 'network constitution' is broadly aligned with work on international markets for environmental governance which proposes a 'war of position' based upon 'material', 'discursive' and 'organisational' pillars (Levy & Newell, 2002; Levy & Egan, 2003). Secondly, these are broadly aligned with Keohane, Haas, and Levy's 'Regimes' as persistent and connected sets of rules and practices that prescribe behavioural roles, constrain activity, and shape expectations (1993); or Krasner's clusters of norms, rules, principles and decision-making procedures (1983).

The literature presented above emphasises the importance of the substance of markets. However, there is a particular field of marketing research which takes these ideas further; namely the practise based perspective of markets. We now give a few examples of where this practice based perspective leads. In our first example we see how a focus upon market practice leads Cochoy (2008) to analyse how the humble shopping cart can influence consumer markets. The cart turns price based decisions into a volumetric constraint set by its size and makes an individual buying experience into a collective one, with the cart acting as the hub for a 'buying collective' such as a family. It can be imagined how the size of the cart, the layout of the supermarket and the configuration of packaging could lead to a number of barriers to market formation in this setting. For example, goods must fit in the cart, must be located on an aisle that the cart can fit down and must be identifiable from their packaging. Another example brings us into the field of industrial marketing, examining the making and exchange of a second-hand oil field (Finch & Acha, 2008). Here it is flagged that multiple versions of an object are created through the frames held by different actors. These frames will have implications for attempts to apply calculations ahead of exchanges and could in certain circumstances represent a barrier to the formation of the new market. Similar insights are given by Simakova & Neyland (2008) when they argue that marketing involves crafting 'constituencies' of relevant people and things that could be recipients of a new offering. They argue that offerings will fail if they are without a compelling storyline articulating the case for the constituency's existence and its need for the new offering. This is again similar to the claim that markets can be understood through a process based explanation of how actors recognise each other and attempt to pre-configure each other for certain desirable outcomes (Andersson, Aspenberg, & Kjellberg, 2008).

Throughout these different treatments of the nature of markets, a number of themes start to emerge. These are loosely based around markets being performed through a mix of description of the market, attempts to regulate it and efforts to perform exchanges. Along these lines, Kjellberg & Helgesson (2007) propose a typology of three categories of market practice that constitute markets. These are the 'normalising', 'representational' and 'exchange' practices. Exchange practices are the exchanges and the supporting activities which accompany them. Representational practices are those which aim to depict markets or how they work. Finally, normalising practices are those which aim to introduce normative guidelines for how a market works. Moreover, Kjellberg & Helgesson's (2007) model identifies a number of translations through which the three types of practices interact. Normalising practices produce translations of 'rules and tools' and 'measures and methods of

measurement'. Rules and tools govern and perform exchanges, influencing exchange practices. Measures and methods of measurement influence representational practices. Exchange practices produce translations of 'interests' and 'measurements'. Interests are driven by exchange practices and inform efforts to influence normalising practices. Measurements are descriptions of exchange which feedback into representational practices and inform how actors see the market. Finally, representational practices produce translations of 'results' and 'descriptions'. Results of representational practices drive exchange practices by influencing how participants view their exchanges. Descriptions drive normalising practices by informing participants' representations of the markets which they are seeking to regulate in some way. This model forms the backbone of our typology of barriers to market formation, as given in Figure 1.

Having attempted to clarify how we conceptualise markets, we now give a brief overview of the business literature on markets for CO₂. This is important for our particular empirical research setting. There is a wealth of work which examines why businesses struggle to take account of environmental considerations when taking decisions. One fairly comprehensive review splits the 'sources of environmentally destructive behaviour' out at the individual, organisational and institutional levels (Bazerman & Hoffman, 1999). At the individual level a number of cognitive biases are proposed which lead individuals to overly discount the value of future gains, make self serving judgements, underestimate damage caused, and to frame decisions as win-lose rather than as potentially mutually beneficial. One example of a contextual factor which exacerbates these problems is that uncertainty gives increased managerial discretion, leading to increased reliance upon institutions for guidance (Levy & Kolk, 2002). Next, at the organisational level, existing structures such as buying policies, espoused values such as maximising shareholder value, habitual routine, resource limitations such as CapEx constraints and threats to established power biases are flagged. Corporate environmentalism is proposed as assigning importance to environmental issues and then integrating these within decision making processes. 'Public concern', 'Regulatory forces', 'Competitive advantage' and 'Top management commitment' are proposed as antecedents for corporate environmentalism (Banerjee, Iyer, & Kashyap, 2003). Finally, at the institutional level, regulative protocols are flagged as potentially causing expensive distractions from the environmental objective at hand, while normative systems such as education potentially reinforce and therefore preserve the existing paradigm. One example of institutional influence is that different sustainability metrics promote different types of responses. Purely technical accounting models do not introduce the political or social dimensions required to deliver lasting sustainability. Calls are made by Molisa & Wittneben (2008) to extend the metrics to incorporate political and social dimensions. Another example of the influence of institutional structures upon the final regulation is that within the European Union, taxes are regulated by 'unanimity', but emissions trading counts as an environmental matter, managed through 'qualified majority voting' (MacKenzie, 2007). Supporting the case that the institutional setting is important, a comparison of the merits of a carbon tax versus a carbon market across eight dimensions (Wittneben, 2009) hints of barriers due to cost, uncertainty, complexity, level of environmental ambition and administrative burdens.

Two final pieces of research merit examination, since they specifically deal with 'barriers' in the business response to climate change (Okereke, 2007; Veal & Mouzas, 2010). Firstly, motivations, drivers and barriers to carbon management are explored (Okereke, 2007). Motivations are set as internal concerns for organisations that may impede or support action on climate change, these are proposed as profit, credibility and leverage in climate policy debate, fiduciary obligations to safeguard the long term interests of the company, risk

management and ethical considerations. Drivers are set as external factors including energy prices, market shifts, regulation and government directives, investor's pressure and technological change. Three specific barriers to carbon management are proposed as weak policy frameworks, uncertainty about government's actions and uncertainty about the marketplace. Secondly, barriers to learning to collaborate in response to climate change are proposed in three high level categories of framing, negotiations and wise trades (Veal & Mouzas, 2010). Framing broadly maps to the representational practices flagged earlier and negotiations and most of the material covered under 'wise trades' maps to exchange barriers. However, this work and that of Okereke (2007) also raises the issues of technical considerations, time constraints and uncertainty. These are issues which do not easily fit into the representational, exchange or normative practices which we have been examining. Instead they span these practices and have the potential to exacerbate barriers under any or all of them. Examples are that uncertainty drives barriers which prevent the development of rules and tools, since the risk of change makes large investments unattractive. Technical considerations are important in exchange, normative and representational practices. Technical considerations can set bounds / barriers for the development of a market. For example the renewables industry looks to a market for CO₂ to help fund its development, but the fundamental barrier is the need for further technical developments. In this case, the lack of a price on CO₂ savings to support these efforts could be seen as a secondary barrier. Time constraints are also important barriers, since certain markets face different barriers in different time frames. We feel that it is of value to pull these three extra barriers out from the three types of market practices identified earlier, we have decided to call them 'catalytic barriers' since they have the potential to affect all other barriers and are quite separate to the human efforts in exchanging, normalising and representational practices. This leads to the typology of barriers to market formation proposed in Figure 1.

Figure 1: Typology of barriers to market formation

Barrier type	Barrier translations
Exchange barriers	Interests Measurements
Representational barriers	Results Descriptions
Normalising barriers	Measures and methods of measurement Rules and tools
Catalytic barriers	Technical considerations Time constraints Uncertainty

This typology of barriers to market formation will be used to analyse the case study that is presented later in the paper. We now move on to briefly outline our research methods.

RESEARCH METHODS

The case study method is suited to our descriptive and explanatory research objectives and the context of the complex, interdependent climate change network (Alexander & Bennett, 2005; Bennett & Elman, 2006; Easton, 2000; Halinen & Tornroos, 2005; Remenyi, Money, Price, & Bannister, 2002; Yin, 2003). Our case study draws upon 18 months of data

collected during the introductory period ahead of the Carbon Reduction Commitment's launch in April 2010. Research access was through participant observation as a consultant in 'Carbon Consultant'. This work supported the response of Manufacturer Beta to the Carbon Reduction Commitment and involved liaison with the Environment Agency and Manufacturer Beta's energy suppliers and bill checking provider. Through the carbon consultancy, we also gained access to training and industry documentation on the Carbon Reduction Commitment. Examples of this material include a one day training session run by the Environment Agency, consultation responses and trade association briefings.

Our data analysis drew upon insights from our epistemology of critical realism. Critical realism is a theory of knowledge that stresses the 'embeddedness' of actions within a stratified social reality (Pawson & Tilley, 1997; Sayer, 1984). This emphasises the importance of seeking causal explanations through generalisable mechanisms. When exploring the case study we first sought to identify and describe the entities performing the new market for CO₂. This involved determining their structures and the powers and liabilities which they possessed. Next we examined the events observed and attempted to explain them through the identification of some generalisable mechanisms. These efforts also drew heavily upon the description of marketing efforts in the previous literature as being focused around representational, normalising and exchange practices.

CASE STUDY: A MANUFACTURER'S RESPONSE TO A NEW MARKET FOR CO₂: THE UNITED KINGDOM'S CARBON REDUCTION COMMITMENT

INTRODUCTION

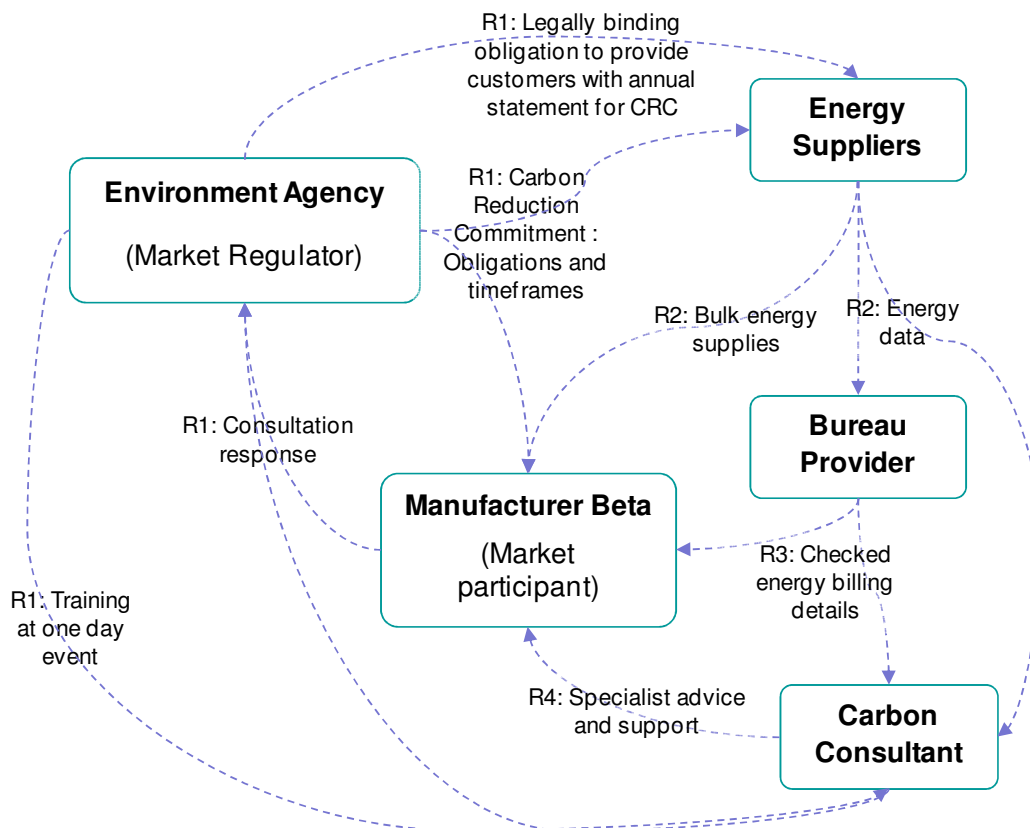
This case study describes an anonymised 'Manufacturer Beta's' interactions during their 18 months of preparation ahead of the launch of the Carbon Reduction Commitment. In the case study we first introduce 'Manufacturer Beta' and the business network in which they operate. Next we detail the structure, timelines and financial implications of the Carbon Reduction Commitment. Finally, we examine Manufacturer Beta's and other organisations' responses to the Carbon Reduction Commitment, closing with a description of the implications and changes apparent for each actor in the business network.

A VIEW OF THE BUSINESS NETWORK

Manufacturer Beta has their head office and over 100 sites in the United Kingdom, as well as multiple manufacturing bases and markets globally. Manufacturer Beta is a high-tech manufacturing organisation; however their specific industrial sector has been withheld for reasons of confidentiality.

Figure **2** below details the relationships affected by the launch of this new CO₂ market, next we briefly introduce each in turn.

Figure 2: Manufacturer Beta within their network



The first relationship is between the Environment Agency, as the regulator, and Manufacturer Beta, as a Carbon Reduction Commitment participant. The second relationship is between the Energy Suppliers and Manufacturer Beta. This relationship is primarily over the provision of bulk supplies of gas and electricity as inputs to Manufacturer Beta's operations. However it also encapsulates a lot of Manufacturer Beta's energy consumption data, which is the basis of their CO₂ emissions reporting and forecasting. This is essential data required for participation in the CO₂ market. The third relationship is between the Bureau provider and Manufacturer Beta. Bureau Provider checks the hundreds of invoices generated by energy suppliers, verifying energy costs ahead of their payment by Manufacturer Beta. This bill checking exercise also overlaps with CO₂ emissions reporting, since it is a source of data that is more reliable than the unchecked invoices. Finally, the fourth relationship involves Carbon Consultant providing compliance support to Manufacturer Beta. Manufacturer Beta is involved in the two CO₂ markets of the European Emissions Trading Scheme and the Carbon Reduction Commitment, as well as the CO₂ tax of the Climate Change Levy. Carbon Consultant had been hired to lead compilation and verification of the various reports required for each scheme. The manufacturing processes employed by Manufacturer Beta are energy intense and accordingly, around ten of their largest sites are covered by the European Emissions trading Scheme and the United Kingdom's Climate Change Agreements. Manufacturer Beta has dealt with these two historical schemes at the level of the business unit, through a team of energy managers who meet on a quarterly basis and employ the 'Carbon Consultancy' to complete their annual returns for each scheme. Through the Carbon Reduction Commitment, all of Manufacturer Beta's sites in the United Kingdom will now be required to participate in the new market for CO₂.

THE CARBON REDUCTION COMMITMENT- A NEW MARKET FOR CO₂

The Carbon Reduction Commitment is a new market for CO₂ within the United Kingdom. It is administered by the 'Environment Agency' and starts in April 2010. The Environment Agency developed the Carbon Reduction Commitment in order to bring the next tier of energy users, those not covered by the European Emissions Trading Scheme, into a national market for CO₂. This extends the number of United Kingdom sites covered by a market for CO₂ from 921 European Emissions Trading Scheme sites to an estimated 5000 organisations, or 25,000-150,000 sites (DECC, 2007, 2009). The Carbon Reduction Commitment will affect organisations such as large retailers, universities, local authorities, landlords, smaller manufacturers and office based organisations with multiple buildings. These organisations will be legally required to participate in the new CO₂ market of the Carbon Reduction Commitment as of April 2010. The Environment Agency has introduced a number of novel elements within the Carbon Reduction Commitment's structures. These include a CO₂ market, but also a public league table, financial bonuses / penalties for league table leaders / laggards and a number of disclosures relating to the overall organisational maturity in their CO₂ management practices. These structures are summarised in Figure 3 and explained in more detail below.

**Figure 3: Summary of the Carbon Reduction Commitment's structures
(DECC, 2009; Environment Agency, 2009)**

- 1. Market price on CO₂ emissions through an annual auction of CO₂ allowances.**
- 2. Public league table on emission reduction performance.**
- 3. Rebates on CO₂ allowances given with penalty or bonus set by league table performance.**
- 4. Tick box questions as supplements to the public league table:**
 - Setting long-term carbon emission reduction targets?
 - Reporting performance against reduction targets?
 - A director named to oversee CO₂ emissions performance?
 - Engagement with employees on CO₂ management?
 - Increase in renewables generation published, but not part of league table score.

First and foremost, the Environment Agency is aiming to introduce a market for CO₂ emissions. Permits will be sold through a month long government auction in April and will cover the coming year's emissions. To be able to participate in the auction, Manufacturer Beta will need to forecast their coming year's emissions and develop a trading strategy. The trading strategy will have to take account of their anticipated internal costs of reducing CO₂ emissions, relative to those of the other players in the CO₂ market. The trading strategy would also have to take into account the anticipated development of a secondary market for permits. In the second phase of the Carbon Reduction Commitment which will start in April 2014, the Environment Agency will cap the number of CO₂ permits available and auction them through a competitive process. This will increase the price of permits and create a further incentive to reduce emissions.

The Environment Agency's second objective is to make the CO₂ performance of organisations public and easily comparable, creating a reputational incentive to reduce emissions. This is a new element to a CO₂ market, which has not been included in previous CO₂ markets. The Environment Agency will produce a public league table using the annual CO₂ emission reports of participants. In early years this public league table will suffer from the challenge that there will not be any previous data to allow year on year comparisons. For example, when the first annual report is submitted in April 2011 to cover 2010/2011 data,

there will not be any data available for comparisons to 2009/2010. To overcome this challenge, the Environment Agency has introduced two 'Early action Metrics' which are proxy measures of emissions reductions. These are, firstly, the level of coverage of 'Automatic Meter Reading' and, secondly, the level of coverage of the government's 'Carbon Trust Standard'. Presence of Automatic Meter Reading represents collection of energy data, which is the first step in identifying and appraising CO₂ emission reductions. The Carbon Trust Standard, a voluntary accreditation framework for organisations wishing to manage their emissions, would signify meaningful action to reduce emissions through adherence to an accredited emission management process. In later years, once there is annual emissions data for year on year comparisons, the early action metrics will be phased out. At this point, the scheme will be dominated by a measure of absolute emission reductions. The absolute metric will be supplemented by an optional 'growth metric' available to organisations if they want to take account of a growth in their operations. However, the growth metric will only ever constitute up to 25% of an organisation's league table score and will be based upon growth in turnover. The main driver of league table performance will be year on year reductions in absolute emissions. This is important because it is an absolute target pushing for reduced total emissions. This is very different to an efficiency metric, which would allow absolute emissions to grow, so long as emissions per unit of through put were falling.

Once the league table has been published, the Environment Agency gives a third incentive to reduce CO₂ emissions. This is also a new development which does not have a precedent in previous CO₂ markets. The third element is the provision of rebates, called recycling payments, which give back the money spent to purchase CO₂ permits during the annual auction. In returning these payments, the Environment Agency aims to make the Carbon Reduction Commitment revenue neutral at the level of the UK economy. However, individual participants will face bonuses or penalties based upon their performance in the league table. In early years they will receive their repayments with an adjustment of up to $\pm 10\%$, based upon their league table position. By 2015, this will have risen to $\pm 50\%$ of their original outlay. Through this mechanism, the Environment Agency hopes to reward leaders and punish laggards, thus providing a further incentive to improve CO₂ emissions on a year on year basis.

Finally, the annual reports for the Carbon Reduction Commitment would also include 5 supplements to the league table which indicate the level of sophistication of each participant's carbon management efforts. Recognition will be given, through four tick boxes, for the presence of long-term CO₂ emission reduction targets, assigning responsibility to a director to manage the target's delivery, reporting performance against these targets and engaging staff in energy and CO₂ management. The increase in renewables generation by the participant will also be published, but will not contribute to the league table score.

THE CARBON REDUCTION COMMITMENT- IMPLEMENTATION & ANNUAL CYCLE

The United Kingdom's Environment Agency is responsible for implementation and eventual management of the Carbon Reduction Commitment. Participation in the scheme is determined by electricity consumption during the qualification year of 2008. An organisation must participate in the scheme if 2008 electricity consumption through an industrial class of electricity meter breaks a threshold of 6000MWh. This threshold represents an annual electricity expenditure of roughly £0.5m. An important consideration is that the Carbon Reduction Commitment is administered at the level of the highest UK parent. This means that an organisation with multiple sites in the United Kingdom would need to total their electricity consumption across all sites and compare this total to the qualification threshold.

The Carbon Reduction Commitment is split into phases and runs to a United Kingdom tax year of April to March. Phase 1 is a three year preparatory phase, running through from April 2010 until April 2013. Phase 1 starts with a single year that requires CO₂ reporting only. This is because one year's worth of data will be required to make year on year comparisons and to support participants' preparation of their forecast emissions for the coming year. For the remainder of phase 1, the price of CO₂ permits will be fixed at £12/tonne and there will be no limit on how many an organisation can purchase. After this three year practice phase, each phase runs for five years and the price of CO₂ permits will be set during an Environment Agency auction followed by a more active secondary market for inter-organisational trading. At the beginning of each phase, organisations must submit a footprint report which represents 100% of their emissions within the United Kingdom. This is used to calculate any exemptions, for example carving out Climate Change Agreement and European Emissions Trading Scheme CO₂ emissions. The footprint report is then used as an 'energy map' of the organisation over the coming phase. During each phase, participants must collect their emissions data for included emissions sources and submit them in the form of an annual report. The Carbon Reduction Commitment is based upon self reporting, whereby organisations are expected to complete their annual submissions and submit them online to the Environment Agency registry. These are not checked upon submission, instead a participant can expect to be audited at random by the Environment Agency at a frequency of approximately once per phase.

The annual cycle of the Carbon Reduction Commitment starts with an auction of CO₂ permits in April. This auction covers emissions of the upcoming year, and so a forecast must be prepared before the participant can decide how many permits to buy. The previous reporting year also ends in April, giving participants until the last working day in July to collate data on their previous year's energy use, convert it to a corresponding CO₂ emission level and submit it in the form of an annual report. The collection of energy data is an ongoing task that is best completed at monthly or quarterly intervals in order to facilitate the generation of the annual report on time. Between July and October the Environment Agency collates all participants' submissions and generates the public league table which is published on the last working day in October. On the same day of publication of the league table, participants receive their recycling payment with the financial bonus / penalty, depending upon their league table position.

FINANCIAL IMPLICATIONS OF THE CARBON REDUCTION COMMITMENT

Manufacturer Beta easily exceeds the electricity consumption threshold for inclusion within the Carbon Reduction Commitment, but for reasons of confidentiality, their annual electricity expenditure will not be disclosed. This does not stop us examining the financial implications of the CRC for them, since what matters in terms of impact of the scheme are the ratios between energy costs, energy consumption, carbon content and carbon costs. Since these are comparable for all participants, there is no requirement to deal with absolute figures for the purpose of the following discussion; instead the costs of the Carbon Reduction Commitment are expressed as a percentage of annual energy spend.

Due to confidentiality restrictions we have based financial figures upon a nominal annual electricity expenditure of £5m, instead of quoting Manufacturer Beta's actual energy spend. This would be equivalent to around 60,000MWh of electricity, or ten times the threshold for inclusion in the Carbon Reduction Commitment. Using the Environment Agency's conversion factor for the CO₂ content of grid electricity of 0.537tonnes/MWh, this amounts to approximately 32,000tonnes of CO₂ per annum (Carbon Trust, 2008: 3). In phase 1 of the Carbon Reduction Commitment, this would cost £12/tonne, meaning that the purchase of

CO₂ permits during the annual auction would cost approximately £380,000 per year. This is equivalent to about 7.5% of annual electricity spend. At the end of the year, following publication of the league table, the money spent during the auction would be recycled with a bonus or penalty of $\pm 10\%$ in the first year, rising to $\pm 50\%$ by 2015. Therefore the maximum potential net cost or benefit due to the Carbon Reduction Commitment would be approximately $\pm £38,000$ in 2011. This amounts to less than 1% of the annual electricity spend. By 2015 this has the potential to approach a net cost of 5-10% of electricity expenditure, taking account of the likely rise in cost of CO₂ permits and the heavier weighting of the league table performance bonus / penalty. As explained earlier, these conversions are linear. The conversion from electricity consumption in MWh to rough energy cost is a multiplication of the price of electricity per unit. Converting from electricity consumption to tonnes CO₂ is also fixed by the electricity generation mix in the national grid, i.e. a weighted average of the carbon content of nuclear, coal, gas and renewables generation. Finally, the price of carbon credits in phase 1 is fixed at £12/tonne. As such, any other organisation which performed such a calculation would forecast similar financial implications relative to annual energy spend. This represents cash flow implications of around 7.5% of annual electricity spend and a net cost or benefit of less than 1% of annual electricity spend. These costs are set to rise in coming years, but not to a level whereby they are considered 'material' in terms of financial implications for Manufacturer Beta or other organisations participating in the Carbon Reduction Commitment.

MANUFACTURER BETA AS A CARBON REDUCTION COMMITMENT PARTICIPANT

Here we examine Manufacturer Beta's interactions resulting from the new obligations introduced by the Carbon Reduction Commitment. We see that the extended scope and rigour of the CO₂ market led to opportunities for the Bureau Provider and Carbon Consultant to offer what were loosely termed as Carbon Reduction Commitment compliance services. We also see how Manufacturer Beta responded to the structures of the Carbon Reduction Commitment as an issue of compliance, rather than as a market opportunity.

The Carbon Reduction Commitment greatly increased the scope of Manufacturer Beta's exposure to CO₂ markets. Prior to the development of the Carbon Reduction Commitment, less than ten of Manufacturer Beta's sites were part of a market for CO₂. These were the larger sites covered by the European Emissions Trading Scheme, or the United Kingdom's Climate Change Agreements. The Carbon Reduction Commitment brought all of Manufacturer Beta's sites in the United Kingdom into a market for CO₂. To be able to cope with the tenfold increase in data flow, Manufacturer Beta had to develop CO₂ reporting and compliance processes. These were seen as essential, in order to mitigate the risk of potential fines for non compliance. This need for support in forecasting, tracking and trading CO₂ was further emphasised by the fact that the CO₂ reporting requirements of the Carbon Reduction Commitment were not targeted at individual sites within an organisation, as had been the case in previous schemes. Instead, the highest United Kingdom parent company had to aggregate emissions data through all sites, business units and subsidiaries to one single number for the whole of Manufacturer Beta. The annual report had to be signed off by a director, or another member of staff with equivalent management control and in extreme cases of non compliance there was the potential for this individual to face a 3 year custodial sentence. These penalties for individuals were backed up with potentially significant fines to the organisation. With these risks in mind, staff in the Corporate Reporting department of Manufacturer Beta sought external support with the preparation and verification of these reports. This led to new business opportunities for Bureau Provider and Carbon Consultant to offer new services in

carbon reporting, forecasting and trading support. These carbon management offerings are dealt with later on in the case.

The wider considerations of the Carbon Reduction Commitment concerned how to deal with the league table, the CO₂ permits costs and the recycling payments received following the publication of the league table. Staff in the Corporate Reporting department at Manufacturer Beta saw the annual publication of a Carbon Reduction Commitment league table as a significant reputational issue. They were worried about being positioned in the lower half of the league table and how they would be placed compared to their peers. This issue was not viewed as being financially problematic. In fact, in light of the relatively low costs involved, it was planned to manage the budget for participation in the CO₂ auction from a central corporate account. The costs of the Carbon Reduction Commitment would not be reallocated to the businesses, since their scale did not justify the administrative effort of reallocation. Although the reputational concerns linked to the league table were given significant attention Manufacturer Beta perceived that they were unlikely to drive business decisions. It was perceived by the Corporate Reporting Department that there was a significant gap to bridge even in achieving compliance and accordingly most management effort was applied to developing the carbon reporting systems.

Finally, the tick box questions included in the annual report caused a great deal of concern to the Corporate Reporting department at Manufacturer Beta. Manufacturer Beta would only be able to satisfy one of the four optional requirements at the start of the Carbon Reduction Commitment. They did not have a corporate target for emission reductions and thus neither had a director named as responsible for the target, nor reported progress against the target. The only question to which they would give a positive response was whether they had staff engagement on energy and climate change. The team managing compliance with the European Emissions Trading Scheme had piloted this engagement approach and it was decided to roll this out across the organisation. The worries of Manufacturer Beta were softened slightly by the fact that less than half of their peer companies had set targets on energy and CO₂ performance and so they did not see that this would paint them as being any worse than average within their sector. These new public reporting obligations gave a new level of visibility to energy and CO₂ management within Manufacturer Beta. What had previously been an issue for local or regional energy managers became an issue that directors, investor relations and legal teams took a keen interest in. Again, this gave rise to new business opportunities for Energy Suppliers, Bureau Provider and Carbon Consultant to support a rapid development of capability and objectives in CO₂ management and target setting. These also became points of comparison for competitive analysis of Manufacturer Beta and its peer companies.

IMPACT UPON ENERGY SUPPLY CONTRACTS

Manufacturer Beta has a number of long-term contracts for the bulk supply of gas and electricity for use in their manufacturing operations. The Energy Suppliers held multimillion pound supply contracts and provided a number of supporting services to develop and protect their relationships with Manufacturer Beta. These extra services were not of significant financial value to the Energy Suppliers and were viewed as being account management type activities. However, these services are still important for this case study, since they were partly in competition with the offerings of the Bureau Provider and the Carbon Consultant.

The major overlap between energy suppliers and carbon reporting is that energy consumption data is the basis for calculating CO₂ emissions. Once energy consumption has been measured, it is converted to CO₂ emissions by multiplying by the CO₂ content factor for the

fuel in question. The fact that the Energy Suppliers held fuel consumption data for their billing processes made them owners of the data for the first step in calculating CO₂ emissions. This consumption data was then checked by the Bureau Provider and compiled by the Carbon Consultant before being converted into the relevant reports for submission to the Environment Agency. The energy consumption data was used primarily for billing purposes, but was also made available real-time online. The web portal for viewing this data allowed site energy managers to track energy performance and support decision making at sites. Because energy management was becoming a core issue, there was a separate contract to provide extended automatic meter reading to a wider range of sites and supplies at Manufacturer Beta. Once installed, the automatic meters simplified billing and improved accuracy. They also gave more live data for real-time energy management. The Energy Suppliers were starting to see a much higher level of concern regarding energy and CO₂ performance. Accordingly they developed small teams of in-house consultants to provide support in energy and CO₂ management, as well as guidance on the Carbon Reduction Commitment.

Another factor which emphasised the importance of the Energy Suppliers in responding to the Carbon Reduction Commitment was a new obligation placed upon them by the Environment Agency. Energy Suppliers were legally obliged to provide customers with annual statements for their Carbon Reduction Commitment related energy consumption. Importantly, the liability for errors in this report lay with the Energy Supplier, rather than scheme participants. This altered the market dynamics for carbon compliance support, since it made reliance upon Energy Suppliers' statements attractive, due to the transfer of risk. Such considerations emphasised the importance of the Energy Suppliers' data and somewhat undermined the value of the checked data held by the Bureau Provider.

Later in the case we explore how Energy Suppliers attempted to move into Carbon Reduction Commitment support services as an extension to their energy management support offered to customers. This was viewed by Energy Suppliers as an account management type activity, protecting their energy supply contracts which they still viewed as their core business.

IMPACT UPON BILL CHECKING SERVICES

The Carbon Reduction Commitment also bought implications for the bill checking services provided by Bureau Provider to Manufacturer Beta. A bureau company typically checks the hundreds of invoices generated by their client's Energy suppliers, ahead of payment by the client. This overlaps with CO₂ emissions reporting, since the checked invoice data has an extra level of verification and reliability over that received direct from the Energy Suppliers. Although this was a useful by product of the bill checking service, it was not explicitly paid for and was a secondary concern relative to the original purpose of detecting multi million pound errors in energy invoices. In other words, carbon compliance services were not a core business offering for Bureau Provider. However, supporting Manufacturer Beta in their response to the Carbon Reduction Commitment was of interest. This was because the original value of their service was being eroded. Bureau services were a historic element of the energy supply industry which had emerged during an era when invoicing was a manual process that was prone to errors. Automatic meter reading had since cut out a lot of errors. In addition, increased competition in the energy supply market, plus the vigilance of the Bureau Providers themselves had further improved the accuracy of energy invoicing. This erosion of their original bill checking business model meant that the Bureau Provider was aggressively attempting to move into the provision of services in Carbon Reduction Commitment compliance support.

IMPACT UPON CARBON COMPLIANCE SERVICES

The Carbon Reduction Commitment also brought changes in the relationship between Carbon Consultant and Manufacturer Beta. Carbon Consultant had previously dealt with Manufacturer Beta's sites that were part of the CO₂ markets of the European Emissions Trading Scheme and the United Kingdom's Climate Change Agreements. This support involved calculating Manufacturer Beta's CO₂ emissions and preparing the reports for Manufacturer Beta's submissions to the Environment Agency. These previous interactions with the Environment Agency meant that Carbon Consultant had a good working knowledge of the Environment Agency's processes. Carbon Consultant attended free Environment Agency training on the structure and timelines of the Carbon Reduction Commitment, and also made use of an Environment Agency email address for enquiries and clarification on the scheme. These communications gave the Environment Agency a quick and informal means to fix problems with the structure of the Carbon Reduction Commitment as they arose. Carbon Consultant also benefited from the process, since they could answer questions on the Carbon Reduction Commitment faster and in more detail than other relative newcomers to the space. Although all communication channels used were free and available to any organisation, this informal route to gathering data gave some advantages to specialist firms such as Carbon Consultant who were active in the right forums to be able to hear about and capitalise upon such opportunities.

Carbon Consultant spent the 18 months prior to the launch of the scheme supporting Manufacturer Beta in the definition of administrative and reporting responsibilities introduced by the Carbon Reduction Commitment. This work involved developing an energy supply inventory for all sites in the United Kingdom, determining the most reliable source of consumption data for each of these supplies, and helping to specify a reporting system to be used once the Carbon Reduction Commitment went live in April 2010. Previously, CO₂ reporting had been carried out manually using spreadsheets, but the Carbon Reduction Commitment brought a scale of reporting that was not possible on this manual basis.

The Carbon Reduction Commitment represented a maturing of CO₂ reporting requirements. Following the introduction of the scheme, the majority of industrial and commercial emissions in the United Kingdom were covered by a market for CO₂. This increased market size justified the development of new database services which supported Carbon Reduction Commitment reporting. This meant that Carbon Consultant saw a large part of its core business eroded by these new competitors who made it harder for niche players using manual processes. Carbon Consultant saw these changes and started to seek out the next innovative niche in energy and CO₂ management, anticipating that compliance support would be commoditised by database providers in less than 5 years. Carbon Consultant developed a new focus upon supporting staff engagement campaigns for energy awareness. This was seen as the next step once CO₂ reporting and compliance was in place at an organisation. With a view to moving on to tackle staff engagement, Carbon Consultant started introducing its customers to database solutions for compliance, the logic being that these were a better long-term solution to energy and CO₂ reporting. Manufacturer Beta chose to use the Carbon Reduction Commitment reporting requirements to develop a database reporting system that would later be able to deal with anticipated CO₂ markets in other regions in the world. Carbon Consultant supported the selection of the database provider and provided training for a new Carbon Compliance Manager who was recruited within the Corporate Reporting Department at Manufacturer Beta.

CARBON REDUCTION COMMITMENT COMPLIANCE SERVICE OFFERINGS

Eventually, all three suppliers to Manufacturer Beta proposed a service to support compliance with the Carbon Reduction Commitment. Here we describe and explain the final selection made by Manufacturer Beta. This discussion is supported by Figure 4, which illustrates the stages that raw data passes through before finally being submitted to the Environment Agency. Figure 4 also illustrates that different data is required for energy management, as opposed to compliance reporting. Energy management data must be fresh enough to inform timely decision making and this comes at the expense of accuracy. CO₂ compliance data is only required at annual intervals, but must undergo a number of checks, presentation in the correct format, and preferably independent verification, before it is ready to submit to the regulator. These ideas are illustrated in the last three rows of the table. The first two rows show how Manufacturer Beta collected and reported CO₂ emissions data before and after the Carbon Reduction Commitment came into being. The first of these shows Manufacturer Beta's original CO₂ data chain for the small number of sites originally affected by the European Emissions Trading Scheme and UK's Climate change Agreements. The second shows Manufacturer Beta's final CO₂ data chain for the large number of sites eventually affected by the Carbon Reduction Commitment.

Figure 4: Chain for conversion of raw energy data into CO₂ compliance reports

1) MANUFACTURER BETA'S ORIGINAL CO₂ DATA CHAIN (~10 sites for European Emissions Trading Scheme and UK's Climate change Agreements)	'Energy Supplier'	'Bureau Provider'	'Carbon Consultant'	'Carbon Consultant' + 'Independent verifier'	'Carbon Consultant'	'Carbon Consultant'
2) MANUFACTURER BETA'S FINAL CO₂ DATA CHAIN (>100 UK sites once Carbon Reduction Commitment goes live)	'Database subscription' + 'Compliance manager'	'Database subscription' + 'Compliance manager'	'Database subscription' + 'Compliance manager'	'Compliance manager' + 'Independent verifier'	'Compliance manager'	'Compliance manager'
Data frequency	Live, hours,	Days, weeks	Months	Yearly		
Suitability for energy management	High	Medium	Low	-		
Suitability for CO₂ compliance reporting	-	-	Legal minimum	Best practice		
	1) Data collection	2) Data checking	3) Report preparation	4) Third party verification	5) Registry account mgt	6) CO ₂ trading

We will first deal with the Carbon Reduction Commitment service proposed by the primary electricity supplier to Manufacturer Beta. Figure 4, shows that Energy Suppliers hold live energy data that is well suited to energy management purposes. This live data was the basis of their online energy monitoring package that managers at Manufacturer Beta used to monitor energy performance on site. It was proposed to Manufacturer Beta to extend this system into Carbon Reduction Commitment compliance services. However, in the first proposal meeting it became clear that the database was not capable of holding, checking and providing a verifiable trail of data for the purpose of compliance reporting. Manufacturer Beta continued to view the package as being useful for supplying timely data for energy management, but didn't see a feasible route towards it supporting Carbon Reduction Commitment compliance reporting. For this reason, the discussions with the energy supplier were not taken any further.

The second proposal for a Carbon Reduction Commitment compliance service came from the Bureau Provider. They held their own database and proposed to complete all stages of compliance reporting using their internal systems. In the original compliance reporting

system they had provided checked data to Carbon Consultant for compilation into the required Environment Agency reports. The proposal from Bureau Provider was the least cost option for compliance with the Carbon Reduction Commitment. However, the corporate team in Manufacturer Beta viewed the development of CO₂ reporting capabilities in-house as being of key importance and as being much wider than simply responding to the Carbon Reduction Commitment. They were concerned that outsourcing the task to Bureau Provider would not build any internal capabilities and would not start to build a system that could be used in the future to respond to upcoming CO₂ regulation in other regions. These doubts were reinforced by the weakening of the original business model of Bureau Provider; the need to check bills was being eroded by automatic meter reading and better billing accuracy. Combined, these considerations meant that Manufacturer Beta did not wish to outsource what was seen as a critical activity to a partner whose long term business relationship was already under question.

Finally, Carbon Consultant had a good oversight of the compliance market and had recognised the development of a number of database products that would replace the first three steps of the compliance reporting process to give a standard system for collecting, checking and preparing emissions data. Carbon Consultant supported Manufacturer Beta in selecting the most appropriate database and committed to shadow the reporting process for the first three years of the Carbon Reduction Commitment. This was on the agreement that, once the system was robust enough, reporting and compliance activities would be centralised and all run through the same database. Carbon Consultant presented this as a three year transition during which systems would be developed and embedded within Manufacturer Beta. In addition to purchasing access to the database service, Manufacturer Beta also recruited a new member of staff with the job title of Carbon Compliance Manager. This new staff member was responsible for implementing and maintaining the database and project managing the Carbon Reduction Commitment data collection processes. At the end of the three year transition, they would take over the activities performed by Carbon Consultant.

ANALYSIS OF CASE

We now analyse our case study using the typology of barriers to market formation developed during the literature review, this analysis is summarised in Table 1.

Our first research question concerned identification of the actors responsible for performing the new CO₂ market created by the Carbon Reduction Commitment. These actors are summarised in

Figure 2. The Environment Agency is the administrator of the new regulation which creates the mechanisms for reporting and trading CO₂ emissions. Manufacturer Beta is our representative market participant. Finally, there are three third parties which are important for the new CO₂ market. The Energy Supplier holds the raw data required for calculating CO₂ emissions. The Bureau Provider checks the energy invoices and so is a source of more reliable energy consumption data. Finally, the Carbon Consultant provides support in processing this energy data to calculate the CO₂ emissions, preparing the annual reports and forecasts required for Manufacturer Beta's market participation. These five actors are taken as constituting the network responsible for performing the new market for CO₂. Accordingly, they are the basis of our analysis of barriers to the development of this market. We now deal in turn with the four types of barrier to market formation proposed as a result of our literature review. The order of treatment does not represent a linear flow; instead we view the barriers as being categorised by type, rather than following a hierarchy or causal sequence.

Exchange barriers are captured in the translations of 'interests' which drive normalising processes and 'measurements' which influence representational processes. We deal first with interests. It can be seen that Manufacturer Beta's main interest was in achieving regulatory compliance at the lowest possible cost. This objective was broadly aligned with the Environment Agency's interest in incentivising CO₂ reductions at the least cost for industry. The Energy supplier's key interest was in protecting their multimillion pound energy supply contracts. The bureau provider's main interest was in finding new business opportunities to help it diversify away from its bill checking services. Finally, the Carbon Consultant's primary interest was to diversify away from CO₂ compliance reporting, including that related to the Carbon Reduction Commitment. The measurements used by each actor were broadly aligned with these interests. The Environment Agency measured the CO₂ market in terms of absolute costs of CO₂. Manufacturer Beta was more interested in the net cost of CO₂ once the annual rebate had been received. Both the Energy Supplier and Bureau Provider appraised the Carbon Reduction Commitment as an opportunity to provide new compliance services. The Carbon Consultant measured the Carbon Reduction Commitment in terms of the volume of data required to provide compliance services.

Representational barriers are explored through the translations of 'results' which drive exchange processes. The results are linked to the measurements given above and the measures and methods of measurement which are explored later on as one of the translations resulting from normalising practices. The Environment Agency saw results as the price of CO₂ being fixed by them at £12/tonne for the first phase of the scheme. However, this £12/tonne gave a different result for Manufacturer Beta, who netted out the £12 / tonne against the rebate that would cover much of this expenditure. This gave a net cost of CO₂ that was equivalent to less than 1% of their annual energy spend. Both the Energy Supplier and the Bureau Provider saw that the potential value of Carbon Reduction Commitment compliance services fell somewhere in the range of £20-50k per year. The key result of measurement of the Carbon Reduction Commitment for the Carbon Consultant was that the data volumes required for provision of Carbon Reduction Commitment compliance services necessitated automation of any data management system developed to support these services. We now briefly examine descriptions of the Carbon Reduction Commitment by each actor. The Environment Agency described the Carbon Reduction Commitment as a market based mechanism aiming to incentivise CO₂ reductions at the least cost across industry as a whole. This description was quite different to that of Manufacturer Beta who described the Carbon Reduction Commitment as a compliance scheme similar to other environmental regulations. Manufacturer Beta described the net CO₂ cost of less than 1% of energy spend as being too small to drive business decisions, but did recognise that CO₂ compliance reporting was

becoming a core capability to hold in-house. Having appraised the potential scale of fees for Carbon Reduction Commitment compliance services, the Energy Supplier concluded that the fees were two orders of magnitude smaller than their energy supply contracts and decided to treat the Carbon Reduction Commitment as an account management activity, rather than to pursue it as a new market opportunity. However, for Bureau Provider, a much smaller organisation with better suited skills, the potential Carbon Reduction Commitment compliance service fees were viewed as being attractive and were taken as an opportunity to diversify away from bill checking and into CO₂ compliance services. Finally, the Carbon Consultant took the high data volumes which they anticipated and developed a description of the market for Carbon Reduction Commitment compliance services as being commoditised by database providers within the next five years.

Normalising barriers were explored through the translations of ‘measures and methods of measurement’ which drive market representations, as well as ‘rules and tools’ which drive ‘exchange practices’. Measures and methods of measurement are linked with the measurements which were described under exchange barriers. The Environment Agency focussed upon absolute costs of CO₂ as measured in £/tonne and set by the annual government auction. In contrast, Manufacturer Beta calculated the net costs of CO₂ introduced by the Carbon Reduction Commitment, but then converted them to a percentage of annual energy spend to put them in perspective. As previously explored, Energy Supplier and Bureau provider measured the Carbon Reduction Commitment in terms of the potential fees chargeable for Carbon Reduction Commitment compliance services; these were estimated by looking at the number of sites to which the service would be applied. The Carbon Consultant used the same metric of number of sites, to estimate their measure of the Carbon Reduction Commitment, which was the volume of data processing required to achieve compliance. Moving on to examine the rules and tools of the Carbon Reduction Commitment, the Environment Agency set the core framework of the market by being able to specify and mandate the protocols for the annual auctions, league table publication and rebates. An important addition to these was the capability to set and enforce significant fines for non compliance; these ensured companies like Manufacturer Beta acknowledged and participated in the scheme. In response to the Carbon Reduction Commitment, Manufacturer Beta recruited a compliance manager and subscribed to a Carbon Reduction Commitment database to ensure that all mandatory requirements of the Carbon Reduction Commitment were met. However, aside from the low cost of Carbon which didn’t justify significant changes to Manufacturer Beta’s core business, there was another rule which prevented full participation in the CO₂ market. Like many large organisations, Manufacturer Beta had a corporate policy prohibiting speculation on non core business activities. This short circuited the market based aspects of the Carbon Reduction Commitment, since Manufacturer Beta had to trade to meet obligations, but was forbidden from speculating on the market to take advantage of the opportunities which it presented. From the Energy Supplier’s point of view, they had one mandatory obligation which was that the Environment Agency obliged them to provide all customers with an annual statement of energy use. The Bureau Provider was unsuccessful in their bid to provide a fully managed Carbon Reduction Commitment compliance service, since Manufacturer Beta had decided to develop these capabilities in-house. However, Bureau Provider did gain a smaller contract for the provision of checked energy data to the Compliance Manager in Manufacturer Beta. This energy data would be the basis of the Carbon Reduction Commitment reporting. Carbon Consultant moved into supporting Manufacturer Beta in other areas of their CO₂ management, but did work with Manufacturer Beta to ensure they selected a suitable database provider for CRC reporting requirements.

These barriers were also subject to a number of catalysts which acted to underpin or multiply their affects. Technical considerations were at the heart of the Environment Agency's selection of a Market based solution, since a market allowed the Environment Agency to retain ownership of setting the targeted CO₂ emission reduction. Technical considerations at Manufacturer Beta were that they had not previously been required to hold a full UK inventory of every site and energy supply. This had previously been held for large sites, but business units or larger sites had been allowed to set up small local agreements. Gaining full oversight of the UK estate of the company was a time consuming and difficult process. However it was necessary for the mandated reporting requirements of the Carbon Reduction Commitment. The Energy Supplier was prevented from providing compliance support services off the back of their energy data, since it was not of a high enough level of reliability for compliance reporting. Technical developments in automatic meters and better billing processes were behind the erosion of the bureau provider's bill checking services. Finally, the excel based spreadsheets that Carbon Consultant used for previous schemes could not cope with the compliance reporting at the scale mandated by the Carbon Reduction Commitment. Moving on to deal with the time constraints, firstly the Environment Agency was responding as part of the UK government objective to reduce CO₂ emissions by 26% by 2020. This partly forced their approach which Manufacturer Beta saw as rigid and inflexible. The Environment Agency had a timeframe of ten years to set up a CO₂ market and deliver significant reductions. This partly explained why Manufacturer Beta was forced to keep to the deadline of the start of the Carbon Reduction Commitment, even though the Environment Agency had missed a number of deadlines up to this point. This tight time frame was the same reason that none of the third parties had time to build a database system for Carbon Reduction Commitment Compliance management ahead of the start of the scheme. Finally, uncertainty around how the market would respond to targets set by the Environment Agency and the inherently variable nature of the price of CO₂ in a market made it difficult for Manufacturer Beta to engage with this market. In part, this uncertainty could be to blame for the compliance based approach taken by Manufacturer Beta.

Table 1: Case analysis

		Environment Agency (market regulator)	Manufacturer Beta (market participant)	Energy supplier (owns raw energy data)	Bureau Provider (owns checked energy data)	Carbon Consultant (CO ₂ reports & forecasts)
Exchange barriers	Interests	• CO ₂ reductions at least cost across industry.	• Minimise CRC costs. • Regulatory compliance.	• Protect energy supply contracts.	• Diversify away from bill checking services.	• Diversify away from CO ₂ compliance reporting.
	Measurements	• Absolute cost of CO ₂	• Net cost of CO ₂	• Scale of potential CRC compliance service fees.	• Scale of potential CRC compliance service fees.	• Data volumes for CRC compliance service.
Representational barriers	Results	• CO ₂ costs of £12/tonne during phase one.	• CO ₂ costs <1% of energy costs during phase one.	• CRC compliance service fees of ~£20-50k.	• CRC compliance service fees of ~£20-50k.	• Data volumes involved in CRC compliance service necessitate automation.
	Descriptions	• Market based mechanism incentivising capital efficient CO ₂ reductions.	• Compliance mechanism similar to previous environmental regulations. • CO ₂ costs not material. • CO ₂ compliance reporting now a core capability.	• CRC fees small compared to energy contracts. • CRC is account management issue for existing energy customers.	• CRC fees comparable to current contracts. • CRC is opportunity to sell new CO ₂ compliance management services.	• Database providers to commoditise CO ₂ compliance services in less than 5 years. • Prompt to exit CO ₂ compliance service.
Normalising barriers	Measures and methods of measurement	• Absolute cost of CO ₂ in £/tonne, as set by government auction.	• Net costs of CO ₂ , as a percentage of annual energy spend.	• Potential CRC compliance service fees, set by number of sites.	• Potential CRC compliance service fees, set by number of sites.	• Data volumes for CRC compliance service, set by number of sites.
	Rules and tools	• Annual CO ₂ auction, league table, and rebates by league table position. • Significant penalties for non compliance.	• Policy prohibiting speculation prevents full CO ₂ market participation. • Compliance manager recruited to run CO ₂ reporting database.	• Environment Agency mandates provision of annual energy statements to Manufacturer Beta as CRC participant.	• Checked energy billing data to form basis of CRC reporting.	• Introduction of suitable database provider for use by new in-house compliance manager at Manufacturer Beta.
Barrier catalysts	Technical considerations	• Market based approach required to retain control over reduction target.	• Incomplete central record of UK estate (sites & energy supplies).	• Energy consumption data is too 'raw' for direct use in compliance reporting.	• Automatic meters and better billing undermining bill checking services.	• Excel templates unable to cope with volume of data requirements for CRC.
	Time constraints	• Aiming for 26% cut in UK CO ₂ emissions in 10 years.	• Data required by scheme start in April 2010.	• Too late to build internal database system.	• Too late to build internal database system.	• Too late to build internal database system.
	Uncertainty	• Market response to CO ₂ targets can't be predicted.	• Variable price of CO ₂ in phase two.	• Future energy policy's affect on energy market.	-	-

The analysis above aims to answer research questions 2, 3 and 4 by exploring the representational, exchange and normalising efforts observed during the formation of this new market for CO₂. Research question 5 asked whether barriers to market formation can be identified which help explain the partial failure of the market. These barriers lie within the analysis above, for example in the tensions between the Environment Agency's and Manufacturer Beta's representations of the Carbon Reduction Commitment. The Environment Agency represents the Carbon Reduction Commitment as a market based approach to delivering CO₂ reductions at least cost across industry, while Manufacturer Beta represents it as a compliance based mechanism. A further barrier is that Manufacturer Beta cannot engage fully in the CO₂ market, due to corporate policies prohibiting speculation. We do not propose specific barriers to the formation of the CO₂ market covered by our case study. Instead, we propose a typology of barriers based on exchange, representational and normalising practices of markets, and introduce a fourth category of catalytic barriers which underpin or multiply the affects of barriers.

CONCLUSIONS AND FURTHER RESEARCH

In this paper we proposed a typology of barriers to market formation. We also gave a brief review of the business literature on markets for CO₂, since it is important for our empirical research setting. Our research was based upon a case study of market formation within the real-life context of the launch of a new market for CO₂ in the United Kingdom. The case study demonstrated a manufacturer's preparations ahead of the launch of the United Kingdom's Carbon Reduction Commitment.

Based upon the theoretical review and our empirical findings, we proposed a typology of four categories of barriers to market formation. These relate to 'normative', 'representational', or 'exchange' market practices, plus a fourth set of 'catalytic barriers' which underpin or multiply the strength of the first three barriers. Exchange barriers relate to exchange practices and the supporting activities which accompany them. Representational barriers impede efforts to depict the operation of markets. Normalising barriers impede efforts which aim to introduce normative guidelines of how a market should work. Finally, catalytic barriers are proposed as underpinning or multiplying the affects of other barriers. These catalytic barriers include technical considerations, time constraints and uncertainty.

The present study demonstrated markets are institutional structures that cannot be taken for granted. An in-depth understanding of the four categories of barriers to market formation is highly relevant, because these barriers may impede exchanges that thus impede the creation of value. Understanding barriers to market formation implies "that systems or subsystems can be evaluated in terms of comparative ease or facility with which voluntary exchanges, contracts or trades may be arranged between and among members of the community" (Buchanan, 1988: 135). In this regard, further research may provide new insights about the comparative difficulty or constraints that impede voluntary trades. For example, it would be useful to study the incentive and interest compatibility among different actors as well as the perceptions of them. It appears that catalytic barriers such as technology, time and uncertainty play a critical role. Further research on these catalysts may help us improve our understanding of the inter-linkages between normative, representational and exchange barriers. The present study has hopefully provided a platform for this new exploration.

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