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DoW	<p>Task description This task will include the identification and validation of business models and strategies to enable the application of the tools developed in WP5 beyond the cases of study. These strategies will be framed by the Sustainable Energy Action Plans (SEAPs) required by the Covenant of Majors. SEAPs will include considerations of the following sectors; Built environment, including new buildings and major refurbishment; municipal infrastructure (district heating, public lighting, smart grids, etc); intelligent energy behaviour by citizens, consumers and businesses; land use and urban planning; citizen and civil society participation; decentralised renewable energy sources; public and private transport policies and urban mobility.</p> <p>Deliverable description The report outlines the implementation strategies and business models for the SEMANCO Platform and tools. This report will present business-model-canvases (business models) detailing building blocks of possible business models to enable the application of the tools developed in WP5 beyond the cases of study. These building blocks will include customer segment, value proposition, key activities, key partners, key resources and customer relationship, channels (communication, distribution and sales) cost structure and revenue stream.</p>			
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EXECUTIVE SUMMARY

The work presented in this report is the output of Task 6.3 “*Identifying implementation strategies and business models*” in the SEMANCO project. The aim of which is to identify and validate business models and strategies to support the application of the SEMANCO platform beyond the current three case study areas in Denmark, Spain and the UK.

For the scope of this study, *a business model is defined as the rationale of how an organisation creates, delivers, and captures value from delivering products and services* (Osterwalder & Pigneur, 2010).

The first step in developing business models for the SEMANCO platform is the identification of customer segments with a potential interest in its commercial exploitation. This research identifies potential customers throughout Europe with an organisational interest in energy assessment in the built environment or the integration of energy related data. These include municipalities, energy companies, social housing providers, environmental consultancies, software companies, special interest charities, community groups, professional institutions and research organisations.

For each of the potential customer segments identified, an example business model is produced. Following this the findings from a risk assessment to identify the likelihood and severity of commercial risks in each of the business models developed is presented. This assessment points to a business model focusing on the provision of direct and indirect services to different public sector customers as being the most promising.

External validation of key elements of the most promising business model (customer segment, value proposition, customer relationships and communication channels) was undertaken with stakeholders. The findings from this validation combined with an internal review of these findings by the SEMANCO consortium provide recommendations for the technological development of the SEMANCO platform and the requirements for commercial exploitation beyond the current project case study areas. These include:

- Establishing a non-incorporated joint venture (JV) that involves some or all of the current SEMANCO project partners as the potential provider of the services;
- Drafting a time-limited memorandum of understanding (MoU) for partnership working that limits financial liability and supports project development opportunities including the addition of new partners where necessary;
- Where possible, the non- derivative software and source code from SEMANCO should be in the public domain free of cost with a requirement for all future modifications and extensions to this code to also be freely available under a General Public License;
- Where possible, the provision of unrestricted open-data sets and data sources are made available under an appropriate public domain license that allows other users to build non-commercially upon the work while crediting SEMANCO and maintaining the open-data sets in any derivative work;
- The production of an additional case study that utilises and demonstrates this software / data and illustrates the changing requirements of the public sector as the key target customer segment for SEMANCO;
- The development of a consultancy support ‘package’ for data management, analysis, visualisation and reporting;
- The development of an Energy Services Platform portal to promote the SEMANCO platform and provide potential customers access to the tools on the platform.

1 INTRODUCTION

1.1 Purpose and target group

The work presented in this report identifies business models to enable the application of the tools developed in SEMANTCO project beyond the initial case study areas. It is of interest to those involved in the application of ICTs to urban planning in both research and business spheres and potential customers that could benefit from the application of the SEMANTCO platform. The information obtained through this task is also of interest to the SEMANTCO partners as it directly informs future exploitation plans for the SEMANTCO platform, associated tools and services.

1.2 Contribution of partners

Teesside University led the work presented in this report supported by NEA, RAMBOLL, FORUM and POLITO. In addition the business models developed were reviewed and fine-tuned during meetings and technical workshops involving the whole SEMANTCO consortium. All of whom therefore contributed to the findings presented in this research.

1.3 Relations to other activities in the project

Figure 1 illustrates the relationship between the work and the other activities in the project.

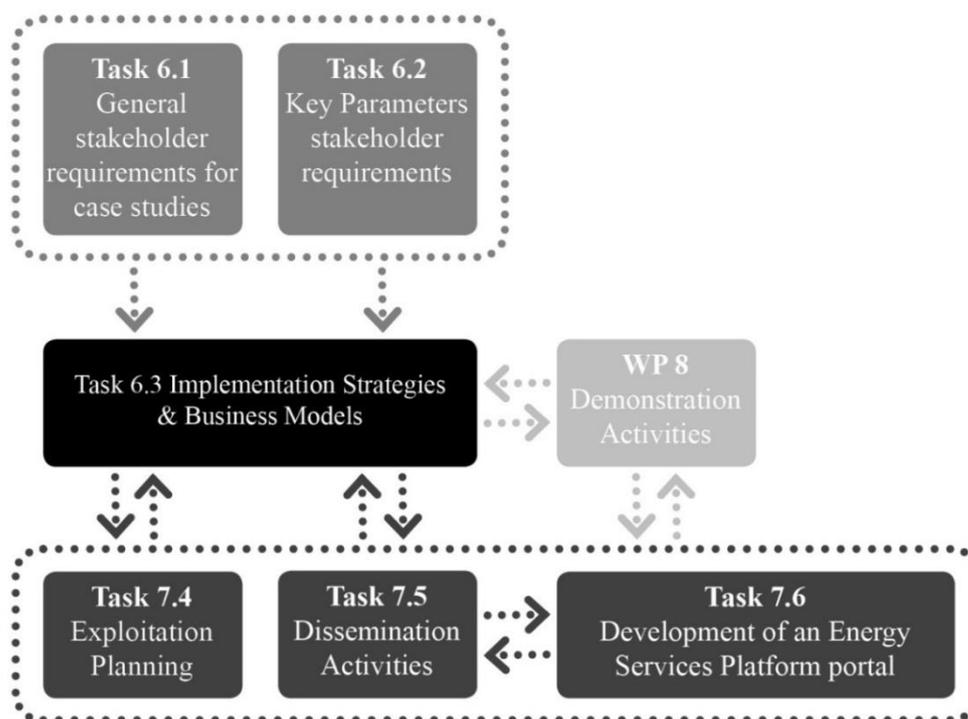


Figure 1. Relationship between the work presented and the wider research within the SEMANTCO project

Work conducted as part of Work Package 6 provided the basis for identifying the customer segments and the outline business plans. Activities undertaken as part of Work Package 7 supported the internal testing of these plans while stakeholder engagement carried out alongside the demonstration activities in Work Package 8 supported the external validation of the business plans. The conclusions inform the Exploitation Planning (Task 7.4) and recommend the development of an Energy Services Platform portal (Task 7.6) to promote the SEMANTCO platform and associated tools and provide future customers access to the project outcomes.

2 METHODOLOGY

2.1 Introduction

The SEMANTCO integrated platform provides access to widely dispersed energy related data about cities stored by many different organisations. In this way, the platform supports improved energy analysis based on the assessment of existing data rather than estimates. It does this using semantic data modelling that enables the development of an urban energy model based on the combination of data integrated from multiple sources, tools that interact with the data and users that operate with the data and the tools in the SEMANTCO platform.

For this purpose, the platform provides different kinds of tools:

- **Embedded**; tools which are part of the platform and developed specifically for it;
- **Interfaced**; existing tools (e.g. simulation, assessment) which can interact with other tools and services in the platform;
- **External**; existing tools that can use data exported from the platform and generate data that can be imported to it.

“The open structure of the platform enables an urban energy model to be enhanced when new tools and data –either from existing data sources or from the data generated by the different applications– become available” (Madrado et al., 2013, p. 13). This enables the functionality of the platform to be extended to cater for the requirements of different potential customers.

This chapter presents the methodology used to develop business models to support the application of the SEMANTCO platform and associated tools described above beyond the current three case study areas in Denmark, Spain and the UK. As such it describes the business modelling approach applied and the different methods used to rank potential business models to identify the most promising business model for the future exploitation of the SEMANTCO integrated platform and associated tools.

2.2 The business modelling approach adopted

For the scope of this study, *a business model is defined as the rationale of how an organisation creates, delivers, and captures value from delivering products and services* (Osterwalder & Pigneur, 2010). The business canvas methodology (Osterwalder & Pigneur, 2010) was used to detail the business models developed. Business canvases are a method of representing key aspects of complex business models. The business canvas contains nine elements arranged in a structured format (see Table 2.1). This approach of representing business models provides a ‘hypothesis’ about what the customers want and how these needs can be met through a mix of activities and services. Applying the methodology involves following a sequence of questions (see Figure 2) designed to identify each of the essential elements of business models which are then mapped onto a business canvas (see Figure 3). A collaborative group approach to completing the business canvas is recommended using white boards and flip charts to record initial ideas in group workshops.

Table 2.1. The elements of the business-model canvas

<p>Key Partners</p> <p>It may be impossible a company to own all resources or perform all activities required to offer all value propositions to its targeted customers. Therefore, a partnership would be forged between companies to optimise the allocation of resources and activities, reduce risk and uncertainty, or acquire specific resources and activities.</p>	<p>Key Activities</p> <p>The most important actions an organisation must take to create and offer a value proposition, reach markets, maintain customer relationships and earn revenue.</p>	<p>Value Proposition</p> <p>How a business enterprise creates values for its customers by the bundle of products and/or services that solve customer problems or satisfy their needs.</p>	<p>Customer Relationship</p> <p>Customer relationships describe the type of relationship a company establishes with specific customer segments. In developing customer relationships the aim is to attract new customers, retain existing customers and encourage re-purchase.</p>	<p>Customer Segment</p> <p>Customer segments represent separate profitable customers into different groups with common needs, common behaviours or other attributes. Hence, it is important for a business enterprise to identify groups of people or organisations it aims to reach, serve and generate revenues.</p>
	<p>Key Resources</p> <p>Key resources describe the most important assets required to create and deliver the value proposition, reach markets, maintain relationships with customer segments and generate revenues. Those resources can be physical, intellectual, human capital, or financial.</p>		<p>Channels</p> <p>Channels represent how a business organisation communicates with and reaches its customers to deliver a value proposition. Channels make the customers (1) aware of and (2) help them evaluate the products/services of a company, (3) allow the customers to purchase specific product/service (sales), (4) deliver a value proposition to the customers (distribution) and (5) provide post-purchase support. A right mix of direct (e.g. mass media advertisement) and indirect channels (advertisement and sale through a partner store) is important to fulfil these five functions of channels.</p>	
<p>Cost Structure</p> <p>The most important costs incurred while operating a particular business including creating and delivering value propositions, maintaining customer relationships and generating revenues.</p>		<p>Revenue Stream</p> <p>The source of profits for a company, e.g. through the sale of product/services, commission from suppliers or partners, fees for coordinating suppliers and buyers, fees to rent/lease equipment etc. Identifying the revenue streams provides the profit formula i.e. it describes how the business activity generates value for a business enterprise itself while providing value to customers.</p>		

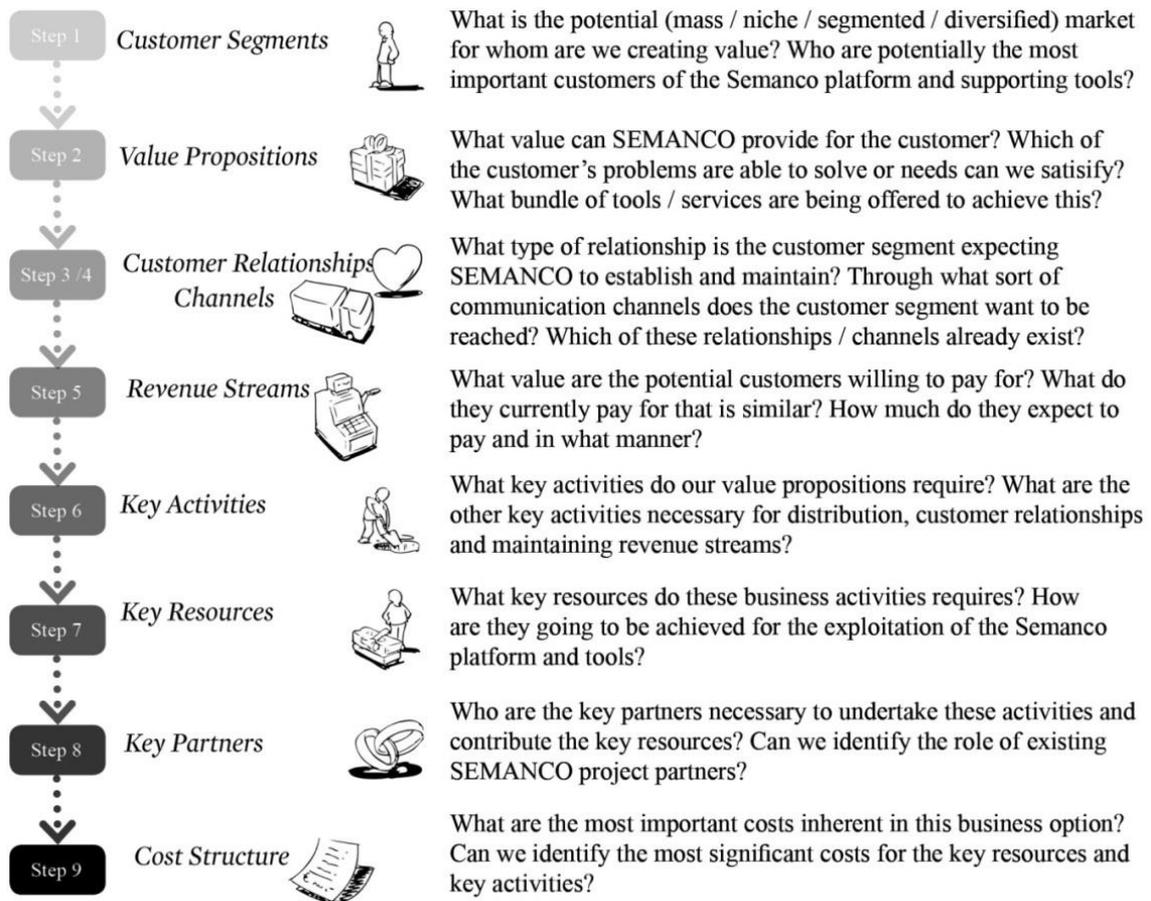


Figure 2. The stages in the development and questions used in the population of business canvases

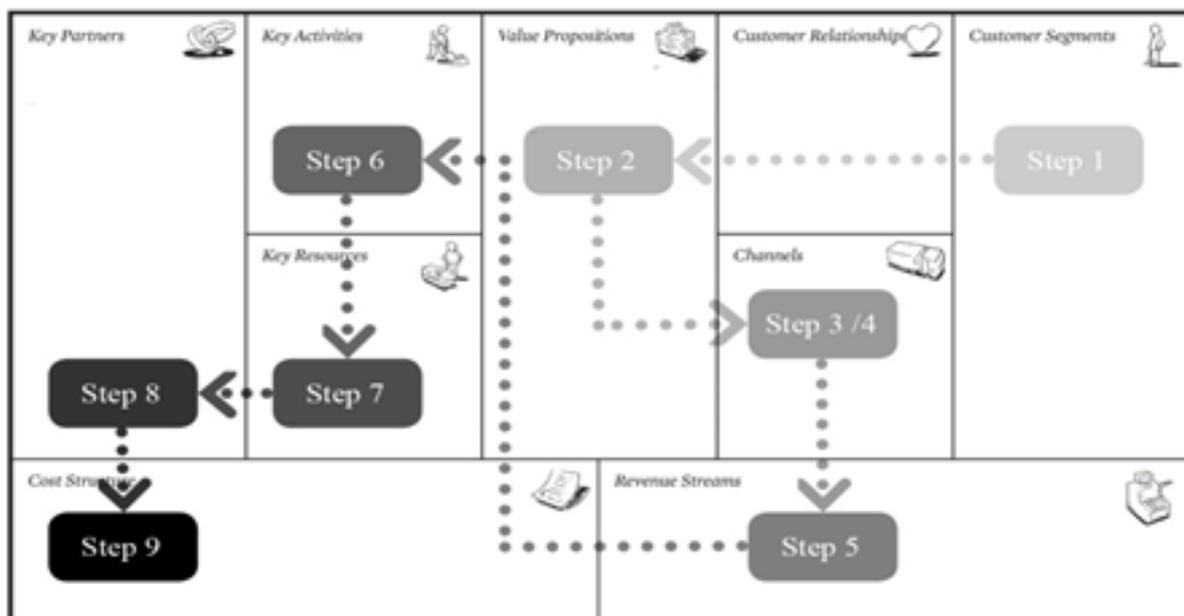


Figure 3. How stages in the development of business canvases are mapped onto the business canvas

Other elements of the previous research also informed the different the different elements of the business canvases as illustrated in the Figure 6.

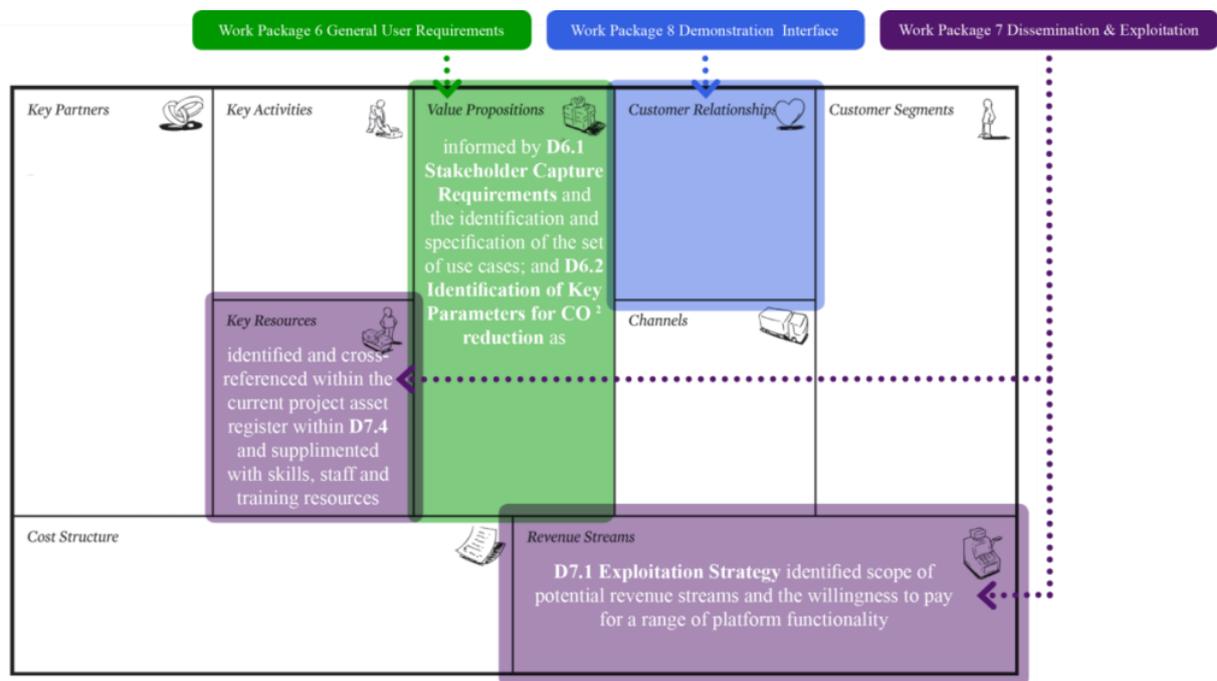


Figure 6. Relationship between 'business canvas' and SEMANTCO work packages

2.4 Risk assessment and ranking methods

Each of the contributors to the individual business plans prepared a standardised risk appraisal that identified the key commercial risks arising from their approach.

The assessment is a scoping of the type, range and potential severity of procedural and technical issues that could prevent the exploitation of the SEMANTCO platform. Each of the business models was considered systematically regarding the threats and risks associated with the practicable implementation of the exploitation strategy. We have used a bespoke framework for preliminary risk assessment based on standard Prince2 project planning and management methodology (Office of Government Commerce, 2009) as the most applicable project management procedure reviewed (Hynuk et al., 2009). Each individual business model tested has its own tabulated framework for ranking and notional commercial risk assessment.

For each business model based on a specific customer segments we have collectively assessed the probability of the 'risk' occurring within a 3 year period, typically the time basis for business planning. We have also indicated the potential impact to the business case arising out of this occurrence and where possible, the steps needed for mitigation against this risk. The risk assessment is included as Appendix A.

In instances where there was a high likelihood of the risk occurring, a high impact due to the occurrence of the risk or no clear mitigation against the risk, these were considered of low or medium viability. In other instances, or relative low risk and impacts, the details of the customer segments were combined into a simplified hybrid business model.

2.5 Review and validation methods

The merged and simplified business model is presented as the most promising approach to exploitation of the SEMANTCO platform and associated tools and services. This business

model was reviewed by the SEMANTCO team and validated with external stakeholders. The key public elements of the business model were validated with external stakeholders while what might be considered the more confidential or private elements of the business model were reviewed by the SEMANTCO consortium partners as the future service providers (see Figure 7).

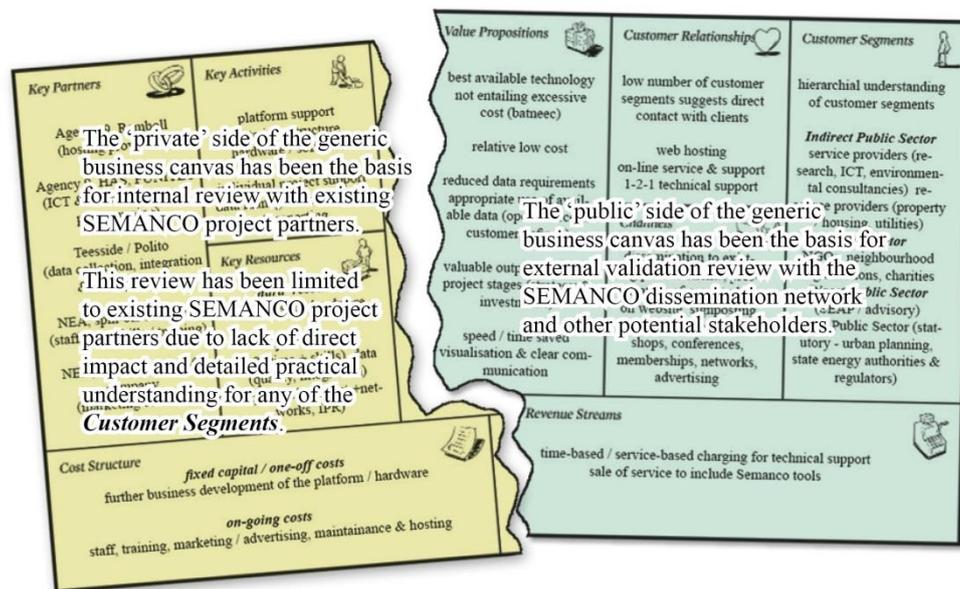


Figure 7. Scope of 'public' and 'private' sides of the preferred business plan

The process employed to validate the business model with potential customers involved a series of informal semi-structured discussions. In most cases these discussions followed a demonstration of the platform and were undertaken at SEMANTCO dissemination events. The participants in the validation were contacted through existing local professional networks and the SEMANTCO dissemination network. Individuals working for an existing signatory to the Covenant of Mayors were targeted to attend these events¹. A full list of stakeholders used for review and validation can be found in Appendix B.

¹ As of 24th March 2014, each of the project partner nation states had the following SEAPs submitted as draft or accepted: Denmark 27, UK 27, Sweden 44, Germany 52, Spain 933, Italy 1832.

3 SCOPING AND RANKING POSSIBLE BUSINESS MODELS

3.1 Introduction

This chapter identifies the scope of the potential *Customer Segments* for the SEMANTCO platform and provides outline business models focusing on each of the customer segments identified. It summarises a risk assessment and ranking of these business models and outlines the most promising business model to underpin the future exploitation of the SEMANTCO platform. The business models presented range from those involving the full commercialisation of the SEMANTCO platform and tools, through to business models for not-for-profit exploitation.

The *Customer Segments* considered as potential customers for the SEMANTCO platform and tools are:

- Municipalities
- Energy companies
- Property management companies
- Technology companies
- Sustainability consultancies
- Professional institutions
- Research organisations
- Charity/community groups.

The envisaged service supplier is a partnership between some, or all, of the SEMANTCO consortium. In some cases it includes working with external partners.

3.1.1 Delivering services to municipalities

This section considers a business model (see Table 3.1) to supply services to European Municipalities that have signed the Covenant of Mayors. As such they have made a commitment to produce a strategy (e.g. SEAP, Sustainable Energy Action Plan) to reduce the level of carbon emissions.

As the signing of the Covenant and the production of a SEAP is voluntary on the part of the municipality, it is generally undertaken by strongly motivated organisations. Typically, there is a mixed interest around major capital investment programmes² as well as statutory planning requirements for forward planning and monitoring. This reflects the often conflicting roles of local government across European as both promoters and regulators of sustainable urban development. As illustrated in table 3.1, there are two board types of requirements within this *Customer Segment* related to (1) statutory planning functions of the municipality and (2) corporate planning roles of the municipality. The former includes requirements for the development of a robust evidence base, suitable for testing at examinations in public or public / planning inquiries. This ‘tested’ evidence can inform spatial planning policies including the broad quantum, distribution and quality of development anticipated within a statutory planning period.

² Typically this is direct construction work for strategic infrastructure and urban regeneration, or similar activities undertaken in partnership with private sector construction partners.

Table 3.1. Municipality Customer Segment Business Plan

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
<p>Ability to deal with public procurement arrangements and contracts. Capacity for recruiting and retaining skill with key software and data handling skills (Agency 9, Polito, NEA).</p> <p>Ideally supporting direct partnership working with SEMANCO.</p>	<p><i>Time</i> 1. <i>maintaining</i> / updating the on-line platform,</p> <p>2. <i>data integration</i></p> <p>3. technical support</p> <p>Identify the CO₂ emissions of existing domestic stock and its CO₂ emission reduction potential³.</p>	<p><i>Quality of evidence</i> to support policy making. <i>Speed</i> of data assembly / acquisition. <i>Simplicity</i> in outsourcing the technical aspects. <i>Reduced costs</i> for the municipality – including the scope of using open-source data supplemented with existing corporate data. <i>Reducing risk</i> of legal challenges on the role of both planning and corporate policy.</p>	<p>Download software with one-to-one technical support.</p> <p>Partnership arrangements would facilitate one-to-one contacts with technical users.</p>	<p>The customers are from two specific municipality roles arising from (1) <i>statutory planning</i> functions and (2) corporate planning roles. They comprise mixed professions working within different service area from both urban planning and corporate management.</p>
<p>Cost Structure</p> <p>One-off costs for hardware and software. Significant costs relating to data acquisition. Revenue needed for staffing costs to manage data and for analysis / reporting.</p>		<p>Revenue Stream</p> <p>Time-based fee schedule for one-to-one technical support, data handling, informed analysis and reporting. Additional time-based support as technical witness. Value in the endorsement of the technical partners for informing policies.</p>		

³ This relates to use case UC2-5 (Crosbie et al., 2013).

The requirements related to corporate planning are broader in scope than those related to spatial planning responsibilities and concerns the non-statutory aspects of monitoring the geographical extent of the municipality, including the voluntary / required monitoring of emissions and other socio-economic indicators. This is dependent upon having access to reliable information and analysis to build persuasive arguments for others within the municipality for undertaking action and changing behaviour. For example, emissions monitoring and energy assessments are used as the basis for business planning for a municipality-led decentralised heat network (Greater London Authority, 2011) and the Energy Company for London⁴. In this context, the planning of strategic development sites is considered central to the provision of new district energy infrastructure with the potential and capacity to be expanded to serve wider existing areas. In this context, the monitoring is concerned with actual CO₂ emissions and energy demands at a strategic scale rather than any specific compliance with standard assessment procedures.

The **Value Proposition** for the municipality is centred on improvements to speed, cost and quality of evidence needed within the organisation. The speed of calculation of estimated emissions and monitoring changes to these emissions would both be considered against current practice within the municipality. Monitoring emissions has historically looked at the scale of the individual building and aggregated up to estimate impacts at the neighbourhood or city scale. Internal (to the municipality) work requires skill training and support for existing staff or the recruitment of new staff. External work would, in comparison lack continuity and consistency of work. Lower costs could be achieved by more effective use of any existing in-house data sets. However, underpinning the value proposition would be the quality of the evidence produced. Specifically the level of confidence it allows for informing planning policies or in making investment decisions. Both of these concerns over quality of the results are data dependent. They place significant weight on the quality (accuracy, age etc.) of the data. For example in the UK, there are statutory planning requirements for the production of ‘core strategies’ and ‘neighbourhood plans’ that raise issues around the delivery of land assembly and / or property acquisition through the use of compulsory purchase orders (CPOs).

The municipality may be provided with access to data and platform tools. In this case the most suitable arrangements for **Customer Relationships** would be a mix of day-to-day digital access with ad hoc technical support when required by the customer. The municipality would enter into a contractual relationship with the SEMANCO service provider. The marketing **Channels** for these customer relationships would be established and promoted through a broad range of professional networking events, including conferences and trade shows frequented by technical users from the municipality.

Potential **Revenue Streams** arising from this customer segment are generally related to time-based consultancy services. This is due in part to the potential difficulties for many municipalities for subscription-based funding. Revenue is more likely in respect of time-limited contracts for goods and / or services where SEMANCO can offer access to the platform for free and get paid for the operation of the platform. In practice, this could be in partnership with the municipality; providing training; or as an external consultancy service.

The **Key Resources** required to undertake these activities centre on staffing issues. There would clearly be options to redeploy and train existing staff within the municipality or to outsource activities, and to manage the work through a permanent or time-limited contract. The latter might be attractive as a lower-risk option initially and more achievable due to the software and programming skills required. However, in practice initial contract-staff / consultants are often directly recruited by a municipality following a successful consultancy contract.

⁴ To be named “Energy for London” (Macalister, 2014b) the London authority has obtained an electricity licence from the national energy regulator as the basis for purchasing local renewable energy for some of the major public sector energy users in the capital.

The attributes of the **Key Partners** needed to support this business model are in response, based on the capacity (staffing with the necessary technical skills) to manage some of the generic public procurement actions. There would be clear benefit in the leadership of an existing SEMANTCO project partner who has ‘pre-qualified’ or sits on an approved procurement panel for the supply of energy management software and services. It would also be beneficial to have a good understanding of public procurement processes, including time-limited consultancy, secondment arrangements, training provision and options for service level agreements. Thus, it may be beneficial for an existing municipal client to work directly with a single SEMANTCO project partner who in-turn subcontracts activities.

The underlying **Cost Structure** relates to capital costs on hardware and data acquisition. Hardware costs would be best suited to out-sourcing to or working with a suitable data hosting organisation. Revenue costs are a mix of project development / promotion and direct on-going staffing.

3.1.2 Delivering services to energy companies

This business model presented considers how the SEMANTCO platform could benefit an energy supplier (See Table 3.2). The **Customer Segment** addressed is an energy supplier responsible for the sale of gas or electricity to both domestic and commercial energy consumers.

This customer segment has a growing role in the promotion of energy efficiency and energy saving through the energy end-use and services directive (EES directive - Directive 2006/32/EC) and national level initiatives arising from this directive. Some limited market information gained via national ESCo trade organisations such as the Energy Systems Trade Association (UK) and European Energy Service Company Association⁵ confirms this is the current business situation.

Here we make specific reference to the possible use for project initiation and business planning to support a local ESCo and / or a community-based energy supply company. Several examples of this business approach are currently being developed as alternatives to commercial enterprises⁶. They include options for heat networks and combined heat and power, with the inclusion of a dedicated network of pipelines and (private wire / distribution network) power cables. They tend to be geographically specific, often relating to key urban regeneration and / or growth areas where there is potential for significant new connections to the energy network. There is a clear interest in linking the phased output capacity of the network with the local demand for heat and power.

In this energy company variation there are wider socio-economic benefits that are often explicit within company policies and controls. These benefits can include the reduction of carbon emissions from the operation of buildings (mixed commercial and domestic) higher environmental standards (potentially attractive to inward investment from business operating their own environmental and ethical standards) in the reduction of a municipal carbon footprint, affordable warmth and the reduction of local fuel poverty.

⁵ <http://www.eu-esco.org/>

⁶ Examples demonstrated under Task 6.2 (Niwaz et al., 2014) include the Leicester Square Mile project and the proposals by Gateshead Council for a localised heat and power network within the Town Centre and the regeneration of Gateshead Quays / Gateshead BIG project sites.

Table 3.2. Energy Company Customer Segment Business Plan

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
<p>Attributes of the partners. Possible partnership with an existing ESCo, particularly a not-for-profit provider (charity and / or community interest company).</p> <p>National Energy Action using similar arms-length business structure to the existing WarmZones⁷.</p> <p>Demonstration of application with community energy company and / or municipal partner with interest in local energy infrastructure.</p>	<p>Analysis of energy demand, reduction and provision of renewable energy. Calculate the costs and CO₂ emissions from district heating systems. Analysis on the viability for a decentralised ESCo. Networking⁸. Sales. Bespoke project utilising the technical platform.</p> <p>Map / visualisation of potential of local energy sources⁹.</p>	<p>Support for <i>forward planning</i> for investment into strategic infrastructure for energy (heat & electricity) distribution.</p> <p>Linked planning for <i>future energy demand</i> planning and assessment.</p> <p>Explicit <i>de-risking</i> (evidence based on geographical targeting of investment) for investors.</p> <p><i>Evidential support</i> for statutory planning, carbon planning and use of smart card (<i>demand-side management</i> and consumer behaviour activities).</p> <p>Trust.</p>	<p>Given the limited absolute number of energy companies this would be through direct one-to-one client contact.</p> <p>Community scale organisation managed through trust-based network contacts.</p>	<p>The customers anticipated from energy supply companies.</p> <p>Subtle differences due to scope and scale of the organisations can be understood as;</p> <p>(1) <i>centralised</i> large scale and mostly privately-owned energy supply companies operating at regional, national scale(s) and above. Mixed activities around long-term supply and distribution networks;</p> <p>(2) <i>decentralised</i> local and small scale ESCo that include <i>community scale</i> energy provision.</p>
<p>Cost Structure</p>		<p>Revenue Stream</p>		
<p>Baseline costs for the platform plus ‘bolt-on’ additional cost to an existing programme or project.</p>		<p>Provided through bespoke project support as a one-off strategic investment decision.</p>		

⁷ <http://www.warmzones.co.uk/> Warm Zones CIC is a Community Interest Company wholly owned subsidiary of National Energy Action.

⁸ These relate to use cases UC6-N and UC1-N (Crosbie et al., 2013).

⁹ This relates to use cases UC4-C (Crosbie et al., 2013).

The **Value Proposition** to an energy supply company is dependent upon their scale and relates to the business benefits gained from effectively guiding strategic investment decisions. These are typically mixed investments relating to management of supply, energy distribution and demand-side management. Specifically, there are current problems in finding a viable value proposition for many small scale consumers interested in renewable energy and energy efficiency (Richter, 2013). Often these are seen as threats to the prevailing energy business models.

The most significant potential is whenever the ESCo works to an ‘invest-to-save’ business model or a form of Energy Performance Contracting (EPC) model. The customer segment would be undertaking mixed activities around demand side management, including the retrofitting of properties and the provision of renewable energy supply (Konstantinos et al., 2006). In this instance the value proposition is in risk reduction within a business model where the major risk of anticipating future energy demand has already been transferred to the ESCo. Better evidence used in predicting and managing energy demand also has clear value in helping the ESCo access finance, with more finance options and lower / better loan rates to support investment in energy efficiency activities. Within this context, better evidence can have a real value in accessing better project finance. There are several examples where a municipality both undertakes capital work and acts as a refinancing bank, providing better rates whenever commercial loans are up for renewal, in effect lowering the repayment rates.

Additionally, some of the potential areas for growth in energy performance contracting have been identified¹⁰ in larger European cities and metropolitan regions. Again however, there has been a “... lack of knowledge, experience and expertise in applying the EPC model (energy performance and verification of the guaranteed savings), precisely because there is very limited use up to now of this contract model in Catalonia and the majority of companies haven’t available trained and skilled technicians.” (ICAEN, 2013, p.5). Better knowledge on potential performance will overcome some of the barriers and help to access finance for infrastructure and fabric investment.

There are alternative approaches such as the “Big Deal” (Taylor, 2014) that start from the basis of energy planning on a collective community basis – collective bargaining with the exploitation of the soft and intangible resources of trust, or at least relative trust compared to the operation of the big energy providers. This is the basis for the production of a community energy plan and how it will work best if fully integrated with stakeholder aspirations and requirements, the current development demands and options for future changes (Shaw et al., 2006). SEMANTCO meets all of these expectations and has the additional value proposition in helping to access suitable ‘outcome’ related finance, specifically funding that is dependent upon tackling climate change.

Gathering of business lessons from municipality-led district heating schemes indicate there are several significant procedural barriers to the establishment of viable decentralised heat systems. These arise out of a heavily centralised energy market and the lack of supportive or persuasive policies to establish decentralised energy networks in local planning policy. Yet underpinning any investment to support the establishment of a heat network is an understanding of the whole life costs. Initial start-up project stages will remain the most challenging as the upfront development costs are high but the marginal running costs are significantly lower. Initial capital costs “... are typically recovered by above-marginal-cost charges for heat, with business models requiring a number of years to break even. The lifetime costs of the system can be reduced by maximising the heat delivered, targeting areas of high heat demand and recruiting users with diverse daily and seasonal heat demand profiles” (Hawkey et al., 2013, p.23).

Yet, beyond these economic considerations, social factors can potentially limit the long-term

¹⁰ <http://eesi2020.eu/>

viability of a decentralised heat network. Integration with regeneration, refurbishment programmes carry significant impacts that have proved difficult to anticipate, estimate or coordinate.

The role and organisational attributes of the *Key Partners* have been described (Hannon et al., 2013) as requiring technology, financial and technical partners. These partners would bring along the following *Key Resources* and provide the appropriate advice and support. Technology partners would support the technical knowledge of decentralised energy provision, fuel supply-chains and distribution costs. Financial partners would bring along assistance with the necessary expertise in the establishment, financing and development of SME demand-management projects. This would include a mixed knowledge of capital and revenue options. Technical partners would assist with the ‘customer-facing’ services for operation. One more abstract resource is professional competencies and organisational trust. This type of ‘Trust’ is increasingly an important concern regarding the uptake of any energy efficiency measures, with many consumers / customers not being convinced by the supporting evidence. One example is the UK’s national Green Deal Finance Company (part owned by Government) having a complaint upheld against them regarding misleading details regarding the cost of refurbishment interventions and supporting loan finance. (Macalister, 2014a). This is in addition to the growth in direct pressure-selling and scamming (Which, 2013) that has added to the public mistrust of many large energy companies.

3.1.3 Delivering services to a property management company

The *Customer Segment* considered in the business model outlined in this section (see Table 3.3) is a large housing association or local municipality with responsibility for the operation and management of social housing¹¹. Operation and management responsibilities can be at the level of drafting local housing policy to guide and support an Arms-Length Management Organisation (ALMO) or through a direct facility management role.

Many recent changes in the housing market and the provision of social housing have brought about changes within the wider housing construction / refurbishment sector. There has been a transition towards improvements to environmental efficiency of housing that address ‘standardised’ approaches in combination with greater emphasis on demand management through information and behavioural or operational changes (Horne, 2012). In this customer segment there is still a separation of property and occupant in ‘standardised’ approaches to the calculation of energy efficiency in buildings and the resultant emphasis on linking the estimated or ‘standardised’ approach to building performance. In this context, there are often simple estimated costs of investment and energy efficiency interventions used as the best available method for informing significant investment decisions (Anisimova, 2012).

Technical solutions are integrated with fiscal and policy implications, especially when there is often the explicit consideration of capital investment intending to reduce revenue costs for the organisation. Pay-back rates arising from any ‘pay-to-save’ policy approach or programme are more and more important as part of strategic investment decisions (James, 2012). Supporting these sorts of decisions with good evidence from a trusted source will be part of the key *Value Proposition* for the complex customer segment.

¹¹ Social housing is a regulated form of housing that provides secure tenancies at low or affordable rents and that is allocated on the basis of need. Distinct from privately owned property, it is typically owned and managed by municipalities, not-for-profit housing associations or charitable trusts as is subject to higher standards of energy efficiency, space provision and quality. These statutory requirements are often linked to public rent subsidies.

Table 3.3. Property Management Company Customer Segment Business Plan

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
<p>‘Trusted’ service providers and experienced socio-economic consultancies (Ramboll).</p> <p>Geographical / property based data management and visualisation capabilities (Agency9).</p>	<p>Optimise multi-occupancy building renovation in terms of cost and CO₂ emissions.</p> <p>Calculation of build costs, revenue liabilities and CO₂ implications of different options for a variety of refurbishment specifications¹².</p>	<p>Accessing better loans rates / prudential borrowing.</p> <p>Cost effective evidence used to inform investment decisions on energy efficiency (stock energy efficiency).</p> <p>Consideration and visualisation of options. Better communication of refurbishment options with tenants and company executive / board.</p>	<p>Managed as supporting consultancy arrangements with one-to-one contact.</p> <p>Offer of formal project management arrangements for bespoke arrangements.</p>	<p>Large-scale asset management organisation such as a regional social housing provider or management company responsible for public sector housing.</p> <p>Arms-length management company responsible for property / facility management and maintenance.</p> <p>Development arm of existing social housing provider interested in provision of new build housing development.</p>
	<p>Key Resources</p> <p>Quality data sets on building geometry, condition and energy performance. Associated metadata requirements.</p>		<p>Channels</p> <p>Web-based promotion.</p> <p>Exploitation of existing professional networks and contacts.</p>	
<p>Cost Structure</p>		<p>Revenue Stream</p>		
<p>Baseline costs for the platform plus area-specific data acquisition. Staffing and project management arrangements.</p>		<p>Provided through bespoke support as a one-off project. Inclusive budget for time and data / resources.</p>		

¹² These relate to use cases UC2-N and UC3-N (Crosbie et al., 2013).

There is a diverse mix of social housing organisations in Europe. Most have a growing interest in delivering energy efficient refurbishment (Rahola & Straub, 2013). Here the use and the value proposition of the SEMANCO platform are supporting decisions around the most cost-efficient delivery model or procurement route able to achieve the necessary reductions in carbon emissions. Studies have suggested that; with the variety in size and type of social housing providers throughout Europe; most will be interested in accessing better evidence and information as the basis for raising third-party finance to undertake retrofitting activities (Salcedo et al., 2011). This may require a flexible and mixed method approach to financial assessment, looking at a mix of payback periods, discounted cash flows, net present values¹³, initial rate of returns and whole life cost analysis¹⁴. What is clear is that within this particular customer segment there “... is the necessity for proper investment appraisals ... (with a) ... (p) roper methodology (that) includes the consideration of irrevocability and preclusion ... (as it is) ... particularly valid for the “economic studies” that support the EU Buildings Directive” (Verbruggen et al., 2011, p.913).

Part of the value proposition is currently valid because “... available information (on energy consumption in buildings) is clearly insufficient and not proportional to its importance. It is not considered as an independent sector and there is a lack of consistent data which makes it difficult to understand the underlying changes that affect energy consumption in this sector” (Pérez-Lombard et al., 2008, p.398). Increasingly, the use of sample databases to provide meaningful estimates of energy saving from retrofitting work have shown there is clear value in “(c)reating a data framework that is based on well-structured and consistent data of a high quality (as it) begins to lay the foundations for a stronger connexion between evidence and policy” (Hamilton et al., 2013, p.479). Where this cost-based evidence can directly relate to existing policy programmes and initiatives¹⁵, the value to the customer will be greater with more staff time saved. Better information is data of higher quality and improved potential for integration. This type of ‘better information’ will be valuable in overcoming many of the transitional barriers to uptake and interventions. For example, a better understanding of growing capital values following refurbishment as one additional way of overcoming market take-up (Tuominen et al., 2012). It seems that most approaches to energy assessment within the customer segment already use publically-available data sets and calculation software for area-based calculations (Cheng & Steemers, 2011). Thus, the additional value to the customer is around the integration of financial costs and energy semantic datasets to inform strategic decision-making (Atkinson et al., 2009).

For most social housing providers, there is also growing complexity over the relationship between ‘hard’ substantive measures (often a limited range of ‘allowable’ physical measures and specifications) and ‘softer’ issues regarding funding, information, cost data and regulatory requirements for accreditation (Home and Communities Agency and Sustainable Homes, 2012). However, in this context, there are also opportunities with guidance and suggestions for social housing providers to extend the scope of activities to allow for direct works on their own properties and those under other ownership. Where the customer is directly undertaking energy efficiency work, the value of accurate data and costs becomes more significant. With regard to *Channels*, some recommendations already state that “... web-based tools should be used to disseminate information and allow self-assessment by residents of the potential for energy and emission reductions in their home” (James, 2012, p.16). Here, there is potential for some of the SEMANCO assessment tools to fulfil this recommendation. This would be expanded to understanding *Customer Relationships* as an extension of existing professional networks.

¹³ For example of an assessment of ‘net present value’ in low energy housing refurbishment see Kumbaroğlu & Madlener (2012).

¹⁴ Detailed consideration of whole life-cycle costs see Menassa (2011) and Heo et al. (2012).

¹⁵ For example in the UK these already include: the Feed-in Tariff, Renewable Heat Incentive, Green Deal, ECO Supplier obligation and proposed changes in energy efficiency standards within the Building Regulations.

The **Key Activities** for this customer segment is basically a mix of housing stock modelling and optimisation. There will be more of an emphasis on any initial business proposition stages and an examination of options and impacts. This would be relatively labour intensive due to the number of possible variables and the need for additional sensitivity testing¹⁶ around assumed cost of physical works and future fuel / operational costs. As the value proposition is also around an energy and cost model, the corresponding key activities relate to the creation and integration of an appropriate financial model. Here there is some useful overlap between the assessment of pay-back periods for capital investments and the growing interest in the use of energy performance contracts (Milin et al., 2011) for social housing providers.

The **Cost Structure** underpinning this would be project specific costs (staff time, third-party data acquisition and management) with a proportion of business development and establishing the SEMANCO platform. These costs would have to be the basis for the calculation of the **Revenue Stream** using some assumptions on a potential number of projects or contracts around the sharing of the baseline costs for establishing and maintaining the SEMANCO platform.

3.1.4 Delivering services to a technology company

The **Customer Segment** considered in the business model presented in this section is an information technology company that is interested in adding the SEMANCO platform and tool to existing commercially available software packages (see Table 3.4). Here, the focus is on the current industry-standard software packages where add-ons can be provided and have been proven to work commercially.

Recently, the IT industry is beginning to address the ‘fuzziness’ within ICT business planning (Al-Debei & Avison, 2010). It is also the case that ICT based tools are only beginning to address the potential for web-based semantic tools for design and decision-support (Anumba et al., 2008) with multi-agent (stakeholder) tools for collaborative use and sharing of data (Ren et al., 2011). There are indications that many ICT providers have identified the market potential for semantic / big data.

“The opportunities to improve efficiencies and create valuable new business models associated with the Industrial Internet are vast. To do so, however, requires the development of specialised platforms, data models and analytic capabilities to meet the many unique and critical requirements associated with industrial data, workloads, and processes. The companies that make up the industrial sectors, manufacturers of industrial equipment and technology vendors must work together to develop the platforms and technologies needed to leverage the Industrial Internet” (Kelly, 2013). In this context, the **Value Proposition** is the ability of such ICT providers to offer sophisticated optimisation tools that make use of big data around energy modelling and consumption.

There has long been a recognisable urban management function for ICT (Crilly & Mannis, 2000) and particularly GIS being used to integrate data on a spatial basis. Increasingly the quantity of available data is initiating many interesting approaches to data integration on a wider scale and scope. Future ICT applications and tools would consider energy controls as an element of smart (and remote) city management (Baudoin, 2014) where objects are capable of collecting data and environmental and energy monitoring are at the forefront of the exploitation of the ‘internet of things’ (Giusto et al., 2010). In this world of big data, businesses are looking at the integration of the ‘warehouse’ (Inman, 2005) of commercial data with open-source social media data (Berlanga et al., 2014) with most commentators suggesting that the value lies in expanding the quality of customers through the provision of free-access software.

¹⁶ This will be an issue to consider as it is unlikely to be a simple linear relationship between cost of works / interventions and scale. Sensitivity analysis would be needed to consider any economics of scale and to include regional / national cost variations.

Table 3.4. Information Technology Company Customer Segment Business Plan

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
<p>Ability to provide specialist coding skills in the development of potential ‘add-on’ to existing software (Agency9, UoT, POLITO).</p>	<p>Data collections, mining, input, formatting, editing.</p> <p>Development of ‘add-on’ package that addresses interoperability, import and export functions.</p>	<p>Provides additional functionality to existing ‘products’.</p> <p>Reinforces their software as industry standard.</p> <p>Explicit support for using open-source data has the potential to extend software use.</p>	<p>Direct contact and negotiation.</p>	<p>ICT companies providing existing modelling and decision support tools within the architectural and construction industry.</p>
	<p>Key Resources</p> <p>Staff specialisms in computer coding, energy efficiency calculation methods.</p> <p>Underlying databases. High specification computer hardware.</p>		<p>Channels</p> <p>Targeted ‘word-of-mouth’ social networking communications.</p> <p>Initial networking through trade shows and demonstration project web site.</p>	
<p>Cost Structure</p>		<p>Revenue Stream</p>		
<p>Negotiated approach with host organisation(s) prior to undertaking any further business development. Cost would reflect staff time plus data with agreement over use of coding.</p>		<p>Different options for licensing arrangements for the use of database and bespoke coding ranging from time-based to quantity of user. Ideally this would develop into purchase of the licensing by host company.</p>		

It is currently a time of rapid ICT technological change. Decisions on the potential investment in ICT within many design organisations and businesses will be based on the relative benefits of software to save on staff time (Goulding & Lou, 2013; Versteeg & Bouwman, 2006). Through this review we have identified emerging ideas for a demand-side business model that recognises the value of open-source data that is well structure. Quality data that is well structured has been proven to attract much larger number of uses and thus potential revenue. Albeit, that this *Revenue Stream* is dependent upon a combination of licensing and advertising. It is the metadata (value in dating, geo-referencing, formatting, accuracy / precision etc; Coots & Smart, 2010) in effect that creates the real value proposition within the business model.

With any ICT based decision-support system, the *Key Resources* will be the underlying databases (Doukas et al., 2009) to be integrated into the SEMANCO platform. The *Key Activities* will be input from the databases. These tasks will be time dependent and require on-going maintenance and regular updating. This will be particularly around the scope of possible interventions and associated costs.

The appropriate *Cost Structure* for the provision of these activities would have to be determined through negotiation with any potential host company within this customer segment.

The most appropriate *Channel* is considered as a targeted ‘word of mouth’ marketing strategy, using key influencers within the ICT industry. This is already the marketing basis of many ICT based companies and is recognised and supported through the work of The Word of Mouth Marketing Association¹⁷. In this context, a key influencer is someone who has a greater than average capacity to influence stakeholders as a result of their centrality to social / professional networks. They can be advocates, ambassadors, citizens, professionals or celebrities (Word of Mouth Marketing Association, 2013), albeit, for the SEMANCO platform, the key influences would be in the professional category and have influence arising from their academic and / or professional expertise in the field of energy efficiency. This approach borrows from the business plans of social media companies (Piskorski, 2014) where ultimately it is the uptake, use and level of interactions that generate data and lead to a sustainable business.

3.1.5 Delivering services to a sustainability consultancy

The potential *customer segment* considered is a small to medium sized consultancy providing technical support on sustainability and energy planning to a range of existing clients. This customer segment is limited to SMEs as in many larger / trans-national consultancy organisations there are already significant elements of in-house research and development capabilities that SEMANCO would not be able to compete with around specialist bespoke ICT tools. It is also the expectation that a significant proportion of the existing clients will be based within the public sector.

The *Value Proposition* for an environmental consultancy is cost-based around the ability to provide an additional in-house service to existing clients rather than resorting to out-sourcing and subcontracting. Within this new in-house capability is the value achieved around the approach to simplified energy modelling. Simplified modelling uses reduced levels of data that is typically more appropriate for initial feasibility and options studies for energy modelling above the individual household (meso) scale. The use of simplified data can help to overcome the limitations regarding the actual availability of data. It can still achieve a similar high degree of accuracy (for example see Reilly et al., 2013; Kokogiannakis et al., 2008) compared to accepted ‘standardised’ approaches that use many more input variables. Such simplified methods of assessment are consistent with international standards and the EU Energy Performance of Buildings Directive.

¹⁷ <http://www.womma.org/>

Table 3.5. Environmental Consultancy Company Customer Segment Business Plan

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
<p>Anticipated key partner support required includes the ability and ownership of web-based hosting platform (Agency 9).</p> <p>Options for direct partnership or out-sourcing or subcontracting through the use of SPV (special purpose vehicle) organisation.</p> <p>Existing project partners who currently provide technical consultancy services (Ramboll, NEA).</p>	<p>Maintenance of the supporting platform (minimal activity), through to the development of specific / bespoke tools (intensive & one-off) for larger ‘clients’.</p> <p>Data management tasks including collection, cleaning, and integration.</p>	<p>Additional service / option provided by the consultancy to existing clients.</p> <p>Relative cost-effective early stage energy options testing, where validation and / or certification are optional and requirements are for reduced data compared to other energy modelling packages.</p>	<p>Direct sales contact.</p> <p>Formal project management arrangements for large scale use and application of the platform.</p> <hr/> <p>Channels</p> <p>Professional client networks and contacts.</p> <p>Sponsorship of professional events or forms of direct advertising.</p>	<p>Offer platform to existing environmental consultancies – with an interest in offering ‘low cost’ and ‘limited data’ analysis to their clients. Assume end-user will have a strong bias towards municipalities and other public sector bodies.</p>
<p>Cost Structure</p>		<p>Revenue Stream</p>		
<p>Essential costs for the environmental consultancy arising from recruitment and training of technical staff in the operation and interpretation of the platform. Assumed additional cost for data mining / collection and / or management in a suitable format for cloud-based hosting. Actual cost of data hosting for internal to the organisation or the use of out-sourcing and sub-contracting to a third-party hosting organisation.</p>		<p>Revenue generated through allowing ‘clients’ access to hosting platform. Method of payment would be subject to the project specifics, particularly the scale, time and scope of data.</p> <p>Two key options for generating revenue.</p>		

This value proposition has a direct relationship with the stakeholder requirements and defined use cases¹⁸ for SEMANCO. In addition, there are the future functionalities of the SEMANCO platform as additional Use Cases can be added to exploit the use of semantically linked energy and environmental data.

The management of *Customer Relationships* and *Channels* would be a simple direct sales contact promoted through a variety of professional networks, conferences, sponsorships and direct advertisement. The limited nature of the customer segment suggests that key individual decision-makers within specific environmental consultancies are contacted through direct digital (web and email) advertisement, marketing with discount offers.

The *Key Activities* would directly reflect the current Use Cases established through the stakeholder capture requirements. The most significant of these are currently (1) undertaking data analysis and calculation of energy consumption, solar potential and CO₂ emissions of buildings / options against a baseline¹⁹; (2) cost calculations of the operational and maintenance costs, and changes²⁰; and (3) calculating the costs of energy production for individual and district systems, energy saving measures, and impacts of alternative energy options on CO₂ reduction, and primary energy consumption²¹. However, it would be understood at this stage, that these individual Use cases are those prioritised and used for demonstration purposes.

The significance of *Key Partners* within this scenario is the ability for a small number of SME partners to achieve clarity and collaboration around the use of the SEMANCO platform and tools. Recent research has highlighted the lack of cohesive direction in the management of consultancies services (Radlovic & Ford, 2013) and the corresponding need for strong leadership and collaboration between professional disciplines (Radlovic & Ford, 2013), particularly around small to medium sized enterprises to make any project or proposal work effectively.

3.1.6 Delivering services charities and community groups

This business model considers the use of the tools and project assets by an environmental charity see Table 3.6. In this case, the *Customer Segment* includes national charities and / or community interest companies (CICs²²). The charity could be working independently or with local municipalities or social housing providers, that have shared interests in the social and environmental outcome of investments.

The *Value Proposition* is slightly different from the other business models in that it concerns a reduction in the cost and improvement in use of pre-existing data for planning projects that reduce fuel poverty through energy efficiency improvements. The charity or CIC interest lies in the use of the SEMANCO platform to offer it with associated support services on a not-for-profit basis (or recycling any profit into the charitable aims of the customer segment), complementing the value proposition in that the cost of accessing services is likely to be lower than other business models available. Indeed, there may well be an inherent bias within the public sector towards this customer segment offering support services through their organisation.

As with the other business models, the *Key Activities* undertaken by the charity may be to offer access to SEMANCO tools providing quick access to data thus speed in producing outputs such as building stock appraisals, identification of energy inefficient building stock.

¹⁸ Specifically the value proposition is around the ability to meet use cases UC2-N, UC4-N, UC5-N, UC3-, UC1-M, UC4-M (Crosbie et al., 2013).

¹⁹ These relate to use cases UC1-M, UC3-M, UC4-M, UC5-M (Crosbie et al., 2013).

²⁰ This relates to use case UC2-M (Crosbie et al., 2013).

²¹ These relate to use cases UC1-C, UC2-C, UC3-C (Crosbie et al., 2013).

²² This is a specific legal entity that is suitable for regulating social enterprises and community groups. It is characterised by clear legal requirements (in the form of an asset lock) to invest any profit made back into the explicit aims of the entity, be it the reduction of fuel poverty or the reduction in carbon emissions.

Table 3.6. Charity or Community Group Customer Segment Business Plan

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
<p>NEA or similar national scale charity.</p> <p>Project specific work with municipalities and / or private sector bodies with the capacity for business legal and financials input.</p> <p>Data providers.</p> <p>Technical ICT developers to maintain current functionality and development of new embedded tools.</p>	<p>Providing access to data and visualisation tool.</p> <p>Analysis and justification. Identify low-income households living in energy inefficient / dwellings²³.</p> <p>Exportability for report generation.</p>	<p>Speed in undertaking a meaningful business stock survey.</p> <p>Low cost for sophisticated analysis & justification.</p> <p>Design benefits in visualisation and comparing business models to non-technical audiences. Integrated outputs into report production.</p>	<p>Self-service approach allowing platform access & training assets / materials.</p> <p>Additional on-line / phone technical support and development.</p>	<p>Environmental Charity offering additional services through their existing consultancy services. Typically these are working closely with local municipalities, social housing providers.</p> <p>Additional interest in acting as a professional support organisation for users / stakeholders within these secondary organisations.</p>
<p>Key Resources</p> <p>Strong existing customer base and customer trust for the key partners.</p> <p>Platform. Skills/ training. Expertise. Human + Kit/IT.</p>		<p>Role in advocacy – having superior evidence.</p>	<p>Channels</p> <p>Existing and well-established charity network within the business / private sector, public sector and limited third sector.</p>	
<p>Cost Structure</p> <p>Low and fixed start-up costs. Overheads hidden / consumed within existing partner organisation. Honest approach to zero /mark-up’ beyond that required for on-going product development.</p>			<p>Revenue Stream</p> <p>Mixed income from provision of data and technical time-based consultancy. [Not for profit] cover costs and overheads. Mix of online /cloud-based subscription and licensing.</p>	

²³ This relates to use case UC4-N (Crosbie et al., 2013).

In relation to the *Channels* offering the service, these would reflect the current awareness of how the third sector is structured. Existing SEMANCO project partners would seek to exploit established networks within the business/ private sector, public sector and third sector. Using existing networks in this way provides charities with a Unique Selling Point (USP) where trust is embedded, setting the tone for an effective *Customer Relationship*. The charity would provide a self-service approach allowing their clients access to the platform with supplementary training materials and support. Additional technical on-line and/or telephone support may be offered to support the client with the application of tools.

The charity may link up with *Key Partners* such as local authorities or social housing providers where trust is established to work on a specific project. Links may also be made with bodies in the business community to seek expertise on other required services such as legal advice, ICT, technical development or data mining. The charity's *Cost Structure* is attractive as the start-up costs are low and likely to be fixed. Indeed, if appropriate partnership arrangements (covering data and software licencing for the platform) could be put in place in advance, the charity's costs would be limited to staff consultancy time for data management and training activities. Within this model, the *Revenue Streams* from work undertaken are generated from cloud-based subscription and licensing. Time based consultancy is also charged to clients to cover costs and overheads.

3.1.7 Assessing the suitability of the SEMANCO Platform for the third sector

There appears to be a rising interest in community-led solutions to renewable energy. This is evidenced by the joint NEA / DECC “Engaging Communities” project. This stressed the importance of trust in the energy and / or service provider, with a strong bias towards projects and initiatives that are based within the community / third sector. It is also currently relevant to the UK, which has seen the introduction of a Community Energy Strategy (Department of Energy and Climate Change, 2014) in what the government hopes will become the beginning of a community-led approach to reform within the domestic energy sector. Interesting modelling of possible options for interventions (Guertler, 2012) has used similar data sets to assess the impact on fuel poor households. Within this context, fuel poverty is a factor of the cost of capital investment and the revenue savings for heating an improved property. There are additional short-term expectations that the market will undergo further transformations as the Department of Energy and Climate Change (DCLG) consults on new national refurbishment standards and there are potential changes to relative VAT levels²⁴ between new and retrofit construction projects. Thus, beyond work at the strategy level, there is already significant work relating to energy monitoring and evaluation that is undertaken by charities and within the community sectors²⁵. This is anticipated to grow in the short to medium terms as more emphasis and associated resources (including project development grants, business planning support etc...) are made available to third sector organisations. In addition, these organisations by their nature tend to be more holistic and interested in sustainable outcomes that reflect improved energy efficiency, affordable energy and increasing levels of renewable energy and fuel security.

One of the current criticisms of many policy initiatives, and the operation of the open-market systems, seeking to reduce carbon emissions is that they by default target higher income households (Rosenow et al., 2013) – those households with the ability to invest in more efficient building fabric and heating systems. Many of these impacts and Government-based financial assumptions have already been tested by charitable research organisations (For example see: Cambridge Econometrics & Verco, 2012). Here, the SEMANCO tools have a realistic role in

²⁴ For example, the Farrell Review (2014 recommendation for equalisation of VAT levels between new build (currently zero-rated VAT) and renovation.

²⁵ Suggestions are that around half of all community organisations undertake evaluation work (Hamilton, 2013) and would benefit from ICT based assessment.

understanding this relationship and at the very least, drawing attention to any potential funding gaps and the need for grant support or similar to incentivise property owners to reduce the costs for property occupiers.

3.1.8 Delivering services to a professional institution

This option considers the potential for a professional institution, independently or in partnership, to exploit the SEMANTCO platform and tools (see Table 3.7) as customers and potential delivery partners These include²⁶;

- membership organisations, such as RICS (Royal Institute of Charter Surveyors), RIBA (Royal Institute of British Architects) in UK, and National Council of Engineers / Architects and their Provincial Orders in Italy;
- institutions of energy and building services, such as CIBSE (Chartered Institute of Building Services Engineers) in UK, and AICARR (Italian Association for Air Conditioning, Heating and Refrigeration), AIGE (Italian Association of Energy Managers) in Italy;
- commercial bodies / former government agencies and quangos, specifically BRE (Building Research Establishment) in UK.

This *Customer Segment* that has a significant interest in the use and application of research carried out that will be of interest to their professional bodies and those undertaking training within the built environment.

Typically, professional institutions are more aware of the complexity and the inter-connectedness of energy and softer social systems (Lemon et al., 2014). In this way the limitations of research funding, which is often thematically limited to technical or socio-economic systems rather than the relationship between them, can be overcome. As with earlier options, there is an overlap between the customer segment and the *Key Partners* and we envisage the interested customers being professional institutions already active in the field of energy modelling and who have to understand levels of energy efficiency and carbon emissions. In addition, these institutions are interested in organising technical workshops on tools and services for training.

Many of these professional institutions have specific roles in bringing similar software tools to commercial application, linking the tool with a statutory design process and / or task.

The *Value Proposition* within this option is based on dealing with probability and variation in costs and performance. Specifically, the proposition is adding value where there are significant differences between modelled (costs and energy performance) and actual behaviour and a noticeable lack of real building performance data (Clark, 2013). The value to professional users / stakeholders (affiliated to the professional institute) is the ability to offer accurate energy predictions for the energy performance of buildings at an early design stage. While there are some modelled options for the building stock at national scale or above (Uihlein & Eder, 2010), the current availability of assessment tools above the individual building scale are limited. SEMANTCO would offer a unique approach to strategic energy master-planning that can currently only be met through the aggregation of the energy performance of individual buildings. This is regarding optimisation at an appropriate scale and will provide very different area-based results to aggregated buildings.

²⁶ These are included as an example of the scope of professional institutions within the United Kingdom and Italy.

Table 3.7. Professional Institution Customer Segment Business Plan

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
<p>Professional institutions active in the field of energy modelling. Examples are:</p> <ul style="list-style-type: none"> - RIBA (UK) - BRE (UK) - AICARR (IT) <p>Data provision from local municipalities, social housing providers.</p> <p>New JV entity (comprising existing project partners) in a franchise arrangement.</p>	<p>Access to data and data mining. Visualisation. Analysis & justification.</p>	<p>Risk reduction in the provision of professional advice. Optimisation (speed, time and cost) of design choices at initial project development stages.</p>	<p>Self-service access and approach to training.</p> <p>Limited offer of technical support and product development beyond the planning training offers.</p>	<p>Professional institutions supporting a broad base of stakeholders and users of the tools.</p>
	<p>Key Resources</p> <p>Staffing for ICT. Utilising key specialists across different sections.</p>	<p>Multi-disciplinary platform supporting different stakeholders.</p>	<p>Channels</p> <p>Add-on to existing services. Typically online communication with national / regional networks and CPD training events. Newsletters on institution websites.</p>	<p>Specifically institutions for urban planners, architects, building services professionals.</p>
<p>Cost Structure</p>			<p>Revenue Stream</p>	
<p>Low cost than other private sector providers. Limited mark-up to be recycled back into product development. Limited impact on any fixed costs of current membership organisations.</p>			<p>Time-based consultancy charges. Plus options for licensing or subscription. Revenue from technical workshops and training. ‘Not-for-profit’ approach requires profit / revenue to be reinvested.</p>	

The *Revenue Stream* would be through a contribution of the current membership fees, with a potential offer of differing levels of support for different membership levels – from full institute membership to associate and affiliate membership. Options would also exist to offer access-only subscription to the platform. In addition, a revenue stream can result from technical workshops and training. This would be considered cost effective as these institutions would have extensive existing membership databases that will in effect cover the entirety of any potential technical users of the SEMANTCO platform. Thus, the strategy for *Customer Relationships* and deliver *Channels* would be bespoke and reflect many of the existing and established arrangements between the institution and the membership / ‘proxy’ customer segment.

Within this option, there are different *Cost Structures* that would reflect whether (1) the partner institution were operating and maintaining the SEMANTCO platform directly, albeit through support and instruction from the current project partners, or (2) if the services and activities were to be provided by current project partners through a branded / franchise arrangement with the institution.

3.1.9 Delivering services to a technical university or a research institution

The *Customer Segment* considered in this section is a technical university (or one of its departments) or an independent research institution. This customer segment will have a specific research focus in the field of building energy efficiency and sustainable urban planning.

Two different options could be foreseen for the interest of a research body;

- research activities carried out within a project co-founded by the European Commission;
- research activities providing a service to the territory, e.g. in case of policy makers involving a university or a research institution for a consultancy.

Both the listed options can be developed considering two possible *Customer Relationships*. The first would involve the use of a temporary licence for the self-service use of the platform, including training and personal assistance whenever users required technical assistance. In this situation, the university or the research institution would allocate part of the budget of the specific research project or of the consultancy for buying the licence. In this case, it is supposed that the customer has researchers skilled in the use of the platform and the tools. The second case would involve a ‘service’ provided directly by the developers of the platform (some or all of the current SEMANTCO project partners) to the customer, where there would be an explicit requirement for additional ‘intellectual resources’²⁷ to allocate to the work. In this case, two forms of working relationships can be established, a contract/subcontract or a partnership. For instance, in the case of a research project, the development of some project tasks can be subcontracted to the SEMANTCO platform owners or, in turn, the SEMANTCO platform owners can be directly a project partner. In case of an activity providing a service to the territory, the SEMANTCO platform owners can have a contract from the university / research institution or they can be a partner in the consultancy activity at the same level of the customer.

In case of exploitation associated to a research project, either by means of subcontracting or a partnership, the success of the business model is linked to the accurate choice of the research topic, the project proposal consistent with the guidelines of the call and finally the acceptance of the proposal by the European Commission.

²⁷ This would include variations around knowledge transfer partnership arrangements, where close working with current SEMANTCO project partners would result in increasing skills and technical capability within the research institution as a customer segment.

Table 3.8. Technical University or Research Institution Customer Segment Business Plan

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
<p>The same customer segment, i.e. researchers employed in technical universities or research institutions (e.g. Italian National Research Council (CNR) and Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA).</p> <p>In case of an activity providing service to the territory, the key partners are the policy makers that own and provide data for the analysis.</p>	<p>Activities based on problem solving. Data accessing, data analysis, results processing and visualisation.</p> <p>Risk management and definition of alternatives.</p>	<p>Innovative product and services consisting data and tools integration.</p> <p>Effective product and services where different tasks can be performed through a unique platform (software interoperability).</p>	<p>Licence and self-service access, with training and assistance if required.</p> <p>Alternatively, direct service to the customer (e.g. consultancy).</p>	<p>Technical universities (or departments) or research institutions. Both these customers are supposed to carry out their research activity in the field of building energy efficiency and sustainable urban planning.</p>
	<p>Key Resources</p> <p>Intellectual resources skilled on the topics of ICT technologies, energy efficiency, urban planning, ontology. Key specialists across different sections and / or university departments.</p> <p>Physical resources (e.g. technologies, networks, etc.).</p>	<p>Use of shared vocabulary in different domains complying with international technical standards.</p>	<p>Channels</p> <p>Emailing to academic researchers or research institutions.</p> <p>Attendance in conferences.</p> <p>Registration to the social networks of scientific research.</p>	
<p>Cost Structure</p> <p>Generally low costs limited to intellectual resources. In addition, costs for buying software licences or for accessing data. Fixed costs for upgrading the associated technology.</p>			<p>Revenue Stream</p> <p>In case of consultancy, time-based consultancy charges. Options for licensing, training and assistance.</p> <p>In case of a research project, amount of the contract / subcontract budget.</p>	

In this regard, some calls from Horizon2020 are suggested below and possible topics to be taken into account:

- “Energy Efficiency – PPP EeB and SPIRE topics” (topic: “Building design for new highly energy performance buildings”);
- “Energy Efficiency Research & Innovation” (topic: “Demand response in blocks of buildings”);
- “Smart Cities and Communities” (topics: “Development of system standards for smart cities and communities solutions”; “Smart cities and communities solutions integrating energy, transport, ICT sectors through lighthouse projects”);
- “Energy Efficiency – Market Uptake” (topics: “Empowering stakeholders to assist public authorities in the definition and implementation of sustainable energy policies and measures”; “Enhancing the capacity of public authorities to plan and implement sustainable energy policies and measures”; “Increasing energy performance of existing buildings through process and organisation innovations and creating a market for deep renovation”).

3.2 Review, risks and ranking the business models

This section identifies some of the technical challenges, procedural and legal requirements that are risks associated with the business models outlined in the previous section. The aim is to anticipate and identify the key risks associated project delivery and exploitation. Each of the business models have been considered systematically regarding the threats and risks associated with their practicable implementation. A bespoke framework for preliminary risk assessment based on standard Prince2 project planning and management methodology (OGC, 2009) was applied see Appendix A. Each individual business model tested has its own tabulated framework for ranking and notional commercial risk assessment. Arising from this preliminary risk assessment we have undertaken the relative ranking of all of the commercial and not-for-profit business models relating to financial viability and technical feasibility see appendix A.

3.2.1 Ranking the business models

Ranking the business models has highlighted the significant overlap between their characteristics and attributes. Where there are a significant number of high risks combined with high impact on the potential viability of the business models arising, these have been ranked lower. Where there are a series of low to medium risks identified that have low impacts on the viability of the business plan, these have been ranked high viability.

Table 3.9. Relative viability of the business model, customer segment options

High viability Characterised by relative low level of commercial risk and impacts	Medium viability Characterised by medium risks and impacts	Low viability Characterised by relative high level of commercial risk and impacts
Municipality. Social housing provider / property management company. Community-scale energy company (small scale ESCo / charity / community organisation).	Energy company (large scale energy infrastructure & supply). Professional institution. Environmental or sustainability consultancy (including charity acting as consultancy organisation).	Technology company. Research institution / Technical university ²⁸ .

In addition, the removal or reduction of the potential risk is considered where the mitigation is reasonable. The specific procedural and legal issues identified within this preliminary assessment are addressed in more detail in the project exploitation plan. The approach is intended to be

²⁸ Excluding universities within the current SEMANTCO project partnership.

aware of the relative risks, uncertainty and potential failure associated with ICT based projects (Kutsch & Maylor, 2011) and to create more fully developed and practical business models for exploitation. This is on a relative basis and doesn't suggest that alternative routes to commercial exploitation are not available but rather, alternatives considered have higher associated risks with the process.

This ranking informed the preferred business model that has been tested in more detail through further primary data collection and targeted soft market testing.

3.2.2 Special purpose vehicle / joint venture business model

The outcome of examination of a range of potential business models is the creation of a single 'generic' business model that merges many of the common aspects of the most highly ranked options explored. This specific business model was subject to several iterations collectively within discussions at the SEMANCO general meetings and individually via electronic communication between project partners.

This final iteration represents the most promising approach to how the application of the SEMANCO platform and associated tools and services can be exploited beyond the current case study project areas and partners. This is described in Table 3.10.

The key *Customer Segments* are the public sector (direct or indirectly) bodies who are signatories of the Covenant of Mayors. This is considered an initial target customer segment that would ultimately be supplemented by larger number of public bodies and groups / organisations working on behalf of similar public sector organisations. The *Value Proposition* is to support the drafting of the required SEAPs (Sustainability Environmental Action Plan) based on sound data and evidence. The value to the customer segment relates to the rigor and quality of the evidence that is able to stand up to quasi-legal cross-examination and inform public policies. This would be a mix of statutory and voluntary policies that can be enforced through planning and / or target significant aspects of public sector funding.

In this context, the initial *Customer Relationship* is formed by contract(s) provided by SEMANCO service providers. A newly proposed Energy Services Platform Portal will act as the main communication *Channel*. The aim is to use the website to retain existing customers, encourage re purchase of SEMANCO tools and services whilst also attracting new customers. This website would be for marketing, promotion of the platform as distinct from the current research and development project website. It is currently being discussed for project variations and through a basic memorandum of understanding between the current SEMANCO project partners that proposes to extend the use of a software licences and project development for up to two years beyond the end of the funded stages of the project.

The *Revenue Stream* is based on a simple time-based charge with the open-source provision of the platform. The implication is that the SEMANCO platform, coding, data sets and associated training materials can be offered on an open-source basis.

The recommendation for delivery of this preferred business model is the establishment of a joint venture agreement between all or some of the current SEMANCO partnership (the *Key Partners* that have the organisation attributes needed to undertake the activities and provide some of the necessary resources) that could directly deliver the project exploitation or acting through a newly formed company. It addresses the legal and procedural issues associated with a mix of different partnership arrangements (Stainback,2000) and the best specific role of individual key partners within the approach. It allows a customised partnership that can meet each partner's needs, acceptable level of risk, responsibility, and economic returns.

Table 3.10. Special Purpose Vehicle-led business model

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
<p>Agency 9 & Ramboll (hosting providers).</p> <p>Agency 9, HAS (ICT programming and technical support).</p> <p>Teesside University. Polito (data collection, integration and management).</p> <p>NEA, spin-off company (staffing, skills development and training provision).</p> <p>NEA, Ramboll, spin-off company (marketing and sales).</p>	<p>Platform support, data infrastructure form hardware and software.</p> <p>Individual project support on data management, analysis and reporting.</p>	<p><u>B</u>est <u>A</u>vailable <u>T</u>echnology <u>N</u>ot <u>E</u>ntailing <u>E</u>xcessive <u>C</u>osts (BATNEEC)²⁹.</p> <p>Relative low cost.</p> <p>Reduced data requirements.</p> <p>Appropriate use of available data (open source and customer defined).</p> <p>Valuable outputs for early project stages (strategy, business proposition and investment).</p> <p>Speed and time saved.</p>	<p>Low number of customer segments suggests an on-line service and support.</p> <p>Web-hosting with 1-2-1 technical support / technical contact points..</p> <p>Channels</p> <p>Dedicated website for exploiting the current SEMANTCO integrated platform and associated tools and services.</p> <p>Signposting through events, workshops, conferences, memberships, networks, advertising.</p>	<p>Hierarchical understanding of customer segments.</p> <p>Indirect Public Sector – research interests ... supporting ... ICT providers ... supporting ... environmental consultancies ... supporting ... charities and social housing providers ... supporting ... public sector segment(s).</p> <p>Direct Public Sector – SEAP / advisory, statutory roles.</p>
<p>Cost Structure</p> <p><i>Fixed capital / one-off costs</i> relating to business development stages, establishment of platform and provision of hardware.</p> <p><i>On-going costs</i> for staff, training, marketing / advertising, platform maintenance and hosting.</p>			<p>Revenue Stream</p> <p>Time-based charging form technical support.</p>	

²⁹ BATNEEC is a pragmatic approach to public policy that aims to balance costs against benefits (Pearce & Brisson, 1993). Albeit there are different interpretations over the meaning of ‘costs’ as they are attributed to private or public sectors. Private costs tend to have clear monetary implications for businesses. In contrast, public costs are often non-monetary and relate to the wider environmental and social impacts. In effect BATNEEC is an approach to ‘tolerable risk’ (Bouder et al., 2013).

4 EXTERNAL VALIDATION

4.1 Introduction

This section summarises the key findings arising from the external validation of the most promising business model. It is structured around the same building blocks used to construct the business model, with a clear emphasis the opinions of external stakeholders and the ‘public’ elements of the business model as defined in chapter 2.

4.2 Key findings

The preferred business model was presented to over 120 stakeholders involved in workshops and discussed in depth on a one-to-one basis with over 16 stakeholders. A record of the stakeholders involved in the detailed discussions is contained in Appendix B.

4.2.1 How do the SEMANTCO business model compare to similar?

There was stakeholder interest in the structured explanation of the generic business and the methodology behind it. It was generally well received and understood following a simple introduction to the use of the SEMANTCO platform and associated tools and services. Where possible, the business plan was explained alongside a demonstration of the most recent version of the SEMANTCO platform.

In response, what was being proposed through the generic SEMANTCO business canvas was often directly compared to recent and similar business plans or propositions that the stakeholders were more aware of. This was particularly true with regard to several approaches to invest-to-save refurbishment plans; such as the Green Deal initiative and the setting up of the Green Investment Bank in the UK; that linked energy supply and demand side management. The timing of this task coincided with many of these national initiatives and had the effect of keeping many issues topic and stakeholders well informed of alternatives.

4.2.2 Who is the SEMANTCO customer?

The identification of the most appropriate customer as municipal or public bodies and organisations was reinforced through the conversations with stakeholders. This segment seems to be the only potential customer who has the motivation (demonstrated in policies and commissioning) to measure and intervene in energy efficiency and carbon emissions at a scale above the individual building.

“We have been working for years to get a municipal heating network up and running. Basically we have come to the conclusion that the Council has to set it up, invest in it, connect their buildings to it and ultimately run it to demonstrate that it can work.” (Local authority planner)

“There have been dead negotiations with all of the private developers about connecting to a municipal heat network ... no sort of evidence is going to convince them because they just aren’t interested ... and we can’t force, or won’t force them to connect. Once we have given away planning permission we have lost our negotiating position ... so, they (the private sector stakeholders) aren’t going to be bothered with your sort of evidence, no matter how accurate it is.” (Local authority planner)

Here there are implications for the customer channels and approaches to marketing and advertising that is targeted towards an already motivated customer segment. It is perhaps the underlying motivation to address environmental and social benefits that characterises the typical public sector customer.

Regulatory requirements or keeping local regulators happy with better information on energy efficiency is not a strong motivator. One comparative example used was of a regional endorsement of a modelling tool with similar functionality that was explicitly designed and intended for use in scheme review and compliance checking. The uptake and use of this tool was limited within the public sector even when it was provided free with support training from the regional planning body. The interest within the private sector was even less as it had an associated cost for software licence and training.

“We depend on our collective experience to advise clients. And at the strategic scale there isn't any real impact of energy considerations ... At least nothing that can't be added into the project at a later stage ... What is more important for us is how ideas about place and environment can be communicated in a unique manner ... I suppose that we might be spending too much time and effort on graphics and communication ... but you still need to start with design ideas based on analysis of the place before you can start to integrate energy considerations. ... Experience suggests that we will be able to find sustainable solutions to fit most ideas and concepts”. (Consultant)

If the identified customer segment is to be interested in the SEMANCO platform, they have to be motivated towards reducing carbon. In practice, this is as much about the personal motivation of the key decision-makers within the customer body as how their corporate plans and policies promote energy efficiency and carbon reduction. However they also have to be informed about how the platform operates and the value to them in achieving their corporate and organisational goals.

“It would be interesting to see how this could be used as a tool for scheme review ... you could get some interest from local or national design review panels ... this is the sort of thing that would add value to most developments but is lacking anyone with a clear responsibility to make sure it is considered.” (Consultant)

Design review could be a useful stage within the scheme development process to use the platform, as part of a ‘closed’ scheme assessment and to look at area-wide ‘off-site’ or displacement impacts for both energy demands and potential costs. Design review³⁰ is typically an independent and impartial process encouraged for most major schemes and those where public finance plays a significant part. The Value Proposition for a commercial developer in paying for this review is a potentially smoother ride through achieving planning consent (subject to the changes made in response to the review recommendations) or in independent evidence to support a planning appeal. Albeit that a higher quality and more sustainable development which can support higher sales values and rents and lower running costs is the given rationale for developer interest.

In this context, introducing better information and evidence for a design review³¹ may have benefits in integrating sustainability and energy efficiency into a holistic and multidisciplinary review, guiding the decisions and recommendations of the review.

The potential scale of the customer segment also demands maintaining a close relationship with any updates to legislative requirements for energy and statutory planning requirements. For example, within England there is currently a presumption in favour of sustainable development (para 10 CLG 2012) within the planning system. However, where municipalities seek explicit performance standards and requirements within their local planning policy for individual developments and buildings, this has to be consistent with any currently recognised nationally

³⁰ Currently costs to the developer for undertaking a national level review (CABE / Design Council <http://www.designcouncil.org.uk/our-services/built-environment>) range from €4,250 to €21,800 per review, in a context where a two or in some cases three stages review is common.

³¹ Design review is explicitly required and encouraged in para 62 (CLG 2012).

described standards (Communities and Local Government, 2012, para 95). Since the announcement regarding the abandonment of the Code for Sustainable Homes (Communities and Local Government, 2014) in the UK, this is now limited to SAP; as the only domestic standard still recognised on a national basis; and SBEM for non-domestic properties (UK Green Building Council, 2014).

4.2.3 How important is validation and accreditation to the *Customer*?

Current policy debate tends to emphasise the importance of validation of the embedded tools. The current debate is also highlighting wider issues that simply validation (and the issuing of Energy Performance Certificates (EPCs) within many different nation states) of the calculation methods. There are questions around the understanding of different definitions regarding the meaning of zero carbon, the emphasis on efficient building fabric (Cartwright & Gaze, 2013) over building energy systems and how these relate to national building regulations. These proposals raise the potential for semi-automated compliance checking of standardised energy performance. In this context, where validation and compliance is possible (or has been implied as part of the SEMANCO demonstration), there is significant and consistent levels of interest from the public sector in the exploitation of some of these embedded energy assessment tools.

“It is inevitable that all of the calculation methods will change ... I would suspect this is to make things easier for developers and to simplify the process. This will start to undermine many of the commitments that were made around carbon neutral development ... we have just been changing the definitions of carbon neutral rather than reducing carbon ... so maybe the need to have government endorsed software will be lessened ... we just need simple methods that professionals can trust.” (Social housing manager)

There was interest in the ability to add additional property sectors, commercial and multi-occupancy, with suggestions for extending the functionality of the platform to cover commercial buildings to begin to illustrate a more holistic view of building energy use within any particular urban area.

“I really like the look of the platform, for me though it would be good to see if it could be applied in the commercial sector. Your map in its current form seems to illustrate commercial buildings ... could the tools functionality be adapted to include those?” (Energy consultant)

“We are interested in the mix of energy supply and demand at the local level. ... We have been finding it difficult with the level of aggregation or disaggregation of other data sets to actually target areas at the right sort of scale.” (Local authority sustainability officer)

Here there were questions around the comparative availability of energy related data for the non-domestic sector. And again, there was a repeated concern regarding (independent) validation of the calculation processes for non-domestic properties, albeit often this was simply seen as a necessary ‘badge’ for the software rather than a prerequisite for its use. Clearly it would benefit from having this form of ‘badging’ to extend the scope of the potential customer segment.

4.2.4 Does SEMANCO present a good *Value Proposition*?

Regarding the value proposition, there was a clear understanding that SEMANCO provides differentiation from other similar energy modelling tools when the approach becomes ‘bespoke’. Many stakeholders are already using ICT tools that are not ideally suited to requirements. Time requirements for data handling and specifically data entry are typically increased significantly due to restricted interoperability and comparability. In many cases ‘bespoke’ responses have added relative value because they save time for the stakeholder. This value increases whenever the scale of energy modelling increases. Thus bespoke approach is a big attraction to

larger scale organisations that form part of the customer segment.

At present, many of the aspects of the SEMANCO platform and tools can be met through one or more of an existing set of commercially available tools for the estimation of energy efficiency. In many cases, there are provided as free-to-use tools, available through a basic requirement to register an interest in the use of the software and provide the software company with contact details. The stakeholder / user become part of a commercial database of professional user contacts with an interest in modelling energy efficiency. Here, the specific revenue streams for the software provider arise from a percentage of the professional users requiring validation and certification³² in the correct use of the software. They are also a self-selecting customer segment that is regularly offered training, software upgrades and other targeted advertising. The provision of free-to-use software is through self-registration and automated web site. Thus, the free availability of the software does not in itself become an additional cost stream for the software provider.

Interoperability is consistently important. In practice this means being able to use the same set of software and energy related data for different professional requirements. Typically they are interested in saving time throughout the calculation processes and thus associated staff costs. In some cases stakeholders were explicit about what this was and how it was evidenced and packaged as part of the value proposition.

“Where does BIM fit into all of this? Does it allow me to export in an appropriate form for later stages of design? That would be useful ... or at least useful to know that I could do it when needed.” (Architect / developer)

This was a repeated theme around the use of a commonly recognised protocol for digital data. There was a clear interest in how the SEMANCO platform could be used in conjunction with current and future investments in ICT.

“... we all know that BIM is, or will be important for much of the construction industry ... so it would be useful to understand how the (SEMANCO platform) relates to these industry developments. Can you use the output in BIM ? ... If you can, it would be a useful approach to jumping on the BIM marketing bandwagon. You can market it as an early stage BIM model and I imagine, the minimal costs to the client would just be hidden in the overall ICT investment arising out of BIM developments.” (Research professional)

“We have started using a local building services engineer simply because they have invested in BIM hardware and software ... for us, the value now is their speed and the standards used mean we can work and share more effectively with other professionals” (Architect)

Another important aspect of the SEMANCO value proposition was the detail around the description as an ‘integrated platform’. The interest was specifically around the way in which a meaningful cost database for construction or refurbishment works and energy infrastructure costs relates to the building geometry.

“I think this is an interesting approach that begins to integrate the financial side of energy efficiency to the technical side ... it is probably more important to get the financial footing right for a technical solution rather than find an impressive technical approach to solving a problem that no-one really thinks is a problem ... or at least a problem worth solving” (Building services engineer)

³² In this particular instance for the UK context, it is due to the requirement to issue an Energy Performance Certificate (EPC) for properties being rented and sold. There are only a limited small number (currently eight) of validated software providers able to issue an EPC.

“We are basically looking for a supportive evidence base to assist in the production of a viable business plan for a new municipal district heating system. With all of the best will in the world, as a public sector body, we still have to deal with prudential borrowing requirements and build ourselves a business case. ... They want to see meaningful numbers around costs and the carbon saving you can ultimately get for your money.” (Local municipality energy officer)

There was concern around the value proposition as it related to accuracy or claims or accuracy in the estimation of energy performance of buildings. This was a concern shared around all types of energy models and most professionals were fully aware of the levels of variation between ‘predicted’ and ‘actual’ energy use.

“What you have described is very similar to the sort of issues we are facing (as an organisation) ... we have real challenges around good quality input data. So we are really interested in the approach you have followed with the use of open-source data. ... We recognise what you are saying about ‘optimisation’ and the diminishing returns with regard to time and cost in dealing with data. What we want is something that is good enough ... good enough for us to make well informed decisions about direction and strategy. The detail can often be too much to deal with around the size of data and it often costs too much. And often it is letting the data define what we measure.” (Housing association sustainability officer)

“Anyone who is familiar with the figures you get from SAP (the standardised energy assessment) and sees the actual energy bills will know that the two bear very little resemblance ... so we tend to have a healthy distrust of SAP figures and rely as much on our own local knowledge and the experiences of dealing with tenants and particular property typologies.” (Local Authority Energy Management Officer)

“I agree that most practitioners will have a good awareness of the differences between modelled (i.e. SAP or Reduced data SAP for existing properties) and the actual building performance”. (Housing association sustainability officer)

One suggested response was to add to the functionality of the SEMANCO platform with the use of ‘live’ or regular monitoring data.

“...(T)here is nothing in this approach that can use ‘live’ monitoring data? Perhaps using real energy bills, meter reading or smart monitoring as input data would extend the value to the customers.” (Research professional)

4.2.5 Does the use of open-source data add to the *Value Proposition*?

There was significant enthusiasm for the overall approach to the use of open-source data and an appreciation of the novelty of the approach for the domestic energy sector. When there was a professional awareness of how the data was being organised and structured within the SIEF, this appreciation of the approach being followed became more pronounced.

“... the application of a data ontology and open source data is very interesting. In the UK and Europe there is a growing interest and demand for projects like this ... it really demonstrates how open source data can be utilised to its full potential and applied to solve energy related issues in the built environment. I really think you could be considered for awards for this time of work ... you know ...illustrating best practice in utilising open source data repositories.” (Environmental researcher)

There were several clear suggestions that SEMANCO best fits a business model based on collaborative or ‘social’ commons and ‘peer-to-peer’ method of working. The rise of such collaborative working has been recognised as a paradigm shift and restructuring of the current capitalist system (Rifkin, 2014). This has significance for the SEMANCO platform as; if it were

offered to various customer segments as an on-line self-service product; it would clearly be working within the model of near zero marginal costs. Here there is particular interest and potential for open-sourcing the coding, database management and even collaborative development of platform functionality (for example, see Marjanovic et al., 2012; Marcus et al., 2011; Pearson & Tsiavos, 2014).

This focus on open-source data has the potential to be the most important element of the SEMANTCO platform and, in turn, the key unique selling point and a focus for the marketing through the identified Channels.

4.2.6 The value of data quality and functionality

It is in this context where many stakeholders understood the *value proposition* of SEMANTCO as the increasing quality and reliability of the data. The main *value* was in the scope of services that added value and functionality to the current level of data availability.

“If we were able to get our own data ready (for integration with the SEMANTCO platform) in the form of a simple spreadsheet structured to your specification and format, then that would be of real value. ... (W)e have our own building stock database that we would like to link to energy data, and then ultimately to link with some of the wider socio-economic data that you have been speaking about. ... We are simply looking for the best evidence to underpin our decision-making. If we have better quality input data for our analysis then it will be of clear value” (ICT support consultant).

Often this *value proposition* will be considered against other potential means of accessing energy performance data for properties. Where these alternatives seem to be lacking in formatting and functionality, SEMANTCO can bring better integration between data sets and the key benefit in the ability to approach basic forms of analysis and options appraisals through the on-line tools.

“There are a host of issues that we have been dealing with around the quality of (input) data. When you purchase it (for example in the form of Landmark EPC data) it is in the wrong format and only shows outputs. You still have to spend time and effort to retrospectively clean and edit the data into some sort of format that is usable” (Data manager, social housing organisation).

“We really have no idea around the standards of storing data and energy information. Lots of things have been ad hoc and we have lost staff ... who have taken their knowledge with them and left their energy data on computers without any idea of where they came from ... we could really use data in a structured and usable format” (Local authority energy officer).

Where existing data can be integrated with other sources, and indeed, where the key partners can bring some additional knowledge of the sourcing of these appropriate data sets, then there are clear indications that there will be many stakeholders willing to pay for these sorts of data management services. This seems to be increasingly true as many organisations have recently lost senior experienced staff who held a lot of local knowledge that was combined with a good procedural understanding of ‘mining’ or sourcing appropriate data sets. Thus, a clearer approach to data management would also assist around business (and staff) continuity and achieve better functionality from existing data sets.

“We have spent time and effort with data extraction, cleaning and we are still addressing a lot of the legal issues that relate to the limitations of data ownership and accreditation. One of the most frustrating things for us has been gaining access to the data but, because we don’t own it, we are left in a position where we are unable to really use it to the best of its ability, and certainly not to the level of sharing it with others online” (Housing association manager).

“... we have suffered a significant level of staff redundancies during the recession ... people have left and an awful lot of knowledge has left the organisation with them ... we are beginning to find (a lack of skills) a lot of energy efficiency projects” (Local authority planner).

“We are finding that we have increasing requirements for dealing with very large data sets. We are still relatively small for a regional housing association, with around 30,000 properties spread over the north of England ... and it is the spread of the properties that seems to make getting hold of the right sort of data difficult. We have found EPC data useful ... but incomplete coverage and certainly in the wrong format for us to do anything with quickly” (Data manager, regional housing association).

These repeating comments suggest that one attraction of the SEMANTCO platform is the potential ‘packaging’ of data management services. This carries value partly due to the potential to simplify the management of data services and partly due to the loss of in-house capacity to undertake this sort of activity. One particular stakeholder picked up on the description of the data repository included as part of the SEMANTCO platform and felt this was a better option and more functional for them than multiple dispersed sources.

“I think that we are suffering from the lack of some sort of central repository of data. Getting hold of data has been painful in the extreme ... it has been like pulling teeth ... the data we need is hidden all over the place. Hard to find, hard to access and that’s before you actually start to do any analysis” (Municipality energy services manager).

4.2.7 The meaning of ‘open-source’ software and coding

The business planning has shown there is a need for clarity around the meaning and working definition of ‘open-source’ as it relates to SEMANTCO. Throughout this task, the phrase ‘open-source’ has been used in relation to both software / code and data sets. It has also been used in relation to both ‘restricted’ and ‘unrestricted’ use of software / code and data sets.

In practice, software and coding can have different types of restrictions relating to its use and still be described as ‘open source’ or ‘free’ software. Typically these are reflected in the appropriate licensing arrangements for different types of users appropriate for commercial, academic or not for profit use.

Commonly used terms of freeware and shareware remain ill defined. Freeware is a description commonly used for software that permits free use and redistribution but without modification. Shareware is software / coding with permission to redistribute copies but where new users are required to pay a license fee. Generally for both cases source code is not made available.

In practice, the key value of SEMANTCO to the customer segment(s) was around the idea of free and unrestricted commercial use of software / coding and data. This is what is meant by ‘open-source’ and is distinct from freeware and shareware.

In this instance the understanding is that open-source is the sharing of software and source code. SEMANTCO is interested in promoting free standards where the wide use of the software and code is vital for the development of the application. Here there are several options;

- The software and source code is provided in the public domain free and without copyright. This would promote use but would also allow users to make changes to the code and convert it into propriety (non-free) software. Here SEMANTCO coding would become ‘public domain’ under the legal meaning and require undertaking steps to disclaim the copyright on it;
- The requirement for this software / code to be ‘copyleft’ that requires all future modifications and extensions to this code to be free as well. An example of this is distribution of SEMANTCO code under a GPL (Tsai, 2008). In this instance modifications

are allowed there is less commercial incentive to adapt and improve the coding. There are several different forms that begin with copyright and introduce restrictive distribution terms that keep the code and the fee use legally inseparable.

- The requirement for this software / code to be ‘copyleft’ as above but with additional restrictions that would limit modifications and changes to the code. An example of this is distribution of SEMANTCO under a LGPL (Lesser General Public License).

Similarly, ‘open data’ is considered in a similar framework. Data sets can be restricted in the form of commercial use as well as confidentiality and data protection.

We have considered ‘open data’ to be data that is available publically in a format that is free to use, adapt, edit and redistribute. Albeit that through redistribution it should be subject to similar data use and cost restrictions. This means that the content and format should be free from royalties and any associated IP restrictions. For example, data subject to a creative commons share alike license.

This is distinct from publically available data, which may have associated costs and be restricted in the ability to redistribute.

4.2.8 Managing *Customer Relationships* and *Channels* for communication?

There was a broad consensus that the best approach to dealing with any potential customers is to use the partnership’s existing professional networks and contacts. This would effectively extend the demonstration activities.

There was also a consensus that a bespoke approach to the application of the SEMANTCO platform and associated tools would also require a tailored approach to working with different customers. It would be advantageous to work closely with some customers where they already have some or all of the necessary skills to undertake the key activities. In other cases, the practical working arrangements could be slightly detached where the customer activities are limited to the provision of data.

“... (a) bespoke approach to your customer requires a good personal contact ... you are only as good as your last piece of work, so you can’t rehash methods and reports”
(Design consultant).

“I think that in the context of higher density development ... the kind of environment that is common within an historic European context ... I think issues like optimisation of energy efficiency will become more complicated. Every approach will have to be bespoke and respond to the local context” (Heritage expert).

4.2.9 What are potential SEMANTCO customers prepared to pay for?

There were some members of existing professional networks who had joined the project dissemination network and were aware of the development of the platform and associated tools. Here, the interest was in the progression of the platform and tools from concept to working prototype. Some considering that it wasn’t too far from a viable commercial exploitation.

“I’m a member of (your dissemination network) and I’ve been following the progress of the project using the newsletters and website. It’s certainly very interesting, if that SAP tool can get accreditation perform SAP assessments as accurately as SAP can be – it’ll be of great interest, not just to us but other Local Authorities too” (Energy executive).

This returning theme of validation and accreditation was a common concern.

“We are attracted by what is offered if it really is affordable ... although we have questions over validation and certification of the calculation processes. We do use a lot of SAP metrics, just because we have to. There are often financial penalties if we don’t

show how we meet these metrics. Some are simply included in our corporate strategy but others are imposed as conditions of funding. So getting a trusted or validated measure in a cost effective manner will always be important” (Data manger, social housing organisation).

There was some sense of a shrinking customer segment that was creating a smaller and smaller market for many existing companies who provide similar tools and associated services to SEMANCO.

“I know that a couple of companies³³ dealing with environmental modelling, assessment and validation software are currently struggling financially ... there are rumours that recent (UK national government) announcements have thrown the cat among the pigeons ... there are too many options with fewer professional using the tools” (Building services engineer).

There was also significant resentment with many of the stakeholders around the need for paying for certain ICT packages and the high levels of costs placed on small companies and those working within the public sector. Ultimately software providers were also providing high cost training, technical / accreditation support and annual fees seemingly for independent auditing roles. Ultimately, these costs had to be passed on to the end-client who was very often based in the public sector.

“I’m starting to see things becoming more competitive with companies providing similar (ICT based tools and services) offers ... and so are giving us fairly good offers, at least in the short term ... and whenever there is a choice between free software and commercial software, most would have a look at the free software first to see if it met their requirements at that time” (Architect).

In some cases there was a clear feeling that it would actually be more cost-effective if the stakeholder were to become responsible for the development of their own ICT tools, even if this proved to be difficult in practice for all of the same reasons on staff and knowledge retention and hardware costs.

The potential demand for SEMANCO in both its current and potential forms and functionality will be dependent upon many externalities, particularly wider macro-economic considerations. Modelling the energy efficiency of buildings or the carbon emissions of urban areas are just aspects of the wider construction industry. Stakeholders will ultimately only use the ICT tools whenever there is actually finance available to invest in building improvements or strong statutory support. In some sense here there was a paradox in the approach of governmental financial stimulus packages promoting construction (a mix of house-building and infrastructure programmes) while removing the mandate for emissions monitoring and assessment.

“The whole thing (business proposition) is dependent upon the state of the commercial construction industry. If things are picking up ... then there will be a growing demand for support tools and services” (Building services engineer).

4.2.10 Validation of the business models

The clear outcome from these semi-structured discussions with many different stakeholders has been positive with regard to the proposed business models. While there was an acceptance that at present, the SEMANCO platform was not at the stage of commercial exploitation, it carries

³³ These were perceived difficulties being discussed within online technical forums and social / professional networking sites, where several ‘established’ companies were having difficulties around their own *Revenue Streams* as a result of legislative changes and governmental announcements which was causing customers to delay their decision-making on training and ICT investments.

clear commercial potential. There were multiple positive views on the platform and what stakeholders understood as its unique selling points or value proposition;

- it was perceived as good value in the maximisation of the benefit of open-source and existing internal organisational data sets, including the scope of metadata standards to add interoperability for importing / exporting and exchanging information;
- it was seen as unique in operating at the scale of the neighbourhood and city and utilising scale appropriate data sets rather than simple aggregation of building scale data;
- it was accessible, understandable and visual using a mixed variety of spatial, three-dimensional and tabular / graphic representation of calculation data;
- it was flexible in the approach to adding additional functionalities and held potential to extend these with validation and certification standards;
- it was practical in allowing for the testing of different options for interventions.

Ultimately, the value to the various stakeholders working in or with the municipal sector was the potential to provide a bespoke tool that grew from the current functionalities and a straightforward one-to-one customer relationship that offer a ‘package’ of both ICT tools and associated support services that understood the issues of limited internal expertise / knowledge attrition and reflected the current needs within the customer segment.

This positive view of the platform ‘packaged’ with a set of tools and services would be enhanced with further practical demonstration and case studies on the project web site, together with download open-access material, coding, standards table, data repository and external data links. The more that material and resources that would form part of this ‘package’ are offered as open-source, the greater the value proposition is the potential stakeholders. The increased demand for technical support would arise out of a mix of openness and trust.

5 INTERNAL REVIEW

5.1 Introduction

This chapter summarises the key findings and recommendations arising from the internal review of the most promising business plan by the SEMANTCO consortium. It has a clear emphasis on the ‘private’ elements of the business model as defined in Chapter 2.

5.2 Key findings and recommendations

Throughout the development of the different business models there was a clear understanding of the potential scope of the exploitation ranging from pursuing an approach to full commercialisation to an approach that supports the provision of open-source resources. While these appear to be following different approaches to exploitation, in practice, there are common areas around the business model requirements for key partnerships, activities, resources and the underlying cost structure as illustrated in Table 5.1.

Table 5.1. Comparison of ‘private side’ business model assumptions

	Full commercialisation	Open-source exploitation
Key Partnerships	Both options would initially be covered by similar arrangements for a non-incorporated joint venture between all of the current project partners. In both cases there would be opportunities for direct partnership arrangements with individual customers.	
Key Activities	Development of data management services Internalised approach to platform development, metadata standards, interoperability provisions and the integration with cost data bases.	Provision of open-source metadata standards, editable ‘standards tables’ and enhanced input / export functionality.
Key Resources	Provision of associated cost-data for capital investment, revenue costs. Up-to-date validation / certification standards and calculation procedures.	Support materials and resources allowing for peer-to-peer file sharing and direct manipulation of data and / or software coding. Each of these would be supported by appropriate open-source copyright conditions to promote wide use and sharing of resources within professional stakeholder ‘user’ networks.
Cost Structure	Both options would have project costs dominated by staff time required to undertake the key activities identified above. Each bespoke project, be it client-contractor or partnership with the customer, would be based on negotiated costs that reflect the requirements for additional services to those already contained in SEMANTCO demonstrations.	
	JV requiring a lead organisation able to take responsibility for client contract and sub-contracting costs for JV partners. Assumes different share of profit and risks.	Legal structure of social enterprise (charity, cooperative or CIC) will have positive benefits for organisational trust ³⁴ and impact on marketability. Support for not-for-profit approach suggests ‘open-book’ accounting. Potential for including social and / or environmental cost benefits.

³⁴ This is trust in social intentions and outcomes of the organisation and distinct from trust in technical competency.

Consideration of these has direct implications for the future exploitation of the SEMANTCO platform and associated tools and services. In both cases, the recommendation for wider exploitation through the initial use of a non-incorporated joint venture (JV) is valid. The use of a joint venture as the basis for the **Key Partnerships** avoids the establishment of a quasi-legal ‘entity’ and the associated legal requirements and costs for accounting and reporting. The recommendation is for the drafting of a JV Agreement that has specific timescales agreed for the potential exploitation that matches the willingness of the current project partners to share data and licenses on a no-profit / no-cost basis. The details of such an approach will be included within the project exploitation strategy.

There are **Key Activities** required to be undertaken by these partners. Most significant of these relates to different aspects of data quality and functionality and arises from the stakeholders’ acceptance that the SEMANTCO platform currently provides a good calculation process but as yet does not guarantee good quality data. The partners need a considered response to these expressed concerns around metadata standards and issues of wider data quality. Here the potential for the platform has to provide for much closer integration with developing metadata standards within the development and construction industry. Thus there would be a series of data management activities require and recommended for the progression of these business options:

- The establishment of an appropriate metadata standard³⁵ that can demonstrate the source and quality of any open-source data used within the platform, including a review of how the system requirements currently compares with existing Cobie, ISO and PAS standards;
- The provision of editable ‘standards tables’ that can support the addition of stakeholders’ own data sets. In this context, we would anticipate that editable ‘standards tables’ would provide the framework for different stakeholders (technical ‘users’) to edit and format their own internal data sets for integration within the SEMANTCO platform;
- The provision of associated cost data. This would address the perceptions on the current weakness of the SEMANTCO data sets around different project and intervention costs. This would require the development and maintenance of a cost database that held capital costs (energy infrastructure investments, renewable energy generation & distribution networks), revenue costs (pay-back projections compared with billing) with an understanding of the non-linear relationship between cost and scale (e.g. CHP biomass network, building refurbishment unit costs);
- Additional worked example(s) of the application of such technical integration, indicating where SEMANTCO has an explicit role within a recognised *Digital Construction Plan of Works*.

In addition, there are a series of key activities recommended as initial steps for supporting business development that would help to demonstrate the above activities:

- The revision of a project web-site designed for the specific municipal customer segment(s) that included a mix of technical downloads and direct contact details;
- Drafting of an agreement (set out in a MOU or similar framework) to develop future demonstrations based on direct partnering arrangements and / or referrals from professional networks or membership of the exploitation network (including direct marketing **channels** with the Covenant of Mayors). Referrals and partnership arrangements directly with stakeholders becoming **key partners** will have the benefit of avoiding complex public procurement processes, company prequalification requirements

³⁵ Scoping of current PAS and ISO (2007) standards does not identify the existence of any current standard of data exchange that dealing with the neighbourhood or urban / municipal scale of the anticipated data sets.

and allow for negotiated costs on a project-by-project basis.

The business models have to recognise the changing nature of energy monitoring and evaluation, particularly with regard to technical changes in standardised assessments and certification and / or validation of the calculation processes. This suggests that the key value and thus activity required in the SEMANTCO platform lies with having up-to-date calculation procedures. Where this can be easily achieved using the current platform, then the *value proposition* is dependent upon the maintenance of the calculation procedures (as one of the *key activities*) and making any changes necessary in response to policy changes at the national or local scales. The business option recommends:

- Detailed and costed consideration of the necessary steps to achieve accreditation in energy calculation procedures within different national states. This is an explicit activity in consideration of whether SEMANTCO can meet the requirements for the Energy Performance on Buildings Directive (EPBD European Directive 2002/91). The issuing of EPCs is one of the outcomes from achieving accreditation and this has an increasing significant the role in marketing / property sales and leasing. Yet it also has a limited impact on tenant / occupier behaviour as recorded consistently in Danish, German and Dutch research reports (Christensen et al., 2014;Amecke, 2012; Murphy, 2014) and so could be presented as a cost-effective and pragmatic alternative to accreditation if the process proved too difficult;
- Parallel negotiation with the appropriate accreditation bodies regarding alternative means of offering BADNEEC accreditation using forms of reduced data and simplified calculation process in a manner that still supports the desired outcomes.

There is also inherent value in getting access to better quality data and effective data integration, including the identification, accessing and cleaning of public –access data sets (including some which have a low nominal purchase costs but high cost regarding cleaning and editing costs. This repeating assertion that the real cost to organisations is that relating to data and that SEMANTCO associated services can add clear value through offering data management services. In this context, there are multiple ways of understanding data costs (identification, validation, editing, mining) and where these are undertaken through a third party there is a clear acquisition cost that has to be added to internal staff time (and software) costs relating to data cleaning, editing and manipulation. Where the package of services offered through the proposed joint venture can minimise the mixed data costs while ensuring maximum use of the most appropriate data (BADNEEC) then there is clear value for multiple institution and municipal customer segments.

Supporting these activities will be a number of key resources provided through the partnership resources.

One central concern is the ownership and / or copyright (including intellectual property rights) around the use of data that would be necessary for an on-line platform. Within the development of the exploitation plan this will require addressing the following:

- Issues around the ability to share the SEMANTCO source code and worked case-study examples through a self-service platform web site that is supported by an open wiki;
- Issues arising out of the use of third-party data sets within any open-source platform. There has to be a detailed consideration around the requirements for sharing third party data online for open-source usage or as part of worked examples and demonstrations. This will have direct impacts on any commissioning of third party data where there will also be an interest in sharing this on-line;
- The ability to ensure compliance with the data protection requirements and the identification of personal data.

6 CONCLUSIONS

6.1 Contribution to overall picture

The main conclusions are the series of recommendations presented for the future exploitation of the SEMANTCO platform and associated tools and services beyond the existing case study areas. Underpinning these recommendations is the qualitative evidence gained from the external validation with stakeholders. This provides encouraging findings with regard the development of the platform beyond the project and planning for activities needed for exploitation. However it has proved difficult to accurately predict the scale of potential use of the platform. Yet the value proposition related to the improved integration of both data and costs is clear.

- Integration of data. The benefit of bringing together metadata standards, quality control (including certification and external validation processes as necessary), data mining, cleaning and editing into a ‘packaged approach’ to digital data management services. These services would use the standard tables and expert ontology developed within the SEMANTCO project as the open-source framework for data management services.
- Integration of costs. Most public sector bodies and municipalities are concerned with balancing different forms of capital and revenue costs. This is increasingly true, even when any potential revenue savings are for the benefit of tenants / occupiers and capital outlay is undertaken by property owners.

Central to commercial exploitation is the number of customers prepared to pay for some or all of the supporting services. The most relevant evidence suggests that a strategy for open-source access to the platform, coding, materials and where possible even the source data, will be the most effective in generating potential customers. Free-to-use software will generate web traffic and expectations are that, with a ‘user focused’ project web site, income is generated from a percentage of customers accessing the project web site that require technical support and consultancy services. To achieve this there will need to be a shared commitment within the project partners towards supporting such an open-source platform.

6.2 Impact on other WPs and Tasks

The findings presented have direct implications for the Exploitation Planning (Task 7.4). It informs the approach to negotiation to setting up an appropriate joint venture agreement and the ‘copyleft’ approach to many of the specific project assets.

Regarding the cost structure underpinning this joint venture agreement, the recommendation is to remove liability and minimise project development costs. This recommendation is informed by an understanding of the balance between initial business development costs and on-going running costs. In both instances, the most significant costs will be those relating to staffing³⁶ and this becomes more pronounced following initial setup. Typically, the initial project development costs include investment within supporting ICT hardware and the appropriate licensing agreements for supporting software.

The key area where additional staff resources could be allocated is in the development of a new web portal. The findings of this business plan review, support the development of an Energy Services Platform Portal as one of the final tasks for the SEMANTCO project.

The Energy Services Platform Portal will have a role in expanding both the potential customer

³⁶ Comparative case study examples have recorded 76% of cost is due to human resources during initial stages and then 91% during operation (Almirall et al., 2008).

segment and the potential applications, or use cases, for the existing stakeholder applications. Any strategy that seeks to widen the scope of applications will have to respond to changes in political emphasis and shifting construction and energy standards at the national and local levels. This will have short-term implications for the creation of additional project resources. The business planning recommends;

- The development of additional case study resources within the Energy Services Platform Portal that can demonstrate the expanded scope of the SEMANTCO platform and response to alternative Use Cases and applications;
- Support additional applications with access to new support / training material that can be provided as an open-source on-line resource.

6.3 Other conclusions and lessons learned

Undertaking the business planning task at this stage in the development of SEMANTCO project has been a useful exercise for all of the partners with an interest in its ongoing development and exploitation.

There has been an acceptance that the initial use cases from the first three case studies have been useful in demonstrating some of the potential of the approach but that pragmatism is required around the further development of other project uses cases and developing the functionality of the platform. Environmental and climate change policy is dynamic, as is the volatility of many potential customer organisations and stakeholders. In a period of such rapid change, the key benefit is the flexibility to add to the functionality of the platform and in the development of bespoke tools.

There will remain a gap between the theory of business planning and the actual implementation. While the mixed qualitative evidence seems to support the potential exploitation of SEMANTCO through a package of tools and services, this can only be proved in practice.

The recommended approach to promoting ‘copyleft’ use of coding and data is seen as the best means to allow the platform to develop while reducing risks and project development costs for the current SEMANTCO partners. The development of the Energy Services Platform Portal will be the mechanism for distribution of the platform, tools and data. The resultant demand arising for consultancy support services will be the only real way of testing the viability of the preferred business plan.

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8 APPENDICES

8.1 Appendix A – Risk assessment

Framework used for risk assessment for each of the business plans.

Description of risk	Probability low / medium / high	Impact low / medium / high	Mitigation
Delivering services to a municipal customer segment			
Changing European and / or national policy context and statutory requirements impacting on the remit of the various public sector <i>Customer Segments</i> .	H	L	Allocation of additional <i>Key Task</i> for a continual review process for changing standards and statutory requirements.
Limited public sector resources available to undertake substantive interventions restrict uptake.	H	M	Maintain distinction for the <i>Value Proposition</i> between monitoring and cost-benefit ‘invest to save’ interventions.
Limitations in platform uptake and interest arising out of inflexible public sector procurement processes and limitations on possible contractual arrangements.	M	M	Provision of <i>Partnering</i> options / <i>Customer Relationship</i> and early project (particularly in the production of SEAP brief and requirements) involvement as an alternative to commercial consultancy.
Restricted access to and ability to share data due to data protection requirements. Specifically meeting the requirements of the European Data Protection Directive (95/46/EC) and the proposed revisions within the General Data Protection Regulation ³⁷ .	M	L	Controlling access to personal information through security controls for any cloud-based <i>Channel</i> and <i>Customer Relationship</i> . Include additional <i>Key Tasks</i> for legal support and data security controls.
Quality of the data and output form SEMANTCO fails to meet the requirements expected from public enquiry and cross-examination.	L	M	Provision of additional, albeit higher-cost, analysis with more reliance on bespoke data. Undertake validation (for additional project development <i>Cost Structure</i>) of software and calculation methods with the appropriate registration bodies.
Suitable skilled staff availability and / or recruitment within the project Key Partners.	L	L	Reallocation and retraining of existing partner staff.
Ineffective marketing strategy. Lack of interest or project endorsement from the Covenant of Mayors	L	L	Reconsideration of additional marketing <i>Channels</i> to meet the decision-making stakeholders within the targeted <i>Customer Segments</i> .

³⁷ http://ec.europa.eu/justice/data-protection/index_en.htm

Delivering services to an energy company customer segment			
Emergence of alternative commercial products offering a similar <i>Value Proposition</i> to the same <i>Customer Segments</i> .	H	H	Allocation of additional time and resources to the flexible management of <i>Customer Relationships</i> . Variation and / or negotiation of costs to the <i>Customer Segment</i> to maintain the unique <i>Value Proposition</i> around project costs.
Introduction of new (or review of existing) governmental initiatives with different data requirements or calculation methods.	H	M	Re-evaluation of the specific <i>Value Proposition</i> and how this could be met through verification, validation, additional functionality of the platform and increased integration with third-party data sets.
Low level of ‘trust’ in the approach by the <i>Customer Segments</i> – relating to technical competencies and ethics / intention of <i>Key Partners</i> . Potentially limiting interest and levels of uptake of offer.	M	M	Ensure that the <i>Key Partners</i> include a trusted provider (typically in the legal form of a charity or not-for-profit organisation, social enterprise) and this is reflected in the underlying legal business structures
Unavailability of suitable data – particularly up to data / accurate cost information and spatial data for the range of possible substantive interventions.	M	M	Ensure <i>Key Activities</i> include the commissioning (sub-contracting) or direct collection of primary data. Consider options for purchase of alternative secondary data with corresponding impact on the <i>Cost Structure</i> .
Business continuity issues around the use of sub-consultants and sub-contracting.	L	L	Options for internalising <i>Key Activities</i> with resourcing from existing <i>Key Partners</i> and / or structure of SPV.
Appropriation of data and software for use by in-house team.	L	L	Project <i>Key Resources</i> protected by appropriate legal arrangements with all <i>Key Partners</i> .
Delivering services to a property management company customer segment			
Indirect impacts for social housing provider arising from European / national level initiatives promoting energy efficiency in both new build and existing housing.	H	M	Updating of platform (including appropriate calculation processes) to remain policy specific.
Lack of availability of appropriate data regarding the housing stock or existing stock data held in inappropriate format.	M	M	Consideration of additional functionality of the SEMANTCO platform regarding interoperability and conversion of different file formats.
Management, staffing or other organisational changes to the priorities of the social housing provider.	M	L	Introduction of feedback opportunities within the appropriate <i>Customer Relationship</i> and communication <i>Channels</i> . Providing the ability to respond to changing project

			requirements.
Organisation emphasis on cost-based data and requirement for more accurate costs. Particularly meeting statutory requirements for project evaluation and financial assessment.	L	L	Management of <i>Customer Relationship</i> and expectations regarding the accuracy from SEMANTCO tools. Additional product development to provide bespoke financial assessment mechanisms that meet national and / or regional requirements.
Delivering services to a technology company customer segment			
Changes in certification processes, calculation methods and / or the need for statutory validation.	H	M	Review and updating of statutory and legal requirements within different national jurisdictions. Editing and updating of calculation method(s) as required.
Changes in certification processes, calculation methods and / or the need for statutory validation.	H	M	Review and updating of statutory and legal requirements within different national jurisdictions. Editing and updating of calculation method(s) as required.
Delivering services to a sustainability consultancy customer segment			
Requirement for new Use Cases and associated functionality for new projects or through the realistic lifetime of current strategic project.	H	M	Requirement to put in place support agreement for the future development of the platform functionality.
Lack of up-take of the platform due to lack of in-house consultancy skills.	M	M	Provision of additional training materials as an addition to the <i>Key Resources</i> provided to the consultancy sector.
Delivering services to a charity or community group customer segment			
Commercial value and associated cost of data limits access to its long-term usage and lack of willingness amongst key players to assist data mining and supply.	H	M	Providing incentives (data cleansing) and or signing non-disclosure agreements / memorandum of understanding (MoU) amongst partners. Free in-kind consultancy in exchange for data.
Lack of funding to sustain marketing within the third sector organisation and raising of the profile of the tools available.	H	M	Reducing the risk by developing MoU with partner organisations, encouraging joint collaborations and small investment where appropriate to cover marketing and exploitation costs.
Skills shortage or skills churn within charitable organisation. Indicative of the impact of long-term staff retention within the sector.	H	M	Ensuring more than one member of staff is trained to use data. Spreading the risk if one member of staff should decide to leave. Access to additional training materials as <i>Key Resources</i> provided to the charity sector.

Limited access to data due to data protection.	M	L	Using charitable attributes to encourage collaboration and trust from key partners.
Availability of skilled staff to disseminate and exploit the tools to their full potential.	L	L	Training and skills support offered by SEMANTCO partners to technical 'users' of the tools within the third sector organisation.
Delivering services to a professional institute customer segment			
Low skill of the professional users (e.g. associates or members of the professional institutions) in the use of the platform and the tools.	M	H	The SEMANTCO platform owners can offer a consultancy rather than a simple personal assistance.
Delivering services to a technical university or research institute customer segment			
In case of subcontracting or partnership in a research project, the project proposal might not be accepted.	H	H	The only solution is to try another proposal. The impact is high because searching a new call is expensive in terms of time.
Lack of data or not accurate data regarding the building stock.	M	M	Some analysis required on available data sets, using for instance inverse models, in order to solve the issue.
Limitations set against the technology readiness level of the platform as a precondition of funding application.	M	L	Raising the platform to an appropriate technology readiness level through further 'real-world' demonstration applications. Requirement for additional business development costs.

8.2 Appendix B - External review and validation sources

External review of the generic business model was based on conversations with; Mark Barlow (Partner / Principal Architect and commercial developer); Richard Charge (Design Consultant and Built Environment Advisor with Design Council / CABE); Mark Corbin (Researcher with Eunomia Consultancy); Tim Crawshaw (Environmental Services Manager for Darlington Borough Council); Hugh Dalgish (Local authority planner with Gateshead Council); Vincent Flannery, (Data manager, Together Housing Group); Andy Graham (IHBC Heritage specialist); Jo Gooding (National UK Cohousing Network); Dr Philip Griffiths (Building services engineer and assessor for the Institute of Electrical Engineers / Assistant Head of the School of the Built Environment, University of Ulster); Delton Jackson (Local authority designer with Leeds City Council); Tim Jones (Chief Executive of decentralised and community-owned energy company, Community Energy Plus); Edward Leddy-Owen (Sustainability Officer, Rykneld Homes); Chris Speller (Energy Specialist with Bristol Energy Cooperative); Andy Stephenson (Building services engineer Consultant); Mark Taylor (Energy Consultant with Taylor Energy); Richard Williamson (Energy Officer, Bradford City Council).