

# An Investigation of the Adoption of Low-Carbon Technologies by Scottish Housing Associations

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## 1. EXECUTIVE SUMMARY

A feasibility study was proposed as a means of investigating the decision-making activity of housing associations with regard to the adoption of low carbon technologies. The starting point for the study was a consideration of what impact incentivisation schemes (in this case particularly feed-in tariffs) had on the adoption of low carbon technologies. The study developed further, in that it added an objective to assess the feasibility of producing a unified business process (UBP) focused on aiding individual HAs when deciding which low carbon technologies (LCTs) are appropriate to them.

The study involved two housing associations that had both considered the adoption of innovative sustainability technologies, but ultimately made different investment (in the form of 'purchasing' sustainable technologies) decisions. Within the study, interview and document analysis methods were used so as to determine both the culture (in terms of propensity to innovate) and any filters that had strong or weak impact on the decision-making of the respective housing associations.

Data analysis revealed that there were differences between the two housing associations regarding their propensity to innovate (as evidenced by them respectively exhibiting perspective-*taking* and perspective-*making* stances) in the context of adopting low carbon technologies, and the strong filters evident within their decision-making activity.

It was concluded that the inter-relationships between factors that could comprise a UBP was more subtle than had initially been thought and that further research was required in a number of key areas. The study partners have agreed to consider how they may work together on such further research. The study also concluded that the presence/absence of a sustainability champion within a housing association that exhibits a sufficiently perspective-*taking* organisation stance to allow the champion to be effective is beneficial to the adoption of low carbon technologies. For a housing association exhibiting a perspective-*making* stance the sustainability champion will have to deal with slow movement to adopt low carbon technologies.

A final consideration is the organisation's distance from the adoption 'tipping-point', which is suggested as being based on the organisation's *minimum* information requirements that must be met before any adoption of specific low carbon technologies can be implemented. Typical information requirements relate to performance-in-use data, maintenance costs, and education/training of both staff and tenants. There appears to be a relative lack of social housing sector-specific information of this kind.

## 2. INTRODUCTION

Anderson Bell + Christie is an architecture practice with a track record of producing sustainable designs for individuals and communities. The practice has an ongoing relationship with a number of housing associations (HAs or Registered Social

Landlords (RSLs)). Initial research carried out in this context by the practice indicates that HAs/RSLs are not generally responding enthusiastically to recent changes in government strategy to 'incentivise' the adoption of low carbon technologies. The introduction of feed-in tariffs – April 2010 - presents an opportunity that HAs may benefit from. According to Ed Milliband, former Minister of the Cabinet Office,

*“The guarantee of getting an income on top of saving on energy bills will be an incentive to householders and communities wanting to make the move to low carbon living. The feed-in tariff will change the way householders and communities think about their future energy needs, making the payback for investment far shorter than in the past.”<sup>1</sup>*

Social housing presents particular problems for such 'incentivisation', flowing from multiple ownership models (many owners at any given moment, and different forms of ownership possible) within the sector and resultant maintenance/metering/tenure 'barriers'. Nonetheless, the potential contribution to achieving CO<sub>2</sub> reduction targets from large-scale adoption of low carbon technologies (LCTs<sup>2</sup>) is significant. This is evident when looking at the Housing Statistics for Scotland<sup>3</sup>. In 2009, HA new build represented approximately a third of the total number of affordable homes. The trend of new build by HAs over the past three years has increased by approximately 40% - which reflects a continued government commitment for investment in affordable housing. However, there is also a need to acknowledge the potential of retrofitting: homes already built account for 99% of our total housing stock. Estimates vary of the proportion these will represent in 2050, but a conservative estimate is that 86% of the current stock will still be in use in 2050, making up two thirds of the total stock<sup>4</sup>.

### 3. THE RESEARCH PROJECT

The project (funded by CICStart Online) studied the feasibility of developing unified guidance for the adoption of sustainable technologies by the social housing sector. Based on the initial research carried out by Anderson Bell + Christie, the feasibility study was focused on seeking to identify factors that could form a decision-making unified business process (UBP) for use by HAs/RSLs. By exploring the manner in which HAs go about making the decision of adopting LCTs the study sought any commonalities in their approaches. Any commonalities identified would be considered as potential bases from which a UBP could be developed. In particular, the study aimed to ascertain as to whether the aforementioned incentivisation of LCTs through feed-in-tariffs would impact positively on HA decision-making.

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<sup>1</sup> <http://www.solarbuzz.com/News/NewsEUGO57.htm>

<sup>2</sup> LCT encompasses the installation of solar panels, heat pumps, wind turbines, etc. The definition of LCTs was kept loose during the project due to the exploratory nature of the study.

<sup>3</sup> [www.scotland.gov.uk/Publications/2010/08/25134141/1](http://www.scotland.gov.uk/Publications/2010/08/25134141/1)

<sup>4</sup> Stock Take: Delivering improvements in existing housing. July 2006. Sustainable Development Commission

**Aim:** To identify factors considered by Scottish HAs when making a decision re the adoption of low carbon technologies (LCTs).

**Objectives:**

- i) Compare and contrast the 'decision' made by 2 HAs regarding the adoption of LCTs.
- ii) Assess the feasibility of producing a UBP focused on aiding individual HAs when deciding which LCTs are appropriate to them.

The project builds on initial research carried out by Anderson Bell + Christie that suggested a number of questions to possibly be addressed within the study:

- i) What does it mean for a HA to retrofit low to zero carbon technologies?
- ii) How can HAs achieve an income stream from such technologies through feed-in tariffs when there are uncertainties with regard to form of housing tenure (who 'owns' the technology and energy produced?), manner of metering, and decisions concerning charging for the product?
- iii) What are the management implications for management of installed systems?
- iv) To what extent do i) and iii) raise unique issues for HAs that are not faced by other user groups, such as private households or commercial sector organisations?
- v) What is the cost-benefit ratio, with regard to adopting sustainable technologies, of each of the two 'ownership' models (rental (the most common model) and shared equity) within the sector?

## 4. OVERVIEW OF HA PARTNERS

According to the Scottish Housing Regulator, there are approximately 217 Registered Social Landlords (including housing associations) and 26 Local Authority Landlords responsible for around 270,000 homes (mainly flats, and 210,000 of post 1945 construction) and 5,000 bed-spaces. They employ around 11,600 staff, and in 2007/8 brought 4,432 new homes (new build and rehabilitations) into the sector; a sizeable proportion of the Scottish built environment.<sup>5</sup>

Housing associations have the potential to make a significant contribution to the adoption of low carbon technologies. However, present indications are that only about 3% of the total social housing stock in Europe is being refurbished (with energy performance in mind) each year.

The feasibility study involved two housing associations (HA1 and HA2) operating in Glasgow. Based on an established working relationship, these housing associations were identified by Anderson Bell + Christie staff as examples of organisations that had both considered the adoption of innovative sustainability technologies, but ultimately made different investment (in the form of 'purchasing' sustainable

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<sup>5</sup> [http://www.scottishhousingregulator.gov.uk/stellent/groups/public/documents/webpages/shr\\_statistics.hcsp](http://www.scottishhousingregulator.gov.uk/stellent/groups/public/documents/webpages/shr_statistics.hcsp)

technologies) decisions. As a matter of context relevant to impact, it is worth noting that in 2009 nearly half of new build dwellings in Glasgow flowed from HAs – higher than any other Scottish region<sup>6</sup>.

In order to provide some background on the two HAs studied, the following section will provide a summary of their stated organisational aims, drawn from their own promotional material. Where no formal statement has been made about these, we have inferred them from our discussions with the organisations and from other organisational materials.

## 4.1 Housing Association 1 (HA1)

### Vision, Values and Aims

**Vision** - HA1 aims to be an innovative and responsive organisation, playing a leading role in the regeneration of their area and continuing to improve the quality of life of residents.

**Values** - HA1 emphasises the values of equality (ensuring that everyone has equal access to services of HA1 in a manner that should closely reflect the evolving needs of the community), quality (all property and services provided by HA1 should be of a high quality, reflect the needs of the users and demonstrate high measurable standards), and participation (HA1 will encourage, and enable, participation by all sections of the community in meaningful consultation to ensure appropriate and responsive services).

### Aims

- to provide high quality affordable housing
- to promote good practice in the planning and delivery of housing services
- to raise awareness of the housing needs of the people in their area
- to influence local authority policies and practices
- to influence relevant central government policies
- to promote and facilitate inter-agency co-operation as a means of meeting the housing, social and economic needs of the people of their area.

It is worth noting at this point that HA1 does not have any **explicit** aims focused on sustainability issues, nor do their tenants appear to exhibit any particular need related directly to such issues.

### A Short History

HA1 grew out of an earlier organization that aimed to encourage greater community involvement in the area's redevelopment.

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<sup>6</sup> [www.scotland.gov.uk/Publications/2010/08/25134141/1](http://www.scotland.gov.uk/Publications/2010/08/25134141/1)

Registered as a charitable housing association in the early 1970s, HA1 claims to be the first community based housing association in Scotland and the model for the development and growth of housing associations in Scotland. HA1 is run by a Management Committee of local people, many being tenants.

The types of property owned and managed by HA1 ranges from refurbished traditional sandstone tenements to newly built townhouses. HA1 has also developed accommodation for particular client groups (wheelchair users, sheltered and very sheltered, etc.).

The Association has promoted low cost owner occupation in their area and works with developers to provide housing for outright sale. It also provides a property management service for domestic and commercial owners.

## Senior Staff

**Chief Executive.** The Association's Chief Executive has previously been active in the provision of core services and regeneration activity within the HA sector (Interviewee HA111).

**Assistant Chief Executive.** *Has overall responsibility for financial management of the Association's affairs. Has several years housing association finance experience, prior to which he worked in a local authority. (Not interviewed)*

**Development Manager.** Responsibility for development. A qualified architect and previously worked for housing associations and in private practice (Interviewee HA112).

**Housing Manager.** The Housing Manager has worked in social housing for a number of years and holds qualifications in housing and is a Member of the Chartered Institute of Housing (Interviewee HA113).

**Maintenance Manager.** Previous experience in local authority capital programmes and has several years experience in public sector housing. Holds an honours degree, a housing qualification, and is a Member of the Chartered Institute of Housing (Interviewee HA114).

## Current Challenges

HA1 currently faces a falling demand of tenemental stock due to factors such as a declining population, changing aspirations, and poor perception of the area. Also, the funding of ongoing investment in stock and maintaining rents at affordable levels is a challenge. Finally, social issues such as crime, substance misuse, and socially excluded young people.

## 4.2 Housing Association 2 (HA2)

### Vision, Values and Aims

**Vision** (assumed) - HA2 is focused on making the areas where it operates better places to live in.

**Values** (assumed, and 'evidenced' by the Business Development Strategy) - creativity, innovation, and 'self-reliance'.

The Business Development department has a wide-ranging remit to develop new initiatives and provide fundraising, consultancy and financial services for HA2. This has resulted in 'spinoffs' such as a separate economic development company providing premises for businesses in the local area, and a property factoring company providing a common repair and general property maintenance service to approximately 1300 owners.

(Note: Within the interview transcriptions there is some evidence of an 'entrepreneurial' perspective taken by some staff. This may be a reflection of HA2's 'business' approach to its activities).

**Aims** Although no formal aims are stated, HA2 is concerned about wider provision than solely housing, and helping their community through providing services such as debt advice, advice on welfare rights, and apprentice and job training courses. It is worth noting at this point that HA2 does not have any **explicit** aims focused on sustainability issues, nor do its tenants appear to voice any needs related to such issues.

## A Short History

Concern over the deterioration of tenement properties, and the ongoing drop in population within their area prompted the establishment of HA2 in the mid 1970s. Since then, HA2 has been involved in the renovation and development of properties for rent, owner occupation and shared ownership, development of workspaces and shop units, and the provision of training and development initiatives

## Senior Staff

**Director of Finance.** Responsible for financial management and recording in the association. The department prepares the annual financial plans, monitors progress against them and evaluates the financial implications of new business opportunities, as well as raising private finance to fund the growth. Has wide experience of accountancy and financial management in the charity sector (Interviewee HA211).

**Head of Asset Management.** Responsible for the Major Repairs Programme, and ensuring the long term viability of the Associations assets, through cost effective planned and cyclical maintenance. Has always been involved within the Housing Sector through projects varying from preparing contracts for new build housing to producing 30 year planned maintenance programmes for housing organisations (Interviewee HA212).

**Head of Technical Services.** Is experienced in housing construction and refurbishment, having worked for various companies and local authorities (building control and architecture). (Interviewee HA2I3)

**Head of Development** (not interviewed). *Manages the development programme which is responsible for the provision of new housing and other related projects, primarily through capital grant funding. Previous experience of social housing sector work within various funding agencies.*

**Development Officer.** Reports to Head of Development. Trained in architecture prior to becoming a partner in a construction company, subsequently leading to a number of private developments focused on improvement work. Has experience of developing worker co-operatives (Interviewee HA2I4).

### **Current Challenges** (assumed)

Innovation through Renewable Energy: One example is that HA2 claims to have initiated the first Scottish urban project to employ PV cells to partly meet tenant's electrical needs.

## **5. ORGANISATION CULTURAL COMPARISONS**

Analysing the nature of the language used by both HA's when 'presenting' their organisations to the public suggests that they each have a culture that differs in the key area of the organisation's direction.

The analysis considers the extent of both 'passive/reactive' and 'positive/aggressive' terms and phrasing within the material posted by each organisation on their respective websites. At this point, the analysis has only sought to identify an indicative direction for each organisation in terms of its propensity to innovate in a general (as opposed to the adoption of LCTs specifically) sense. This does not presume that innovation-focused organisational behaviour is, of itself, a positive or negative behaviour; simply that its presence would allow an organisation to adopt technologies and processes that would be generally regarded as innovative.

A high level of passive/reactive content is taken to indicate a culture that is characterised by behaviours such as risk avoidance, seeking a slow rate of change, and 'protection' of both the organisation and those it regards itself as being responsible for. A high level of positive/aggressive content is taken to indicate a culture that is characterised by behaviours such as risk tolerance, accepting of an above-normal (for the sector) rate of change, and sponsoring of those it regards itself as being responsible for.

## 5.1 Housing Association 1 (HA1)

HA1 appears to have a culture of influencing through participation and discussion so as to bring about (over time) an environment of provision through structured policies, good practice guidance, and an awareness of needs.

There is a focus on identifying the needs of tenants through formalised tenant participation/discussion.

The culture appears to flow from the organisation's initial aim (at the point of start-up in the early 1970s) to encourage greater community involvement. This results in largely reactive (to tenant needs, once identified) rather than proactive (through guiding tenants beyond their immediate needs) values.

*“The Association will encourage, and enable, participation by all sections of the community in meaningful consultation to ensure that services are appropriate and responsive”*

Within such a culture it would seem that if tenants were to become “incentivised” regarding LCTs, then HA1 would react in a manner similar to that for any other need expressed by its tenants. Thus it can be posited that it may be a case of incentivisation of tenants proving a more effective driver of the adoption of LCTs by HAs than seeking to incentivise the management team. This suggestion is included in the Further Research section.

## 5.2 Housing Association 2 (HA2)

HA2 appears to have a culture that values creativity as a key tool in helping its community. Within this, there is a pride in being at the “forefront” and seeking opportunities there.

The culture emphasizes economic growth, as expressed by their Business Development Strategy. This results in an entrepreneurial environment that comprises a belief that innovation and new initiatives are of value.

HA2's culture is suggested as focusing more on exhibiting the behaviour of ‘leading’ (being at the forefront) than on influencing. The organisation is aware of the needs of its tenants but also places an emphasis on being aware that helping the community can, on occasion, be best achieved through a consideration of other needs beyond those that are immediate.

## 5.3 Initial Assessment

The initial overall assessment of the two organisations' cultures is:

HA1 is essentially focused on maintaining correct and professional relationships that emphasise consultation with all stakeholders and then responding to the results of that consultation. There may be a desire within the organisation to go beyond

meeting community needs as identified through consultation, but this will typically not happen unless sanctioned by a substantial majority of its community. HA1 appears to recognise that there is a value in innovating, but will probably only do so when its community answers the question of 'Should it be us that innovates?' with a 'Yes!'

HA2 is essentially focused on seeking entrepreneurial opportunities that will provide benefit to its community. Consultation seems to be targeted on key individuals/groups within the community, possibly on the basis of an individual starting the consultation through the formulating of an innovative idea. The culture does not disregard the voice of its community, but it seems not to have a strong need for its community to sanction its intentions before implementing change.

## 6. RESEARCH METHODOLOGY

Data were collected by the research team through the use of interviews and a literature search and analysis (focused on HA1 and HA2). The literature analysis provided the basis of the initial cultural assessment. The interview transcriptions were then analysed (see Interview Analysis). The outcomes of the analysis were then discussed with Anderson Bell + Christie staff prior to the final conclusions and suggestions for further research being written up.

### 6.1 Interview Method

Interviews were carried out using an iterative design, consisting of a number of different passes at the same focus with slightly different questioning techniques in order to reveal as rich a picture as possible. The method comprises 5 stages:

**Stage 1: stories.** Tell the interviewee the background to the research (sustainability in the context of HAs) and start them thinking of decisions within projects that they have been involved in. Select one of their projects, focus on that and ask them to describe a particular decision in detail. The intention is to provide interviewees with an opportunity to begin a 'purchase story' (in this context the story relates to 'purchasing' (adopting) LCTs), told without any interruption apart from generally positive encouragement or, if requested, more instruction (they might ask, what do you mean?).

**Stage 2: more detail.** The interviewee is encouraged to fill in more information about the decision through the asking of questions related to actions prior to it, and factors within the decision itself. The interviewer only moves on to another question if the interviewee is going off at a tangent or they have finished talking about the present question. Within this stage the interviewee is given an opportunity to reflect on the decision (was it generally positive?) and the impact it had (has anything changed?).

**Stage 3: revisit list.** If there is time available, repeat stages 1-2 for further decisions.

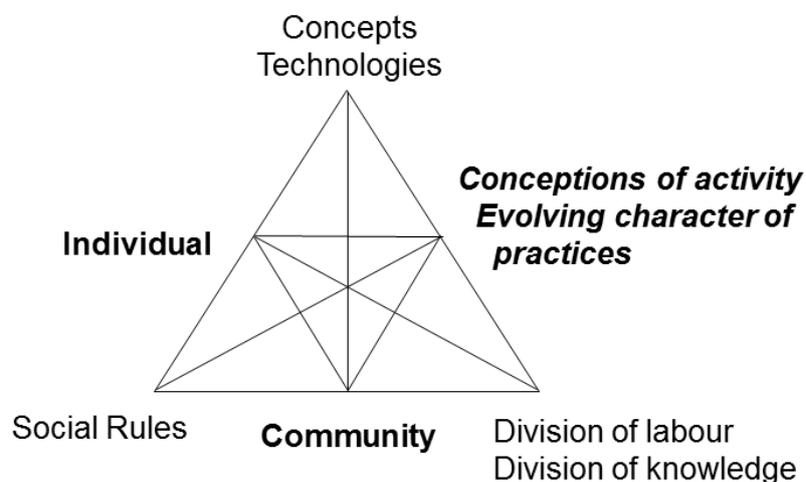
**Stage 4: overview.** The end phase of the interview is used to ask general, broader questions and perhaps ask directly about sustainability issues.

**Stage 5: classification.** The notes, tapes, transcripts and classification sheets each need to be clearly marked with the unique code which corresponds with that interviewee. Time, date and name of interviewee should also be recorded on the classification sheet after the interview is complete.

## 6.2 Interview Analysis

The interviews were analysed by two members of the research team, each of whom worked independently and utilised differentiated approaches to the analysis, thereby resulting in an opportunity to triangulate the research findings.

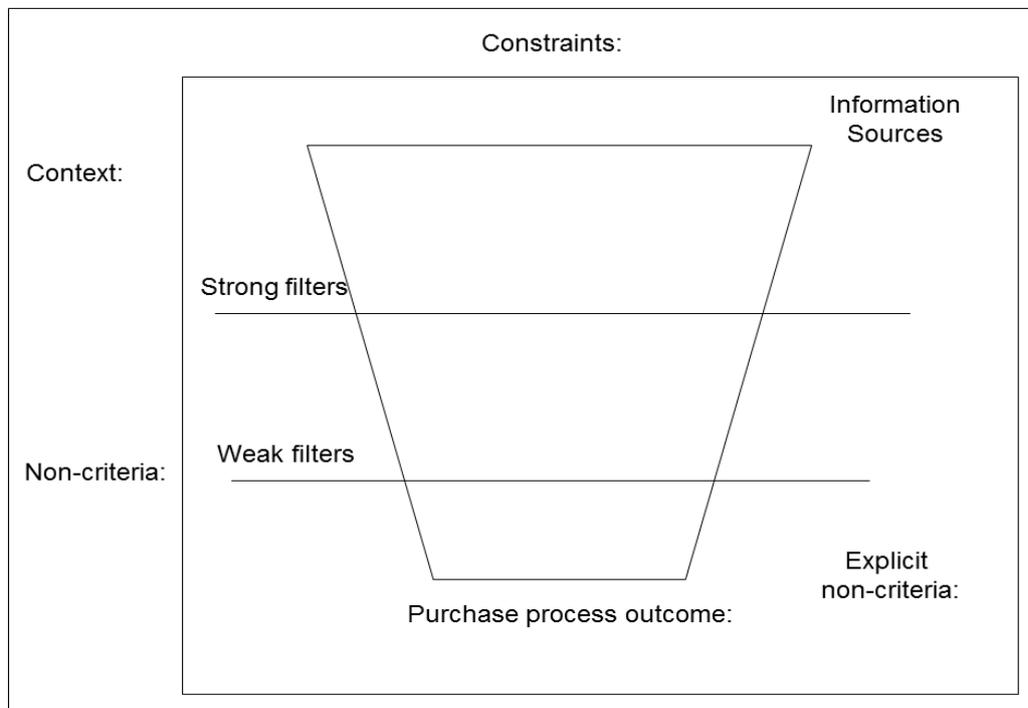
Researcher A analysed the interview data from two perspectives, and made use of analysis tools developed on previous research projects focused on “green” purchase decisions. The first perspective applied made use of the structure illustrated in Figure 1 to carry out activity theory analysis<sup>7</sup> for each HA. This analysis shows how each of the organisations sees themselves and their goals and how the adoption of low carbon technologies (LCTs) fits into this. Results from this stage of the analysis are presented in Appendix 1.



**Figure 1. Activity Theory Analysis: Blank Structure**

<sup>7</sup> Activity theory focuses on human information – not objective (lacking a physical reality) and based on individual, group or organisation (IGOr) needs that inform the organisation’s actions. It brings together notions of understanding, history, mediation, culture and community.

The second perspective applied made use of the structure illustrated in Figure 2 to carry out an analysis to identify strong and weak filters within the decision-making activity of HA1 and HA2. This analysis shows the factors that have affected the final decisions to adopt (HA2) and not adopt (HA1) the low carbon technologies under consideration. Results from this stage of the analysis are presented in Appendix 2.



**Figure 2. Decision Making Analysis: Blank Structure.**

Researcher B analysed the interview data by using a form of behavioural event interview method. Within this approach, the manner in which language is used is taken as an indication of behaviours relevant to the project of considering the decision to “purchase” sustainable technologies, materials and processes. For the purposes of this research, the behaviours were classed as either facilitating or impeding the adoption of sustainable technologies relevant to the low-carbon agenda.

## 7. CONCLUSIONS

The aim of this research was to investigate decisions concerning the application of LCTs by Scottish HAs. Unsurprisingly, each HA has its own way of operating as dictated by its local challenges and priorities when it comes to the adoption of LCTs. Incentives, such as the ‘feed-in tariffs’ scheme, are unlikely to persuade HAs to adopt LCTs, particularly if there is a lack of support, or more fundamentally lack of awareness of the available LCTs, on the part of the residents’ community.

The study enabled the following conclusions with regard to the proposed unified business process (UBP):

- I. The extent and nature of the inter-relationships between factors that have been identified as potentially relevant to the development of a UBP are more subtle than was initially anticipated.
- II. Providing a fully defined UBP is not possible at this point. However, this study has identified a basis (see item iii) below) for further research on this topic. Further, it is clear that the decision making model originally developed through research with individual consumers can also provide important insights into the decision making of an organisation, making it a useful tool for the study of the (non) adoption of low carbon technologies within the relatively unexplored HA setting.
- III. The key factors have provisionally been identified as; presence/absence of a sustainability champion within the organisation (HA1 has a sustainability champion but lacks a sufficiently perspective-*taking* organisation stance to allow the champion to be fully effective with regard to adopting innovative zero/low carbon technologies); sufficient level of authority 'awarded' to the sustainability champion (HA2 places significant trust in the decisions of its champion, particularly given that the champion does not possess strong positional authority within the organisation); the nature of the organisation's perspective regarding innovative technologies (an organisation that emphasises perspective-*making*, such as HA1, will typically be slow to adopt whereas an organisation that emphasises perspective-*taking* will be more open to adopting innovative technologies); the organisation's distance from the adoption 'tipping-point' position (based on the organisation's information requirements in the context of its existing organisation perspective, on which basis HA1 is further away from the tipping point, and therefore requires more information, than HA2). It is interesting to note that the cultural factors noted seem to have been more influential in the eventual outcome of the decision making process than the structural issues: HA1 has a more participative decision making culture which has led to the non adoption of low carbon technologies; whereas HA2, which is much more traditional and hierarchical in its decision making, decided to adopt.
- IV. Both the initial 'culture' assessment (see 4.3) and the activity theory analysis findings (see Appendix 1) are substantially in agreement concerning the extent of differentiation between the two HA's with regard to the adoption of innovative zero/low carbon technologies.

On a more general basis, the study has indicated that the Scottish HA sector is not currently considering potential opportunities such as Feed in Tariffs as sufficient incentive to adopt relevant low carbon technologies. Even in the case of HA2 the incentive appears to be more closely related to its perspective-taking stance (and the message that this sends to other HA's) than to any strategic intention concerning the use of micro-generation to provide additional income. The implications of such a situation for the wider adoption of low carbon technologies across the Scottish HA sector as a whole (and possibly for the built environment outwith the sector), are such that the partners to this study have agreed to seek opportunities to extend the work by applying for further funding in

order to build on its findings, particularly with regard to addressing the need for relevant datasets that are specific to the needs of the social housing sector.

The development of an appropriate UBP would allow design consultants to work with HA clients in a manner that is responsive to an understanding of their specific information needs and thereby encourage the wider adoption of zero/low carbon technologies by the sector. In addition, the UBP can be regarded as a potential contributor to filling, in part, the existing carbon skills gap that exists within the construction industry.

## 8. FURTHER RESEARCH

Possible areas for further research that have been identified within the data collected from this project are:

1. **Monitoring of performance ‘in use’ of technologies.** Interview material suggests that there are several factors within this area that would merit more detailed research. These include: Lifespan of the technologies (when will they need to be replaced; what is the cost-recovery period); consistency of performance (do the technologies retain a consistent level of performance; will any drop in performance result in increasing costs); how can any variation in performance be separated from factors related to use (variation in other costs related to use).
2. **Assessing the impact of educating tenants in the use of novel, sustainable technologies.** The findings of this project suggest that there are two aspects to the ‘education’ issue. The first aspect may be more appropriately regarded as training, with a specific focus on identifying the training needs flowing from ensuring that tenants understand how their novel technologies should be used. The second aspect is essentially educating tenants in the most effective way of ‘living’ with the novel technologies. This differs from the training aspect in that it would be seeking to bring about sufficient behaviour/lifestyle change to achieve the potential benefits-in-use of the technology.
3. **Training of HA staff regarding maintenance requirements of novel technologies.** This area can be regarded as a specific, well-bounded example of what is generally acknowledged to be a UK-wide problem; the low-carbon skills gap.
4. **Guidance on life-cycle models based on sufficiently accurate data regarding the recovery of costs.** The project findings indicate a concern amongst ‘clients’ that there is insufficient and/or inaccurate information available for the development of investment/maintenance planning. Given that this kind of planning may be carried out in the context of a period up to 30 years, the impact of information/knowledge ‘gaps’ is suggested as acting as a barrier to the adoption of novel technologies..
5. **Defining the nature of the potential non-payment problem for communal systems.** The interviewees consistently expressed a concern (at various levels) that they would not be able to either; a) determine an accurate charge

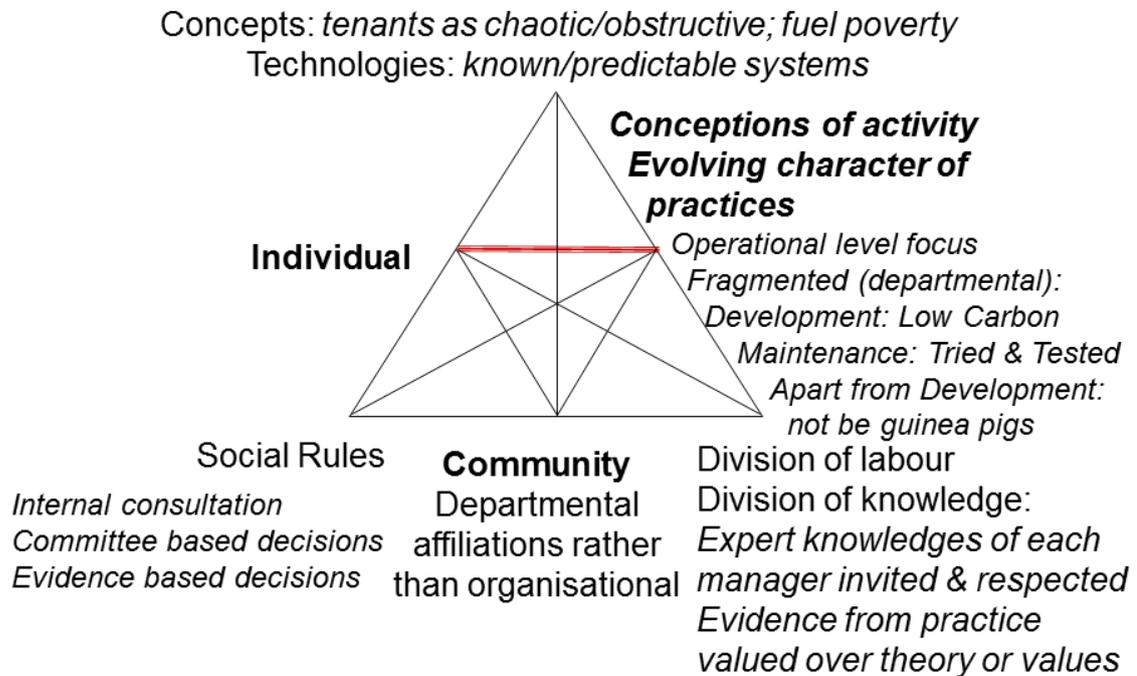
for energy generated (wholly or partially) through the use of novel technologies, or b) address the problem of non-payment for the energy-related component of a tenant's rent, particularly in the context of communal systems. In part, this seems to be a tenure-related concern, but there may also be a technical aspect to the problem. Achieving a clearer understanding of the 'payment' problem is a key step in the development of an effective UBP.

6. **Identifying the gaps with regard to knowledge and understanding of the design, installation, operation and maintenance of sustainable/low carbon technologies.** Within the interview material there is a recurring suggestion that there is a lack of understanding with regard to both the technical aspects of any given sustainability-related technology and also the relationship to the context in which it is to be used. This appears to be largely congruent with the emerging concern that the UK has an emerging low carbon skills gap.

The research team are currently discussing the possibility of collaborating on a further funded research proposal (initially targeted at EPSRC) to carry out a longer-term PhD level study of the factors involved in items 1 and 4 on the above list. The reasoning underpinning this focus comprises an increased (subsequent to completing the study) understanding of the impact of these factors in the context of being filters within the HA decision-making activity. For a HA that is considering sustainable technologies in a perspective taking context a factor such as considering renewables is a strong filter, while factors such as maintenance costs and cost recovery data are weak filters but exist as filters nonetheless. For a HA operating in a perspective making context maintenance costs and cost recovery data become strong filters. The presence of these factors as filters for both HA perspectives indicates their importance with regard to the development of a HA sector-specific UBP. Their presence within both perspectives also underlines the need to develop datasets (regarding performance in use of technologies, etc.) specific to the social housing sector.

## Appendix 1. Activity Theory Analysis Findings.

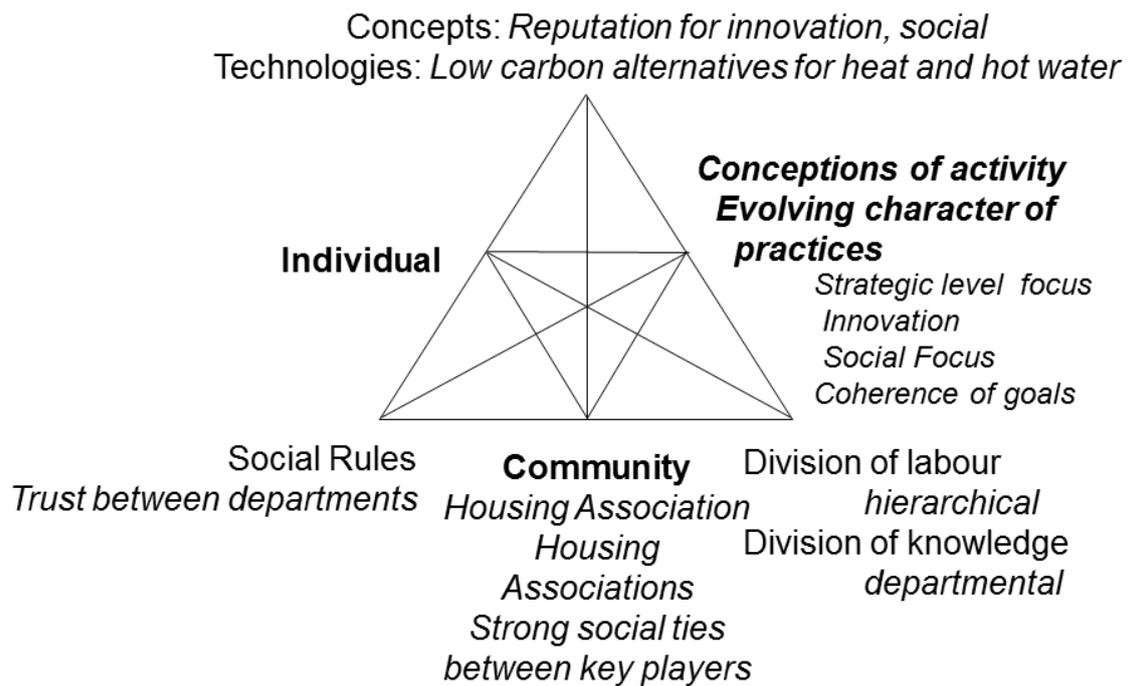
Overall: decision making is characterised by a perspective making approach



A single activity system is very hard to draw due to the multiple objects of activity

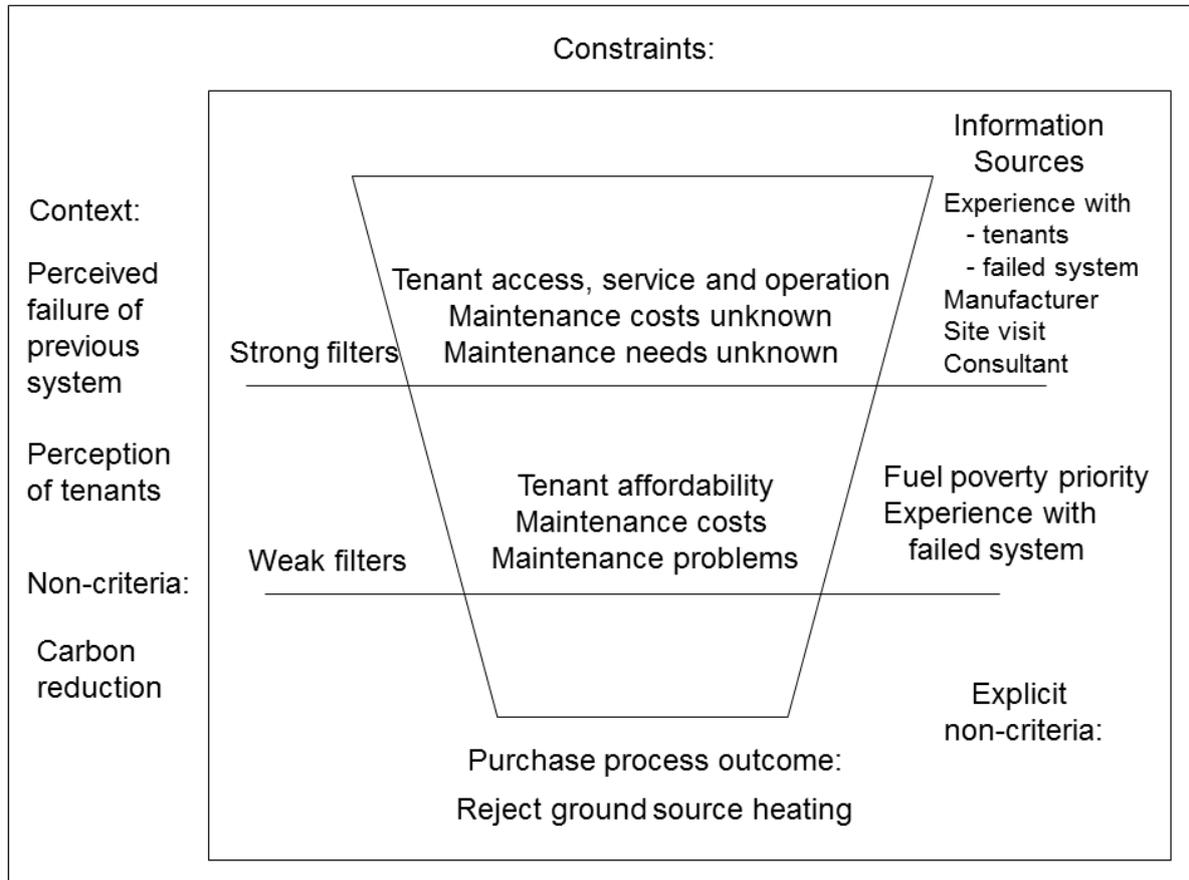
**Figure 3. Activity Theory Analysis: Housing Association 1**

Overall: decision making is characterised by a perspective taking approach

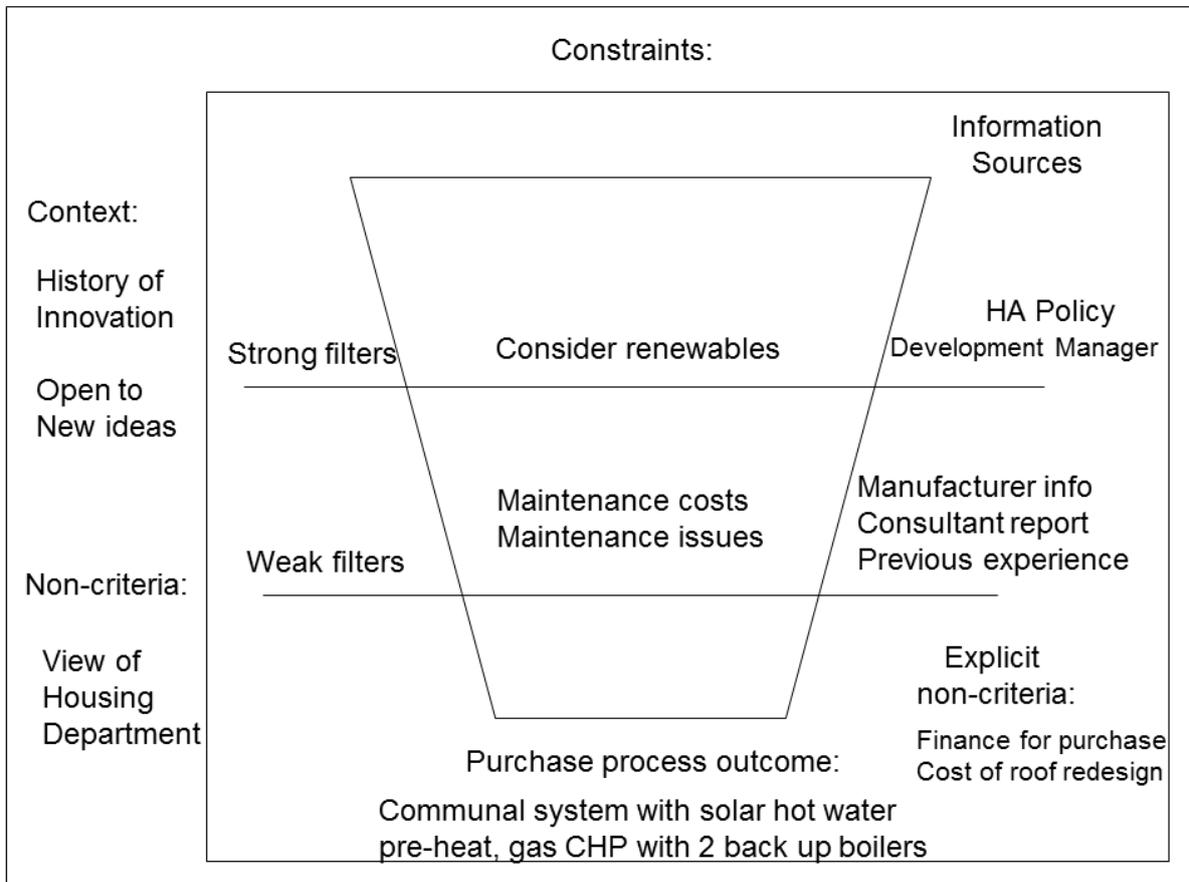


**Figure 4. Activity Theory Analysis: Housing Association 2.**

## Appendix 2. Decision Making Analysis Findings.



**Figure 5. Decision Making Analysis: Housing Association 1.**



**Figure 6. Decision Making Analysis: Housing Association 2.**

### Appendix 3. Outcomes of Behavioural Event-Based Analysis of Interview Data.

Housing Association 1	Housing Association 2
<ul style="list-style-type: none"> <li>• Focuses on meeting the needs of specific ‘client’ groups (sheltered/very sheltered, etc.), the nature of which is perceived as presenting difficulties for the adoption of sustainable technologies.</li> <li>• Fuel poverty is of greater concern than reducing carbon.</li> <li>• Consultation emphasises cross-departmental involvement, thereby increasing the impact on decisions of risk-averse culture – novel technologies are less preferable than proven technologies.</li> <li>• Housing section appears most difficult to convince on the adoption of novel technologies.</li> <li>• Maintenance section is more ‘open’ to novel technologies, but is still relatively risk-averse.</li> <li>• Risk-averse characteristic has been strengthened through a particular negative experience of a specific sustainable technology.</li> <li>• Cultural emphasis on ‘inclusivity’ appears to result in there being no sustainability ‘champion’ to drive the adoption of novel technologies.</li> <li>• Views itself as the original ‘model’ for Scottish Housing Associations and therefore appears reluctant to change substantially away from what that perception means in terms of values.</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence of a level of uncertainty regarding how decisions were actually made. This ties in with the comment by one interviewee that there is little time to ‘learn’ from projects.</li> <li>• HA2 has a hierarchical structure that does not require wide consultation. This does facilitate the maintaining of focus but also seems to result in some stakeholders (e.g.: Housing) not having an opportunity to comment.</li> <li>• HA2 culture had a tolerance for sustainability issues prior to commencement of recent projects.</li> <li>• Incorporation of ‘novel’ sustainable technologies was eased by availability of sufficient (but not total) external funding.</li> <li>• An acceptance that someone has to ‘first’ in adopting technologies, allied with evidence of strong personal relationships that facilitated trust in the sustainability ‘champion’.</li> <li>• Uncertain as to what the <b>actual</b> benefits and <b>full</b> implications of the ‘novel’ technologies will be.</li> <li>• Has become aware of skills/knowledge gaps within the supply chain (including design) for sustainable technologies.</li> <li>• Belief that users need both training in the use of new technologies, and encouragement to undertake behaviour changes.</li> </ul>

## **Appendix 4. Expenditure.**

Awaiting CIC pro-forma.