

Project Information Booklet

Phase One

August 2011



PROJECT SUMMARY

- The aim of LEEP is to create a sustainable and replicable solution that attracts commercial capital at scale for a national residential eco-refurbishment program delivered through local authorities to achieve climate change targets.
- LEEP is a project bringing together experts from the Climate Bonds Initiative, Ecofin Research Foundation, Energy Saving Trust, and Marksman Consulting and has been funded to date by the Sainsbury Family Charitable Trusts and these organisations.
- We believe local authorities can act as facilitators to attract private sector commercial finance for residential energy efficiency (EE) and renewable energy (RE) programmes
- Since 2009, members of the LEEP team have been working with local authorities in the UK on a financing and delivery model for rolling-out energy efficiency retrofits designed to work with private sector partners.
- The focus of the current research undertaken by LEEP through desk research and extensive market testing to date, is to mitigate three identified risks in the implementation of the local authority model.
 1. Accessing capital markets for re-financing: How to design programmes so that a capital markets financing mechanism can be created.
 2. Tackling adoption risk: How to maximise household uptake to improve commercial viability and durability of the scheme?
 3. Maximising sustained reductions: How to ensure sustained emission reductions and energy savings to ensure continued government support?

ACCESSING CAPITAL MARKETS FOR RE-FINANCING

- For residential energy efficiency bonds to achieve market acceptance, they will need investment-grade risk/return profile but not necessarily AAA.
- A long-term liquid market must be created and this will be driven by ensuring volume of issuance through high consumer demand, strong local authority leadership and consistent government policy. A expected market size of approximately £10 billion would be required with minimum product size at £300 million.
- Mainstream investors will be required to create the market and should be targeted by positioning the products as being economically rather than responsible investment driven.
- Bonds must also complement existing investment portfolios. This requires aligning the security with existing long-term markets such as credit cards, car finance social housing or mortgaged-backed securities. The underlying programme must be simple and benefits clearly articulated to overcome extra costs of due diligence for novel products. And achieving inclusion in indices could increase uptake significantly as it creates a compulsion to buy for index trackers.
- A bank warehousing facility is required to allow aggregation of project finance debt across different local authorities into capital market vehicles.
- A warehouse facility would make early re-financing possible and bring significant efficiencies to the roll-out and expansion of energy efficiency financing programmes.
- In this model new local authorities would be able to join existing programmes and make contractual agreement with the Green Deal warehouse and not with each other; but there would need to be sufficient scale across the initial local authorities for the warehouse to be established.

TACKLING ADOPTION RISK

- UK Government policy targets 14 million households or 70% of the UK housing stock to have received improvements in energy efficiency by 2020. This will be supported by the introduction of a Green Deal, a new type of consumer finance involving little or no upfront costs, a pay-as-you-save system, and allowing repayments to be tied to dwellings rather than householders. Investors need confidence a large-scale market can be achieved in a relatively short timeframe to ensure its viability and durability.
- Historically, take-up of energy efficiency schemes has been low. There is no recognised solution for large districts to achieve market penetration of whole-house retrofits at more than 2% a year.
- Existing EE schemes provide useful lessons around gaining trust and legitimacy and overcoming consumer inertia. They also help with how to develop and structure a programme but still do not solve the issue of needing to address adoption of EE schemes at scale and achieve significant market penetration well beyond early adopters.
- Mandatory schemes in recycling, district heating and the roll-out of natural gas in residential houses in the 1960s provide useful lessons to how an EE programme could tackle adoption on a large scale.
- General understanding and evidence of the potential of nudge-type schemes in EE is poor. Behavioural economics research and take-up rates in other consumer sectors supports greater testing of different approaches to choice framing or opt-in defaults in EE schemes.
- Applying a classic adoption curve approach with specific product offerings and messages for different segments – starting with those most willing, early adopters, moving to the mainstream market and finally, to those least willing or laggards - provides a structured approach to frame a large-scale adoption strategy.
- In looking at the range of tools available to ensure adoption of EE schemes we realise that local authorities are uniquely able to consider the full range including marketing, incentives, penalties, mandation and choice framing to fit local needs and context.

MAXIMISING SUSTAINED REDUCTIONS

- In a pay-as-you-save energy efficiency scheme that aims to attract commercial capital investment, the credit risk linked to realising sustained emission reductions and energy savings directly impacts its implementation. Investors need to be reassured of the long-term performance and sustainability of the scheme when its success is dependent on the energy use behaviour of householders and hence the continued support of policy-makers.
- For a complex problem such as rebound – when EE measures do not result in the overall savings or reductions originally estimated due to behavioural responses - it is important to break it down and identify controllable risks within the boundary of the programme. We believe that in the context of capacities to implement policies at local level, it is important that local authorities recognise limitations in attempting to manage economy-wide rebound effects. Ways to reduce such indirect rebound effects may be better locked-in through complementary policies at the national level.
- Making private sector delivery partners responsible for reductions at an aggregate level could ensure high quality energy use estimates and installations and limit the potential for direct rebound effects.
- Additional savings through greater sustained behaviour change can be facilitated by delivery partners through improving information and awareness around energy use within the household. This will have important ramifications on the roll-out of smart meters in the context of the Green Deal where technology will need to provide not simply raw data but enough information to consumers to effect behaviour change.

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ABOUT LEEP

LEEP Mission

To create a sustainable and replicable solution that attracts commercial capital at scale for a national residential eco-refurbishment program delivered through local authorities to achieve climate change targets

LEEP is a project bringing together experts from the Climate Bonds Initiative, Ecofin Research Foundation, the Energy Saving Trust and Marksman Consulting and is currently funded by the Sainsbury Family Charitable Trusts. More information on the LEEP consortium members is provided in Appendix A.

Background

The UK Government has set ambitious climate change targets of 80% reduction of emissions from 1990 levels by 2050 and a recent affirmation of a 50% reduction over the 2022-2027 period.

Representing 27% of UK GHG emissions, the residential sector represents a substantial part of the low carbon solution and in combination with energy security and employment agendas, is currently the focus of a considered policy response by government departments.

The UK Government has committed to the roll-out of a Green Deal¹ for households involving little or no upfront costs, a pay-as-you-save system, and allowing repayments to be tied to dwellings rather than householders. However, there is yet to emerge a detailed and viable private sector financial solution to achieve emission reductions at the scale and costs necessary to meet climate change targets

We believe local authorities can act as facilitators to attract private sector commercial finance for residential energy efficiency (EE) and renewable energy (RE) programmes.

The local authority operating model

Local authorities can deliver programmes that act as the catalyst for securing early financing of EE programmes, and through a comprehension of investor demand from bond markets and policy certainty from governments, ensure that long-term finance is also available to achieve climate change targets. Specifically, local authorities have the appropriate characteristics to deliver at scale such as:

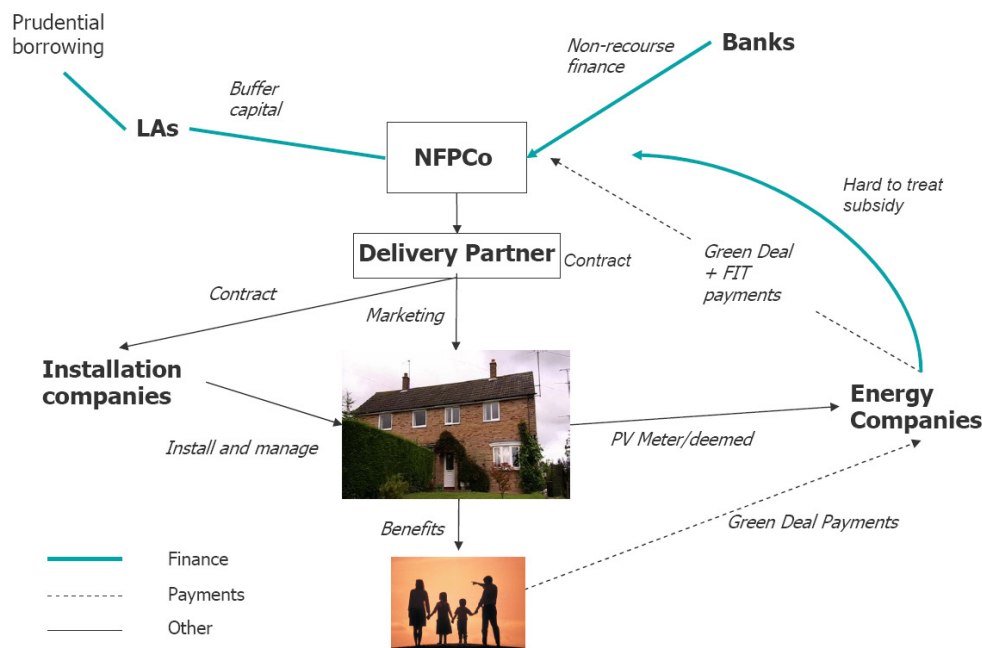
- Trusted institutions by householders
- Have existing relationship with householder/house
- Strong convening powers
- Ability to provide opportunity or reduce risk through own local actions
- Good credit risk with access to low cost finance
- Large property owner
- Fits in with localism agenda
- Ability to facilitate area-based or geographically concentrated approaches
- Some autonomy to legislate locally
- Relationship with local organisations and community groups

¹ More information on the Green Deal can be found at http://www.decc.gov.uk/en/content/cms/tackling/green_deal/green_deal.aspx

Since 2009, members of the LEEP team have been working with local authorities in the UK on a financing and delivery model for rolling-out energy efficiency retrofits designed to work with private sector partners.

To do this, local authorities would need to part finance a Not-For-Profit company (NFPCo) created for the purpose of financing energy efficiency and renewable energy measures in houses. Local authorities have access to low-cost capital, for example they can prudentially borrow from the Public Works Loan Board (PWLB). The costs of measures installed would be repaid by householders from payments collected via energy companies based on the Green Deal legislation or via feed-in-tariffs (FIT) through the roof-rental² model.

Figure 1: Local Authority Operating Model



The costs of setting up and running this fund are not insignificant which means that to keep costs down for the householder, it is best to start with a finance programme of at least £100m in total size and deployment of 15,000 houses. As part of the proposed Green Deal programme, energy companies will be obliged to deliver carbon reduction on hard to treat homes and this programme accesses this support to deliver this before a scaled-up market will reduce the amount of subsidy needed.

Current work with local authorities

Members of the LEEP consortium are working with a number of local authorities in relation to the operating model.

In April 2011, Birmingham City Council confirmed its commitment to establish a transformational and pioneering public private partnership programme to improve the energy efficiency of 200,000 properties by 2026 by taking advantage of the Government's Green Deal proposal.

To get the project underway they approved plans for an initial programme for 15,000 properties with an initial scheme value of £100m with an option to extend to a £400m programme. They also approved the commencement of a procurement process to select a Delivery Partner for this initial scheme.

² Solar PV measures would be financed via a roof rental model with the NFPCo owning the equipment and having a call on the feed-in-tariffs but the house occupiers receive zero cost electricity during daylight hours

Newcastle City Council has been working on the business case for the local authority model extending its ability to work across a number of neighbouring local authorities. The project board has approved this and it will go to cabinet in July. Seven other councils across the UK are at various stages of the engagement process.

Phase One Research Objectives

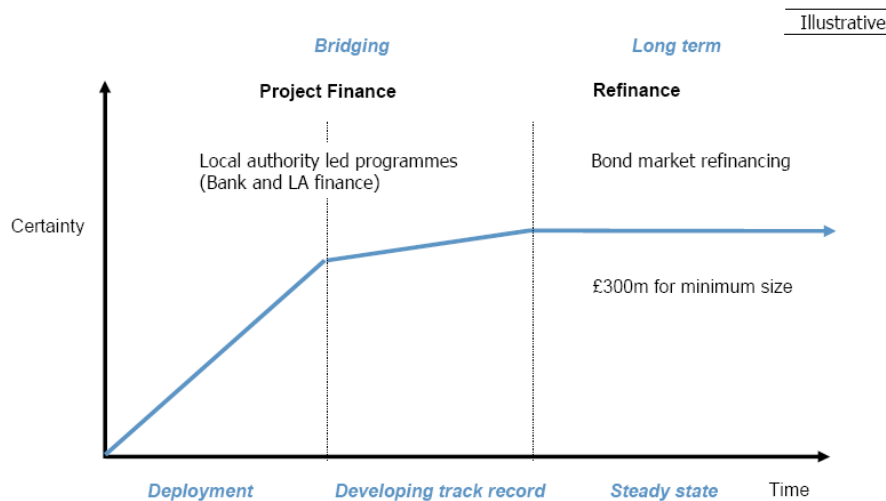
The focus of the current research undertaken by LEEP through desk research and extensive market testing, is to mitigate three identified risks in the implementation of local authority model:

1. Accessing capital markets for re-financing: How to design programmes so that a capital markets financing mechanism can be created.
2. Tackling adoption risk: How to maximise household uptake to improve commercial viability and durability of the scheme?
3. Maximising sustained reductions: How to ensure sustained emission reductions and energy savings to ensure continued government support?

ACCESSING CAPITAL MARKETS FOR RE-FINANCING

In the model described above, local authorities (LA) provide project finance along with banks to initiate the programme, but capital market aggregating and refinancing solutions using the fixed income capital market are required to accelerate finance and to create the scalable solution required to achieve the low carbon and job creation targets.

Figure 2: Capital market solutions are required



Without suitable commercial re-financing solutions, there will not be enough capital to realise energy efficiency objectives under local jurisdictions, not to mention at a national scale.

The research objectives during Phase One were to

- market-test the local authority model among capital market investors
- understand the key requirements to support re-financing by local authorities.

This was achieved through market research and semi-structured interviews with over 12 private sector capital providers over a number of weeks.

1. Investor requirements

The interviews revealed four key factors that will influence the uptake of energy efficiency fixed income instruments by capital market investors. These are the risk/return profile, liquidity of the product, sustainability of the market, and complementary to existing asset allocation strategies of investors.

Mainstream investors will be required to create the market and should be targeted by positioning the products as being economically rather than responsible investment driven. They are likely to include them in their fixed income portfolios if properly constructed and presented as being part of an incoming liquid, durable and long-term market. A liquid market was deemed to be in the range of £10bn, which is achievable given the size of the UK residential housing market. However, investors would need to be reassured that adoption among householders would be forthcoming.³

³ For example, one investor suggested that mandatory sign-up of householders may provide the comfort required to attract investors of energy efficiency-backed bonds

In order to create mainstream investor demand for these energy efficiency bonds market feedback has been to align the security with existing long-term markets such as credit cards, car finance, social housing and mortgage-backed securities; to ensure risks and reward align with asset allocation models; to present cash flows as government policy-backed rather than “green” and to keep programmes simple to enable low costs in due diligence. Long-term securities of over 20 years will be important to match the underlying characteristics of the Green Deal type assets backing it. Uptake would increase significantly if each issuance achieved £500m in value and so is included in indices such as iBoxx, iTraxx.

Buyers of these securities are likely to be fund managers, on behalf of institutional investors, and insurance companies. To make the investment attractive to this investor community a suitable investment grade rating on security is required but this does not need to be AAA. Benefits of investment to the investors and their managers will need to be stated clearly to justify the extra cost of analysis / due diligence in novel products with a strong message that it will be part of a new large scale attractive liquid market.

The feedback on the four key investment criteria is summarised below.

Table 1: Investor requirements for EE backed bonds

What investors told us	
Risk/return profile	<ul style="list-style-type: none"> • Suitable investment grade rating is required but not necessarily AAA • Higher risk/higher cost of capital
Liquidity	<ul style="list-style-type: none"> • Market size must be large enough and liquid for securities to be traded, approximately £10bn. This is achievable within the UK residential market although investors would need to be assured of adequate adoption by householders • Securities should be standardised to ensure comparability and support market liquidity. • To be attractive for institutional investors, the minimum size for an individual bond or asset backed security (ABS) should be £300m, with £500m being a target to ensure uptake in market indices.
Sustainability	<ul style="list-style-type: none"> • Mainstream investors are required to create the market and should be targeted by positioning the products as being economically rather than socially responsible investment (SRI) driven - SRI buyers will buy anyway • It does not have to be the right size from the beginning but needs to have a policy framework that will credibly grow the market to that size to attract investors. • Any barriers to this growth will have to be addressed from the beginning
Complement investment portfolios	<ul style="list-style-type: none"> • Benefits of investment to the investors and their managers will need to be stated clearly to justify potential extra cost of analysis / due diligence in novel products. • Align the security with existing long-term markets such as credit cards, car finance and mortgage backed securities. • Inclusion in indices creates a compulsion to buy for index trackers. This would require issuances of £500m.

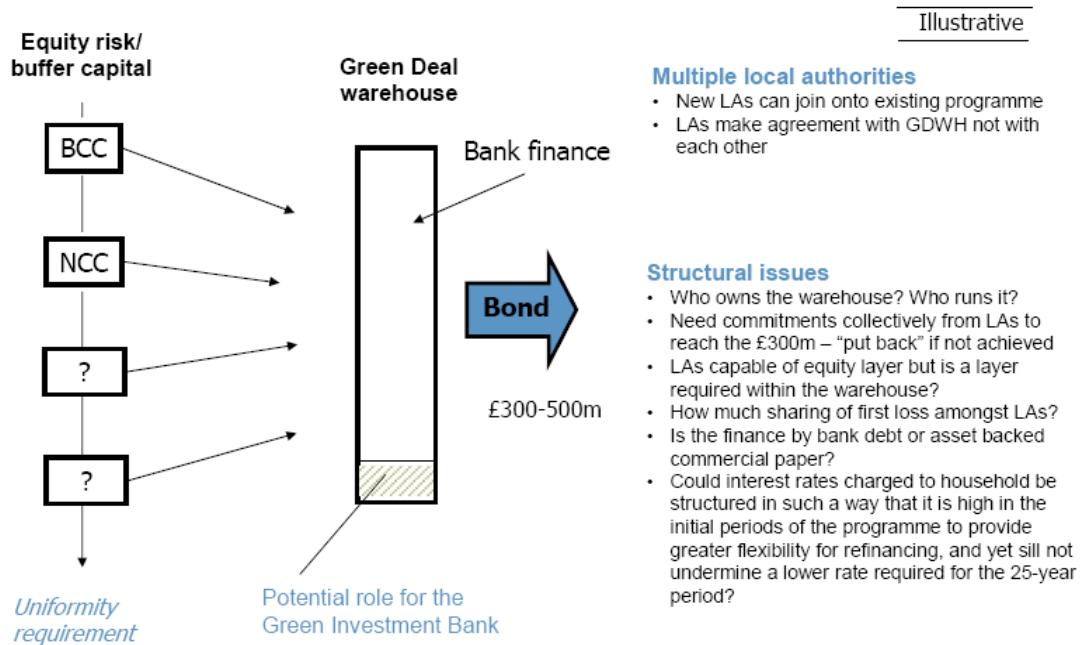
2. A bank warehousing facility is required

A local authority could develop a £300m bond programme on its own but only large local authorities or local authority groupings will have the ability to this, and it is likely to be a 7-year, 60,000 house programme with £100m of local authority and £200m of bank finances required.

In contrast, an aggregating solution across local authorities would bring significant efficiencies. This aggregation and hence early refinancing might be achieved through a banking “warehouse” facility.

In this model new local authorities would join existing programmes and make a contractual agreement with the Green Deal warehouse and not with each other; there would need to be sufficient scale across the initial local authorities for the warehouse to be established.

Figure 3: A Green Deal Warehouse could aggregate local authority EE debt



Further discussion is needed over the governance, running structure and timing of such a financing vehicle and this is proposed in the next stage of work as part of LEEP.

A long-term liquid market must be created and this will be driven by ensuring volume of issuance through delivering high consumer demand, strong local authority leadership and consistent government policy. The latter will be achieved if the programmes are seen to not only deliver customer adoption but also CO₂ savings, issues being addressed in the following sections.

ADOPTION

The widespread adoption of energy efficiency measures by homes is central to achieving the UK's legally binding carbon target of 80% emission reductions by 2050.

Achieving that target will require all consumer segments to have their homes made more energy efficient well ahead of 2050. This is not an initiative or programme that can afford to sell only to early adopters, or to break into the mainstream and go no further.

High adoption rates are also important to attract investors into the sector. To be willing to invest in energy efficiency-backed bonds, they need confidence that the market is going to be large enough to support liquidity.

However, we know that historically take up rates of residential energy efficiency measures have been low. A recent international review of over 20 years of residential retrofit strategies has revealed that no jurisdictions have yet to achieve significant market penetration. It states, "*studies suggest the least cost path to meeting climate goals requires averaging at least 5% annual market penetration of whole-house residential retrofits, yet no jurisdiction is currently reaching even 2% per year*".⁴

Even the more successful free and heavily subsidised schemes can struggle to get householders interested. Research for the Committee on Climate Change supports this, showing 30% of households would not take up measures even with 100% grant.⁵

In order to better understand the issues and to then start to frame some potential solutions to the adoption challenge, we have focussed our research on 3 areas:

- Lessons from existing energy efficiency schemes that have operated at a larger scale
- Exploring different approaches to choice architecture
- Applying the adoption curve approach

3. Lessons from existing energy efficiency programmes

In reviewing existing EE programmes, we firstly identified schemes that had worked at a larger scale with relatively significant penetration rates. We then sought to identify if such schemes had tried to extend beyond early adopters in the take-up of the product offering. To do this the research drew on the experience of EST programmes in the UK and some international examples.⁶

Take up rates vary greatly among different schemes ranging from 2% to 56% of householders targeted. It is important to note that the vast majority of successful schemes featured free or subsidised offers.

These schemes have often been operated on a geographical area basis including going door to door to engage with householders. Examination of these schemes identified a number of common risks to uptake and ways to mitigate those.

⁴ Neme, C., Gottstein, M. & Hamilton, B. (2011) Residential Efficiency Retrofits: A roadmap for the future; Regulatory Assistance Project

⁵ Committee on Climate Change (2009) Meeting Carbon Budgets – the need for a step change; United Kingdom

⁶ Key schemes included 5 PAYS pilots, Kirklees area-based scheme, London RE:New, Scottish area-based schemes funded by SSE, and 14 US schemes

Table 2: Lessons on adoption from existing EE schemes

Risks/Issues	Mitigation
Trust	<ul style="list-style-type: none"> In consumer surveys, local authorities and community groups are generally the most trusted by householders.⁷ Programmes led by community groups were best for securing uptake and achieving legitimacy among local population
Upfront costs	<ul style="list-style-type: none"> High uptake in many schemes was secured by free services and grants Commercial schemes will need to formalise Green Deal pay-as-you-save format into model
Overcoming consumer inertia	<ul style="list-style-type: none"> Community kick-off events can result in significantly more uptake Use of trigger points to minimise hassle. Participants drop out with each additional step and each time delay
Sector driven	<ul style="list-style-type: none"> Multi-stage strategy to deal with different consumer groups – landlords, new owners, renovators etc. however, the research did not uncover any lessons on how to evolve the product offer to appeal to different segments over time.

This provides useful lessons for how to develop and structure a programme but still does not solve the issue of needing to address all segments in time and achieve significant market penetration beyond early adopters. In order to understand how this may be achieved we broadened the research scope to explore different approaches in achieving participation in other sectors.

4. Exploring choice-framing as viable approach to EE adoption

In recent years there has been a focus on behavioural economic approaches to achieve public policy priorities. These involve setting default choices, for consumers to combat inertia over decision-making, yet allowing consumers to opt-out if they do not agree with the default choice.

For example, consent to organ donation in different countries can increase from 12% to 99% in the presence of a default affirmative position. In the US, automatic enrolment in employee pension schemes had a dramatic effect in uptake. Companies which had participation ranging from 26% - 46% in an explicit option choice framework, increased to over 85% when employees were automatically enrolled and were required to opt-out if they did not agree with the default choice.

The research therefore explored different approaches to choice framing for consumers from such ‘nudge-type’ schemes. The aim was to explore how such approaches could be applied to energy efficiency schemes. Schemes selected were due to their similarity to the household or residential refurbishment sector. These include mandatory participation in district heating in Copenhagen and recycling in Netherlands. In addition, the roll-out of natural gas in residential homes in the UK in the 1960s was examined.

While mandatory retrofitting may be politically unpalatable and little evidence exists for the impact of ‘nudge-type’ scheme in residential EE, research suggests that such a scheme could increase uptake providing some key elements are accounted for:

- Non-profit elements of the programme are essential for a scheme which promotes a default opt-in choice model. For example, consumer consent to the ‘obligation to connect’ model in the Copenhagen district heating system was enhanced by the knowledge that the system would be a non-profit operation⁸

⁷ 46% of respondents identified local authorities as most trusted in a 2010 survey by the Great British Refurb Campaign

⁸ Elsman, P. (2009) Copenhagen District Heating System – application for the Global District Energy Climate Award. City of Copenhagen

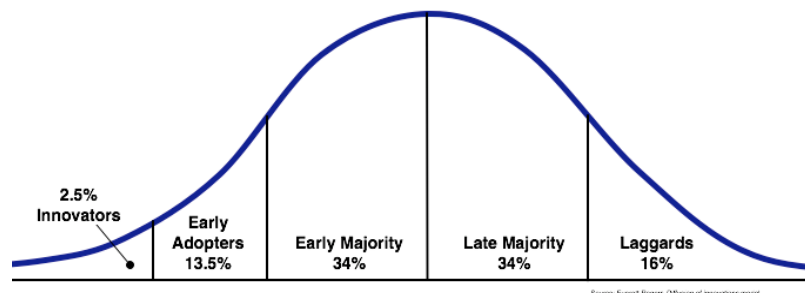
- Extensive marketing would still need to take place in order to reduce knowledge gaps around suitable work to be done in each home
- Situational constraints need to be minimised. All householders must receive some benefit regardless of suitability to target unfairness beliefs
- Free-riders would need to be penalised for unreasonable energy use. In a scheme contingent on aggregate energy-savings to be successful, it would be important to ensure poor behaviour is visibly penalised to provide confidence to adherents of the integrity of their actions.
- Local consultation and community sign-off through a local plebiscite or town hall meeting may be a prerequisite in order to legitimise the deployment of the default opt-in approach and maximise the consent of individual households

5. Applying the adoption curve approach

The final area considered was how we might apply innovation adoption tools to the development of future programmes.

Research from the Great British Refurb suggests 13% of the UK would find new residential finance schemes for energy efficiency very attractive, a further 43% consider it 'fairly attractive', 27% find it 'not very attractive' and the remaining 17% of the population did not find the proposed scheme attractive at all.⁹ This fits with the distribution you might expect to find in the classic adoption curve.

Figure 4: The technology adoption curve¹⁰



In reviewing our research we concluded there would be 3 ways through the adoption curve that any emerging residential energy efficiency offers would need to consider:

1. Segment customers and evolve marketing, communications and value proposition over time.
2. Take an opt-out approach where the default is that households receive energy efficiency advice, assessment and measures, but they can choose to opt-out of the schemes at each major decision point.
3. Make schemes mandatory so that all homes are obliged to take up measures

TESTING OUR FINDINGS

Findings and proposals were tested at one EST Finance Innovator Group meeting. This group has representatives from 16 UK local authorities who are actively considering or developing innovative finance schemes for residential energy efficiency. Semi-structured interviews with marketing experts

⁹ Great British Refurb Campaign (2010) Green Deal – public appetite market research

¹⁰ Rogers, E. (1983) Diffusion of Innovation

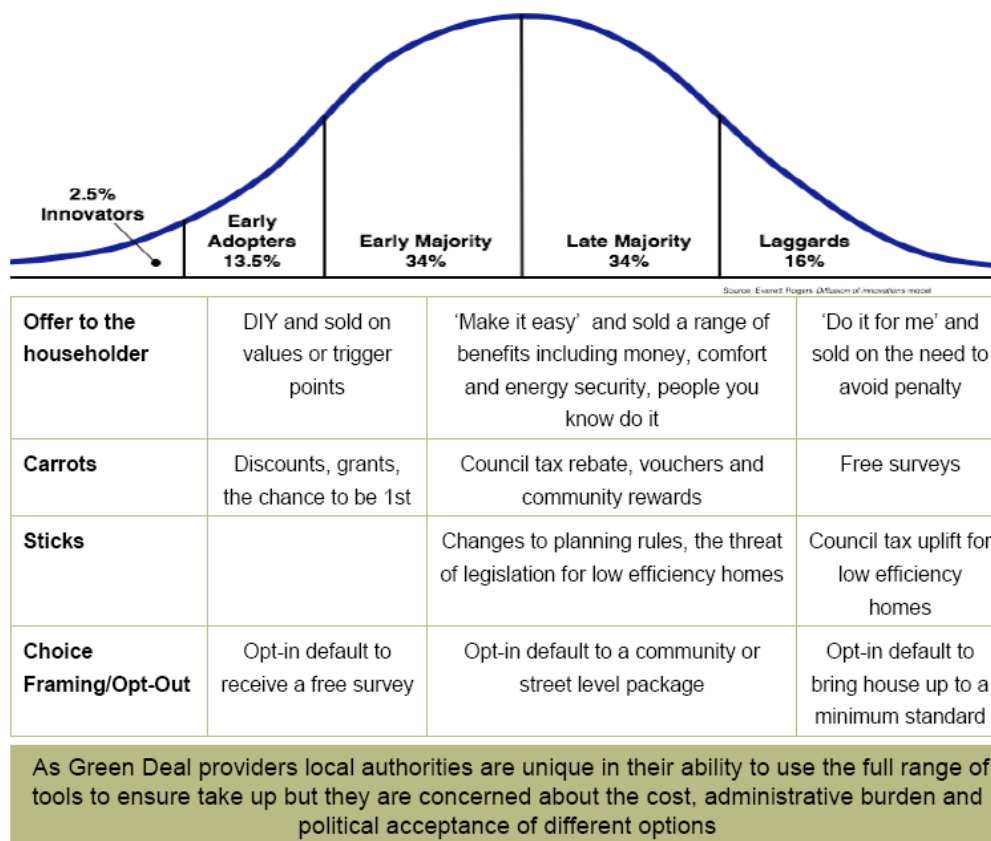
and a selection of community organisations and NGOs who are delivering schemes on the ground were also carried out.¹¹

There was consensus that the adoption curve approach is useful to framing our thinking about how to tackle take-up at scale. It was recognised that mandatory approaches or “sticks” will be necessary at some point, however incentives or “carrots” are also important. Finally there were concerns about the opt-out approach from all those interviewed. Local authorities were concerned about the administrative burden and political acceptance, others were concerned about the consumer rights issues and negative perceptions.

From these initial presentations we reached two key conclusions. Firstly there are a number of tools to encouraging take up of schemes and local authorities are able to make use of all of these tools to some extent. Our second conclusion is that opt-out is not well understood and we will need to do further work to test the feasibility of applying this to any local authority residential finance models.

In looking at the range of tools available to ensure adoption of EE schemes we realise that local authorities are unique in their ability to consider the full range including marketing, incentives, penalties, making mandatory and choice framing. In Phase Two of the project we want to consider the feasibility of local authorities using the different tools to tackle the different segments of the adoption curve.

Figure 5: A menu of tools for local authority adoption strategies



¹¹ Please find a list of interviewees in Appendix B

SUSTAINED REDUCTIONS

In energy efficiency schemes where the costs are borne by government grants or free offers from sponsors, there is less pressure on realising sustained energy savings and emission reductions over the long term. While the success of the scheme depends on the degree to which sustained reductions have been achieved, it does not hinder its implementation.

In a pay-as-you-save energy efficiency scheme that aims to attract commercial capital investment, the credit risk linked to realising sustained emission reductions and energy savings directly impacts its implementation.

Investors need to be reassured of the long-term performance and sustainability of the scheme when its success is dependent on the energy use behaviour of householders as well as the continued support of policy-makers. Having a proven and comprehensive strategy to mitigate against non-performance risks in energy savings and emission reductions will support a cheaper initial cost of finance and provide for viable opportunities for re-financing through the bond markets.

Achieving sustained reductions is also in the interests of other stakeholders. For householders, maximised cost savings are required so that they can benefit from increased comfort and afford to repay the cost of implementation through their energy bills.

For delivery partners and local authorities, they will reinforce the success of the scheme, product offerings, and also facilitate greater private sector competition and cheaper costs of implementation.

While for policy makers, maximal cost savings and emission reductions will allow the programme to be politically sustainable - something required by the investment community, especially rating agencies.

They allow all stakeholders to reap the financial, environmental and health benefits of the scheme while also helping to improve its economic viability.

The research on sustained reductions for Phase One set out to:

- Minimise the rebound effect: We reviewed literature on the rebound effect, identified the boundaries to which it applies within the LEEP framework and considered measures to mitigate the risk
- Align incentives for stakeholders with the policy goals: We considered how to align policy goals of LEEP, with key performance indicators (KPIs) for Delivery Partners, and also what performance indicators householders would respond to.

6. Combating rebound

DEFINING THE ROLE OF REBOUND IN LEEP

The 'rebound effect' is a term used to describe when energy efficiency measures do not result in the overall energy savings or emission reductions originally estimated due to behaviour responses. There is much debate as to the precise definition, extent, size and causes of rebound due to energy efficiency improvements.

At the micro-level, it could be defined for example as a result of householders taking some increased comfort level from improved insulation by turning up thermostats. At the macro-level, the term is also applied to economy-wide rebounds that may have resulted from the initial energy efficiency improvements. For example, householders could use savings gained from energy efficiency improvements to purchase long-haul flights, large appliances or other energy and emission-intensive

products and services. If these choices result in a net increase in energy consumption then a ‘backfire’ effect has occurred.

LEEP is concerned with implementing a commercially viable residential energy efficiency scheme led by local authorities. While this supports significant reductions in the overall energy consumption and carbon emissions of the UK economy, it is limited to energy use within households. **LEEP therefore aims to minimise rebound insofar as it *directly* effects the energy savings and emission reductions within the household, and the economic viability of the scheme.** Consumer choices around products and services outside the household which may *indirectly* effect estimated savings, or the additional energy needed to implement the energy efficiency improvements, are therefore outside the remit of this research.

EVIDENCE BASE

Rebound is generally mistaken for the shortfall of the actual energy savings compared to the engineering estimates.¹² In households, there are a number of different factors at play which may result in a shortfall including:

- poor quality of the initial estimates themselves;
- poor installation of improvements;
- actual behaviour change or comfort take-back where householders use savings to increase energy consumption due to the poor physical nature of the house prior to the improvements or simply due to having a lower energy bill.

It is the latter element that is considered the direct rebound effect. Sorrell (2007) found that while the evidence of the *existence* of direct rebound effects in household heating and cooling as well as other energy services is robust, evidence for the *extent* of rebound is far from comprehensive.

This is mainly due to a lack of clarity around definitions and levels of analysis which make it difficult to independently evaluate and compare results. For example, several studies have been found to place the shortfall entirely on behaviour change without taking into account other relevant factors. This is also not to mention the relatively short time periods in which rebound has been studied compared to the long-term effect of the improvements.¹³

In analysing 15 evaluation studies and four econometric studies, an estimate of direct rebound effect of approximately 30% for household heating was derived. However, the underlying results revealed wide ranges due to selection bias, small sample sizes and other methodological weaknesses.¹⁴ Estimates for cooling were 1 – 26% and more minor energy uses such as appliances were less than 20%.

The government meanwhile has applied a flat 15% comfort-taking factor in its impact assessment of forthcoming Green Deal legislation. This is based on a review¹⁵ of five studies and has been applied through the assessments of CERT and CERT extension policy initiatives.

LEEP APPROACH TO REBOUND

A strategy to minimise the rebound effect in a local authority energy efficiency scheme will need to include the following principles:

¹² Sorrel, S. (2007) The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency. UK Energy Research Centre

¹³ Sorrel (2007)

¹⁴ Evaluation studies results ranged from 10 – 50% rebound while econometric studies were from 1.4 – 60% (Sorrel 2007)

¹⁵ Sanders, C. & Phillipson, M. (2006) Review of Differences between Measured and Theoretical Energy Savings for Insulation Measures. Crown Copyright

- **Manage direct rebound:** For a complex problem such as rebound, it is important to break it down and identify controllable risks with the boundary of the programme. We believe that in the context of capacities to implement policies at local level, it is important that local authorities recognise limitations in attempting to manage economy-wide rebound effects. Ways to reduce such indirect rebound effects may be better locked-in through complementary policies at the national level.
- **Get engineering estimates right:** Improving the initial estimate around energy savings and emission reduction potential will help to limit the prevalent overestimation revealed in previous studies. Including specific data from households in calculations has been shown to greatly reduce the risk of shortfall.
- **Get installation right:** Technology performance and installation are also important factors. Some UK studies have reported insulation installations where 20% of cavity wall area and 13% of loft area had no insulation.
- **Allow for some comfort level:** While the previous steps will allow a more accurate evaluation of rebound potential to occur, elements to manage behavioural responses will be required to combat actual rebound effects. Firstly, it will be important to allow for area-specific comfort-taking factors, particularly considering income levels of households and current physical condition of housing stock.
- **Facilitate greater behaviour change at the aggregate level:** Due to these range of factors related to rebound, it would be difficult for a local authority scheme to guarantee savings at the household level but the evidence is that a properly managed and delivered energy efficiency programme at large scale will deliver savings in aggregate and this should be the basis of ensuring sustained reductions. This has led the LEEP team to consider how we treat savings across a local authority programme at the aggregate level rather than the household level and where the responsibility for this should lie. These are elaborated in the next section.

7. Incentives to promote behaviour change and emission reductions

Building on the previous research, it is possible to identify incentives that could align the objectives of the scheme to actions on the part of local authority Delivery Partners and householders.

Making Delivery partners responsible for reductions at an aggregate level could ensure high quality energy use estimates and installations. This could be achieved through adopting some capacity based incentives that have been proven to work in the US such as¹⁶:

- incentives for training and certification of employees that are paid out after several households have been surveyed and treated.
- Incentives for reporting survey results back to programme management to track and provide quality assurance
- Incentives for achieving targets for renewable energy installations which improve the economic viability of the programme

For householders, improving information and awareness raising around energy use within the household has been shown to promote sustained behaviour change.

Several large-scale, longitudinal studies have demonstrated more frequent billing and feedback tailored to the individual household can achieve this.¹⁷ At a community level, householders have been

¹⁶ Dyen, M. (2010) Contractors as Allies in Home Performance Programs. Regulatory Assistance Project

shown to respond to comparative billing of neighbours with reductions of 2-4% depending on the profile of the end-user.

In the UK, British Gas observed in its 2011 Home Energy report that customers who changed payments from a credit service through bank accounts to a prepayment meter based service, reduced household gas consumption by 20% on average. In addition, the report noted that, “once households become accustomed to closely monitoring and tracking their gas bills and associated consumption, such behaviour becomes embedded.”

This will have important ramifications on the roll-out of smart meters in the context of the Green Deal where technology will need to provide not just raw data but enough information to consumers to effect behaviour change.

Such ‘easy-wins’ in terms of consumer behaviour may be easily achieved through a behavioral-based incentive regime for householders including:

- Incentives for installing very smart meters/hubs
- Consistent messaging on kwh/£ savings performance for households given relevant considerations
- Technology based rewards for community achievements and organisations

The research therefore points to making the delivery partner in the local authority energy efficiency model responsible for emission reduction savings. This is not the current approach currently undertaken by Birmingham and Newcastle City Council as there is not enough confidence in the local authority or the delivery partner in having this as the primary driver of remuneration, but the aim of the next phase will be to build this confidence, understand the potential for this to be part of the model and how to integrate responsibilities gradually over time.

¹⁷ Allcott, H. (2010) Social Norms and Energy Conservation. MIT-CEEPR (Series); Abrahamse, W. et al (2007) The effect of tailored information, goal-setting, and tailored feedback on household energy use, energy- related behaviors, and behavioral antecedents. Journal of Environmental Psychology.

CONCLUSIONS AND NEXT STEPS

Phase One research has identified several conclusions in support of LEEPs aim in developing a sustainable and replicable solution that attracts commercial capital at scale for a national residential eco-refurbishment program delivered through local authorities to achieve climate change targets. These include:

- Local authorities have access to low cost finance which can be used as project finance along with that of banks.
- Local authorities can then create aggregation programmes that create a supply of fixed income investments that ensure there is a liquid refinancing market that brings in further finance. Any local authorities can adopt the model to create supply and create aggregation opportunities by doing so.
- Investors are open to investing in such fixed income instruments given suitable risk/return profiles, liquidity and sustainability of the market, and that the product aligns with asset allocation portfolios.
- A warehousing facility is required to allow aggregation of project finance debt across different local authorities into fixed income vehicles and would support early refinancing and bring significant efficiencies to the roll-out and expansion of Green Deal debt programmes.
- Local authorities, with their trusted role and the legitimacy of their convening and delivery power can create large scale householder uptake through applying an adoption curve approach.
- Applying a classic adoption curve approach with specific product offerings and messages for different segments – from early adopters, to early and late majority, through to laggards - is an optimal way to frame a large-scale adoption strategy.
- General understanding and evidence of the potential of nudge-type schemes in EE is poor. Behavioural economics research and take-up rates in other consumer sectors supports greater testing of different approaches to choice framing or opt-in defaults in EE schemes.
- By managing the rebound effect and incentivising behaviour change through the delivery partner, the programme will deliver carbon savings and maintain central government support.
- Making Delivery partners responsible for reductions at an aggregate level could ensure high quality energy use estimates and installations and limit the potential of direct rebound effects.

NEXT STEPS

In Phase Two, LEEP will continue its research and begin forming solutions to achieving its aims across five related work packages:

1. **Addressing adoption risk:** Test the application of an adoption curve approach to tackle the mass scale adoption of energy efficiency measures required over time. This will include feasibility on the use of different tools in the local authority model and a high level estimate of cost effectiveness of the tools.
2. **Ensuring sustained emission reductions:** Test the ability to create appropriate incentive structures for delivery partners, to encourage them to take responsibility for sustained emission reductions. This could be done over time and at an aggregate level.
3. **Establishing a local authority Green Deal banking warehouse:** Deliver a full feasibility review of a local authority Green Deal banking warehouse. This would provide a means to refinance local authority programmes through quicker and cheaper access to capital markets.

4. **Developing a residential energy efficiency bond market:** Deliver an outline proposal of how a timely residential efficiency bond market can be developed. This will include establishing bond characteristics and standards that would assist uptake by mainstream investors, and preparing the market for the introduction of these bonds.
5. **Exploring roll-out cost reductions:** LEEP has identified the potential for roll-out cost reductions as relevant to the achievement of national energy efficiency programmes and will initiate a new work package in this area. It will aim to develop a scoping paper on achieving cost reductions for the rollout of energy efficiency measures through the supply chain and possible economies of scale to improve commercial viability of the programmes.

Appendix A: The LEEP Consortium



The Climate Bonds Initiative (CBI) is an investor-side policy group working to mobilize finance for a rapid global transition to a low-carbon economy. It is a joint project of the Carbon Disclosure Project and the Network for Sustainable Financial Markets. The Initiative has a multicountry Advisory Panel of experts from the finance industry and capital providers.

Chair Sean Kidney has substantial experience in financial services marketing and in policy marketing. Associate Nick Silver is Chair of the UK Actuarial Profession's Environment Committee and a consulting expert on the financial aspects of addressing climate change and on pension fund design. He has extensive experience working with the finance, insurance and asset owner sectors.

The CBI is currently developing standards for "Green" or "Climate" bonds, with the ultimate aim of these bonds becoming mainstream, preferenced and part of an index. It has recently effectively developed and launched the first climate bond standard.

The CBI has led the work on adoption and rebound risk as part of Phase One delivered by LEEP.

www.climatebonds.net



The Ecofin Research Foundation is a UK registered charity established by, but independent from, Ecofin Limited, a London based investment management firm that specialises in the global utility, infrastructure, alternative energy and environmental sectors. The Foundation uses its knowledge of the global utility and finance sectors and its network of contacts to promote the development of sustainable, low carbon solutions. Its understanding of the finance sector and experience with companies, capital providers and regulators enable it to engage and collaborate with stakeholders to deliver workable low carbon solutions. Having the ear of a wide range of private sector capital providers enables the Foundation to engage with key decision makers to increase the access to capital markets for specific initiatives.

Dr Angela Whelan (CEO) has expertise and a strong reputation with capital providers. She also has a deep understanding of the criteria capital providers apply to investment decisions and are used to talking to and working with the finance community

The Foundation has recently canvassed over 30 senior private sector capital providers (with responsibility for investment decisions), to understand and accelerate private sector financing for Carbon Capture and Storage projects. Senior policy makers, project developers and the finance community have expressed strong interest in the initial findings.

The Ecofin Foundation and the Climate Bonds Initiative are also working together on the European Climate Foundation's Roadmap 2050 capital markets initiative.

ERF has led the management of LEEP Phase One. It also supported Marksman Consulting in the initial research into the bond market and the Energy Savings Trust and Climate Bonds Initiative in research into adoption and sustained emission reduction.

www.ecofinfoundation.org



The Energy Saving Trust is the UK's leading impartial organisation helping people save energy and reduce carbon emissions.

Founded in 1992, it is a not-for-profit company limited by guarantee, set up to help reduce the UK's carbon emissions by reducing UK residential and transport energy use.

The EST's mission is to find the best ways to change people's behaviour and to introduce energy saving measures into homes. The EST does this by providing expert insight and knowledge about energy saving, supporting people to take action, helping local authorities and communities to save energy and providing quality assurance for goods, services and installers.

Practical help outreach service

The EST has run an enquiries and outreach service for the Department of Energy and Climate Change (DECC) for 10 years. This service allowed local authorities and housing associations to ask questions on sustainable energy. Within this service, the EST offered presentations and workshops on a number of topics, including implementation of best practice planning policies in Local Development Framework documents and understanding how to evidence these policies. The service was an early champion of the Merton Rule and helped local authorities to understand the opportunities to make developments more sustainable. Workshops were also run for local authority members to engage them with climate change issues and the importance of their high level support in delivering on local and national emissions targets.

Local authority one-to-one programme

The EST one-to-one support programme is aimed to help local authorities to assess their progress on addressing climate change in their community. EST support managers worked with local authorities to:

Collect – baseline data on a council's activity across all energy related activity

Review – progress to date

Identify – opportunities for further development and improvement

Provide – case studies of similar work carried out by other local authorities

Work – with local authorities to produce an agreed action plan

Support – local authorities as they begin to implement an action plan

The local authority one-to-one support programme assisted 143 authorities across the UK. As part of the benchmarking process, the EST reviewed the local authority's climate change mitigation policies and made recommendations on how they could be strengthened

www.est.org.uk



Marksman Consulting (www.marksmanconsulting.co.uk) is an environmental finance consultancy providing advice and support to clients in the low carbon economy financing sector.

Principal Christoph Harwood is a former McKinsey consultant with energy and finance sector experience. Christoph has a broad expertise in the packaging of financial solutions and has delivered the current thinking for the EST on the local authority energy efficiency project and on the work being delivered for Birmingham and Newcastle City Councils; he is also a member of the Climate Bonds Initiative Advisory Panel.

The work at Birmingham and Newcastle has led to the development of business cases whereby these cities are now moving to procure delivery partners. Marksman Consulting is also working with a number of other local authorities on adopting the model.

Marksman Consulting has led the work on refinancing the local authority programmes as part of LEEP Phase One working on both the Green Deal warehouse and the appetite for the bond market in buying energy efficiency programmes

www.marksmanconsulting.co.uk

Appendix B: List of advisors and interviewees

Over the course of Phase One of the LEEP project we consulted with an expert advisory panel and have interviewed a wide range of stakeholders. While taking sole responsibility for the contents of the report, we would like to thank all those who have generously given their time and insight into this project. These include the following:

Advisors

Andrew Rainsgold	The Aldersgate Group
Chris Neme	Energy Futures Group in association with RAP Europe
Will Dawson	Forum for the Future
Caroline Fiennes	Executive Director, Global Cool Foundation
Chris Hewett	Green Alliance
Colin Hines	Green New Deal Group
Nick Robins	HSBC Climate Change Centre of Excellence
Garry Felgate	Orion Innovations
Meg Gottstein	Principal, European Programmes, The Regulatory Assistance Project

Interviewees

Ingrid Holmes	E3G
Ed Matthews	E3G
Patrick Durkan	Director of Ecofix Ltd.
Jay Stuart	Director of Ecofix Ltd.
Paul-Michael Rebus	Eversheds
Ed Gillespie	Futerra
Rebekah Phillips	Green Alliance
Terena Plowright	Greening Campaign
Tim Lunel	National Energy Foundation
Paula Owens	Paula Owens Consulting
James Robson	RM Capital (NCM Finance Limited)

Other organisations interviewed

Department for Energy and Climate Change (DECC), UK Government
M&G Infracapital
State Street Global Advisors

As well as a further 11 other organisations comprising mostly of financial institutions

The Local Energy Efficiency Project consortium – Climate Bonds Initiative, the Ecofin Research Foundation, Energy Saving Trust, and Marksman Consulting – believe that the information presented in this document is reliable. However, we cannot and do not guarantee, either expressly or implicitly, and accept no liability, for the accuracy, validity, or completeness of any information or data (whether prepared by us or by any third party) for any particular purpose or use, or that the information or data will be free from error. We do not undertake any responsibility for any reliance which is placed by any person on any statements or opinions which are expressed herein. Neither the Climate Bonds Initiative, the Ecofin Research Foundation, Energy Saving Trust, or Marksman Consulting, nor any of our affiliates, directors, or employees or any contributors to this project will be liable or have any responsibility of any kind for any loss or damage that any person may incur resulting from the use of this information.