GRESSEL LANE HOME ENERGY HOUSING ERDF PROJECT
SUMMATIVE ASSESSMENT
REPORT JULY 2023

SDRC CONSULTING LTD

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Executive Summary

The Gressel Lane project is set out in the Birmingham City Council Route to Zero (R20) action plan as a technological demonstration project to be undertaken to inform the design of 7,000 new homes to be delivered by 2031.

The economic context at the time of the project development was substantially different to the prevailing conditions in 2023. The current high cost of energy and threats to security of energy supply reinforce the need to develop low energy housing.

European Regional Development Fund grant (ERDF) was secured by Birmingham Municipal Housing Trust to gap fund the costs of piloting low carbon energy installations in Birmingham City Council new build housing. A Summative Assessment is required as part of the final reporting of all ERDF projects.

The project is expected to be successfully delivered despite a number of unforeseeable challenges along with those anticipated when planning to deliver an innovation project. The project delivery process illustrates the range of dependencies in designing and delivering an innovative construction project.

All interviewees report that the project has been well managed and will meet the headline objectives.

Post Occupancy Monitoring (POM) will be carried out for a minimum of 12 months post project completion to assess any performance gap issues and to understand tenant energy management behaviour and operation of the low carbon technologies.

The POM will also look at wider issues such as low carbon mobility choices and use of the EV charge points.

Gressel Lane key facts

Project application name	Home Energy Housing
Working name	Gressel Lane
Investment priority	PA4
Application budget	£1,042,157
Application ERDF grant request	£521,077

Start and Finish Dates	February 2021 – June 2023
Contracted outputs	C30 - Additional capacity of renewable energy production 333 kW

The Summative Assessment formal reporting is through ERDF Summative Assessment Report Summary (ESIF-Form-1-014)

The following report follows the questions in Form 1 – 014 but provides the opportunity for extra text as the Form 1 014 has a restricted word count.

1. Project context

The Gressel Lane project is included in the Birmingham City Council Route to Zero (R20) Action Plan. ERDF grant was secured to gap fun the addition of renewable energy technologies so the Gressel Lane development could be built off the gas grid.

The project will deliver a net zero carbon energy demand and generation/storage solution for whole place low carbon communities through attention to the building fabric and through installation of renewable energy generation and storage products as part of a local building level energy system for a minimum of 30 smart homes, with an integrated electric vehicle charging infrastructure, supporting low carbon mobility options.

The project will demonstrate test:

- How new building designs and low carbon technologies can support decarbonisation of the domestic sector
- Whether low carbon innovation in the housing and energy sector is affordable and a business case can be built for the rollout of net zero housing and low carbon place solutions by social housing developers
- How the design and products chosen also provide opportunity for local economic development
- What other benefits arise from the technologies chosen and improved energy performance of the house.

Since 2009, Birmingham City Council, through the Birmingham Municipal Housing Trust (BMHT), has provided new homes that are economic to run, look attractive and meet the needs of Birmingham's residents. Homes were higher quality than current Building Regs (developed to Code 4 of the former Code for Sustainable Homes) and are Secure by Design compliant. They incorporate the latest building technologies for creating lower running costs for both tenants and owners. To achieve this, BMHT has introduced new building specifications which include energy and water saving measures for new developments. Additionally, BMHT continually explore options for using more sustainable construction methods to reduce the impact on the environment.

The Home Energy Housing project at Gressel Lane was developed as a technological demonstration that the design of 7,000 new homes that will be built by BMHT for Birmingham City Council by 2031 can contribute to the Birmingham 'Route to Zero' (R20) goals through enhanced energy performance of new build housing with integrated energy generation and storage. Gressel Lane was included in the R20 Action Plan[1] . This is the first BMHT scheme to add the use of battery storage and ground source heat pumps to the BMHT specification which was enhanced in 2022 to move from gas to electric heating in line with the Future Homes Standard and ban on installing new gas boiler systems from 2025 and installs triple glazed windows and MVHR as standard.

[1] file:///C:/Users/dsysh/Downloads/Accessible_Route_to_Zero_Call_to_ActionAF%20(1).pdf

At a more detailed level, the project will:

- Compare heat pump types and use the information to inform future housing specification choices
- Examine potential conflicts between networked energy strategies and local authority's responsibility to uphold 'right to buy' policy
- Investigate combinations of a range of products
- Assess the potential for new technologies and air tight designs to reduce tenant's energy bills and fuel poverty risks
- Test innovative new energy storage options to maximise the benefit of energy generation from installed renewables
- Develop alternative installation and construction methods to improve ease of future maintenance or replacement
- Avoid the reduction of internal floor area or storage space required by renewable energy systems by housing them on in energy ‘pods’ on the exterior of the building
- Carry out additional design stage analysis and testing at handover to allow improved understanding of design goals vs tenant experience, intended to determine possible 'performance gap' problems in housing stock
- Include products to encourage adoption of green transport choices such as EV chargers
- Commit to a legacy of monitoring and research to provide guidance to future project teams

The primary policy drivers for the project included the local authority's commitment to meet its 'Route to Zero' (R20) goals, in the context of the national drive to meet its responsibilities to the global need for carbon emissions reduction targets by 2050.

The need to increase the quality and size of the Council housing stock.

Commitment to reduce carbon emissions and improve air quality associated with mobility.

Build on the aspirations of the development of HS2 with a new Birmingham terminus and on the success in securing the 2022 Commonwealth Games and the green civic activity around the Games.

Although Britain had already voted to leave the EU, the post-cession structural relationship was not apparent and indeed it continues to be far from settled. Moreover, few envisaged and even less prepared for the Covid Pandemic and its global economic aftermath. The immediate surge in economic activity as nations came out of lockdown, stretched global supply chain capacity & stimulated prices pressures. More recently, the invasion of Ukraine has served to further fragment global supply chains and created a global shock on energy prices, accelerating already firming inflationary trends. As a result, the combination of these factors has had profound impact on output, demand and prices. High energy prices have a negative impact on project costs but provide a driver for investment in renewable energy generation and storage and an imperative on investing to create energy security of supply.

For 2017 the government was forecasting the real GDP growth would be 2.2%, which the OECD forecast would be one of the fastest amongst the industrialised economies. Currently the UK is hovering above formal recession.

On 11 June 2019, following a cross-party motion, a climate emergency was declared at Birmingham City Council. A report was presented to City Council in September 2020 setting out the progress made to date and an Action Plan based on work undertaken by consultants Anthesis. At that meeting, Council requested a further prioritised and costed action plan to be brought back to the City Council by the end of the year. This resulted in the Route to Zero R20 (2020)

The Birmingham City Council Route to Zero (R20, 2020) outlines a roadmap for Birmingham City Council's activities to become carbon neutral:

"**Our ambition is for the council and the wider city to become net zero carbon by 2030, or as soon as possible as a just transition allows**."

The R20 identifies seven areas where Birmingham City Council aims to reduce CO_2 emissions: new build houses, retrofit, transport, EV charging, waste, energy and natural environment.

Birmingham City Council, working through its subsidiary Birmingham Municipal Housing Trust (BMHT) was asked to develop and submit a European Regional Development Fund (ERDF) bid to fund a trial of technologies for reducing energy demand, such as heat pumps, photovoltaics and storage batteries.

Local authority specific policy issues considered at the design stage also include the council's ability to uphold its 'right to buy' options, and the subsequent impacts on their ability to adopt energy strategies dependent on collective or networked systems.

Fuel poverty risks and increased recognition of the relationship between housing comfort and tenant health, provide a context that demands improvements to housing construction specification that delivers highly improved energy efficiency, seeks to eliminate the performance gap and installs low carbon technology that can be operated effectively by tenants.

The Council requires a step change in building performance - both energy generation and reduction in energy demand. The market currently does not have an affordable, trusted offer that has been implemented at scale.

There is a persistent market failure in the delivery of new highly energy efficient homes at or near zero carbon standard. Building Regulations do not currently require near zero carbon performance and those homes built today will not meet either the 2025 Future Homes Standard or the Council's 2027 carbon standard . Additionally, new homes fail to meet even current Building Regulations performance requirements due to a persistent 'performance gap' which arises from a number of stages in the design, construction and operation stages[2].

There are still market failures in investment in renewable energy and local low carbon energy schemes and in local smart grids. Connection to the gas network a preferred option for many developers despite the costs of bringing gas onto new sites. Consumer demand is cited as a key reason why developers have not moved to electrification of heating and hot water.

[2] https://www.thebuildingshub.co.uk/resources/performance-gap/

A further market failure factor that has been identified is one of the weak supply chain for low carbon goods and services. Achieving net-zero housing in Birmingham requires significant transformation across the housing supply chain, a persistent market failure nationally.

Even with the support of the renewable heat incentive there is still a very low investment rate in low carbon and community/district energy schemes. The market failure here stems from a range of barriers including poor specification, installation and maintenance of low carbon energy technologies; issues of adoption of shared pipework and lack of business models for District Network Operators to accurately price grid connections for community schemes.

Although the economic and policy goals were present to support investment in net zero housing, market failures were evident that presented barriers to their achievement. These can be summarised as:

- Energy reduction solutions for both space heating/hot water and power demands
- Energy storage solutions allowing improved efficiency and tenant control
- Integration of different products to create energy systems
- High DNO charges for connection of energy centres to the grid and issues with requiring peak demand to be met although most capacity would be underused
- Landlord maintenance hindered by complexity of tenant appointment and property access
- Construction / material quality failures causing unexpected energy consumption ie. 'performance gap' problems
- Strategy for tenant access to green transport choices
- Energy losses and air quality issues caused by poor ventilation strategy

There is a persistent market failure in supply chain capacity.

1. Availability of sustainable materials: The availability of sustainable materials can be a challenge, particularly in the context of the scale of the construction industry in Birmingham. Sourcing and using sustainable materials can be more expensive than traditional materials, which can affect the cost of net-zero housing projects.
2. Skills shortage: Achieving net-zero housing requires a range of new skills and technologies. There is a need for skilled workers in design, construction, and installation of renewable technologies. The shortage of these skilled workers can lead to delays and cost overruns.
3. Complexity of technology: The installation and maintenance of renewable energy systems and other sustainable technologies can be more complex than traditional systems. This requires the development of new technical expertise, and the associated training and support systems.
4. Planning and policy framework: The regulatory and policy framework for net-zero housing is evolving, which can create uncertainty for investors and developers. This uncertainty can lead to delays in planning and financing decisions.
5. Supply chain integration: Net-zero housing requires close integration of the supply chain to ensure the delivery of sustainable solutions. *This requires collaboration between designers, architects, developers, contractors, and suppliers.* The lack of integration can lead to project delays and reduced quality.

To overcome the market failure challenges, the project seeks to develop a coordinated approach that involves collaboration between all stakeholders in the housing supply chain. This includes the development of clear policies and regulations, the promotion of training and education programs, and the fostering of closer collaboration between suppliers and contractors. By addressing these supply chain issues, the development of net-zero housing in Birmingham can be accelerated, helping to create a more sustainable future. The project aims to promote these through an extensive publicity programme.

All elements of the project represent a response to critical issues that must be tackled by the housing sector in order to meet the energy, carbon and health/wellbeing minimum targets expected of social landlords to respond to the climate crisis declared by the local authority.

The detail of the project addresses a range of issues:

- Minimisation of space heating (and cooling) demand
- Low carbon generation of residual energy
- Energy security of supply by onsite generation
- More efficient maintenance by easier access to pods on the outside of homes
- Simpler tenant operation of controls
- Improved comfort, indoor air quality and affordability of total cost of energy
- Access to green mobility choices

The robustness and sustainability of the proposals are also dependent on long term maintenance and care and informed the decisions to design bespoke products to position products on the exterior and improve access.

Fuel poverty pressures on affordable housing residents must be recognised by landlords as serious challenges to the health, wellbeing and financial security of their tenants. Improved energy performance should reduce energy demand and therefore bills, thereby also reducing the risk of rent arrears and ultimately eviction. The reduction in rent arrears contributes to the business case for investment in high quality, low carbon housing.

Performance specification targets must improve to mitigate the ongoing energy crisis and provide equity.

The rationale for the combination of technologies installed and analysis undertaken seeks to respond to all these concerns.

2. Project Design

BMHT (Birmingham Municipal Housing Trust) was specifically set up in 2009 to deliver high quality housing. This project is already informing BMHT on design and product solutions for new housing that meets the vision of Route to Zero. The delivery model was appropriate. It includes a tested design and delivery process and provides a pathway for adoption of project learning within the City Council and its wider housing sector partnerships.

The project was appropriately designed with the assistance of specialist technical input, procured to ensure that the appropriate level of design development was completed before construction. Project funding also provided additional energy consumption analysis using tools usually deemed beyond the minimum requirements of housing design, providing a robust set of targets and post occupancy monitoring benchmarks.

Digital modelling of the proposed collection of products was undertaken to test the scale and installation detailing required to accommodate the additional renewable energy technology proposed. This information informed tender documentation and was continued to be used to inform fabrication accuracy during construction. This degree of technical detailing using Building Information Modelling (BIM) is unusual during the 'pre- contract' stage in the housing sector. Further use of this process is recommended in future projects.

Although some concern was raised by suppliers during procurement regarding the installation innovation proposed, this was examined further as a team at an appropriate point in the design development and all factors considered carefully. Whilst the Design & Build (D&B) procurement model provided a successful arena for this design discussion, other aspects of the technical control required on the project are not ideally suited to this delivery method. The product and design detail commitment required during the pre-contract stages unavoidably reduce the supply chain choices usually preferred by D&B contracting.

BMHT budgets are set on the numbers of housing units delivered. The ERDF gap funding supported the installation of renewable energy generation and storage. The delivery programme was informed by previous similar projects and the target outputs were set by pre-application design calculations based on site layout and property orientation. The targets were realistic and achievable.

The output targets set for the project were realistic and achievable given the experience of BMHT in delivery of new housing and the research that had gone into the new technologies and products. The total renewable energy capacity consists of established, reliable individual output specifications for each product installed providing a clear specification for the appointed contractor.

Supply chain capacity was expected to be sufficient given the opportunity to use the DLUHC framework.

3. Project Context and Changes

There has been a significant impact on supply chain capacity due to Brexit and Covid 19, further exacerbated by energy price rises due to the war in Ukraine. This has affected costings during the tender process, the delivery programme and shortage of products normally available on short order times. Government economic stimulus investment in housing retrofit in 2021 and 2022 has also caused significant supply chain stresses. The management of this programme stress has been made more difficult by the fixed ERDF deadline due to the end of the current ESIF programme. However, the City Council Cabinet, elected members and officers have been very supportive and the delivery team have been committed to delivery of the project and its objectives.

Jessups are the main contractor and have been under new management during the course of the contract resulting in more robust internal systems which has also caused some impact to programme that Jessup have had to manage to enable the contract requirements to be satisfied

Since the conclusion of the Order of Cost exercises, inflationary pressure has emerged across the UK economy with of the most extreme inflationary pressures are being seen in building materials, which has resulted in significant increases in tender prices. Building materials shortages are a worldwide trend, affecting globally traded products across all trades. The consequences are rising prices and extended delivery times – both having a significant impact on capital projects. Volatility in the markets continues and tenderers are unsure of its longevity or extent over medium and longer duration schemes.

According to the Building Cost Information Service (BCIS), construction material inflation is currently running at around 10%. Construction materials typically account for about 30% of the cost of a project, so the overall inflationary impact on the cost of a scheme is likely to be around 2-4% depending on the materials mix of the scheme. Some increases are higher – particularly on housing and civils schemes where markets are more active.

Labour rates across all trades are increasing in response to lockdowns and impaired demand for site trades and skills. For example, bricklayers are seeing wage inflation of 10-20% highlighting the strength of demand for key trades. Mechanical and electrical and joinery trades are also in demand, with corresponding wage inflation of approximately 10% over the year.

Materials such as timber, plaster and bricks have extended lead in times and trade associations are warning of expected supply problems from a combination of global and domestic factors. In reality all materials have been affected to some degree with buyers increasingly unable to secure fixed prices over medium and long programmes. Suppliers are asking for short term orders only.

This did not impact during the contract which was fixed cost aside from provisional sums but inflation during the tender period resulted in costs coming back higher than budget. This had a knock on effect that budgets agreed and signed off as part of the project approval process were not sufficient and a further round of approvals had to be sought. Officers cannot go out to tender without cabinet approval. If tender prices exceed the agreed budget it is necessary to go back for further approval which can take months. The approval process involves representatives from many departments and every change in response to comments must be signed off by the whole group. A

recommendation is that net zero training is given to all those involved at every level who will be involved with R20 Action Plan projects including decision making related to them.

4. Logic Model

The contracted output target is additional capacity of renewable energy production of 333 kW. Whilst there has been programme slippage for a number of reasons including weather, changes in contractor project management processes including 'just in time delivery', the equipment is being ordered for delivery to site in Q2.

Project delivery pressures were caused by the additional level of technical approval required by the client-side team to ensure the ERDF funded specification was met by the contractor. Final confirmation of coordinated mechanical and electrical specification was required to inform follow-on packages of work such as Post Occupancy Monitoring and procurement of this element was delayed.

Renewable energy product supply chain issues caused by the national energy crisis resulted in pressures on the procurement team.

5. Project Progress

The project spend and outputs delivery profile has slipped due to a range of factors. It is expected that this will be completely or largely resolved by the end of the project.

Slippage has been due to:

1. A delayed project start due to the need for further Cabinet approval for higher than authorised contract prices
2. Introduction of new management systems by the contractor
3. Unseasonal bad weather

The expectation that slippage will be fully or largely pulled back is down to:

Innovation fostering interest and enthusiasm in team members and potential suppliers.

Regular communication between team members and a supportive, collegiate attitude from all project participants has assisted performance greatly.

Extensive pre-contract design development discussion and testing which provided a robust set of proposals with contingencies considered at an early stage.

A range of design solutions which could be used to respond where needed to particular house type or site requirements.

Documentation quality. The use of BIM contributed to this and this is innovative in terms of national construction.

The mock up of technologies enabling site teams to examine the installation design before actual site installation.

ERDF output targets are forecast to be mostly met. There is a current query on the installation of low carbon technologies on 5 properties which may not be complete until late July/early August. The situation is being closely monitored. Comparative technology types will have been installed, allowing Birmingham City Councilto undertake valuable post-completion analysis.

Other outcomes such as provision of EV chargers supporting low carbon mobility and reduction in energy demand helping reduce fuel poverty will have been achieved. Planned training of colleagues and residents, post occupancy monitoring and dissemination in the 12 months post project completion will raise awareness and improve knowledge on actions to deliver the City Council R20.

6. Project Delivery and Management

There are many different layers of management within this project – internal, of the contractors, by the contractors. There are also different partnerships including suppliers and manufacturers which are also important. Some large stockholders are beginning to work directly with manufacturers to give them better understanding of the options.

The rationale behind the decision to deliver this pilot innovation project through BMHT was that on a complicated pilot project, this delivery model was the most appropriate. BMT were already delivering at higher than Building Regulations and had an interest in long term outcomes for the City Council as part of an ongoing delivery programme. Secondly, it was important for BMHT to gain the learning to roll out onto other projects.

Initial interviewees feel the project has been well managed in delivery and reporting aspects. Although it was pointed out that communication could have been better . Also it was mentioned that turnover of staff, and the need for comprehensive on-boarding, both at the beginning of the project and as new staff joined as replacements, could have been better.

There have been the typical contractor performance issues and it has been difficult at times to separate issues due to introducing innovation into a housing construction project from normal construction contract issues.

There has been learning which will be used to inform future projects regarding the resourcing and the appropriate stages to bring in technical expertise as part of a 'no regrets' decision making process.

Governance including budget approval and response when costs rose during the tender process have caused some delays to the project. However, this is a known factor by the City Council where fiscal responsibility must be strong and effective.

The project was under the management of Birmingham City Council, supported by Arcadis with inputs from Axis Design. The project is implemented by Birmingham Municipal Housing Trust (BMHT) an independent arm of Birmingham City Council and delivered by a contractor from the DLUHC framework.

Birmingham Municipal Housing Trust (BMHT) is a housing development program run by Birmingham City Council in the United Kingdom. The program was launched in 2009 to address the shortage of affordable housing in the city and to provide good quality, affordable homes for Birmingham residents.

BMHT works in partnership with a range of housing providers, contractors, and developers to deliver new homes across the city. The program aims to create sustainable, inclusive, and well-designed communities that meet the needs of a range of people, including families, older people, and those with disabilities.

BMHT has delivered thousands of new homes across Birmingham since its launch, including both social housing and affordable homes for sale. The program has been recognized for its innovative

approach to housing development and for its success in delivering high-quality homes that meet the needs of Birmingham's diverse communities.

In terms of procurement of inputs, a problem identified was that it a few large companies were the ones most likely to respond to tenders – even though SMEs were in the framework. This seemed to be a reluctance for SMEs to tender as they did not have the resources to develop a tender; but also they felt that, as a large company would be most likely to succeed, they would be sub-contracted on the tender anyway. Birmingham City Council are trying to widen the scope of companies on the framework. Additionally, as the project developed the specifications failed to keep uo to date as techmology improved (although it was noted that specifications were required before the tenders are issued)

Jessups won the contract for Gressel Lane; a change in ownership has resulted in a much more rigorous procedures for compliance. Although this has resulted in short term difficulties, it was welcomed and recognised as important in future project management.

Birmingham City Council's own in house manufacturers have been unable to meet the enhanced specifications for supply of doors and windows. It is unknown whether they will be able to gear up to deliver triple glazed windows.

An in-depth interview with the prime subcontractor highlighted a number of interesting points:

The experience of working within this project has been largely positive. It provided the opportunity to look at new technologies.

The upfront cost of the technologies, although comparatively large, has been proven to be worthwhile in the longer term.

Additional time in installation (put at about 20% more than conventional systems); however, as some required new installation drawings – for example moving the pumps away from the dwelling to minimis noise – requires additional pipework for which drawings and specification and now available. This relocation may require additional qualifications and expertise, as the liquids required may be different.

The price of the technologies should fall as they are bought up to scale.

The experience gained by installer staff have led to the increasing poaching of staff – showing a demand for qualified staff in the sector.

The quality of the work has passed all necessary inspections; and can therefore be deemed to have been to a high standard.

A key objective is to reduce or eliminate the performance gap. The quality of work is checked on site. Post occupancy monitoring will confirm the in use performance.

The brief and technical solutions for the Post Occupancy Monitoring program have now been confirmed. A specialist testing and monitoring consultant team has been appointed via the Arcadis framework and services agreed. 11plots will receive fabric performance testing at handover to confirm air tightness of construction and energy losses through the construction, setting a

benchmark against desktop analysis at design stage and confirming extent of any 'performance gap' issues. In addition, a range of sensors measuring energy use and temperature will be installed, providing access to user energy consumption for a 12 month period and allowing the council to examine the outcomes described in Summative Assessment logic model.

The ERDF programme deadline and the related project deadline resulted in a compressed period for the contractor's proposals development. Increased dialogue and design testing would have been beneficial.

Earlier budgetary allowance for physical prototyping and testing, supported by further discussion with post-handover teams such as maintenance and housing management teams may have improved early design development.

A clearer, dedicated role within the appointed contractor's team for ERDF/grant funding specific issues may streamline communication.

As an innovation project, beneficiaries include officers, decision makers, contractors and suppliers who have all learnt about design and delivery of low carbon housing on the project. The project was intended to be a demonstrator to inform the design of new build housing as part of the City's commitment in the R20 Action Plan.

The end user beneficiaries will be identified through the standard City Council social housing tenant allocations policy, which is points based with those with highest points getting the first options to move in. Some tenants in may be specifically selected because of particular property characteristics which they require.

Given the range of tenants, care has been taken to specifying easy to operate controls and to design accessible handover manuals/information. This includes plans for a demonstration house where staff and tenants can see and operate the technologies used on the project.

Post project monitoring and evaluation will provide further detail on the perceptions of the occupiers. This will include tenant surveys and outcomes from stakeholder workshops. Post project dissemination will gather design and outcome summaries and provide information to the wider construction sector via compiled reports, photographs and diagrams to be shared online. Face to face events will be considered going forward but time scale and accessibility/inclusion preferences may result in online as preferred technique.

All Council activity is based on meeting the Councils Equality and Diversity themes. The project itself is supporting opportunities for the most vulnerable to access high quality housing, with the enhanced fabric reducing space heat demand and the installed renewable energy generation with battery storage providing low cost residual energy. Good quality housing responds to the growing understanding of the impact of poor housing on health and wellbeing, improves opportunities for educational attainment and employment. Warm, safe and comfortable homes that are affordable to heat are of most benefit to those spending a lot of time at home: young families, elderly and unwell or disabled. By reducing carbon emissions and contributing to the Council drive for net zero, climate mitigation activities are intended to slow down the increase in extreme weather events associated

with climate change. It is the poorest communities that suffer the most from the impacts of extreme weather.

7. Project Outcomes and Impact

Despite the challenges, Birmingham City Council and the project team remained committed to delivering this innovation project. The ERDF grant helped provide value for money for the council for this pilot project. Costs were verified through national procurement. The jobs created lever immediate economic impact of £243,600 construction worker and £315,000 heat pump engineer per FTE (source Ons STATISICA AND Indeed .com) and over the BMHT programme of 7,000 new builds would deliver £1,193,640,000 construction economic impact and £283,500,000 renewables economy impact over 7 years.

Living in homes of EPC C has benefits calculated by Citizens Advice nationally as unlocking almost £40bn in cumulative social and economic benefits. Including £23.8 bn in consumer bill savings and associated reduction in greenhouse gas emissions from using less fuel. £9.3bn in societal savings including low emissions and lower excess winter deaths and £2bn savings to the NHS as warmer homes reduce causes and severity of illnesses associated with cold homes.

All of this means that the Council has delivered on addressing environmental and social cross cutting themes by building 30 new high spec, highly efficient and renewable energy powered homes. The full impact of the impacts and benefits will be confirmed at the end of the POM.

Birmingham City Council has demonstrated strategic leadership and acted as a catalyst for low carbon innovation. It has been able to use its strategic influence and leverage It has also managed to marshal and effectively engage a diverse range of stakeholders within and outside the Council. The Summative Assessment Plan set out 4 intended outcomes for evaluation from the logic model. All have been addressed in the summative assessment or in plans for post occupancy monitoring.

Logic model outputs:

1. On-site energy generation targets are expected to be delivered (in fact, slightly higher than expected - 337 kW - as PV panel installation design was more efficient than predicted)rom combination of photovoltaic panels, heat pumps and PV battery storage.
2. PHPP modelling completed during design development stage and has resulted in increased accuracy of benchmarks for Post Occupancy Monitoring (POM). This will subsequently result in improved ability to advise tenants on energy and fuel savings by distinguishing between building fabric and user choices.
3. Reduction of GHG expected over standard BMHT house types due to additional technology installed. Post occupancy monitoring plan in place to confirm emissions during 12 months post completion.
4. Dedicated EV charging point to be installed on all properties as intended. Post occupancy monitoring to confirm up-take after 12 months.

To what extent are the changes in relevant impact and outcome indicators attributable to project activities?

This pilot project has amply demonstrated the feasibility of a move to low carbon housing if suitable conditions are met. These include appropriate trained and motivated staff and knowledge of relevant technologies and how to install them. The knowledge of this process, within BCC, BMHT and the

wider contractor and subcontractor ecosystem will feed through to the aim of meeting the target of building 7000 low carbon homes by BMHT by 2031. Additionally, the impact of the project in demonstrating the feasibility of this approach will be felt – and implemented – beyond the project. Anecdotally, the contractor suggested that his staff, having gained knowledge from this project, were being approached by other companies interested in expanding their own low carbon offers. This will contribute to increasing the uptake of training opportunities and therefore expanding the skills base.

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Economic Impact

	Average Weekly Wage	Weeks Worked	Annual Average Salary	Project Period (years)	Economic Impact per FTE	Number of FTEs	Total Economic Impact
Average Construction Worker Salary	725	48	34,800	7	243,600	4,900	1,193,640,000
Average HQ Heat Pump Engineer			45,000	7	315,000	900	283,500,000

source: ONS, Statistica & Indeed.com

9. Conclusions and Lessons Learnt

The economic context at the time of the project development was substantially different to the prevailing conditions in 2023. The current high cost of energy and threats to security of energy supply reinforce the need to develop low energy housing.

Birmingham City Council understands a net zero enhanced housing design will cost more and acknowledges that the cost benefit analysis to support this investment must include wider benefits such as GHG emissions reduction, impact on fuel poverty alleviation, reduced maintenance costs etc.

The learnings about the technologies and products choices, integration and management and any process changes to ensure high quality design and delivery run through the whole project and are being disseminated across BMHT.

The outcome of the assessment of technology options is not a single preferred specification but information to support site by site decision making based on site by analysis. Some aspects such as water demand reduction need further investigation.

Dawberry Fields Passive House project was due to run in parallel to Gressel Lane to add information to options appraisal for design solutions to be adopted by BMHT. However, the programmes did not run concurrently in the end so it is not possible to draw any conclusions on how the two approaches might together inform a new BMHT specification.

The order of appointment of consultants to a project was analysed, exploring whether a different approach would be beneficial. Traditionally is it project manager, then health and safety, then the technical specialists, for example. The traditional linear decision making process can result in irreversible decisions or decisions which are too expensive to reverse. It is important to carry out an energy analysis before site layout is fixed so that the maximum opportunity can be taken from orientation and grouping of buildings to share heat pump systems, for example, understanding the space needs and layout requirements for different low carbon/renewable energy technologies.

The Birmingham City Council Cabinet reporting process flow was discussed with acknowledgement that a transparent, comprehensive and accountable decision making system does result in the involvement of many consultees in an iterative process with long timescales thereby resulting. It is complicated by consultees also commenting on aspects not directly within their jurisdiction.

Projects are authorised to go to tender on the basis of cost estimates, made by highly experienced staff. However, Gressel Lane was impacted both by unexpected cost increases due to global disruptions and possibly by the contractor pricing in the risk of an innovation project. It was noted that longer than anticipated timeframes in assessments and final decision making during the precontract stage impacted on tender returns as the economy and construction industry experienced an unprecedented increase in materials and labour costs due to the war in Ukraine, COVID and other external factors (impact on the supply of the blockage of the Suez Canal, fire at 2 key semiconductor factories etc). There are no contingencies allowed on projects beyond a 10% uplift allowed at the time of the Cabinet Report. Any reduction in timeframes for the Cabinet sign off process during the precontract period would provide a benefit. At the point of contract signing the preferred developer wanted to introduce cost fluctuation clauses into the contract (these were excluded) given the extreme market fluctuations at that time. It is noted that contractors wouldn't normally hold prices for longer than 3 months after tender return (as the tender requirement) but presently it is not uncommon to have developers holding for only a few weeks (or even less). However, once signed the contract does become fixed (aside from any Provisional Sums). So there is a Fixed Lump Sum Contract Sum for Gressel Lane, which provides certainty to Birmingham City Council(aside from the Provisional Sums). This may be changing as a national approach for many of the reasons above.

In summary:

- Covid, Brexit and latterly the war in Ukraine have had major effects on the project. As well as the obvious effects of Covid (both national and international), the effect has been to disrupt the supply chain.
- This has resulted in the inflation of the price of materials (and labour) above what could have been expected in their absence.
- The result of this has been that the tender process has produced quotes that are valid for a much more limited time that would have otherwise been the case.
- The process of accepting tenders, which are subject to normal scrutiny procedures, may be longer than the validity of the tender.
- The necessary democratic oversight of public expenditure and input to the planning process unavoidably contributed to delays.

BMHT projects are set out on a 10 year programme. This does provide a pipeline for contractors. However, Birmingham City Council procurement regulations work on Frameworks but not currently on long term partnering which could offer long term cost reduction pathways. The Homes England Framework is commonly used. Management are looking at widening partners in addition to Jessup and Lovells. Birmingham City Council decided against running its own framework.

Larger SMEs don't tender having been disincentivised by repeatedly not winning against larger Tier 1 contractors such as Jessups but may engage as sub-contractors, exchanging investing resources in bidding for less project management risk but also a squeeze on profit, in many cases.

Training and upskilling is a significant issue. For example, there is a big turnover of construction site staff, especially site managers etc so one contract can have several site managers. This means that new staff have to become aware of the different approach which may need to be adopted in this type of construction.

When developing a low energy development, a low energy development expert must be involved from the initial stages and take a lead on all stages of planning.

Market pressures and supply chain issues still represent risks, however, and global market forces can impact availability. Energy crisis impacts have increased demand and reduced availability of some renewable energy products, resulting in the need to ensure careful programming and ordering.

EV charging points have been installed in all properties as future proofing. This raises a number of questions about future rollout in other projects – individual houses vs flats, individual vs collective, are there enough charging (and parking) spaces, how will the management work, how will this affect public transport and so on? As the take up of EVs accelerates towards the 2030 deadline for end of production of fossil fuel powered vehicles, demand for EV charging points may increase. Currently the cost of EVs may be more than many social housing tenants can afford. Interest in EVs will be gathered though post occupancy surveys.

The project has planned for a demonstration house so that prospective tenants can learn how to manage the house effectively. It will also serve as a training resource for maintenance technicians as well as a showcase for the technologies used as part of the dissemination process for Council staff.

The summative assessment will not include Post Occupancy Monitoring (POE) which cannot be realistically developed until residents have moved in and 12 – 18 months data of building performance, resident experience and maintenance issues can be collected and analysed. There is residual budget for this. However, as it is part funded by ERDF the work needs to be completed by June 2023. Additional budget will have to be found for ongoing POE over the next 12 – 24 months or longer.

In addition to project timescales being tied to the ESIF programme end date, project delivery pressures were also caused by the additional level of technical approval required by the client-side team to ensure the ERDF funded specification was met by the contractor.

More broadly, the timescale required by the funding project close deadline is challenging within the context of construction programs generally, which are subject to many external factors that can impact program. Future projects would benefit from the allowance of increased design development by the appointed Design and Build contractor before starting on site.

The main strengths include the following:

Learning of the team has been significant regarding different ERDF options eg heat pump designs

Spectrum have dealt with the challenges professionally and feel confident in outcomes and their future business plans in this sector.

1. Metrics from Citizens Advice show benefits of EPC C to beneficiaries. POM for Gressel Lane will show how the enhanced fabric and renewables spec will provide additional benefits.

2. Site delays, mainly weather, have been closely monitored with additional progress meetings instituted to keep to the challenging but extended programme.

3.A1 333kW renewable capacity will be installed through the project with ERDF funding installation to 30 homes. It is not an option to go live with the ERDF elements ahead of the whole house electrics going live due to significant health and safety risks if circuits are partially live ahead of hand over.

4. Project dissemination in place via video summary and instructions. This will work well for a range of audiences.

5. PHPP modelling has confirmed the as built deliver the intended performance. This will be further monitored during the POM phase.

The principal barriers and weaknesses were identified as:

Those affecting all construction projects where programme risks such as weather impacts can be predicted but not quantified. Tight funding deadlines are always an issue. The project was delivered in a period of post covid recovery affecting UK and global markets. The other point highlighted was that the M&E coordination process was dealt with at a later stage in the construction process than would have been ideal.

Appendix 1 – House Types

		house type			
plot	type	bed	person	TFA	m3/h.m2
1	Weoley	2	4	82.2	3
2	Northfield	4	7	123.9	3
3	Northfield	4	7	124.9	3
4	Harborne	3	5	87	3
5	Harborne	3	5	87	3
6	Harborne	3	5	87	3
7	Harborne	3	5	87	3
8	Northfield	4	7	112	3
9	Northfield	4	7	112	3
10	6b10p	6	10	155	3
11	6b10p	6	10	155	3
12	Highgate	2	4	87	3
13	Weoley	2	4	73	3
14	Edgbaston	5	8	132	3
15	Weoley	2	4	73	3
16	Edgbaston	5	8	132	3
17	Walmley	2	4	72	3
18	Walmley	2	4	72	3
19	Walmley	2	4	72	3
20	Walmley	2	4	72	3
21	Weoley	2	4	73	3
BCC funded 22	Edgbaston	5	8	132	3
BCC funded 23	Edgbaston	5	8	132	3
BCC funded 24	Harborne	3	5	87	3
BCC funded 25	Harborne	3	5	87	3
26	Walmley	2	4	72	3
27	Walmley	2	4	72	3
28	Harborne	3	5	87	3
29	Harborne	3	5	87	3
30	Walmley	2	4	72	3
31	Walmley	2	4	72	3
32	Moseley	2	4	67	3
33	Moseley	2	4	67	3
34	Highgate	2	4	87	3
BCC funded 35	Harborne	3	5	87	3
BCC funded 36	Harborne	3	5	87	3

Appendix 2 – Energy analysis + CO2 emissions

We have reviewed the energy and carbon modelling for this project. The following documents were made available and have been provided with this document.

GBEC685 - ERDF PHPP Initial Summary Report

GBEC685 - PHPP Summary Table 20220519 HJ

GBEC685 - ERDF Harborne PHPP Rev 1 Notes and Assumptions

Gressel Lane energy analysis summary.xlsx

Energy modelling was undertaken in both PHPP and SAP, although only partial SAP modelling was available for the properties at the date of the summative assessment. PHPP is a useful tool in generating more realistic energy consumption profiles for the houses. It has more flexibility in the inputs and allows users to model actual occupancy, indoor temperature and other variables. These variables cannot be changed in most SAP softwares.

PHPP should ideally be used with the intermittent heating tool (from the Passivhaus Trust) for uninsulated buildings, or it will overestimate the baseline energy use. In this project, the baseline data has been normalised using data from actual energy bills for similar properties owned by Birmingham Municipal Housing Trust (BMHT). This is noteworthy as it is quite rare, but is the best practice way to obtain baseline energy and emissions data.

The PHPP and SAP inputs looked within the ranges expected for new build properties, however no design or as-built information regarding the construction was forthcoming. This meant that the U-values, thermal bridging values and other inputs could not be verified. Calculating these inputs from design information is an important part of the modelling process, and would probably have been done at the time, but unfortunately none of the original modellers were available to confirm this.

The PHPP energy and carbon modelling will be compared with actual data from 11 houses that have monitoring installed to measure energy consumption and internal temperature for 12 months. Using actual occupancy and temperature in the PHPP models should give a good indication of the quality of the design and construction in terms of energy performance. It should highlight what the performance gap is (if any) in the monitored properties, which would not have been possible if only using SAP modelling.

<u>CO2 emissions reduction</u>

(summary and data provided by project technical lead – Axis Design Architects Ltd

Additional outcomes include carbon emission reductions against recorded results from comparable housing previously delivered by the applicant. The project application/GFA stated an estimated reduction of 38 tonnes per year. Further analysis was undertaken during the project using the PHPP process described above, resulting in two further stages of design based measurement. The 'PHPP Initial Summary Report' provided in the appendix demonstrated the potential for a reduction of 34.9 tonnes not including on-site generation, using two example types before contractor's proposals were

finalised. The final design estimate following analysis of all 30 plots indicates a reduction of 36 tonnes not including on-site generation.

Initial estimates for energy generation provided by the PV panels installed on the project suggest a potential saving of a further 12 tonnes of CO2. Further detailed analysis will be undertaken during the Post Occupancy Monitoring but at project close the design results have substantially exceeded the originally intended target.