

Report on Sustainable Construction Method at Bryn Bragl, Bridgend

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Summary

This report reviews Bryn Bragl (Rhiw Cefn Gwlad), a 14-home social housing development in Bridgend delivered by Wales & West Housing (WWH) with Zenergy Design. The project has been recognised externally and is described as one of the first “energy positive” housing developments in the area, designed to export more electricity to the grid than it imports over a year.

The scheme is useful for our company because it demonstrates a practical “whole systems” approach: improve the building fabric first (to reduce energy demand), then specify efficient all-electric services, and finally add on-site generation (PV) and storage (battery) to reduce bills and carbon in use.

Key technologies and findings include:

- **Fabric and structure:** Walls were built using factory-made Structured Insulated Panels (SIPs) with Cedral (fibre cement) and a single brick external layer. WWH report a cost premium of around **£21,000 per home** compared with traditional open-panel timber frame, but they also indicate it is difficult to match the same performance without paying extra at present.
- **Heating and ventilation:** A combined exhaust-air heat pump and MVHR system (Pichler PKOM4) provides heating and hot water with a measured COP of around **3.2** and a **212-litre** hot water tank. The system requires early coordination of ductwork and ceiling zones.
- **Electrical strategy:** In-roof PV (reported **3.7–7.4 kW**) and Tesla Powerwall 2 batteries (**13.5 kWh**, 10-year guarantee) are used alongside export limiting and monitoring. WWH highlight that remote monitoring and ability to tweak settings is a major benefit.
- **Performance in use:** In 2021, the 14 homes reportedly exported **over 27,000 kWh** to the grid. WWH also note that whether each home is “energy positive” depends heavily on lifestyle and household makeup, so resident guidance and aftercare are part of the performance strategy.

The main conclusion is that Bryn Bragl’s outcome is not solely down to selecting advanced technology. Success depends on early design coordination, supply chain capability, airtightness and quality control, thorough commissioning, clear resident guidance, and planned post-occupancy monitoring. For our company, the approach is transferable, but only if we price and programme the additional coordination, aftercare, and skills requirements properly.

1. Introduction

This report appraises the sustainable construction methods and building services used at Bryn Bragl, Bridgend. It has been prepared for senior staff within our South Wales

construction company to capture what has worked well on the scheme and what lessons could be transferred to future housing projects.

It assesses: (1) the building fabric and construction method, (2) how design decisions were influenced by technology and the local environment, and (3) building services, comfort and control. It then evaluates performance in use and post-occupancy learning, before setting out practical recommendations.

The evidence used is drawn from the lecturer-provided ventilation and air conditioning materials, the Bryn Bragl project presentation (Wales & West Housing), and supporting industry guidance where it helps explain the technical and practical issues in plain terms.

2. Project snapshot

Bryn Bragl (Rhiw Cefn Gwlad) is a development of **14 homes** comprising **four one-bed flats, eight two-bed semi-detached homes**, and **two four-bed homes**. The project originates from the “Solcer House” concept developed in Wales, aiming to demonstrate an affordable, all-electric home that can export more energy than it imports over a year.

WWH state that their primary target was to achieve **affordable energy costs for residents** with the added benefit of reducing carbon in use, and that the “energy positive” target was an exciting but secondary goal. The homes were completed and occupied on **6 January 2021**, which means there is now real operational data and post-occupancy learning that can be used for evaluation.

3. Appraisal of sustainable construction and technology

3.1 Whole-systems approach

A consistent theme in the project information is that Bryn Bragl is not a “single technology” solution. It is a linked system where each part supports the next:

1. Reduce heat demand through a high-performance fabric and airtightness.
2. Use efficient all-electric heating and ventilation that works well at low demand.
3. Add PV generation and battery storage to lower imported electricity and export surplus.

This matters commercially because projects can fail if one element is missing. For example, a heat pump can be specified, but if the fabric is poor or the building is draughty, the heat pump may rely on electric boosts, costs increase, and residents lose confidence.

3.2 Building fabric and construction method (SIPs)

The project uses **factory-constructed Structured Insulated Panels (SIPs)** for the external walls with **Cedral (fibre cement) cladding** and a **single brick external layer**. The stated reason is high insulation and consistent factory quality. A contractor benefit reported is that the SIPs system was buildable with no issues.

From a commercial view, the key point is the cost premium: the project states an additional cost of approximately **£21k per home** compared with open-panel timber frame. This does not automatically mean SIPs are “too expensive”; it means they should be treated as a deliberate specification choice. If we were pricing similar work, we would either:

- Accept the SIPs premium and show the client the performance and defect-reduction benefits; or
- Explore alternatives (improved timber frame, enhanced airtightness strategy, thermal bridge detailing) while being honest about the risk of failing to match the same performance.

3.3 Airtightness and why ventilation becomes more important

The ventilation lecture materials make a very clear point: **ventilation is the intentional supply of fresh air and removal of stale air**, whereas **infiltration** is accidental air leakage through the fabric. As buildings become more airtight (to improve energy efficiency), proper ventilation design becomes more critical.

WWH emphasised airtightness early on because, with electric heat pump systems, homes do not heat “as fast” as gas and radiators, meaning heat losses and drafts are more noticeable. Site inspectors undertook Passive House style training, and improvement issues were tackled on site (for example, inappropriate use of expanding foam as an airtightness product).

WWH report an average airtightness of **1.85 m³/(h·m²)** and note that pushing much lower may not be worth the extra cost and effort if the difference to bills and carbon is small. This is an important and realistic lesson for our company: “better” can have diminishing returns, so the target must balance performance with buildability and cost.

3.4 Heating and hot water: Pichler PKOM4 system

Heating and hot water are provided by a **Pichler PKOM4 combined exhaust air heat pump system** linked to **Mechanical Ventilation with Heat Recovery (MVHR)**. The project reports a measured **COP of around 3.2** and a **212-litre** hot water tank. Residents were reported to be happy with heating and hot water performance, including in cold winter months.

Buildability and coordination points are very relevant:

- The unit is approximately the size of a large fridge/freezer and weighs around **240 kg**, so it affects plant space planning and handling.
- The system requires **larger ducting than typical MVHR**, and the project reports needing to slightly lower one ceiling in the flats.
- Filter changes are described as easy, which supports maintainability.

Cost-wise, WWH estimate an additional cost over a gas system of around **£9,000 per home**, including MVHR. They also indicate price needs to come down for wider housing association uptake.

3.5 Ventilation and indoor air quality (IAQ)

The ventilation lecture materials highlight CO₂ as a useful indicator of indoor air quality in typical occupied spaces (where there are no unusual contaminants). Outdoor CO₂ is around 400 ppm. For guidance levels, Building Bulletin 101 uses a daily average of **<1500 ppm** in teaching spaces, while CIBSE recommends **<900 ppm** (primarily linked to odour acceptability). Although Bryn Bragl is housing, the principle remains: controlling ventilation is key in airtight buildings.

The lecture materials also highlight the importance of **controls**. BSRIA guidance (quoted in the lecture) notes that ventilation systems require control to enhance comfort and minimise energy consumption, and that automatic controls with appropriate user override offer the best opportunity to achieve both. This aligns well with Bryn Bragl's learning that controls and settings (not just hardware) can drive performance differences.

3.6 PV generation: in-roof panels

The project uses **GSE in-roof PV panels**, reported at **3.7–7.4 kW capacity** depending on dwelling type. WWH note several benefits:

- Reduced need for roof tiles (potential embodied carbon benefit).
- Contractor feedback that panels were easy to fit.
- Reduced leak risk compared to on-roof PV systems.

The project estimates an additional cost of around **£8,000 per home** compared with standard tiles.

3.7 Battery storage: Tesla Powerwall 2

Battery storage is provided by **Tesla Powerwall 2**, reported at **13.5 kWh storage, up to 5 kW output**, with a **10-year guarantee**. WWH highlight that the Tesla app provides good resident-facing data and that WWH can view live data for all homes and adjust settings remotely without disturbing residents.

A practical risk noted is that one battery tripped several times, possibly due to loose wires, this is a reminder that even good technology depends on correct installation and QA.

The project estimates the battery cost at around **£6,000 per home** and notes that a smaller, cheaper battery option could be more suitable for future roll-out.

3.8 Export limiting and DNO requirements

The PV system requires export limitation (reported 3 kW to 5 kW limiter) and DNO export certification. Post-completion learning states that delays in subcontractors obtaining DNO export certificates delayed residents receiving export payments. This is a strong practical lesson: on future projects we should treat DNO approvals and export paperwork as a managed deliverable, not an assumed admin task.

3.9 Cooling strategy and why air conditioning was avoided

The air conditioning lecture materials state that air conditioning can give closer environmental control and comfort, but has disadvantages including additional capital cost, increased electricity consumption (up to 50% cited), higher CO₂ emissions and extra maintenance.

The lecture materials also provide a clear “when to specify” principle: only specify air conditioning when it is not possible to maintain comfort using natural or mechanical ventilation (for example, where humidity control is needed, heat gains are high, or external noise/pollution prevents natural ventilation).

For Bryn Bragl, the strategy is to avoid high-energy cooling by combining good fabric performance, ventilation design, and controls. The ventilation lecture also highlights night cooling strategies, where outside air is used to cool the building before occupancy when conditions allow, reducing overheating risk. This reinforces that, for housing schemes like Bryn Bragl, a well-designed ventilation and controls strategy is preferable to installing active cooling, unless there is a clear need.

4. Performance in use and post-occupancy learning

A key strength of the Bryn Bragl information is that it includes results and learning after occupation.

4.1 Energy export and “energy positive” reality

For 2021, WWH report that the **14 homes exported over 27,000 kWh** back to the grid, described as the annual electricity use for around nine average UK homes. They report that five homes exported more energy than they imported, with another four close.

WWH also state that meeting the energy positive target is not linked to home size but more linked to lifestyle and household makeup. This is commercially important: it shows why we should present performance claims carefully and support residents with clear guidance.

4.2 Energy affordability, vulnerable households and controls

WWH mention an example where a high-use household had very high energy needs due to a medical issue, but energy costs remained low (reported as around **£55 per month**) when using a Tesla tariff. This supports the project's primary objective: affordability for residents, including those with unavoidable higher demand.

The project also identified practical performance issues caused by controls:

- Some homes had towel rails on too much due to complicated controls; controls were changed.
- Factory settings caused the space heating electric boost duct to run unnecessarily; this was adjusted.

This is strong evidence that post-occupancy monitoring and the ability to tweak settings are not “nice to have” they are part of making the project succeed.

4.3 Aftercare as a planned resource

Post-completion learning states that these homes needed extra time after occupation communicating with residents, consultants and internal teams, and that someone must be allocated time to do this until the technology becomes “the norm”. This has direct implications for our company's future projects: if we deliver similar homes, we must price for aftercare and assign clear responsibilities.

5. Commercial and practical implications for our company

5.1 Costs, premiums and funding context

The project provides useful cost information for benchmarking. Reported build cost is **£3.412m** (tender originally £3.6m, reduced through retendering packages and some specification/value changes). Reported on-costs are **£391k**, total costs **£3.803m** (land excluded).

Funding reported includes **£940k** IHP funding and **£1.511m** Social Housing Grant (total **£2.451m**). This highlights that innovation funding supported delivery. If we aim to mainstream similar specifications without grant support, we will need to focus on repeatability, supply chain efficiencies and reducing complexity.

5.2 Buildability, programme and skills

The key buildability learning is that this type of scheme increases coordination requirements (ducting routes, ceiling zones, plant space, and airtightness detailing). It is achievable, but it requires stronger “first time right” processes:

- Early design freeze on services routes and penetrations.
- Airtightness training for site teams and subcontractors.
- QA checks at the right times (before closing up).

5.3 Risks and limitations

Main risks to plan for if we repeat this approach:

- **Supply chain risk:** limited suppliers for specialist systems can affect lead times and pricing.
- **Installation quality:** battery trips due to loose wiring show the importance of QA.
- **Paperwork risk:** DNO export certification delays can become reputational issues.
- **Resident understanding:** controls must be simple, and guidance needs to suit different confidence levels.

6. Recommendations

Based on Bryn Bragl’s outcomes and learning, the recommendations for our company are:

1. **Adopt a fabric-first baseline** for future housing projects (insulation, airtightness strategy, thermal bridge detailing), while setting realistic airtightness targets that balance performance and buildability.
2. **Standardise coordination deliverables early** (services routes, ceiling zones, plant space, access for maintenance) to reduce redesign and on-site rework.
3. **Treat controls and commissioning as critical work**, not a handover afterthought. Build time into the programme for commissioning and “soft landings”.
4. **Plan and price for aftercare and monitoring**, especially for any project that includes new technology for residents.
5. **Manage grid/export approvals properly** by making DNO documentation a tracked deliverable with clear responsibility.
6. **Consider staged adoption:** trial the full “PV + battery + combined heat pump/MVHR” specification on a small scheme first (as WWH did), then repeat and standardise once supply chain confidence is built.

7. Conclusion

Bryn Bragl demonstrates that sustainable, affordable, low-carbon housing is achievable in South Wales when a whole-systems approach is taken. The project's real value for our company is the practical learning: high performance relies on build quality, coordination, commissioning, controls usability, and post-occupancy support not just on selecting sustainable products.

If we want to shift towards this type of construction method, the approach is transferable, but it must be delivered with clear QA processes, strong M&E coordination, realistic pricing of premiums, and planned resources for aftercare and monitoring.

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