

Report to	Sustainable development panel	Item
	28 January 2015	
Report of	Head of city development services	4
Subject	Norwich City Council new build and the Passivhaus standard	

Purpose

To explain the council's current engagement with Passivhaus technology to achieve high levels of energy efficiency in new council homes.

Recommendation

To note progress to date relating to the council's approach to Passivhaus technology.

Corporate and service priorities

The report helps to meet the corporate priority decent housing for all and the service plan priority to build new council homes.

Financial implications

N/A

Ward/s: All wards

Cabinet member: Councillor Bremner – Housing

Contact officers

Paul Swanborough, private sector housing manager 01603 212388

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Background documents

None

Report

Background

1. The council is committed to enabling and delivering high quality affordable housing through working with partners and now as a developer in its own right.
2. We have a good record of delivering houses to a high standard of sustainability. We championed the Ecohomes standard which became mandatory for affordable housing in 2003 and have worked with housing association partners to achieve 'good' and 'very good' ratings on a number of schemes, including the Corporation Yard development, which was at the time of its completion, held up as an example of best practice by the Housing Corporation (now the Homes and Communities Agency).
3. As the Ecohomes ratings were gradually phased out in favour of the new Code for Sustainable Homes (see table below), we have continued to work with local developers in both the private and public sectors to ensure standards are raised and exceed minimum requirements where possible.

Code for Sustainable Homes	Definition	Cost (approximate build cost for 3 bed house)
Level 3	Current minimum requirement for Building Regulations	£110,000
Level 4	A renewable technology must be built in, (such as a biomass boiler or photo voltaic cells), or the walls must be super-insulated, with mechanical heat recovery	£114,000
Level 5	More than one renewable technology must be built in and the walls should be super- insulated	£125,000
Level 6	A 'zero- carbon' home (heating, lighting and hot water energy generation does not emit carbon	£130,000+

Orwell 2014

4. In recent years, we have worked with our housing association partners to learn as much as we can about new technologies and sustainable building options and products, such as air and ground-source heat pumps, mechanical ventilation and heat-recovery units (MVHRs), biomass boilers, mini wind turbines and photo-voltaic cells. As well as learning about how these technologies can be incorporated into new homes, we have also researched and implemented a programme of fitting energy-saving technology to existing homes, in particular with photo-voltaic cells on existing council properties.
5. For the last three years this work has focussed on the Passivhaus standard following the decision by Broadland Housing Association and Hastoe Housing Association to develop pilot Passivhaus schemes in the Eastern Region. Last year we also commissioned specialist advice on design implications and costs to build to the

Passivhaus standard and as a result are now in a position to develop our own Passivhaus homes as summarised below.

Current legislation and requirements going forward

6. Developers in this country are currently required to build schemes which meet the Building Regulations, which is the equivalent to the Code for Sustainable Homes level 3 (CSH3). However, any social housing provider that utilises government funding via the Homes & Communities Agency must build to code level 4 (CSH4) so all affordable housing built on council owned land by registered providers in recent years has been built to that standard. The recently completed council homes at Pointers Field were built to CSH4.
7. The government has recently announced a move away from the Code for Sustainable Homes and is currently undertaking a comprehensive design standards review. The Department for Communities and Local Government (CLG) has identified over 100 different design standards that are in use by developers and local government officers and is aiming to replace them with a new draft national standard late later this year, for adoption in 2016.
8. The government has set a target of 2016 for developers to achieve “zero carbon” in development and as part of the design standards review and eventual new standard; CLG has said that a definition of the term “zero carbon” will be published.
9. In conclusion, the exact standard for housing and affordable housing from 2016 is not yet established but we do know that it will be a higher standard than CSH4.
10. CLG has stated that those developers unable to achieve the zero carbon standard will be able to make use of a scheme called ‘Allowable Solutions’, whereby any developer unable to develop a zero carbon development will be liable to pay a sum of money to off-set the carbon in their development. It has not yet been established what level the level of payment will be or to which organisation it will be payable to.
11. As a developer of new homes we therefore must investigate ways in which we can achieve improved energy efficiency beyond CSH4.

The Passivhaus standard

12. The Passivhaus standard was devised in the 1990s by professors Bo Adamson of Sweden and Wolfgang Feist of Germany with the first Passivhaus home being completed in Darmstadt, Germany in 1991. The Passivhaus approach to design and build is a relatively simple ‘fabric first’ method, with a focus on excellent thermal performance and controlled ventilation. Design principles include triple-glazing, a highly insulated ‘thermal envelope’ (the walls, roof and floors), controlled ventilation via mechanical ventilation and heat recovery (MVHR) systems and no requirement for traditional central heating methods.
13. The MVHR systems are as crucial to a successful Passivhaus design as the super insulation. This is because of the increased air-tightness of the thermal envelope, which if left unventilated could result in significant issues such as mould spore growth. MVHR results in very good indoor air quality with reduced levels of indoor air pollutants and allergens which is of particular benefit to those suffering from asthma or hay fever. By comparison, recent research is beginning to indicate that modern construction methods that don’t use MVHR (e.g. built to comply with building

regulations) may create homes that are susceptible to condensation and mould growth. **(Inside Housing 23/09/14 & 27/11/14.)**

14. Summertime cooling is ensured through the use of window shading to prevent the build-up of heat from the sun and providing opening windows to allow cross-ventilation.
15. Across Europe and North America, there has been a steady increase in the volume of properties built to the Passivhaus standard, with over 30,000 certified properties now in existence. In San Francisco, projects that aim for Passivhaus certification are fast-tracked for planning approval. In Hamburg, public money will be provided only to schemes designed to the Passivhaus standard. In Oslo, Frankfurt and Brussels, no building is permitted to be built within the city unless it has been designed to meet the standard. From 2017, all residential new builds in Luxembourg are required to be built to the Passivhaus standard (see appendix 1 for full extent of Passivhaus adoption).

Costs

16. The current costs of building a Passivhaus home compared to the minimum requirement for building regulations and Code for Sustainable Homes level 4 is set out below:

Building method/ type	Building Regulations	CSH4 (additional 4%)	Passivhaus (minimum additional 10% above CSH4)
One bed flat	£100,000	£104,000	£114,000
Three bed house	£110,000	£114,000	£125,000

Oxburys 2014

17. Because the cost of building to the Passivhaus standard is an approximate 10% increase on the cost of building to CSH4, this means that for the same price, it would be possible to build 10% more properties.
18. Despite being a well-established construction method, Passivhaus is relatively unknown in the UK and this explains the higher costs of development which are anticipated to fall as the local supply chain improves and as developers gain experience. For example, Hastoe Housing Association has seen a reduction in build-costs on recent schemes by using contractors that have worked on previous schemes. They also said that when they started building to the standard there was only one UK Passivhaus window supplier whereas there are now thirty two.
19. Local experience of passivhaus is growing. Hastoe housing association for example, has completed over 100 homes to date and Broadland Housing Association is planning a significant passivhaus development in Norwich as well as completing smaller schemes elsewhere in Norfolk. There is, therefore, an opportunity for the council to work in partnership with other affordable housing providers to learn from their experience and to improve the supply chain.
20. Whilst currently more costly to build, passivhaus homes do offer considerable cost savings to their occupants as indicated in the table below.

House size/ type/	Typical property	Passivhaus	Reduction
One bed flat	£700 p/a	£70 p/a	-90%
Three bed house	£960 p/a	£120 p/a	-87%

Hastoe 2014

Management and maintenance

21. Passivhaus homes do require a different approach to maintenance compared to traditionally built homes. For example, the MVHR filters need to be cleaned regularly. However, this is not necessarily any more onerous than the need to maintain traditional central heating systems. Care also needs to be taken to ensure that any future upgrading (e.g. windows) is compatible with the passivhaus system. It is worth noting, however, that new technology is being developed to reduce the need for regular maintenance. For example, some MVHR systems no longer require filters.
22. The performance of each Passivhaus home is reliant on its thermal envelope being maintained and on a lack of thermal bridges (areas vulnerable to heat loss). However, if the thermal envelope were to be compromised in any small way, for example by the occupant drilling a hole, there would not be significantly detrimental effect on the building's overall performance. Experience has shown that minor damage can easily be repaired.

Update on current projects

23. The original design for the proposed development at Goldsmith Street offered a good opportunity to provide up to 105 Passivhaus homes. Because of its favourable orientation and the fact that it is based on terraces with blocks of flats at each end it has been straightforward to amend the designs to meet the standard. A similar approach was taken to evaluate the design of Three Score phase 2 and as a result, Cabinet has agreed to submit a planning application which will provide 112 Passivhaus homes out of a total of 172.
24. When considered alongside the Broadland Housing Association scheme which proposes 250 Passivhaus flats, this activity will place Norwich at the forefront of Passivhaus development in the UK.
25. NPS(Norwich) and its partners in the wider NPS group is also developing Passivhaus expertise with plans to build Passivhaus schemes elsewhere in the UK. NPS is working in partnership with a local builder, Beattie Ltd, to develop a Passivhaus product and has already delivered Passivhaus homes in Great Yarmouth.

Appendix 1: full extent of Passivhaus adoption

(International Passive House Association, 2014)

Austria

Lower Austria

On 23 January 2008, the State Parliament of Lower Austria resolved to implement the Passivhaus standard for all public buildings. This directive applies to both new builds and retrofit projects. The State Parliament of Lower Austria budgeted 130 million euros to complete these construction measures.

Vorarlberg

In October of 2007, several municipalities in the Austrian state of Vorarlberg pledged to plan and construct all new public buildings to the Passivhaus standard. These municipalities are Altach, Bregenz, Dornbirn, Frastanz, Götzis, Hörbranz, Krumbach, Langenegg, Mäder, Rankweil, Thüringen, Wolfurt and Zwischenwasser. An excerpt of the Passive House legislation of the city of Altach may be taken as an example: "The city of Altach resolves that all public new builds are to be built to the Passive House Standard. A specific heating demand of 15 kWh/m² is to be demonstrated by means of the Passive House Planning Package (PHPP); the use of active cooling systems is to be avoided."

Wels

As per its "Passive House Declaration" of 2008, the city of Wels will ensure that all new builds and future retrofit projects will include renewable energy and energy efficiency goals. New builds are to be both conceptualized and constructed according to the Passivhaus standard. When retrofitting existing buildings, Passive House Components (insulation, windows, ventilation with heat recovery) are to be used and the standard is to be achieved. This policy applies to all developments maintained and administrated by the city of Wels and the Wels GmbH holding company.

Belgium

Brussels

With its new Energy Performance and Indoor Environment in Buildings Regulation, the Brussels Capital Region has adopted the targets of the European Energy Performance of Buildings Directive that calls for all buildings to be Nearly-Zero Energy Buildings by the end of 2020, 6 years ahead of time. Brussels' new regulation is based on the Passivhaus standard, making it mandatory for all new builds as well as all retrofits as of January 2015.

Antwerp

The province of Antwerp announced on 7 June 2013 its decision to apply the Passivhaus standard in all public new builds and complete renovations. This is a concrete step towards the implementation of the EU's Energy Performance of Buildings Directive. This decision also supports the province's own climate plan, which aims to reach carbon neutrality by 2020.

Germany

Aschaffenburg

According to the Draft Resolution of 16 July 2008, the city of Aschaffenburg committed itself to the implementation of sustainable energy-saving measures in municipal buildings as per its "Aschaffenburgener Energiespar-Offensive". Points 1 to 3 of this 16 point plan stipulate that all new builds are to be built to the Passivhaus standard:

- 1) All new municipal builds ought to be constructed to meet Passivhaus standard requirements. Deviations from this norm must be well-founded and carried out to an energy performance at least 25 percent better than that of the Germany national code (EnEV). Adherence to principles of economic and ecological sustainability is paramount.
- 2) Passivhaus training courses and excursions are to be attended by public servants and relevant departments of the City Council in order to illustrate the implementation, tendering, viability and quality assurance of the Passivhaus standard.
- 3) The mandatory requirements for general refurbishments are target values of 25 percent below EnEV (the current energy-saving directive) as well as increased target values for thermal standards and component retrofits.

State of Bavaria

On 19 July 2011, the council of ministers of the State of Bavaria passed legislation regarding energy standards for public buildings stipulating that all new build administrative buildings be constructed to the Passivhaus standard. In special cases, such buildings will be chosen as pilot Passivhaus projects.

Bremen

The initiative, signed on 25 August 2009, came into force on 1 January 2010. It stipulates that all new public buildings owned by the city of Bremen must be built according to the Passivhaus standard. The Senate emphasized that this measure facilitates the achievement of the city of Bremen's target of reducing the CO₂ emissions coming from public buildings by 50%.

District of Darmstadt-Dieburg

The Da Di-Werk is in charge of construction, operation and maintenance of the 81 schools in the Darmstadt Dieburg district. Maintenance activities include all real estate properties, energy management as well as janitorial and cleaning services. According to the district's guidelines for economy in building (Wirtschaftliches Bauen), published by the building management section of Da-Di Werk, all new buildings must be designed and implemented according to the Passivhaus standard, achieving a maximal annual heating demand of 15 kWh/m².

Frankfurt

As per the Resolution of 6 September 2007, the Magistrate will ensure that all new buildings belonging to the city administration including municipal facilities and enterprises together with all the buildings that will be constructed in as part of the "PPP-Modelle" programme in the city of Frankfurt, will be conceptualised to meet the Passivhaus standard requirements. In the cases where the Passivhaus standard cannot be achieved, this should be justified. In all instances, the minimum energetic efficiency that will be aimed at is a third of the national EnEV norms demand.

Freiburg

The city of Freiburg, with the resolution from 22 July 2008, determines that from 2009 onwards all new residential buildings will have to follow the KfW 40 standard. Furthermore, from 2011 onwards the Passivhaus standard will be mandatory.

Hamburg

The Senate of Hamburg resolves: from 2012 onwards, municipal funding for new housing projects will be granted exclusively to Passivhauses. The municipal housing subsidies will thus

gradually focus in the promotion of the construction of Passivhauses which do not use conventional heating.

Hanover

One of Europe's biggest and most innovative climate protection estates, consisting of about 300 terraced houses, semi-detached houses and detached single-family houses built to the Passivhaus standard, is currently being constructed as a zero-emission estate in Wettbergen, to the south-west of Hanover. The remaining CO₂ emissions for both the residual heating demand and the domestic electricity will be accounted for in a climate neutral fashion by the re-activation of an abandoned hydroelectric power plant.

Heidelberg

New municipal builds are to meet Passivhaus criteria, as verified by the Passive House Planning Package (PHPP). Passivhaus airtightness values (N50 values of less than 0.6 air changes per hour) are to be ensured through a pressure test. When selling building plots owned by the city of Heidelberg, property buyers will be obliged to construct residential and commercial buildings to the Passivhaus standard through a corresponding provision in their purchasing agreements. This provision will apply to properties sold after the "Energy Concept 2010" (Energiekonzeption 2010) comes into force. Exceptions to the Passivhaus standard are permitted in case of technical or economic unfeasibility. The Passive House Planning Package (PHPP), which is to be submitted to the Municipal Agency for Environmental Protection, Trade Supervision and Energy (Amt für Umweltschutz, Gewerbeaufsicht und Energie) during the building permit application period, shall be the basis of the calculations.

State of Hesse

As of September 2010, all public building projects must show energy performance that is, on average, 50% better than that stipulated by the national energy norms of 2009 (EnEV 2009), equal to Passivhaus levels of energy efficiency.

Cologne

On 26 April 2010 the operating committee of the municipal building industry, together with the votes of the SPD, Green and FDP parties, resolved that as of that date, all new buildings in the city of Cologne must be designed under the Passivhaus concept.

Kempten

New municipal buildings must fulfill Passivhaus standard requirements and are to be conceptualized accordingly (e. g., an annual heating demand of 75 percent). The Passivhaus standard shall be met, whenever possible. In case this standard cannot be met for technical or economic reasons, a justification must be given.

Koblenz-Asterstein

As part of its climate protection efforts, the city of Koblenz is committed to promote the implementation of the Passivhaus standard. In the development area of Asterstein, at least 120 Passivhaus buildings are to be built. A majority of these properties is aligned to the south and allows for a great variety of innovative architecture.

Leipzig

According to Resolution No. RBIV-1138/08 of 19 March 2008, the Mayor or the city of Leipzig is asked to ensure that all new buildings belonging to the city administration, municipal facilities and municipal enterprises, as well as all the new buildings of the "PPP-Modelle" programme in Leipzig, are built under the Passivhaus standard and are conceptualised accordingly.

Leverkusen

On 16 February 2009 the City Council of Leverkusen resolved that all new buildings to be constructed must reach the Passivhaus standard.

District of Lippe

The administration is commissioned to plan and construct all new buildings to the Passivhaus standard with a heating requirement of 15 kWh/m². Passivhaus components are to be applied when retrofitting existing buildings in order to achieve the Passivhaus standard.

Lohfelden – Lindenberg

The municipality of Lohfelden is currently in the final planning stage of the Passivhaus district of Lindenberg. All Passivhaus buildings here will take into account the locally stipulated climate protection targets.

Münster

Construction of the student dorm "Boeselagerstraße", one of Europe's largest Passivhaus areas, was completed in May 2014. It provides housing for 535 students in total.

Nuremberg

According with the building guidelines of the city of Nuremberg, all new building projects will implement the Passivhaus standard. In order to provide proof of this, the presentation of the current PHPP calculations is required.

Offenbach Harbour – Mainviertel

For its new city quarter known as the "Mainviertel", the City Assembly of Offenbach passed a resolution dictating that property buyers and developers sign an urban development contract with the city of Offenbach in which all parties commit to reducing the energy demand of the buildings through higher thermal standards. Passivhaus criteria are to be met for 50 percent of the gross floor area.

State of Rhineland-Palatinate

As of 2010 and as part of the goal to have a CO₂ neutral State administration, all planned municipal new builds and renovations must be analysed to see whether these buildings can be feasibly constructed as Passivhaus buildings.

State of Saarland

According to the coalition contract of the government of Saarland, all public new builds must be built to the Passivhaus standard and this standard will serve as a guideline for all renovations of public buildings owned by the State. Any deviation from this norm must be well founded.

Ulm

In 1993, the city of Ulm resolved to implement increased thermal standards for new builds within the municipal area. The new Passivhaus district "Im Sonnenfeld" is taking this trend to the next level: The city of Ulm, in co-operation with regional and supra-regional investors, architects, energy consultants as well as the building trade, built this development of up to 104 row and semi-detached houses completely to the Passivhaus standard.

Walldorf

The community council of Walldorf passed an energy programme on 20 July 2010 that requires all municipal new builds to be built to the Passivhaus standard and to make use of renewable energy, where possible. All new buildings constructed on any property for sale by the city must achieve the Passivhaus standard.

Luxembourg

As of 2017, all residential new builds are required to be built to the Passivhaus standard.

Norway

Oslo

In 2010, the city of Oslo resolved that as of 2014, all public new builds are to be built to the Passivhaus standard.

Spain

Villamediana de Iregua

In June 2013, the municipality of Villamediana de Iregua passed a master plan, mandating that all public new builds must meet the Passivhaus standard. In addition, 10% of all dwellings built within new urban development areas must be passive. This master plan makes Villamediana de Iregua the first Spanish municipality to adopt the Passivhaus standard in its urban development policies.

USA

City of San Francisco

The City of San Francisco has included Passivhaus projects that aim for Passivhaus or EnerPHit certification in their list of options for fast-track planning approval.