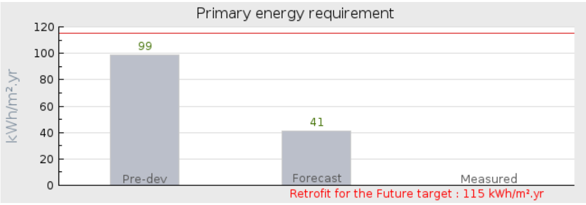
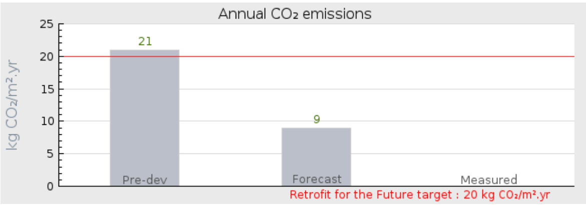
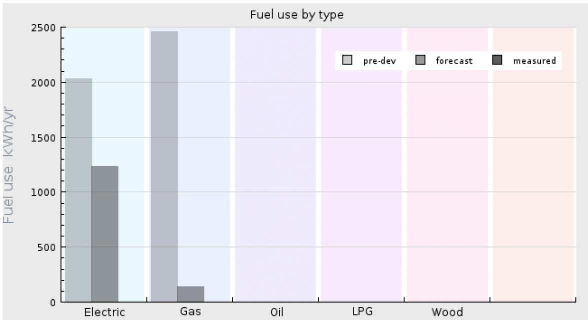
http://lowenergybuildings.org.uk

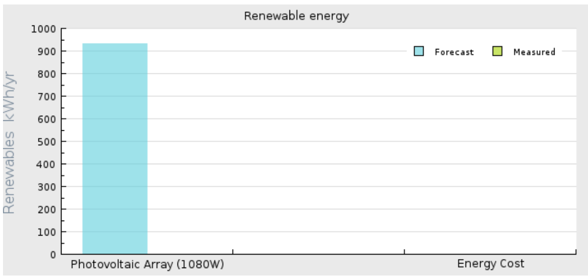
Project name A2 Dominion- Northholt,

Project summary This typical semi-detatched property has poor orientation for exploiting solar gain and the residents will remain in their home during the works, making this a particularly hard to treat property. The rewards however are great, with approx 5.9 million semi detatched properties in England which could be treated similarly. We aim to deliver a highly cost effective and replicable solution, using innovative solutions such as the solar shed , blown underfloor insulation, cork external insulation and bio-foam loft insulation in a holistic design approach. The proposals have been detailed and specified with a strong emphasis on UK based expertise and technologies.









Project Description

Projected build start date	
Projected date of occupation	
Project stage	Under construction
Project location	London Borough of Ealing, London, England
Energy target	Retrofit for the Future
Build type	Refurbishment
Building sector	Public Residential
Property type	Semi-Detached

Existing external wall construction	Masonry Cavity
Existing external wall additional information	Block internal, 50mm (insulated) cavity, brick external
Existing party wall construction	Solid blockwork party wall
Floor area	80 m²
Floor area calculation method	PHPP

Project team

Organisation	Breyer Group PLC
Project lead	Breyer Group
Client	A2 Dominion
Architect	ZED factory
Mechanical & electrical consultant(s)	DPS heatweb, Solar Empower & The Greener Alternative
Energy consultant(s)	Dr Mark Gillot, University of Nottingham
Structural engineer	n/a
Quantity surveyor	Breyer Group
Other consultant	n/a
Contractor	Breyer Group

Design strategies

Planned occupancy	For the SAP and PHPP modelling an occupancy of 2.1 people has been assumed as per the TSB competition requirements. For the hot water assumptions for sizing the solar thermal system an occupancy of 3 people was assumed which we feel is a more realistic figure for a 3 bedroom house.
Space heating strategy	Substantial reductions in space heating demand have been achieved by bringing the building fabric close to Passive House / CSH Level 6 standards, with an MVHR unit to minimise ventilation losses and particular attention to detailing for airtightness. Triple glazed windows with fibreglass frames achieve a Uvalue of 0.9. An oversized solar thermal array is proposed for the "solar shed" in the garden, with vertically mounted arrays to optimise winter gains. This will meet approx 53% of the propertys' combined space heating and water heating needs. A boiler with flue gas heat recovery has been proposed with an efficiency of 95.1% to meet the shortfall. The existing radiators will be retained with TRV's added for extra user control.

Water heating strategy	The space and water heating stategies have been developed as one wholistic solution. The solar shed with oversized solar thermal will ensure that 100% of the Hot Water demand of the property be met by free, renewable energy. The gas boiler and solar thermal will both feed into a UK manufactured thermal store designed specifically for this application, optimising the efficiency of the heating system and reducing its phantom electrical loads.
Fuel strategy	Solar and gas. The overall shortfall of thermal demand will be approximately 4000 kWh, meaning annual space and water heating bills of just 120 (assuming gas price of 3p / kwh). This illustrates the benefit of the improved building fabric and solar thermal array not just reducing CO2 emissions but also fuel poverty; particularly in the light of rising fuel costs.
Renewable energy generation strategy	The innovative "solar shed" concept allows for the installation and ideal orientation of solar arrays on less favourable properties. This also minimised disruption to residents whilst providing them with extra covered amenity space in their gardens. The locally produced Douglas Fir timber framed structure can be pre-manufactured off-site and erected on a patio slab in 1 day. This also avoids disruption of the roof structure, health and safety issues of maintaining a roof mounted array, and can be installed with minimum disruption to residents.
Passive solar strategy	The passive solar aspect of the design has remained as existing, but with improved window specification. The orientation of the properties do not allow for a more ambitious passive solar strategy without major alterations to the street side of the property, which could become a contentious planning issue. This is something we felt was unrealistic for the wider roll out across the UK. The higher performance windows and building fabric will ensure that thermal demands are minimised. External insulation allows the internal thermal mass to be retained, hence retaining heat from solar gain and internal sources.

Space cooling strategy	The results of the Passive House (PHPP) model shows that there is no risk of overheating on these properties, with the proposed alterations. This is achieved by the retained levels of thermal mass internally and the ability for secure ventilation whilst residents are out at work. The MVHR unit also has an over-ride function which allows increased ventilation without heat recovery if required during the summer.
Daylighting strategy	It has not been considered appropriate to alter the window sizes and locations due to planning considerations. Current lighting levels are felt to be adequate.
Ventilation strategy	The proposed Mechanical Ventilation with Heat Recovery (MVHR) unit is one of the most efficient systems available at time of writing. The "Itho HRU ECO 4" unit has a SAP appendix Q rating of 0.46 W/L/sec, with a 91% efficient couterflow heat exchanger. The system is also to be integrated with the cooker hood which incorporates an innovative "air curtain" to the perimeter, increasing the removal of odours directly from the cooking area.
Airtightness strategy	Airtightness has always been a key consideration of ZEDfactory's design approach, and we have applied our experience in this field throughout the detailing process. All key junctions have been drawn and detailed as existing and proposed, with a red line indicating the airtightness line (see example in the image section). The walls airtightness is achieved by the external insulation system, returning at windows to a double silicone seal (internal and external). In the roof we are proposing a new product; a bio-foam insulation, which is spray applied around joists in the loft, providing a single homogenous airtight line, whilst still allowing timbers to breathe. This tackles the particularly complex junctions such as rafter to wall plate.

Strategy for minimising thermal bridges	External insulation is specified with thermally broken fixings. Windows are located on the outside of the existing wall to minimise thermal bridging between window and wall insulation. The integral strength of the fibre glass windows also means that no steel fixing reinforcements are required. This reduces cold bridging but is not reflected in the Uvalue due to the standard calculation method. Bio-foam sprayed insulation ensures complete coverage in roof area and should be able to connect to the external wall insulation with minimal bridging. In the floor the only cold bridge is the internal leaf of blockwork, but since the wall cavity is already insulated this isn't considered a cost effective problem to remedy.
Modelling strategy	The project will utilise the Microwatt wireless eZone system for monitoring. The system will monitor the overall electricity (including individual power circuits and PV contribution), gas consumption, water consumption, external temperature & humidity and heat meter readings from the gas fired combi-boiler (seperately for space heating and hot water use). Internal environment monitoring will also be carried out for temperature, humidity, light, CO2 and occupancy sensors (hall & upstairs landing) to assertain occupancy patterns. Soil temperature probes will be used to evaluate the effect of the perimeter insulation and moisture probes and temperature sensors will be used to investigate thermal bridging details and changes in dew point location. Data will be collected and stored for 2 years and supplied in a CSV format to the EST at 5 minute intervals

Insulation strategy	Walls: 200mm of external cork insulation, giving Uvalue of 0.16 W/m2'C. Roof: 100mm of Bio-foam sprayed insulation, then 200mm mineral wool on top. This approach gets the benefits of the Bio-foams airtightness and thremal bridge reduction, but taking it up to passive house levels of insulation with a more cost effective product. Floor: We are proposing an innovative use of polystyrene beads usually used for cavity walls, by blowing them into the floor void. This is far more practical than taking up the floor(with the residents remaining in their homes during construction), and more effective than perimeter trench insulation. We intend to monitor the moisture levels in the void to ensure condensation does not occur and prove this concept
Other relevant retrofit strategies	Whole house smart metering: A real time monitoring unit (from award winning UK company Onzo) will display real time data of energy use and energy generation of a range of appliances around the home. This should encourage behavioural change and engage residents with their new renewable energy installations. Whole house standby mode: A switch next to the door enables residents to disable any non-essential power sources (e.g fridge, washing machine) before leaving the house - reducing phantom loads. Efficient lighting and appliances: An allowance has been made to replace all tungsten and halogen lighting and supply each home with a highly efficient new fridge, washing machine and induction hob for cooking.
Other information (constraints or opportunities influencing project design or outcomes)	Planning issues have been considered and it is felt that all proposals will fall withing Permitted Development rights. Confirmation is currently being awaited from Ealing Council planning department. In the event it is not classified as permitted development we have been informally advised that a full application would be viewed favourably and we have no serious concerns that planning would provide a barrier to the projects progress.

Energy use

Fuel use by type (kWh/yr)

Fuel	previous	forecast	measured
Electric	2029	1236	
Gas	2461	136	
Oil			
LPG			
Wood			

Primary energy requirement & CO_2 emissions

	previous	forecast	measured
Annual CO_2 emissions (kg $CO_2/m^2.yr$)	21	9	-
Primary energy requirement ($kWh/m^2.yr$)	99	41	-

Renewable energy (kWh/yr)

Renewables technology	forecast	measured
Photovoltaic Array (1080W)	933	
-		
Energy consumed by generation		

Airtightness ($m^3/m^2.hr$ @ 50 Pascals)

	Date of test	**Test result**
Pre-development airtightness	-	9.06
Final airtightness	-	7.59

Annual space heat demand ($kWh/m^2.yr$)

	Pre-development	forecast	measured
Space heat demand	-	29	-

Whole house energy calculation method	PHPP
Other energy calculation method	
Predicted annual heating load	-
Other energy target(s)	

Building services

Occupancy	NULL
Space heating	NULL
Hot water	NULL
Ventilation	NULL
Controls	NULL

Cooking	NULL
Lighting	NULL
Appliances	NULL
Renewables	NULL
Strategy for minimising thermal bridges	NULL

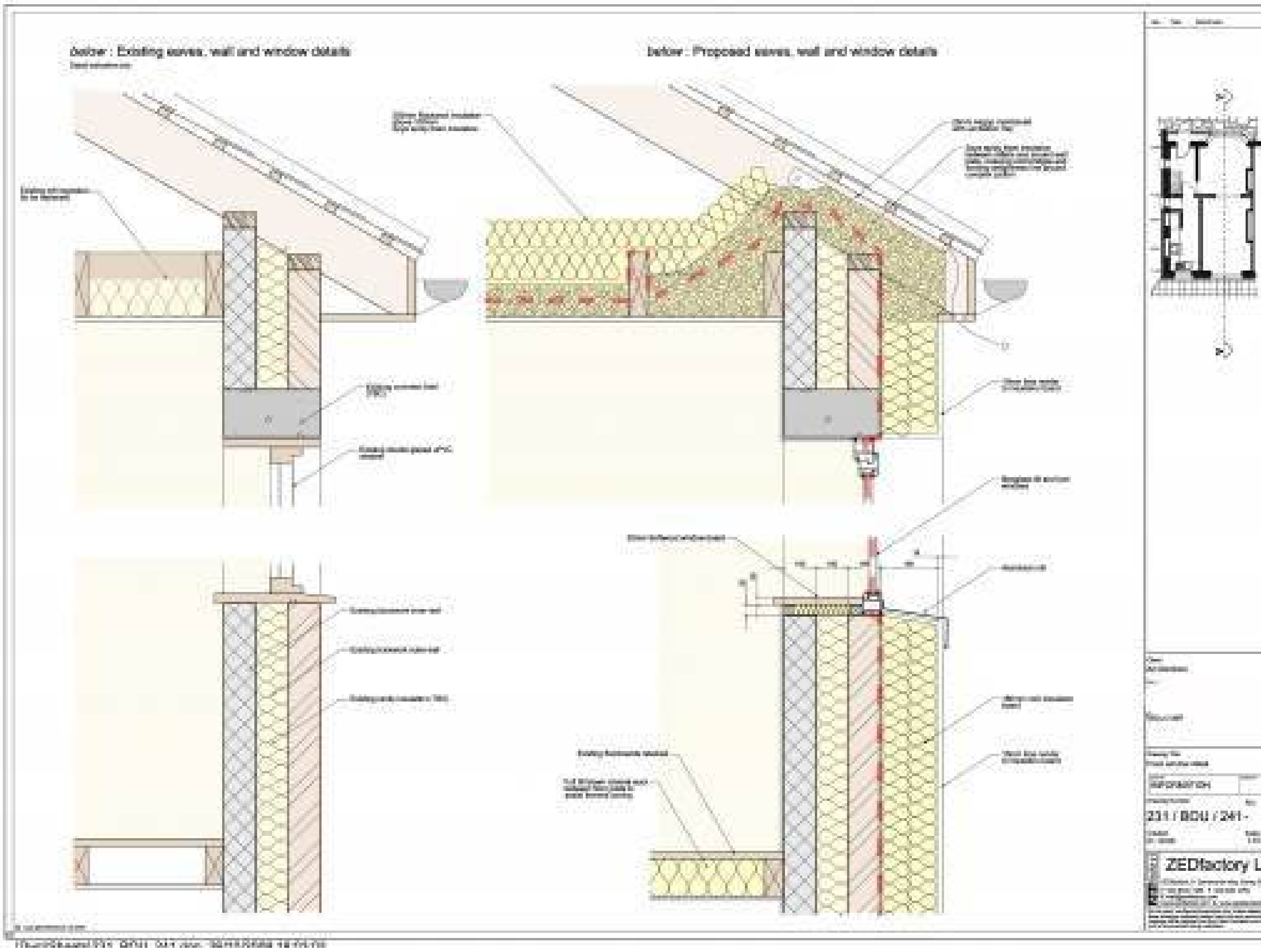
Building construction

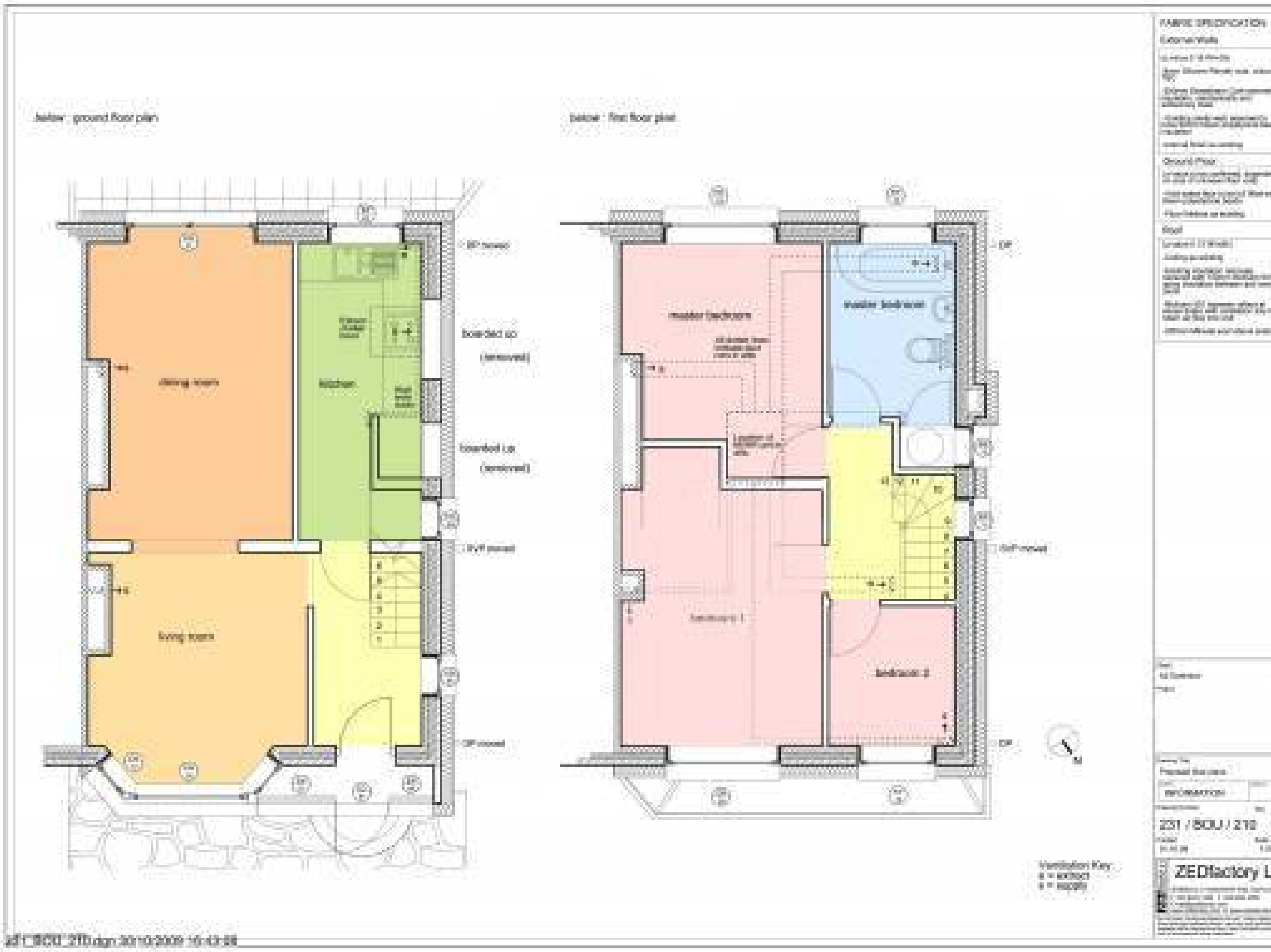
Storeys	
Volume	
Thermal fabric area	
Roof description	NULL
Roof U-value	0.00W/m² K
Walls description	NULL
Walls U-value	0.00W/m² K
Party walls description	NULL
Party walls U-value	0.00W/m² K
Floor description	NULL
Floor U-value	0.00W/m² K
Glazed doors description	NULL
Glazed doors U-value	0.00W/m² K
Opaque doors description	NULL
Opaque doors U-value	0.00W/m² K
Windows description	NULL
Windows U-value	0.00W/m² K
Windows energy transmittance (G-value)	
Windows light transmittance	
Rooflights description	NULL
Rooflights light transmittance	
Rooflights U-value	0.00W/m² K

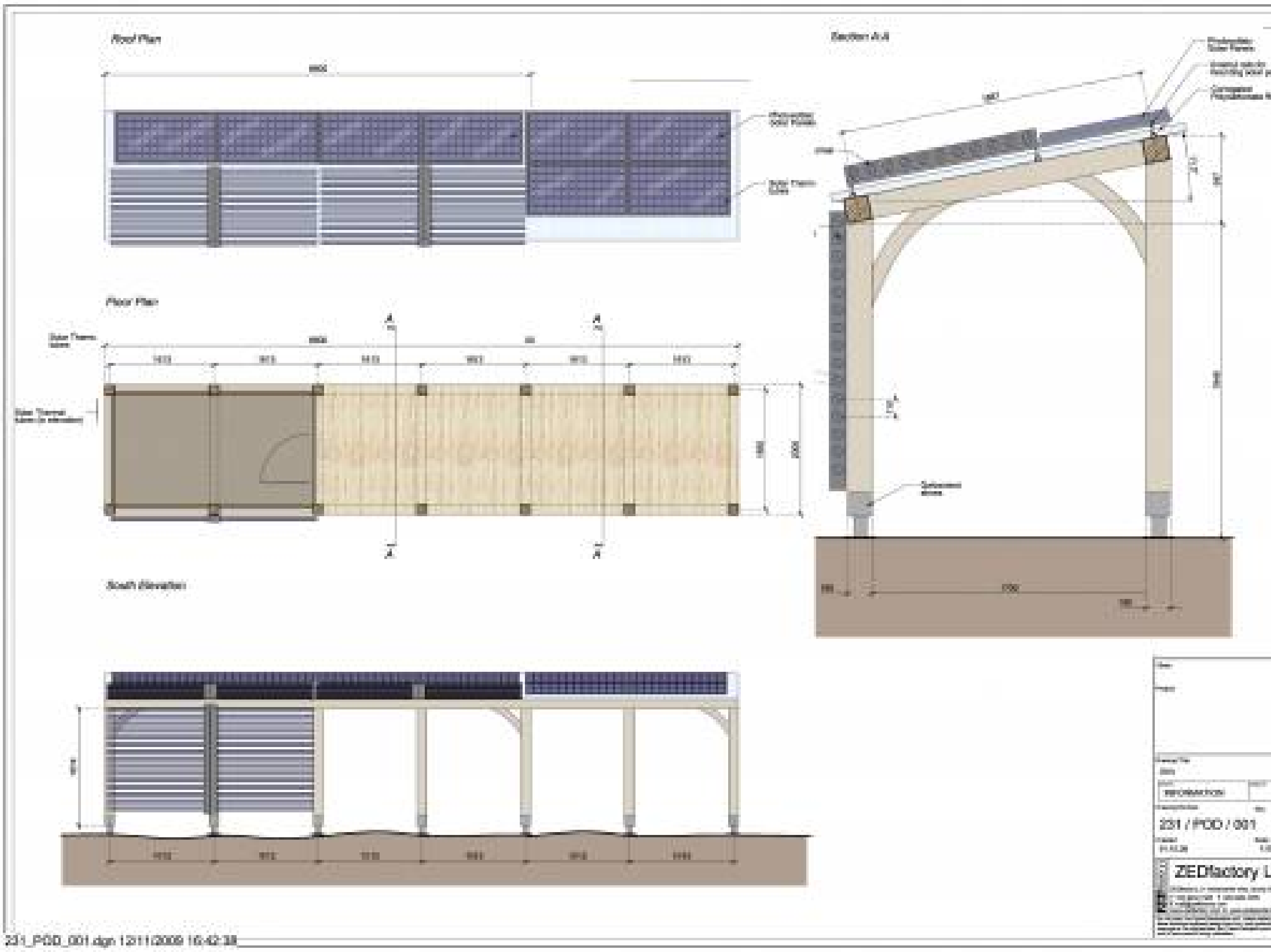
Project images


N
201 / BOU / 201-
ZEDfactory L

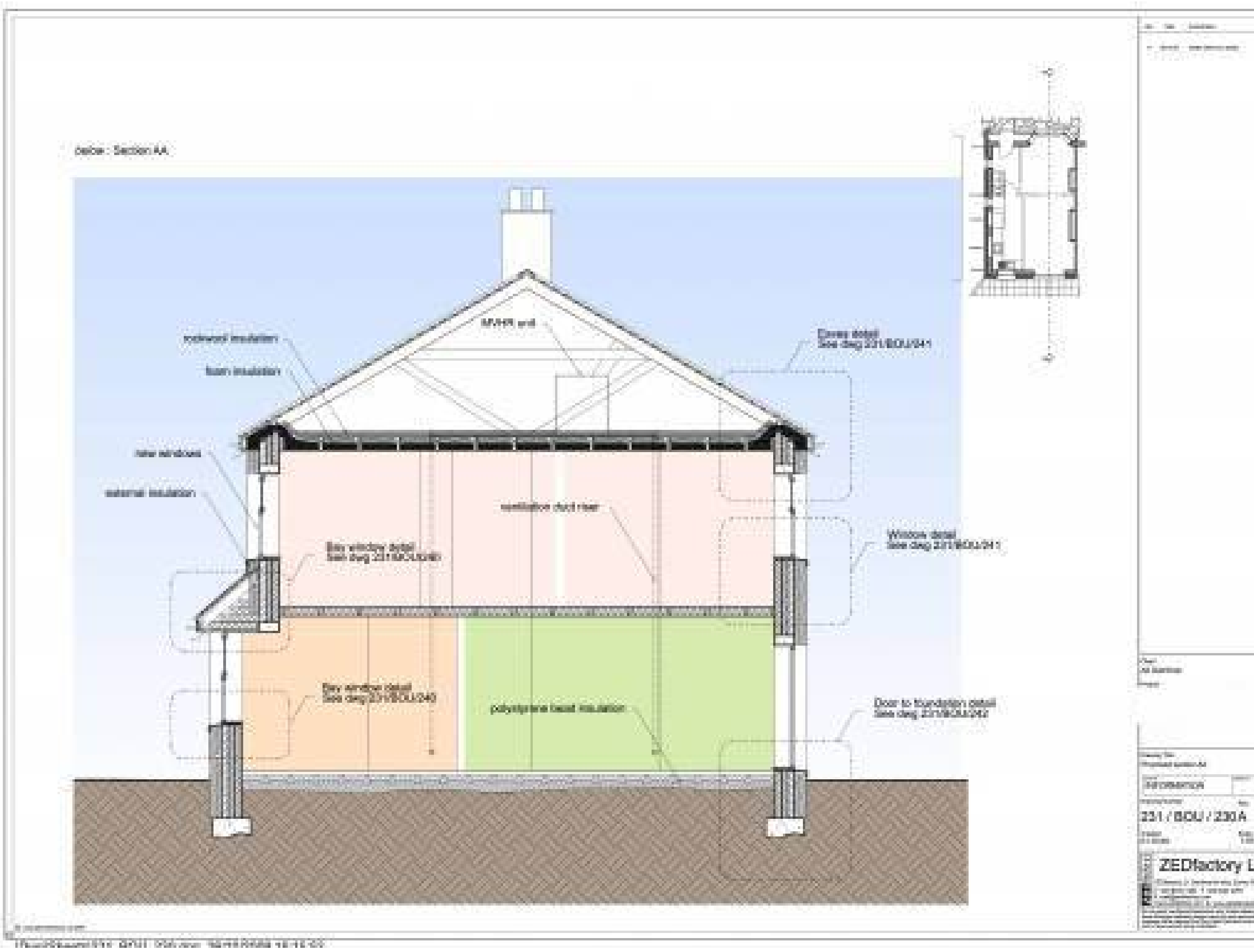

the zed factory ltd


below : Existing eaves, wall and window details
below : Proposed eaves, wall and window details
INFORMATION
231 / BDU / 241 -
ZEDfactory L




Roof Plan
Section A-A
Floor Plan
South Elevation
INFORMATION
231 / POD / 001
ZEDfactory L
231_POD_001.dgn 12/11/2009 10:42:38


the zed factory ltd


MVHR unit
external insulation
ventilation duct riser
Eaves detail
Window detail
Bay window detail
Door to foundation detail
ZEDfactory