



MACRO MICRO IN DUNDEE

SSEG's visit to this innovative project by Neil Burford of the School of Architecture at the University of Dundee coincided with beautiful sunny weather a few days after the spring equinox 2015 – always a good morale-boost for site visits.

Neil had submitted this project for the 2013 Green Energy Awards in the category 'Kerr MacGregor Memorial Award for Innovation in Solar Energy'. To give an overview, the text of his submission is useful, albeit written some 18 months before our visit:

"The Macro Micro Studio is a highly innovative student-led research project to develop and construct a

fully working 50m² ultra-low energy, Passivhaus standard, off-grid, live/work prototype building in the University Botanical Gardens. It has a full roof size solar array (PV and thermal) which will supply all the energy needs of the studio, and surplus will be used near the site.

A self-build, it is being delivered by a multi-disciplinary team from across the University and in

collaboration with The Wood Studio at Napier University's Forest Products Research Institute.

The objectives are to go beyond the UK's future environmental legislation governing energy efficiency of buildings by providing Passivhaus compliant, off-grid buildings that rely entirely on renewable energy sources for generating space heating, hot water and power. Modelling has shown

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George Goudsmit with Neil Burford (right)

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this can be achieved using a 2kW vertical axis wind turbine and 24m² array of photovoltaic panels to run technical systems, LED lighting and appliances. A 60kW/h lithium ion battery unit will provide three days of energy storage needed for mid-winter at a latitude of 56.45°N. The building also incorporates 6m² solar thermal panels, composting toilet and rainwater harvesting. The construction uses an innovative Scottish Manufactured timber system that makes use of locally grown timber in a new, commercially viable structural product. The use of a novel foamed concrete raft foundation slab provides structure and insulation in a single material reducing groundwork costs.

As a measure of the value of this project, Neil and his team have done amazingly well in securing in-kind industry support circa £138,00 to facilitate the construction. Architecture students have built the structure themselves, gaining valuable skills for their future careers. Future students will be able to study the solar systems, their performance and their effect on behaviour in great detail."

During our visit Neil gave some more detailed information about the construction, using local Scottish materials or systems as far as possible. Wall and roof panels are virtually identical, the main structure comprising 202mm JJI joists/studs (James Jones I-beams) on roof and an equivalent self-assembled 'ladder-stud' structure for walls – a 'Cullen space-stud' system with metal connectors as the 'rungs'. Both are filled with sprayed Icynene insulation, a non-toxic, water blown, vapour permeable foam with no ozone depleting agents such as CFCs (chloro-fluoro-carbons), HCFCs (hydro-chloro-fluoro-carbons), HFCs (hydro-fluoro-carbons), HFAs (hexa-fluoro-acetones) or harmful flame retardants such as PBDEs (penta-bromo-diphenyl ethers), and a

BBA-certified conductivity of 0.039W/mK. This is encapsulated in two layers of OSB (oriented strand board), the inner layer bounded by a services gap, plasterboard and skim-coat plaster, the outer with a further 150mm layer of Icynene, another gap and zinc cladding on 22mm sarking, connected back to the structure with pressed metal brackets. This composite construction of some 500mm thickness was estimated to give a U-value of approximately 0.1W/m²K. The unusual 1.0m deep (two 500mm pours) aerated concrete floor slab, with an epoxy resin floor finish over anhydrite levelling screed, is expected to give a similar U-value. Since there is a small footprint of the order of 30m², this implies a conductivity of approximately 0.11W/mK, a value that is viable for autoclaved concrete and the density given at 400kg/m³, as well as the presence of the 100mm EPS edge insulation that Neil told us about (off-cuts provided by Proctor's of Blairgowrie). Since the aerated concrete is difficult to fix into, a timber ring beam was set into the formwork, this secured back diagonally with a long 'elbow-bolt', in its turn secured to a 'uni-channel' running horizontally deep within the concrete. Waterproofing of the slab is achieved with a tanked clay damp-proof membrane (dpm), running below it and up its edges. Thermocouples have been embedded in the concrete to enable monitoring of its performance. Finally, windows and doors are triple-glazed Nordan Ntech 0.7, which are quoted in Nordan literature as having U-values "as low as 0.7W/m²K" and were donated by Nordan (but are not Passivhaus certified).

Overall, Neil told us that the original calculations using the Passivhaus PHPP software, indicated that annual space heating demand would be as low as 11kWh/m², comfortably below the Passivhaus



standard of 15kWh/m². However, Neil acknowledged that the amount of timber structure was greater than envisaged, which could push this value upwards. The final demand for space heating in use would of course also depend also on the intensity of occupation, the temperature regime adopted for comfort and the use of the mechanical ventilation system in tandem with natural ventilation – smaller windows can be opened at upper and lower level. Neil also talked about the geometric strategy of the design, a “defining set of rules”, using a 1:10 structural model; with consistent thicknesses for all wall and roof facets, each of which constituted a plate structure and as a complete entity enclosed a large volume relative to the exposed skin. The dark surfaces of the zinc cladding when exposed to the sun will also tend to depress the effective U-value lower, even below zero to indicate net gain, and the PV array will similarly lose some heat whilst generating electricity to the underside. Further, the footprint or plan-profile reduces to the north, and hence the north-facing roof surface and walls also reduce to limit areas of maximum temperature difference – altogether a cunning plan and section! At the time of our visit Neil stressed that the aim of the Macro Micro was for energy self-sufficiency, but not for export. Since our visit, he has added the following (e-mail 03/09/15):

“The building has been through a number of iterations over the last few years before we settled on the occupancy target which determined the capacity of generation and storage. ...

The current configuration has a 5kW Siemens array (20 panels approx. 36m²). It was originally intended to install a 2.5kW VAWT but this has subsequently been revised to a 4kW turbine, which will probably be a conventional configuration. We also need ideally 24kWh of battery storage (based on a Toyota Prius). In this respect we are considering 2nd life EV modules but there is also some interest in a micro hydrogen scheme. The turbine and storage are future areas of development after the building shell has been completed. The energy system is sized to be autonomous in mid-winter with 3 days of storage capacity. This means there should be an excess generation for the remainder of the year. The optimisation was carried out in Physics [Dundee University] based on an occupancy of 4 people using the building 9-5, 5 days a week.

I’ve managed to get almost a year of temperature/humidity data now without the technical systems working and ducts open to the outside so not very airtight. This is understandably quite variable giving some high summer temperature peaks and a gradual decline in temperature from around mid-November to mid February with quite low (6/7 degrees) nighttime temperatures. Stephan Huber managed to get the MVHR commissioned a couple of weekends ago and already the diurnal temperatures are beginning to stabilise although it’s showing a tendency to overheating on sunny days.

I’ve been working with my colleagues in Physics on developing a novel wireless Arduino based monitoring

module, which we’ve almost got working. It will take temperature, humidity, gasses air movement and PIR occupancy readings. I’m about to write an SFC with an engineering company in Dundee to develop this further.

The last of the technical systems were commissioned last week so we should have an operational near Passivhaus building – I’m reluctant to say it is Passivhaus standard with all the compromises made in the design and construction but hopefully it can be monitored so this can be determined.”

Apropos the second paragraph in this e-mail and going back to the time of our visit in March, Neil emphasized that the development of an Energy Management System (EMS) to operate the batteries, plus a Building Management System (BMS) to operate the whole building, was the next key stage. What we noted was that immense care had been taken to incorporate servicing such as the Paul Mechanical Ventilation with Heat Recovery (MVHR) unit and its ducting as discreetly as possible and with short and simple delivery and return routes. For example, the MVHR unit itself is housed along with the batteries in a small semi-cellar plant space below the stairs to the upper floor, there is one extract from the kitchen at ground level and one from the upper level close to the apex, and ducting is as far as possible embodied within finely detailed birch plywood bespoke storage units, as well as delivery outlets. Another significant part of the servicing, and the greatest single demand-load, is a small-reservoir 7.8kW Zip ‘hydro-boil’ for tea-making and the hot-water tap to the sink, the unit again housed neatly in the base unit below. The supply for this comes from a 250 gallon (1,137 litre) storage tank collecting rainwater from the roof’s secret gutters; a pressure issue relative to the Zip ‘hydro-boil’ at the time of our visit now resolved along with the



rest of the technical systems. There is a single 1kW panel post-heater, while artificial lighting will be provided by a big-ballast LED system.

Regarding the construction process Neil told us that achieving an approved health and safety protocol had been daunting, and that the contractor McAlpines had been involved training students on site – twelve initially, half of whom were climbers, skiers and so forth – and that, since there wasn't sufficient room for a crane, a 'Tek-lift' had been used to aid assembly of the roof panels. All such prefabricated components had been constructed by the students off-site within the Civil Engineering Department, and, given the geometry, working to tight tolerances with dimensions electronically computed. Of the initial team of twelve, five had stayed on for a more prolonged period, leaving only the finishes internally and externally to be done by outside contractors.

One other matter that is worth mentioning relative to the 'free-floating' conditions prevailing at the time of our visit on a clear-sky spring afternoon, with only ambient natural forces interacting with the building before services were commissioned, is that the temperature on the upper level was some 25-26°C – not intolerably warm. Neil also told us that during winter when temperatures fell to around -5°C, those inside varied roughly between 7°C overnight and 12°C during the day.

This is an exciting and beautifully designed and executed project, and absolute credit to Neil, his students, all the sponsors and others associated participants. I'm sure Neil's narrative will be more fully told in due course. We also hope to be able to entice Neil to give a talk to some of our members this coming winter. In the meantime, a big thank you.



THE FUTURE OF HOUSING?

At the beginning of February 2015 a longstanding sister organization for SSEG, the Scottish Ecological Design Association (SEDA), held one of their 'Green Drinks' events in Glasgow School of Art's new Reid Building. They had invited Ben Adam-Smith to present a video with the ambitious title 'The Future of Housing'; this about how his own house functioned as a guinea pig for an air-tightness, energy-efficiency upgrade initiated by Paul Jennings and involving contractors nicknamed 'Gunge Brothers'.

One paragraph in the Spring 2015 issue of the SEDA Magazine (p23), having introduced the context of Ben's upgrade in the film, summarizes a key misgiving:

"Unfortunately this very useful start swiftly moved onto remedial works with plenty of 'squirry' foams and sealants by the aptly-named "Gunge Brothers" – at which point most of us wondered if this was some sort of practical joke. After all, SEDA wrote an excellent airtightness guide back in 2006 full of best practice airtightness measures, none of which include squirry foam."

Although the next paragraph goes on to say that the Q&A session was "more polite than probing", there were actually quite a number of serious questions as to why the issue of indoor air quality (IAQ) and suitably controlled ventilation had been completely ignored. These included comments about poor measured IAQ in homes with MVHR as well as those reliant on mechanical extract from wet rooms and supply via trickle vents in windows. In other words, there were more issues to do with IAQ than just the off-gassing from the chemical foams used by the Gunge Brothers. These would include off-gassing from other materials, including those impregnated with fire retardants, build-up of moisture level associated with Ben, his family and domestic activities, potential presence of excessive numbers dust mites, airborne and/or surface mould spores, ion imbalance etc.

In retrospect, however, there was another question that I should have asked: Why was there no recognition of the role that we know solar energy can play in enabling energy-efficient ventilation – air supply windows, solar air collectors, solar attics, sunspaces as ventilation-preheat spaces, and so on?

Conclusion: 'Future of Housing ... Not', unless we wish to risk serious health problems.

EDINBURGH COMMONWEALTH POOL

A visit to the Royal Commonwealth Pool (RCP) in early December 2014 was preceded by a talk given by Janice Foster at SSEG's AGM in early September. Originally commissioned in 1966 and completed in 1970 by Robert Matthew Johnson-Marshall and Partners (RMJM), it was A-listed on 29th March 1996.

This specific aspect had some significant implications for Janice's involvement during her employment with BuroHappold Engineering as M&E consultants for the most recent upgrade as well as for S&P Architects; design commencing in 2006, construction in 2009 and hand-over in 2012. In particular, the involvement of Historic Scotland and their restrictive attitude to altering any visual detail constrained the quest to improve the energy-efficiency performance. Not only did this affect the proposal to mount solar thermal collectors on the highest area of flat roof over the pool, it also meant, for example, that the extensive area of single glazing could not be improved, as well as making efforts to thermally

upgrade opaque parts of the envelope more challenging. Moreover, it meant finding space for modernised plant around the building without aesthetic impact. Starting with the solar thermal array, the architect's initial proposal for evacuated-tube solar collection on the flat roof was turned down, as was any form of solar collection involving a pronounced tilt. The accepted proposal is unusually almost horizontal and without a glazed cover, and when viewed from above at a distance, say from an upper window of a higher nearby building or even by the general public via binoculars at some topographical distance – the Salisbury Crags – looks like a normal proprietary metal roofing of some sort. It was not at the end

of the day fully roof-integrated (i.e. functioning as the waterproof layer) as the contractor was not happy to take the risk in this regard. It is a Swiss product by Energie Solaire SA (ESSA), and the 500m² array, which was mounted at a near-horizontal angle (3°) was modelled by the company for the Edinburgh climate – one might have expected a loss of some 13% compared with a more favourable 30-degree, south-facing tilt. At any rate, the prediction gave an annual yield of 212,500kWh or 425kWh/m². This implies an efficiency of some 55%, which seems credible, if on the optimistic side. The lack of a transparent cover is bound to increase losses, but on the other hand the incident irradiation will be greater, and the resultant efficiency of the collector itself will be very dependent on flow rates through the collector relative to convection losses in particular, given Edinburgh's reputation as the 'windy city'.





Paul Whiteside braves the breeze

However, the performance of the Solaire system has thus far been disappointingly well below predictions, this for a complex number of interactive reasons including the BMS set up. The figures Janice indicated to us were under 55,000kWh for the first year and 44,950kWh for the year up to Aug 2014, or approximately 90kWh/m². Apart from the BMS not being optimized, the pumps, for example, were on a time schedule whether heat was available or not, which seemed to suggest lack of differential control. There were also times when the solar-heated water could not be used – e.g. when it was above 70°C. Paul Whiteside, our technical guide (Pool Water and RCP Technical Manager) during our December site visit, also told us that differential pressure devices on the solar system had never been operational. However, the BMS has now been changed and better performance is now expected. Although it was quite a cold and windy day prone to squalls, Alan agreed to accompany us on to the roof itself to gain an

impression of the Solaire panels. One perception, perhaps without validity, was that they appeared rather reflective to the low winter illumination from the sky vault. Given ESSA's claims for a "highly selective coating" – Janice told us 0.94 absorption and 0.18 emission – and a "higher efficiency than any other covered flat-plate collectors at low temperatures", this may well have been a deceptive perception. Even so, one can't help wondering about the efficiency at higher temperatures taking ESSA's quotes at face value.

Overall, Alan Hughes, Energy and Sustainability Manager for Edinburgh Leisure, told us that the complex's carbon footprint had actually increased since the 2012 refurbishment. This was a surprise, not least to Janice who, regardless of the disappointing performance thus far of the solar collectors and the inability to significantly upgrade the building envelope, was anticipating that the three 2,500 gas CHP boilers (meeting all of the heat and some half of the electrical demand) and other refinements would have resulted in

a reduction. One key culprit must surely be the enlargement of the pool, now up to 5 million litres of water and involving the loss of some 500 seats for spectators. Perhaps standards have also increased with regard to water or air temperatures and rates of air change. Regardless of the explanations, there are valuable lessons to be drawn from this particular case study over and above that of over-extreme regulated aesthetic barriers to visible technological solutions. A completely different approach, apparently not considered in the recent makeover, would have been to rethink what represents a tolerably comfortable environment within the immediate enclosure around the pools. For example, cooler air would render the perception of water warmer, so that one approach would have been to operate at a lower air, and somewhat higher radiant, temperature range within the hall itself, and slightly cooler water. Of course, there may be regulatory barriers, or at least a bone of contention by departing from established 'best practice'. But such an approach synthesizes mitigation and adaptation within a given building envelope, the latter in terms of differently enabled comfort that comes from less use of energy in a notoriously carbon-intensive building type.

We are indebted to Janice for both her September talk and also for enabling and organizing the later visit. For all the A-listing constraints and subsequent performance gremlins, it was fascinating and informative inclusion on SSEG's 2014-2015 programme, and many thanks also to both Alan Hughes and Paul Whiteside for their contributions.



EDINBURGH COLLEGE'S SOLAR MEADOW

SSEG often finds that field visits coincide with sunshine, which tends to provide a boost to morale and perceptions if nothing else. On this occasion, our visit to Edinburgh College's Midlothian Campus near Dalkeith to investigate its 'solar meadow' coincided with copious quantities of rain.

Nevertheless, the occasion, which was organized by SSEG stalwart Rory O'Riordan with Jimmy Lough of Midlothian Campus as our guide, was very well attended. The interest in the serried ranks of solar photovoltaic (PV) panels was also enhanced by the knowledge that they also functioned as part of the teaching life of the campus alongside ecological features such as beehives, wildflowers and a pond. The solar meadow, albeit quite muddy in places on that particular day promised much more than the adjacent car park with its rather different functional role. Jimmy told us that the PV panels were co-owned by Edinburgh College and SSE, comprising 2,560 polycrystalline Astronergy panels of 0.245Wp (CHSM6610P series: 1,652 x 994mm outer dimensions; 1628 x 970 net collection surface, with total area 4,042.65m²) to give a total capacity of 627kWp. We were told at a later event in March 2015 that there are 32 Power One Aurora Trio inverters, each with a maximum capacity of 20kW and a nominal efficiency of 98%; and that the predicted annual output is nearly 569,000kWh, which would indicate as much as 140kWh/m², a figure that seems wildly over-optimistic. The Midlothian Campus website prediction of 560,000 kWh is only slightly less so at 138.5kWh/m². Although these annual forecasts were apparently given for CSun 245-60P panels, which are monocrystalline according to the CSun's web information, they do seem unrealistic. From my skimpy notes jotted down in the rain, I don't think Jimmy gave us a measured performance figure, but I did take site measurements. These

indicated that the angle from the top of one array to the bottom of the next one is 17.8°, which means that there will be some over-shading in the central winter period, say from early November to early February. However, despite my skepticism as to the likely actual performance, the achievement of the 'solar meadow' is one with which the Midlothian campus may feel justifiably proud. It is certainly a pioneer for Scotland for an industry that could offer much more, and since has with the opening of a much larger PV farm north of Aberdeen of 1.8-1.9MWp. As a footnote to our damp visit, one of our members, Peter Randall of Kingdom Solar, commented that these particular Chinese Astronergy panels were now "as cheap as chips", approximately £100 per panel.

Many thanks to both Rory O'Riordan for setting this event up, and giving me a lift there and back from Haymarket, and to Jimmy Lough of course.



Jim Norris with grand weans



EUROSUN 2014 FEEDBACK

Eurosun 2014 was introduced in Issue 33 of SunTimes, with a synopsis of the key findings in a paper written by Janice Foster and myself. In February 2015 Janice gave an illustrated talk on various projects she had seen during the Eurosun 2014 Technical Tour.

She started with an administration building and café that comprised part of the Jacob-Bellecombette University campus in Chambéry, to the south of Aix-les-Bains, which hosted Eurosun 2014 (itself about an hour and a half south of Geneva). A spiral building form, area approximately 1,000m², is aimed at passive, rather than active, solar collection, with a 50kW heat demand estimated and the complex linked up to a district heating system. It has automated blinds to inhibit solar overheating and also incorporates light pipes to illuminate deep parts of the building. However, it looked as if of lots of artificial lights were still on despite good levels of daylight, a common circumstance despite the efforts of architects and their consultants.

Janice then moved on to several buildings in Montmélian to the southeast of Chambéry and classed as a 'solar city', with a fair amount of solar thermal installations as well as PV in evidence. The first building here on her tour was a gymnasium which had approximately 50m² PV (yielding 4.2kW at time of visit), as well as solar thermal panels and a 'SolarWall' – an unglazed transpired solar air collector originally marketed by Alcan, and essentially perforated metal cladding used to preheat incoming air for ventilation. Next on the tour was a children's village catering for ages from 6 months up to 6 years. In this case a combination of PV and biomass meets all energy needs, with sun-awnings to windows to prevent overheating and other green features such as rainwater harvesting to use as 'grey' flushing water for WCs.

Then the tour took in an open-air summer swimming pool, operational from the end of May until the end of August. This had been originally built in Orwellian 1984 and upgraded ten years later with 220m² glazed solar thermal collectors, heating and filtration plant located below the changing accommodation. Over its life since, it has apparently saved two-thirds of the energy load, equivalent to about 600,000 Euros.

Finally, the tour was concluded with a visit to the French National Solar Energy Institute, Helios INES building, located in Savoie Technolac, le Bourget-du-Lac at the south end of Lake Bourget (with Aix-les-Bains on its eastern shore) – i.e. back to the north of Chambéry. According to the website, this striking building by architect Atelier Michel Rémon with Frédéric Nicolas was completed in 2013 and has an area of 7,500m². However, Janice's figure was nearly three times larger. I initially wondered if the web has given the footprint rather than total floor area, or possibly

the area excluding the atrium and any other unheated spaces, but it seems more likely that it embraces another larger INES building complex to the north of the Helios one that Janice illustrated. The key features of the Helios building include a stand-alone brise-soleil to shade the main fenestration facing some 18° south of due west and a dramatic skewed 30°-pitch butterfly roof over-sailing part of the central atrium and providing sufficient opaque surface on its due-south slope for solar collectors. The remainder of the glazed roof over the atrium has a horizontal fabric diffusing later below it. According to one key website for this building there is a 280m² solar thermal array, which provided roughly 40% of an annual heat demand of less than 27kWh/m² (this figure assumed to include hot water), a pellet boiler the remainder. Another feature is the low temperature of 45°C used for the 'wet' radiators to facilitate maximum solar contribution and inhibit losses. Janice gave an area of 1,500m² for solar collection surface, but although PV panels as well as solar thermal collectors are mentioned on the web, the area of these is not given. Again it seems likely that this is a gross figure for both the Helios building and the other INES complex to the north, which appears from the web aerial view to have a series of PV arrays mounted on its roof. Photos also show ground-mounted solar test rigs between the Helios building and its northerly neighbour.



INES Helios from north with butterfly roof and sunscreen

In any event, according to the web descriptors Helios with its butterfly solar-thermal roof is a highly insulated, naturally ventilated and naturally cooled (nocturnally purged) building that makes full use of prevailing northerly breezes and high-level openings within the atrium, and uses high thermal capacity as part of its tempering strategy – between 775-926kJ/m² for various bounding surfaces. However, although the text implies that this is the whole story, it does also refer to heat recovery, and Janice confirmed that ventilation is in reality mixed mode with mechanical supply available. Regardless of the means of supply at any particular time, Janice also confirmed that there was good indoor air quality (IAQ) and daylight quality inside offices.

A general comment Janice made about Eurosun 2014 stressed the relative paucity of passive solar design in conference papers and a dominance of papers on hybrid solar PV-thermal (PV-T) collection, as well as solar thermal district heating and some mention of the role for phase change material (PCM). Of course, the technical tour made up for some of the apparent passive solar lack, and a big vote of thanks goes to Janice for presenting the paper on her own, sitting in as National Liaison Officer (NLO) for Scotland at the ISES-Europe Board Meeting, and finally for making time for another SSEG presentation.



Inside Helios atrium

PETER RANDALL'S SOLAR KINGDOM

Peter Randall, a relatively new kid on the SSEG Committee block, kindly agreed to host one of our regular meetings in early December 2014 at his own home in Oxgangs, quite well to the south of Edinburgh's centre, but still to the north of the ring road.

Generous hospitality from Peter and his wife included food and beverages, including wine or beer if desired, and by the time we had dealt with our agenda, Peter gave a short presentation primarily focused on three aspects of PV – Storage, Scale and Grid Balancing – that also had relevance for other aspects of renewable energy generation.

Storage: In this regard he stressed the bi-directional side to storage, and not only for batteries. Then he mentioned demand-side management, including for hot water cylinders; electrical vehicle charging; district heating; pumped storage (which can be quite small-scale as at Earth balance in Northumbria that SSEG visited many moons ago); flywheels on generators; fuel manufacture as in hydrogen from electrolysis of water; other forms of energy exchange; and electric vehicle battery re-use. Overall, Peter's message was 'watch this space' re storage, mentioning improved battery technology including 'flow' batteries, Maslo smart energy storage with 32kWh batteries and rewiring houses with direct current using a USB 3.0 port (if my notes are accurate).

Scale: This was really a continuation of the storage issue, where, for example, Peter discussed incentives for the domestic sector in Germany, including in individual houses. A key point Peter made was that there is a lot going on at a major grid level, but not at a small scale. Orkney's Storage Network Park may have been somewhere in-between.



Grid Balancing: Peter started by saying that this was essentially a matter of operating reserves within the grid, and referred to a paper by Paul Barwell of Solar Energy UK and CEO of the Solar Trade Association (STA). This is likely to be 'Reducing barriers to large-scale integration of pv electricity into the distribution grid', European Advisory Paper, Annex III – national barrier assessment, July 2014; available as a pdf via www.pvgrid.eu, where Paul Barwell is listed as a UK author in terms of national responses (see 4.15, United Kingdom, p107, for National Barrier Assessments). Back to Peter, he forecast that electricity from solar PV would be cheaper than gas per kWh by 2017-18 (with import duties from China ending during 2015). However, it seemed likely that there would be zero subsidies such as the Feed In Tariff (FIT) by 2020 affecting all scales and the current surge in PV farms were encountering grid-connection problems. Peter's concluding comment (at least that I have noted) was that the Microgeneration Certification Scheme (MCS) did not cut the mustard!

Many thanks Peter for your concisely presented insights, and of course for your hospitality.

WISTON SELF-BUILD 2015



Having missed out on 2014 at Wiston after our 'hot tub' self-build venture in 2013, we were anxious to organize in good time for 2015. What we planned turned out to be quite challenging for SSEG, if an excellent learning experience for the students involved. The following is a brief chronological account of what we have achieved (thus far).

25/09/14: 1st meeting of involved staff – Wendy Johnstone and Meg Beresford from Wiston, myself and Kathy Li from the Mac and Stas Burek from Glasgow Caledonian; Tom Grassie from Napier giving apologies, but indicating enthusiasm and the potential to donate materials etc. We agreed a provisional booking with Wendy for 13-15th March 2015 for the build operation of a solar hut to accommodate eco-meditation/poetry pursuits. We also agreed the need for two half-day pre-meetings involving students, the first suggested at one of the HEIs and the second at Wiston – 17th and 27th February mooted. Then we discussed the need for robust health and safety protocols for

each HEI as well as insurance issues, and agreed that materiality should prioritise home-grown timber with a view to again seeking sponsorship from the Forestry Commission via Andy Leitch, in this case £2k agreed. We further agreed that the site would have to have good solar access – i.e. not in the woodland. Regarding meeting Wiston's accommodation costs, travel, any shortfall for materials and so forth, it was agreed to charge the students the same contribution as formerly and that we would seek 100% of staff costs and 50% student costs from each HEI per previous practice.

18/12/14: 2nd meeting of involved staff – Wendy Johnstone and Jonny Sutherland from Wiston, myself

and Kathy Li (Mac), Stas Burek (GCU) and Tom Grassie (Napier). By this time we had established that to avoid need for a Building Warrant, the area could not exceed 8m², no services inside (even a sink) permitted, and there was also a restriction for a low single-storey height for such huts to avoid the need for Planning approval. We located a suitable site with good





solar access immediately to the south of former tennis courts and it was agreed that Jonny could get staff at Wiston to erect a grid of 6 larch posts on a 1.8m grid, with a minimum of 2.6m projecting above the ground, this in advance of the build-weekend to function as an armature for the students that would enable reasonably rapid erection of floor, walls and roof structure around it. We also discussed the potential for a solar air collector to provide a modicum of heat for the hut, but did not rule out other forms such as sub-floor heated serpentine at this stage.

The next priorities were to be the health & safety protocols (Kathy for Mac, Tom for Napier and Stas for GCU), seeking the sponsorship from the Forestry Commission, finding names of suitable suppliers of Scottish larch, working up a provisional schedule and seeking costs (Colin). The first turned out to be a daunting task for Kathy at the Mac, mainly due to the disastrous 2014 fire, but also in

part due to the tragic death of a Mac student returning from a field trip (an accident in his own car). The eventual protocol, extending to 38 pages, was only fully signed off days before the March build-weekend. So that was still work-in-progress at the time of the first pre-meeting of staff and students.

18/02/15: This was held at the Mac, steered by Kathy with the full complement of students from Napier and Glasgow Caledonian also attending, plus Tom and Stas. By this time I had received confirmation of the £2k sponsorship from the Forestry Commission and obtained prices for a preliminary schedule of material based on a hut of some 7.2m² (i.e. comfortably less than the maximum allowed with a Building warrant, and about the size of a typical single bedroom in social housing). It was apparent at this stage that getting adequate material for the basic superstructure without its final external cladding would mop up the sponsorship fund, but that in any case this was going to stretch the self-building capability over a single weekend. Fortunately by this stage, Tom had confirmed that he could donate two double-glazed window units (glass only) and one double-glazed, timber-framed door, plus a 2nd-hand solar air collector and sundry other materials. Stas was also able to contribute rolls of roofing felt. So the task for the students, allocated into multi-disciplinary teams from the three HEIs was to arrive at viable sketch ideas without departing significantly from the timber quantities in the schedule. The teams presented these as the closing part of the day, and they dispersed with the remit of keeping in touch electronically and arriving at a preferred design before the second pre-meeting two weeks hence.

27/02/15: Held at Wiston Lodge, by this time the 'armature' 150mm square and 3.6m long larch posts had been delivered, but not yet erected by Jonny and his staff team. The reassembled students familiarised themselves with the site and set about refining the

agreed L-shaped design (Mac students had made a preliminary model to assist with this), and progressed to working out constructional options that would conform reasonably closely with the priced schedule – larch supplied by Scottish Wood near Dunfermline, tongued and grooved Sterling board sheathing from a building merchant in Paisley and breathing paper from an English company (local merchants only supplied very large rolls).

13-15/03/15: Two very able self-builders, Suzanne Dunscombe and Graeme Robertson, augmented the staff team from the Mac, bringing the total from the three HEIs to six. The safety protocol also prohibited students working at height, so that only staff members were permitted to go up ladders. After the briefing, with specific emphasis on health and safety with presence of trained first-aiders, the first tasks comprised carrying the delivered timber to the site and helping Tom to erect a guyed parachute canopy and surveying the 'armature' by this time erected by Jonny's team of volunteers at Wiston. We were fortunate that the weather remained mainly dry for most of the weekend, but the first day in particular was sunless and very cold. Although necessary to give the students a realistic start around which to initially construct the floor structure, to be followed by that for the roof, the posts were inevitably off-plumb as well as slightly off-grid. Stalwart efforts were made, with the assistance of





Graeme's 4x4 and tensioning devices to bring the posts as close to vertical as possible, but the armature remained as much a problem as solution throughout the building operation. Varying heights also meant hand sawing at height, a daunting task resolutely carried out by Graeme and Suzanne. There was also fine-tuning of teamwork within the student body over the weekend and acknowledgement that staff's role was to advise and assist as required rather than to take over.

Some of the decisions reached resulted in running out of structural larch by close of operations on Sunday. But, in terms of achievement, we all departed feeling very satisfied with progress – structure 90% complete, partially sheathed and with floor and walls partly insulated, roof reasonably watertight (2nd hand roofing felt inadequate, and so plastic sheeting used a temporary measure), one window in place and solar air collector installation complete, tested and demonstrated to deliver pre-warmed air to the hut.

29-31/05/15: It had been evident in March that at least one more weekend would be required to complete the self-build operation, and that extra funds would be required to enable this. Fortunately the Mac had a Sustainability 'pot' and an application to this for an extra £1,500 was successful (thank you Sustainability Manager, John Thorne). In turn this had enabled a fresh delivery of larch cladding, together with some extra structural sections. Unfortunately, it turned out that part of the cladding order had been delivered in 150mm

widths instead of 200mm. This slowed covering progress over the weekend by a somewhat reduced number of students and staff, as well as necessitating the delivery of more cladding to make up the shortfall later in the summer. But at least the weather was warmer than in March, and by the end of work on Sunday, the cladding was about 75-80% complete, the donated double-glazed door was hung, the second window was in place and the roof was fully felted.

31/07/15: Having returned to Wiston in June to double-check how much more cladding was needed to make up for the error in initial delivery, and this having been delivered to site, Tom and I completed the remaining cladding during a break in our summer monsoon so that the shell is now complete; remaining tasks being completion of roof and wall insulation (more required from Wiston's New Lanark source) and internal lining (material on site under tarpaulin) and construction of steps up to entry platform (adequate larch remaining on site). We hope that a final work party may be arranged in the near future.



Second weekend team — bunch of posers!

'SOLAR ENERGY RESEARCH IN SCOTLAND' SEMINAR

SSEG Chairperson Anne-Marie Fuller organized this well attended event at the Heriot Watt University campus on the afternoon of 18th March; also wearing her other two hats – Scottish Institute for Solar Energy Research (SISER), a pan-university alliance of solar energy researchers with the aim of increased collaboration, and the related Energy Technology Partnership (ETP) – and hence the good turnout of some 50 participants.

As the name suggests, Anne-Marie explained that ETP is wider in scope than SISER, embracing all energy research areas, with some 600 researchers across numerous academic institutions providing the most broad-based power and energy research establishment in Europe. She then gave a brief overview of the various esoteric areas of solar research to be outlined by the speakers to follow, much of it associated with photovoltaic development and refinement.

First on after Anne-Marie was Dr Eli Zysman-Colman, a chemist at St Andrews University, whose website states that his group is involved in "research at the interface of organometallic optoelectronic materials, physical organic and supramolecular chemistry". His presentation talked specifically about dye-sensitized solar cells (DSSCs) with chemically stable panchromatic dyes; illustrating the position of dye molecules embedded with TiO₂ nanoparticles as the penultimate layer a PV sandwich below the outer glass, platinum catalyst and electrolyte. Another chemist, Prof Neil Robertson, until recently Director of SISER (see SunTimes 33, 'Transforming Scotland with Solar Energy') and now Chair of Molecular Materials at Edinburgh University, then led us through various materials for solar energy – light absorbing, conducting, luminescent – as well as photo-catalysts for water purification and high-performance, perovskite solar cells combined with hole-transport materials or HTMs. I did say this is an esoteric area of solar research, and more was to come!

Continuing in the same vein as Eli and Neil, Prof Peter Skabara, Professor of materials Chemistry at the University of Strathclyde led us through self-assembled polymers and molecular materials for organic PV (OPV) devices – organic field effect transistors (OFETs) and organic light-emitting diodes (OLEDs). Next on was Prof Graeme Cooke from the University of Glasgow (Professor of Physical Organic Chemistry), who has taken over the directorship of SISER from Neil, and again talked about his work on materials for solar cells including dyes, small molecules and polymers. Then came Prof Ifor Samuel from the School of Physics and Astronomy at St Andrews, who talked about the photophysical characteristics of OPVs and architectural applications, citing the work of Dorothy Hardy on 'Solar Electricity for Art and Architecture' (See SunTimes 32, article by Gloria Lo, pp9-10); and returned later to talk of 'device fabrication'.

There was still much to come: Prof Russel F Howe, University of Aberdeen on hybrid semi-conductors; Dr Nick Bennett of Heriot Watt on Lunar PV and radiation damage (all that I noted!); Dr Adrian Quarterman, University of Dundee, on solar-pumped semi-conductor lasers located or 'power beaming' above the atmosphere on satellites (blue-sky thinking!); Dr Efthymios Klampaftis, first of a series of researchers from Heriot Watt, on high-efficiency, coloured and graphically designed PV modules, who mentioned challenges such as poor short-wave response and monotonous blue-black colour

(efficiencies varying from 14.3% from orange to 15.2% for violet); Dr Jose Marques Hueso on photonic crystal-driven spectral concentration to enable 'upconversion' PV for higher efficiency; Dr Robert Mather with Prof John Wilson (past member of SSEG Committee at time of inaugural 1984 North Sun, and coincidentally father-in-law to my optician), describing the development of flexible solar cells in polyester fabric (five nano-layers, topped by thin-film Si coating by PECVD at 200°C); Dr Gudrun Kocher on Photonic crystals (PhC) in planar solar collectors integrated within a glass structure (more stable than dyes); Dr Roberto Ramirez-Iniguez, from Glasgow Caledonian University on non-imaging optical concentrators incorporated within a prototype window; our old friend Prof Tariq Muneer from Napier University on his building-added photovoltaic (BAPV) performance, which produces some 10.7MWh annually, and has a peak January output (16/01/07) of 12.8kW.

There followed a brief presentation on the 'solar meadow' at Dalkeith (see our Nov 2014 visit above) and then one on the new larger solar-PV farm of just under 1.9MWp the ice-cream famous Mackie family (the talk I think given by Mac Mackie?); this combined with three existing 850kW wind turbines and one of 500kW added, and both PV and wind sharing the same connection to the grid. My notes were a bit sketchy as I had to leave to catch a train back to Glasgow, but a feature of the site was its slight slope down to the north. Now opened, and with self-shading inevitable, it will be interesting to see how well this performs.

Overall, the afternoon represented a spectrum of quite narrowly focused Scottish research that will inevitably influence the global solar industry in years to come. Thank you Anne-Marie for bringing all this together.

NEILSTON TRUST

The activities of the Neilston Development Trust (NDT) came to our attention in 2013, this project under the banner 'Building Our Future' having been short-listed in the 2013 SURF Awards (SURF being Scotland's Independent Regeneration Network, the acronym originally standing for Scottish Urban Regeneration Forum, but not now used explicitly as SURF's scope has widened).

At any rate, Pauline Gallagher was a key player in getting this project off the ground, and, at the time of the SURF recognition much had already been achieved (quoting directly from the Award citations): "Having developed a clear vision of a socially cohesive, sustainable and economically robust 21stC village, Neilston Development Trust has been tasked with coordinating a number of projects to make this a reality. So far, they have made two key community led initiatives come to fruition: The Bank, a community owned 'living room' in the heart of the village, and Neilston Community Windfarm, which provides long-term financial resources to support further 'Building Our Future' projects."

Two years later, on a beautiful spring afternoon in the second half of April, Pauline, still a volunteer stalwart of NDT's management committee, and Gordon Keenan, Chief Officer, welcomed us to their converted bank for an explanatory lunch followed by a tour through the building and its immediate environs. Gordon started by telling us that NDT had bought the former bank in 2006 with £1m start-up funding – mainly Big Lottery – and was now at the end of its revenue funding. In other words, NDT now has to be self-funding, with the no mortgage outstanding on the building, but no reserves either. The building had been significantly upgraded thermally with new glazing and insulation to walls and roof, but that there was nevertheless a 'north-south divide', whereby

rooms facing south towards the street could overheat, whilst people occupying a north-facing office felt the need for auxiliary electric heaters at times. On the south side, this can lead to blinds lowered to avoid overheating, and consequently lights on, together with windows open. During the sunny afternoon of our visit, the floor, incorporating warm-water serpentine, still seemed warm to the touch, suggesting that heating was still circulating or that the effects of it being switched off by thermostat had not yet become apparent. At any rate, Pauline was not satisfied with the automated controls, and Stas Burek suggested that an investigation of performance and how to improve it could make an interesting student project. We also discussed Knowledge Transfer Partnership (KTP) potential between an HEI and NDT and relationships to the Energy Technology Partnership

(ETP), with potential for Masters or PhD students.

The heating plant chosen is a Czech Ponask KP22 wood pellet boiler (supplier Pentland Biomass) designed to run continuously at some 8.5kW, at the bottom end and approximately 30% of the maximum output of 29kW – i.e. with a capability greater than the building it actually serves. Thus it was frustrating for the users to find some rooms facing north that feel under-heated, this despite the energy-efficiency upgrade and despite automated controls from a central unit together with the usual thermostatic radiator valves (TRVs) and room thermostats. Solar thermal panels mounted fairly discreetly of the south-facing roof surface also augment hot water.



Pauline & Gordon NDT; Rosalie & Stas SSEG



Gordon also talked about NDT's community wind farm comprising four 2.5MW turbines and the implications for local jobs and the plan to have this re-financed (£1m borrowed for 50% share). He also mentioned an NDT cycle enterprise and coppicing project, as well as blue-sky opportunities such as the B-listed Neilston Mill, with the owner keen to do business with NDT and only 30% of its space currently used by a waste-management business, a small-scale hydro system and sewage plant being a part of this. Gordon's thinking concerned viable supply chains and who were getting jobs. This promoted discussion on other projects visited by SSEG in the past such as Northumberland's Earth Balance comprising a series of cooperatives such as bakeries and small breweries established at Fleekburn Farm near Blyth; this using low-head generated power from a pumped storage, earth-dammed reservoir, having its own reed-bed sewage system and also involving intensive horticulture. New Lanark's rejuvenation was also mentioned, with its restored hydro system along with efficient water-source heat pumps.

The visit ended and its useful exchange of ideas and information ended with a tour of the building and its immediate environs, this including a productive growing area complete with two life-size and life-like scarecrows. Many thanks to NDT, in particular to Pauline and Gordon, and for the welcome lunch.



GLENN MURCUTT: ISI METZSTEIN DISCOURSE 2015

I have included a brief piece about Glenn Murcutt as 2015's internationally famous guest for the RSA Isi Metzstein Architecture Discourse in Edinburgh (19th May), because, aged 79, he remains one of the most ecologically sensitive architects in the world. .



Photo of Mosque kindly supplied by Glenn Murcutt

One issue that was precious to him, and has relevance for the piece to follow on SSEG's visit to Lancaster Housing Associations's Passivhaus-certified project three days later, is his hostility to "hermetically sealed windows and doors". Rather, Murcutt welcomes the sensory engagement with sounds of water gurgling in gutters, wind passing through different tree species, birdsong at daybreak and the smell of freshly fallen rain on leaf litter. In this sensory awareness of natural ambience from within a building, Murcutt adds a third word to a well-known concept – "prospect, refuge and *serenity*". He also advises that "failure is great learning experience", and uses the term 'ecological functionalism',

quoting a late friend, with architecture as a "sublime statement of human dignity". He finished his talk, which he had delivered with tremendous energy, passion and speed, with slides of one of his relatively rare collaborative projects (with Hakan Elevli, born in Australia of Turkish background). This is a new mosque in Melbourne, currently under construction, and which, amongst other attributes, has ninety-six 2.8 metre high triangular glazed lanterns facing to all cardinal points – these admitting passive solar energy in the form of daylight from the sky vault with differing coloured glass according to orientation, as well as natural ventilation, into the deep-plan interior.

LANCASTER CO-HOUSING & ECOLOGICAL EQUILIBRIUM

The topic of cohousing came up in SunTimes 32 with respect to John Gilbert's Award-winning East Whins cluster at Findhorn.



Looking west from communal south patio



Looking east along south facade

Reputedly co-housing originated from Denmark in the 1970s, and one descriptor is "housing that combines the autonomy of private dwellings with the advantages of community living (Kathryn McCamant and Charles Durrett with Ellen Hertzman, [1988] 1994, Ch 1 Addressing Our Changing Lifestyles, in 'Cohousing, A Contemporary Approach to Housing Ourselves, Ten Speed Press, Berkeley, Cal, USA, p12 in pp10-20).

Long-standing SSEG members may recall a visit in 1996 to a Danish cohousing project at Ottrupgård, Skorping, located in a rural area of Jutland (reported in Issue 17 of our newsletter before we named it SunTimes) and also the visit in 1999 to the co-housing by Michael Gies in Freiburg (1999, Sun at Work in Europe, Vol 14 No 4, p5 in pp2-5; Colin Porteous with Kerr MacGregor, 2005, Ch 4 Adaptive Control, in 'Solar Architecture in Cool Climates, Earthscan, pp 121-122). In any event, the visit to East Whins in August 2013 promoted some interesting discussion with longstanding SSEG member Andy Swales, who holds strong feelings as to what constitutes co-housing. So I was very pleased that Andy, who knew quite a bit about the background to the Lancaster project, was not only able to join our guided tour, but also able to collect a couple of us from Lancaster Station and drive us several miles to Forgebank at Halton Mill on the River Lune.

The concept of 'ecological equilibrium' has been aired by eminent people such as Richard Wilkinson of 'The Spirit Level' fame (2009) in his much earlier book 'Poverty and Progress' (1973), and defined as "any combination of a method and a rate of resource use which the environment can sustain indefinitely". However, its apparent application can raise conflicting issues for architects and their clients.

Lancaster Cohousing's Forgebank project of 41 homes (35 cohousing units and 6 for sale) and various communal facilities – refectory/kitchen ('common house' with shared meals every alternate day), laundry, tool shed, food store, bike store, district heating plant – by architects Ecoarc in the small village of Halton is no exception. It undeniably ticks many boxes – highly energy efficient, with the German Passivhaus certification proudly displayed; district heating supplied by a 50kW wood-chip boiler and 5,000 litre thermal store, and domestic hot water



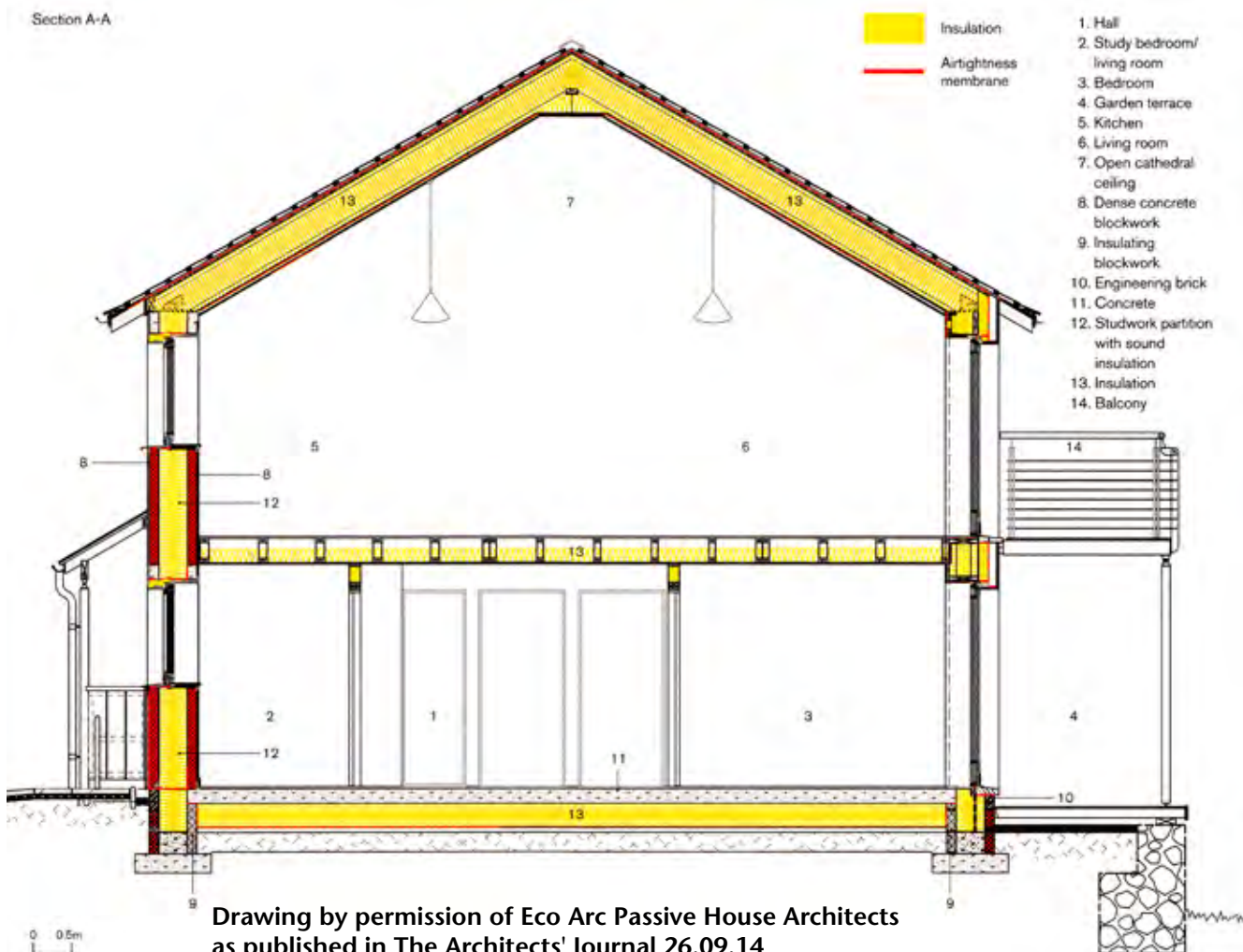
Upper terrace looking east

augmented by 50m² solar thermal panels (40kW); micro-grid electricity supplied by a 100kW low-head turbine using the hydro-power of the adjacent fast-flowing River Lune (second 60kW turbine in pipeline), plus 50kWp (kilowatt peak) solar photovoltaic (PV) arrays on house roofs and 28kWp on the old Halton Mill building. It is also located on a former industrial 'brown-field' site on the steeply sloping north bank of the river, well above the level of flood risk, and incorporates several of the surviving buildings for ancillary use. And the informality and character of the pedestrian lane running, not quite in a straight line like a social spine through the middle of the site, is extremely successful.

Moreover, the southern façade of the linear housing terraces both captures useful solar energy passively via generously sized windows, a concrete ground floor slab and internal block leaf providing plenty of thermal mass or capacity. However, although the south-facing windows provide a stimulating prospect of the river and woodland on the far bank, we did notice that where living rooms were located on the ground floor (not in every house, but certainly in that of our host, Jan), the combination of a relatively deep plan and mature trees on the far bank of the river had a considerable impact on daylight penetration. On the other hand, a fringe benefit of the site is that the combination of flowing water and trees will enhance the ion balance in the ambient air, which effectively constitutes a *resource* for the houses and their shared

facilities. And indeed, its harnessing can be sustained indefinitely.

But here lies the rub! That very asset is carefully managed by mechanical ventilation with heat recovery (MVHR) units in each home, an intrinsic part of gaining Passivhaus status. And it seems that the rate of supply results in complaints of the air being perceived as too dry. Either in anticipation of this or in retrospective justification, there is a deliberate policy of devolving the drying of washed laundry back into each home in order to humidify the air. Having been involved in a big research project that found the consequences of such passive indoor drying could involve a significant increase in some quite threatening species of airborne mould spores, I was a bit stunned by this tactic. Indeed, the notion of riverside air actually being too dry is likely to be mythical. The most likely explanation for the perception of dryness is that the low rate of supply leads to rather high concentrations of CO₂ breathed out by the occupants together with water vapour; and the consequent warm stuffiness is interpreted as excessive dryness – this with RH quite likely to be at a low percentage given warm temperatures, but unlikely to be very low in absolute terms (indicated by vapour pressure or mixing ratio – e.g. at 22°C and 40% RH, vapour pressure would be comfortably above 1.0kPa and mixing ratio approximately 6.5g/kg; or at 24°C the same vapour pressure and mixing ratio would coincide with 35% RH). Also, even when





Pedestrian lane looking east



Upper terrace

the MVHR is heated, this may reduce RH, but not absolute moisture unless significant quantities of condensate occur. The other key downside of the MVHR together with closed, triple-glazed windows is the sensory disconnect between people indoors and the ecological bounty outside. Sounds of river, birdsong, bees buzzing around early spring blossom, wind through trees, and so on, are completely silenced. And that arguably introduces an ecological imbalance – between human and natural ecology – and an imbalance that is to the detriment of the former's wellbeing. And of course, this is exactly what

Glenn Murcutt had been alluding to three days before our visit to Forgebank.

I gave a fairly brief run-down of the above at the AGM on 3rd September at GCU (hosted by Stas), this being the last event of the 2014-2015 season of visits, talks etc.

Many Thanks for our main guide and host, Jan, on this informative visit, as well as all the other staff who served us beverages and tempting items of baking from the communal kitchen, not to mention allowing us to enjoy the MVHR-free atmosphere of its open-plan common room and refectory, leading out to a commodious suntrap on the south side.

ALL-ENERGY 2015 EMBRACES SOLAR

Not only was this the first All-Energy conference and exhibition to be held in Glasgow – at the SECC – it was the first to include a specifically solar session in the conference, principally thanks to the influence brought to bear by players such as SSEG's chairperson Dr Anne-Marie Fuller.

This was held on the afternoon of the second day, May 7th (also UK General Election day), and the Alsh 2 room used to accommodate it was packed. John Forster, chairing the session and also chairperson of the Solar Association in Scotland, duly stated satisfaction at the size of the audience and gave due credit to the efforts of Ann-Marie in getting it included – with a Q&A session at the close.

Ray Noble (see p3 of Suntimes 33) was first to speak, making a number of key claims:

- Solar use worldwide is growing at some 30% annually.
- Solar energy, principally PV, will become the largest provider of electricity.
- Mass production continues to drive down prices.
- Solar is at 'grid parity' in many countries, and should be in the UK by 2020.
- Solar is a secure energy supply as its 'fuel' is free – 5.77 GW installed capacity in UK and 1 million 'happy customer'.

- Commercially, up to 1MW is 'deemed' (no planning permission required in England & Wales, Scottish equivalent expected) and system transferability is allowed.
- Solar fields are now recognised as small power stations (on previously used land).
- Community-owned solar installations are encouraged.

Ray then went on to usage, which included lighting and equipment, transport and grid scenarios (no gas), and mentioned that daytime generation is good for non-domestic buildings and that solar is the fastest energy generator to deploy at known cost – 25 year warranty and circa 35 year life expectancy. Ray also seemed unfazed that FIT would be faded out. He finished with some examples of applications such as car parking canopies, with potential of perhaps 1GW, also stating that it was a governmental aim to raise the bar in terms of standards, that new-build PV would constitute a significant component of zero-carbon objectives and that storage would become the

Fiona & Elaine at All-Energy



'holy grail' of solar – his parting comment: “nothing will stop solar now” (see also The Guardian Business Focus, 12/04/15, pp38-39 for news and statistics of solar uptake in UK cf. other RE sources).

Anne-Marie Fuller was next to speak, referring the need to appraise the 'solar thermal' industry, and the role of SSEG, effectively a not-for-profit social enterprise, in promoting solar uptake of every kind. She then referred to p6 of a Department of Energy and Climate Change (DECC) report covering 1970-2013, stating that approximately 20% of electricity demand was fairly stable, and there was some 70% of heat demand that needed to be addressed; also that from 1998-2012 electricity prices had roughly doubled, gas had tripled and heating oil quintupled. All in all, said Anne-Marie, “solar thermal’s flag needs to be reflown”, and she showed the test site at Heriot Watt University with both flat-plate and evacuated tube collectors, as well as architectural examples such as the 'Glasgow House', with both passive and active solar thermal (see SunTimes 31, pp1-4). She continued with some statistical information about solar thermal markets up to 2013), peaking in 2008 and then declining and currently with up to 29,000 MW annual capacity in the EU plus Switzerland. Unfortunately the Renewable Heat Incentive (RHI) had had no impact so far in the solar thermal marketplace; and, according to the Solar Trade Association (STA), biomass the only renewable heat doing well and solar thermal about 10% of that expected. In terms of what is holding it back, Anne-Marie averred that it was being eclipsed by PV with its FIT incentive, and that possibly the non-inclusion of solar space heating in the RHI was another handicap. She then went on to cite opportunities for solar heat, such as swimming pools and sports centres, contributing to district heating, process industries, social housing retrofits, particularly for the fuel-poor, and so on; and ended by mentioning the EU Solar Heating and Cooling Technology Partnership and the scope for integration of solar and other renewable technologies – e.g. borehole storage.

Prof Neil Robertson was the next speaker and he began by promoting SISER, with its new Director Graeme Cooke of the University of Glasgow and embracing 12 Scottish universities and research centres. He then talked about a specific area of

interest, photocatalysis, which can destroy dirt and bacteria and is comparable with photosynthesis where the chlorophyll of plants is a natural photocatalyst; more technically in photocatalysis light is absorbed by an adsorbed substrate – i.e. it activates a substance to modify the rate of chemical reaction without being involved itself. Neil then referred to the 2014 Solar Vision for Scotland (see SunTimes 33); the fact that some 900,000 households in Scotland were in fuel poverty, that Prof Sue Roaf had predicted that an investment of £70 million in Dundee could eliminate fuel poverty; and worldwide 1.6 billion people had no access to electricity. He went on to emphasize that PV is now an established technology, with high efficiency and stability compared with newer developments that were low-cost and light-weight but with lower efficiency and, so far, stability; hence referring back to the SISER-SSEG-ETP event at Heriot Watt University in March, he talked briefly about hybrid solar cells, oxide semi-conductors, dye molecules, perovskites new luminescent materials.

Next on was Rob Shaw of LDA Design, an independent design, environment and sustainability consultancy, who spoke about the solar story of innovation and change, with the cost of renewable technologies dropping fast, especially PV, compared with a trend of increases in fossil fuels (although not oil in recent times). Rob spoke of LDA Design helping clients to respond to big drivers of change and quoted Jeremy Leggett on 'winning the carbon war'. In terms of projects, Rob cited Kenwyn solar farm in Cornwall, where there had been a heritage-cum-visibility issue relative to an historic barrow on the site; Vine Farm, a 50MW solar field with a community stake near Wendy in the parish of Shingay-cum-Wendy in South Cambridgeshire. Rob then referred to challenges such as the grid not being suited to a variable supply as well disappearing subsidies and closed with the comment: “This is an exciting time for the solar industry!”

The penultimate speaker was Andrew McGowan of Absolute consultancy, which had the ice-cream Mackies as client on the Scotland’s largest solar farm in Aberdeenshire that was mentioned above in relation to the event in March at the Heriot Watt campus. Andrew drew attention to the importance of grid voltage control and mentioned the 70 SMA inverters in this regard. There was also some discussion about the self-shading issue given the north-facing slope and that given the economics ground coverage and standard tilt of 30 degrees, some shading during the year was inevitable. Finally, Stuart Stephens, Commercial Director of e-POWER Renewable talked about auctioning power at 95-98% of full market value, a checklist for Power Purchase Agreements (PPAs), and mentioned customers such as Assynt Hydro. The Q&A session include discussion around the frustration of grid connection problems (raised by Alastair Roberts), how to stimulate solar thermal, Ann-Marie suggesting that extra 'incentive-isation' was desirable – i.e. over and above RHI. For sure it is, but is this wishful thinking in a culture currently centred around PV? At least the mood of the meeting was definitely for a review of incentives.



SSEG AGM 2015

This year we were again in Glasgow at Glasgow Caledonian University. The Committee for 2015-16 also bears remarkable similarity to last year as follows: Chairperson, Anne-Marie Fuller (even though now based back in Ireland, Anne-Marie is visiting Glasgow on a fairly regular basis and is prepared to give things a go for the coming year on the basis there being a Vice-chairperson); Vice-chairperson, Elaine Morrison; Treasurer, Stas Burek; Secretary, Rosalie Menon; Membership Secretary, Fiona MacLennan; other Committee members, George Goudsmit, John Gilbert, Jim Norris, Rory O'Riordan, Colin Porteous and Peter Randall. Their affiliations are as follows:

Dr Anne-Marie Fuller: Energy Technology Partnership (ETP); International Collaboration Manager for European North Sea Energy Alliance; Non-executive Director AES Ltd; Director Innofull.

Dr Stas Burek: Senior Lecturer, School of Engineering and the Built Environment, Glasgow Caledonian University.

Rosalie Menon: Senior Lecturer in Architectural Technology, Mackintosh School of Architecture; Co-director of MEARU, Mackintosh Environmental Architecture Research Unit.

Fiona MacLennan: Carbon Reduction Project manager, Creative Carbon Scotland.

Elaine Morrison: Energy Action Scotland; Doctoral researcher Housing Studies, University of Stirling; Co-founder UrbGen (multidisciplinary collective).

George Goudsmit: Managing Director of AES Ltd and Member of Thermal Working group of Solar Trade Association; Co-founder of Scottish Renewable Forum (SRF).

John Gilbert: Director of John Gilbert Architects Ltd; Chair of RIAS Scottish Community Projects Fund.

Jim Norris: Director of Solar Energy Systems, Dunfermline.

Rory O'Riordan: P/T Lecturer in Building Services Engineering (MCIBSE CEng), Edinburgh College Granton; Board member (and Founder) of Dundee Sun City, now expanded into Solar Cities Scotland (New Projects).

Colin Porteous: Professor of Architectural Science, Mackintosh School of Architecture and Co-director of MEARU, Mackintosh Environmental Architecture Research Unit; Retiring member ISES-Europe Board.

Peter Randall: Managing Director, Solar Kingdom Ltd.

Finally, at the AGM, **Janice Foster** was elected as National Liaison Officer (NLO) for Scotland on the ISES-Europe Board (this as Colin was standing down).

SSEG PROGRAMME FOR 2015-16

First up will be a visit to the renewably refurbished home of Nina Baker and Alastair Whitelaw in Glasgow's south side – date agreed with Phil McCafferty of ASSIST Architects – 15th Nov, time 3.00-5.00. This includes a deep-bore ground-source heat pump, solar thermal and PV. Other events not yet in the diary: a visit to substantial refurbishment project in Edinburgh, the home of Rob Goodburn, a client of Peter's Solar Kingdom, complete with solar cells: a return visit to the former 2014 Athletes' Village to be organised via Thenue Housing Association, we hope including a visit to at least one home to gain impressions as to performance; a solar conference pencilled in for Sep. 2016 (Anne-Marie); a solar HW test site; possibly widening our interest in renewable energy to include Harlaw Reservoir near Balerno – Micro-Hydro scheme with its 66.8kWp cross-flow turbine and an expected yield of over 260,000kWh (Rory O'Riordan); and SSEG will again have a stall at All-Energy 2016.

OTHER NEWS

Sue Roaf has secured the Passive Low Energy Architecture, PLEA 2017 conference for Scotland, to be held in Edinburgh, probably using the Assembly Rooms as the main plenary venue. The Secretariat will be handled from Heriot Watt University, but several other HEIs will be involved in the organization around different themes.

MEDIA MISCELLANY

Further to the Heriot Watt event in March and All-Energy in May, the financial section of The Guardian, 23/03/15, p30, published a piece by Perry Carroll, founder of the Cambridge-based Solar Cloth Company on flexible solar PV; the strap-line "Solar is moving from being hard and inflexible to soft, light and flexible". Another Guardian article, 03/08/15, p11, has the intriguing headline: "Electricity from the air – new power source or just a kite-flying exercise?" Here Damian Carrington describes a notion by Bill Hampton of Kite Power Solutions for 40 metre wide kites to harness wind energy, but there seems to be no reason, if viable, why they might not also have solar cells. Later on 05/10/15, pp12-13, James Randerson reports that "The Guardian's campaign for fossil fuel divestment champions the rise of solar power and the hope it offers."

With regard to the completion of the transforming of the Athletes' Village to normal housing, there has been quite a bit of publicity in Project Scotland – e.g. solar crowd-funded scheme in the February 2015 issue, p8; saying hello to first residents in March 2015 issue, p2; discussing legacy one year after the Commonwealth Games in the July/August issue, pp14-20. The magazine of CAT in Wales, Clean Slate No. 97, Autumn 2015, highlights the UN Climate Summit in Paris this December: 'Getting Ready for Zero? Finally the STA have published 'The Solar Independence Plan for Britain'.

Note: all articles in this issue unless stated otherwise are by Colin Porteous, and represent his views rather than those of SSEG as a whole. If members wish to respond, this would be most welcome.

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