Spring 2022

SEDA

Scottish Ecological Design Association

£7.50incl. p&p

Plastic Alternatives

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Spring 2022

SEDA was formed in 1991. Our primary aim is to share knowledge, skills and experience of ecological design. SEDA is a network and links those seeking information and services with those providing them.

SEDA's membership comprises a large number of people involved, and with an interest in design, principally in Scotland. Members include academics, architects, artists, builders, planners, students, ecologists, landscape designers, materials suppliers, woodworkers, and many more whose work or interest involves design for a sustainable future.

SEDA is a charity and is run by a Board of Directors, who are elected at Annual General Meetings. The Board is advised by a voluntary Steering Group which meets 8 times a year for discussion and for planning the activities of the Association. All members are welcome to take part in these meetings. SEDA registered as a Company Limited by Guarantee in February 2011.

A SEDA membership is a great way to support ecological design in Scotland. As a member you will receive the SEDA Magazine for free, get discounted tickets to SEDA events, and have the opportunity to connect with a wide network of talented designers.

Editorial team

Nick Domminney, Viktoria Szilvas, Doug Tullie

With thanks to all our contributors, sponsors, and supporters.

What do you think of this SEDA magazine and its new layout? Do you have any disagreements or something useful to add to the issues covered? Do you have an idea for an article? Drop us an email at magazine@seda.org

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Cover image: Transparent wooden table by Nendo, Nendo

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Plastic Alternatives

SEDA Sustainable

SEDA Specification

SEDA Solar

SEDA SE-CS

SEDA Land

SEDA Thoughts


Coke
Coke

Editorial

Nick Domminney

COP26 has come and gone and the world reconvenes around other more immediate disasters. SEDA's post-COP recommendations to the Scottish Government collects dust, unacknowledged, in Patrick Harvie's filing tray. The UK government gives the green light to drilling in the Cambo field and 30 Tory MPs demand an end to the fracking moratorium because Ukraine is burning.

Our Winter 2021 editorial posed a question from future generations; why didn't we do more today to stop the climate catastrophe and destruction of our biosphere? What indeed can a tiny association of good hearted activists, like SEDA, do in the face of such a global challenge? Well, we are going to assemble in the next month to decide exactly that. Watch out for your invitation and for a full report in the next magazine.

Meantime, this Spring edition looks at plastics, their use, reuse and alternatives. Some of the contributions contradict each other. "Bioplastics" can seem a great way of tackling the undoubted environmental and climatic destruction wrought by petrochemical derived plastics. But do they actually degrade as claimed and do they not contaminate recycled petrochemical plastics feedstock?

Make no mistake, however, petrochemical plastics are the problem, so we make no apology for recycling Howard Dryden's shocking findings, presented to SEDA's Summer 2021 Conference, of the devastating role microplastics play in concentrating toxic chemicals in the world's oceans. These microplastics, the abstract from his GOES paper explains, have wiped out around 50% of vital carbon sequestering plankton since the 1950s and are on track to tip the oceans' PH below a level which could lose 80-90% of all marine life by 2045 with disastrous consequences for life on the planet. See the GOES Foundation website https://www.goesfoundation.com/ for what humanity needs to do.

We have also invited back Plastic Free Dunfermline to remind us of some plastic facts. Architectural practice, Dress for the Weather have just completed a fascinating study of how the vast amount of plastics disposed of by the NHS could easily be recycled back into the health-related building materials. Architect, Sam Foster, outlines some alternatives to plastics in the building industry, while Richard Broad explains the work of the Alliance for Sustainable Building Materials (ASBP) and their Reducing Plastics in Construction Group. SEDA has just signed up to the ASBP's Anti-Greenwash Charter, of which more anon.

Sam pops up again in our SEDA section to report on Gaia Architect's fascinating 2020 competition submission for an "age-friendly and inclusive living; low environmental impact; healthy living; and deliverable and scalable", community. This section also has a salutary reminder from SEDA founding member, Jim Johnson, on this, the 50th anniversary of the first tenemental improvement- in which he and his architecture students played such a seminal role- that the most important challenge facing architects and architecture students is improving many thousands of homes and buildings to a "zero carbon" standard.

Of course we also have reports from SEDA groups and activities as you would expect. We hope that you enjoy this edition! ■

To Print Or Not To Print?

SEDA magazine went online a few years ago for a number of reasons: advertising dried up so it had to be paid out of membership subs; p&p increased substantially; and then there was the view that an ecological association should not squander resources on p&p when the publication can be emailed to every member with significantly less CO2e. There is the option, of course, of a posted copy at cost- see the front cover of every edition.

Despite these eminently ecological explanations, however, the magazine team is aware that some members look forward to receiving their SEDA magazine through the post as a benefit of membership. What do you think? Are you happy with the online version? Would you accept an increased membership fee to pay for a chunky quarterly magazine through your letterbox?

Please write to the magazine, or dare I say, email us, at the addresses on the inside front cover.

The Anti - Greenwash Charter

Overleaf:
Top: Crushed plastic bottles, an all to familiar sight.
Above: ASBP's Anti Greenwash Charter Logo

Plastics & Alternatives: A Summary

Dr Richard Atkins, RIBA, FRIAS, FRSA Chartered Architect

Plastics are ubiquitous and pernicious. How did we get to this point? And what can we do about it?

The answer to the first question lies in understanding the history and benefits of plastics. Early plastics were organic (cellulose) based. Dr Bakeland invented the first synthetic plastic – Bakelite – in 1907. The nature of polymers was identified in 1920 and led to the development of Polyethylene, Polystyrene and Nylon, all of use in arms production. Post war, more polymers were developed and often combined to make new wonder materials[1] .

Polymers (from the Greek words for 'many' and 'parts') can be derived from natural or synthetic materials and form chains which can be moulded or extruded when soft, then hardened to retain their shape[2].

By synthesising petrochemicals, an economical source of raw materials, a remarkable number of attributes can be gained. Plastics are durable, shapable, lightweight to transport. They can be transparent or opaque, soft or hard. They are easy to sterilise and are, generally, inert once manufactured[3].

We shouldn't be afraid of acknowledging these benefits. What modern health service could function without plastic syringes? However, with great benefits come environmental consequences.

Synthetic polymers can be poisonous[4], flammable[5] and carcinogenic[6]. Whilst perceived as durable, this is seen through the lens of a consumerist world, where single use has become acceptable. Their low cost makes them financially disposable and unattractive to collect and recycle. Their polymeric structure means they fragment to the point where they form the microplastics, which have polluted our rivers, seas, and are killing the wildlife they support.

So what can we do about it?

On a macro scale, we must continue to highlight these issues (even in the face of well-funded vested interests - which SEDA has stood against in the past (see The Art of Redaction) and advocate for Governments to introduce policies which: minimise the want on use of synthetic plastics; support research into emerging alternatives; and ensure the use and disposal of plastics carriers with it the financial impact of what are, currently, externalised costs to the plastics industry.

On a micro scale, we should consider what alternatives to plastics are already available. The starting point in some ways is simple; what did we use before plastics? Obvious alternatives are: timber for windows; cast iron, copper or clay for pipes; linoleum for flooring; glass (ideally returnable) bottles; ceramic tableware; leather, cotton and linen; paper bags, the list goes on.

Other alternatives currently only have a small toehold: potato starch, mushroom, seaweed and banana leaf packaging: wood fibre and sheep's wool insulation; grape waste derived artificial leather – I kid you not. They need our support and that of Governments and big business if they are to become the norm.

We must also consider whether a direct alternative is required? If linoleum is not your thing, why not use timber, seagrass matting or a polished slab instead of vinyl?

Not all plastics are the same, some are biodegradable[7], including cellulose derived plastics[8]. Press manufacturers on the precise chemistry and reuse / recycling processes for their products.

Choices need context. It is, however, undoubtedly possible, and environmentally crucial, to minimise the use of plastics, both to sustain planetary biodiversity and to conserve what we should treat as a precious resource, not a windfall without consequences.

Now more than ever, is not the time to run out of syringes. ■

[1] https://www.plasticsindustry.org/history-plastics

[2] https://www.sciencehistory.org/science-of-plastics

3https://www.sciencedirect.com/topics/engineering/petroleum-based-polymer

[4] https://sciencing.com/environmental-problems-caused-by-synthetic-polymers-12732046.html

[5] https://www.researchgate.net/publication/285736205_Polymers_and_fire_Chemical_and_physical_processes

[6] https://www.polymersolutions.com/blog/government-cites-some-plastic-components-as-carcinogenic/

[7] https://en.wikipedia.org/wiki/Biodegradable_plastic

[8] https://www.daicel.com/cell_ac/en/cellulose/ca_biodegradable.html

The Art of Redaction

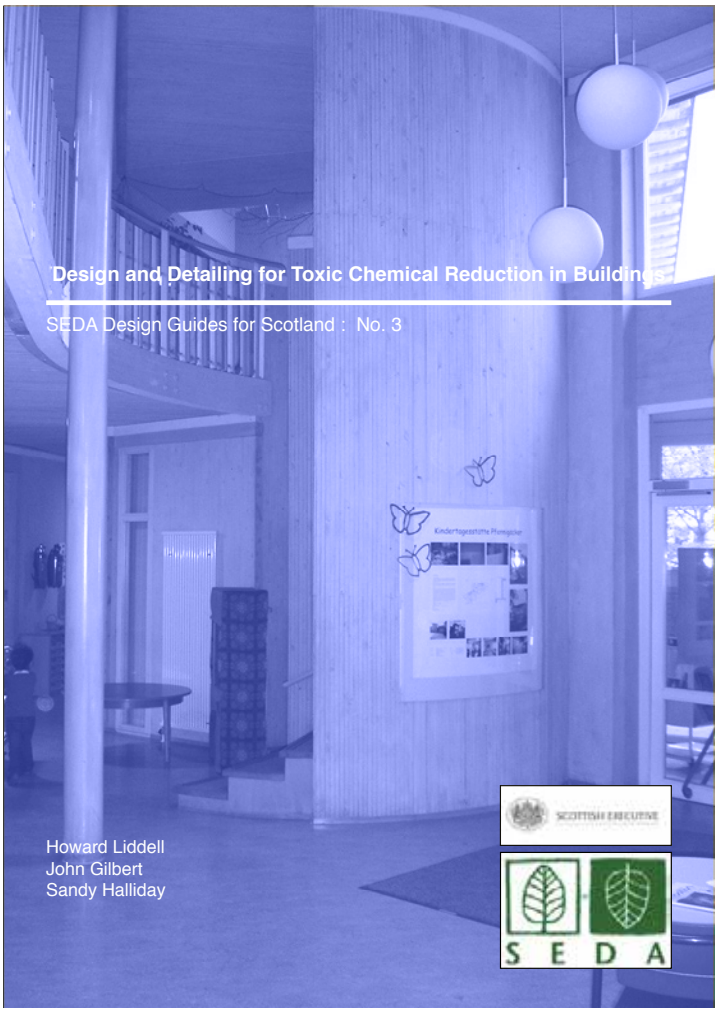
Dr Richard Atkins, RIBA, FRIAS, FRSA Chartered Architect

The eagle eyed amongst you might have noticed that the SEDA; Guide to Design and Detailing for Toxic Reduction in Buildings, has a few black splodges in the text. Why?

Shortly after publication, some manufacturers' associations approached SEDA, unhappy with the Guides reservations about some product. Most of these comments could be defended, but one group made it clear that they had deep enough pockets to test, what turned out to be very few statements in court.

It is the reason SEDA moved to become an incorporated (and protected) organisation.

Redaction – it's a dark art.



Reusable packaging – the circular alternative to single-use plastics

Louisa Coursey, Business Support Partner, Zero Waste Scotland

In 2017, each person in Scotland consumed an average of **18.4 tonnes** of materials – or 50kg of material per person per week[1]. A sustainable level of material use, whilst maintaining a high quality of life, is about **eight tonnes** per person per year[2], therefore it's perfectly clear that we still have a long way to go.

Although new legislation, such as the upcoming UK Plastic Packaging Tax and Scotland's Deposit Return Scheme will help to improve this figure by increasing our recycling rates, what about efforts higher up the waste hierarchy? Reuse is a well-known option, and is one of Zero Waste Scotland's nine identified circular business models. It's one of the simplest circular strategies, because continuing to use products as they were originally intended for, as long as possible, will always be more sustainable than creating new products. It's a no-brainer.

In Scotland, we're starting to see more and more companies emerge into the reusables market, in recognition of the consumer demand for this service, and to help tackle the immense issue of our take-make-waste economy.

Beauty Kitchen https://beautykitchen.co.uk/ is one such company, a Glasgow based beauty product business that embeds circularity into everything it does. They've recently transitioned to a return, refill, repeat model, which exists to help change their single-use plastic packaging, to packaging that is designed to be refillable and reused. This system is also offered to other businesses, meaning that additional brand owners can more easily transition to a reusable packaging model.

EcoEats https://ecoeats.uk/places/st-andrews in St Andrews is another example, offering customers using their take-away delivery service the option of reusable containers, rather than single-use plastic. Customers simply pay a small deposit for the container, which is reimbursed once returned or collected by EcoEats.

Looking further afield, **RePack** https://www.repack.com/ is a Finnish company offering a reusable postal bag, allowing online retailers to drastically reduce the impact of single-use postal packaging. The durable, flexible bag is posted back to RePack by customers, to be assessed and cleaned, ready to be used again.

If you're interested in pursuing an innovative reusable packaging model, Zero Waste Scotland operates a Circular Economy Business Support Service, offering free and impartial advice to assist with the transition to circular business models. For further information on reusable packaging, watch our Reusable Packaging Webinar, offering a 'how to' guide, as well as further insight from the companies listed above. ■

[1] Zero Waste Scotland (2021) Scottish Material Flow Accounts Technical Report

[2] Lettenmeier et al. (2014) Eight Tons of Material Footprint—Suggestion for a Resource Cap for Household Consumption in Finland.

Wood Plastic

Andrew Heald: Forestry and Sustainable Plantations Consultant

If we are to decarbonise our economy, then we need to look at our use (and re-use) of a wide range of materials, and reducing our consumption of those with higher "embodied carbon". In simple terms these are materials which require a lot of energy to extract and/or manufacture for example concrete, steel and oil based plastics. In general, plant-based products and materials will usually have lower associated carbon emissions and can sequester carbon too, meaning they should have a lower negative impact on our climate.

However, we also need to look at the wider impacts and broaden the scope of our sustainability assessments. Wood based components, such as cellulose and lignin, are already being used as alternative feedstocks for oil-based plastics. The challenge is, how we manage the forests and plantations, which supply that wood, and how it can be re-used and recycled at end-of-life. We already have well established mechanisms in place for sustainable forest management.

Obviously, there are trade-offs and any material is going to have an environmental and social impact, there are no simple silver carbon bullets or quick climate fixes. ■

Further info

Your future is plastic free - https://www.storaenso.com/en/inspiration-centre/your-future-is-plastic-free-en

The new generation of high-performance wood materials offers unexpected hi-tech possibilities to the worlds of design and architecture - https://www.lifegate.com/wood-architecture-design-future

Plastics from the forest - https://www.upm.com/about-us/innovation/innovation-in-action/plastics-from-the-forest/

For a useful update on recent thinking about integrating plastics in too the circular economy see - https://www.azom.com/news.aspx?newsID=58281

For the original paper see - https://link.springer.com/article/10.1557/s43581-021-00015-7

Below, left:Ettore Sottsass Alpi product range, wooden veneer, Sottsass
Below, right: Transparent wooden table by Nendo, Nendo

Are Bio-plastics a Viable Alternative to Conventional Fossil-fuel Plastic?

James Daw, Plastic-Free Dunfermline

Since its invention, plastic has changed the world. It is lightweight, waterproof, dirt cheap, and it lasts forever. These properties have made it so attractive that it has been used for just about everything, even for things we didn't need - we've all seen bananas wrapped in their own plastic packaging. Massive over-production and mis-management has led many of us to become accustomed to a convenience lifestyle where it is very difficult and expensive to avoid using single-use plastic. As a result millions of tonnes of plastic packaging are being thrown away everyday with much of it being dumped or it escaping into the environment. The accumulation of this has had a disastrous impact on the natural world with (for example) animals ingesting and becoming entangled in our plastic waste.

Bio pollution

In an effort to solve the plastic pollution crisis alternative bio-plastics were invented. There are broadly two types of bioplastics.: Bio-based plastic and oxy-degradable plastic. Like conventional plastic neither of these biodegrade and, as such, are no better than conventional plastic. Biodegradable plastic requires lab-based facilities to create the precise conditions necessary to break down, otherwise it will last forever too. Compostable plastic requires the right balance of aeration, heat and moisture to biodegrade in your compost heap and even then it may take many years to break down. To be an effective alternative to conventional plastic, industrial composting is required. The world of bio-plastics is a complicated and potentially confusing place!

Indeed, we have been asked by householders how they should dispose of the biodegradable and compostable plastic packaging they have. Fife Council advise that bioplastics should not be put in organic waste, but instead placed in general landfill waste where it is likely to last forever. Fife Council, like many councils, does not have the infrastructure to process these new plastics. This is perhaps because bioplastic production only makes up about 1% of all plastic production.

To make matters worse, bio-plastic cannot be recycled and will contaminate an entire convention plastic recycling batch. At least with conventional plastic there is an opportunity for recycling. Initiatives like the Deposit Return Scheme where consumers reclaim cash for recycling empty containers, will improve recycling infrastructure. However, recycling is only part of it - we should also focus on solutions that turn off the flow of single-use plastic.

R R R

Regardless of what it is made from, we should also be making every effort to refuse / reduce / reuse the amount of the single-use plastic we use. Everyone has a role to play in this - governments, large corporations, small businesses and individuals. Initiatives like "Refill" provide the public with the locations of businesses that provide tap water, coffee, groceries and lunch without the unnecessary plastic, via a map-based app. There are local Refill Schemes starting all over the country, run by community groups who want to help tackle the plastic pollution problem where they live.

As consumers, we are led to believe, because of clever packaging and persuasive language, using words such as 'green', 'eco-friendly', 'biodegradable' and 'compostable', that products made from bio-plastic are good for the environment. In the end, controversial as it may sound, it is likely to be better to avoid bio-plastics, reduce the amount of conventional plastic you use and focus on other solutions, such as refilling. ■

Below: Plastic Free Community Status award given to Plastic Free Dunfermline by Surfers Against Sewage, Steve Ward
Bottom, left: Covid Ocean Pollution, SAS
Bottom, right: Plastic Free Wilmslow, SAS

Plastic Recycling Set to Take a Leap Forward

Tim Baldwin, Sustainable Certifications Group (SCG) Executive Director enquiries@scgroupuk.org

Plastics – why recycle?

Sound economics and a growing public perception of the environmental issues concerning carbon footprint of oil based plastics along with global plastic pollution is driving the increasing demand and use of recycled plastic materials. There are big numbers in play here …. the world produces some 300 million tonnes of virgin plastic each year.

The recycling of plastic has had a chequered history since early schemes started to emerge in the 1980s …. indeed, only 9% of plastic ever produced has been recycled. Well-documented difficulties in collection, separation and contamination have meant a slow take up, and therefore insufficient infrastructure at home and abroad to provide quality recycled plastics to the plastic product manufacturing sector.

Plastic made from bio sources can essentially be the same as oil-based plastic, a very good thing as long as feedstock to grow the bio-material for such plastics does not use up arable farm land that could produce food. Degradable plastics have their place e.g. disposable nappies. Some degradable plastics have been or are likely to be banned in Europe, but I am not an expert on that.

Now the wider industry is more aware of the need for action. Manufacturers, importers, suppliers, brand owners, end users, and recyclers amongst others all have a role to play.

A New Tax-monetary levers

To increase resource efficiency, material circularity and drive the demand for recycled plastics, a new Plastic Packaging Tax will take effect from April 2022, administrated by HMRC. The rationale of this tax aims to increase the use of recycled content in plastic packaging. The UK's Treasury department has estimated that, as a result of the tax, the use of recycled plastic in packaging could increase by around an estimated 40%. This is equal to carbon savings of nearly 200,000 tonnes in 2022 to 2023, based on current carbon factors.

Businesses handling larger amounts of plastic packaging (greater than 10 tonnes a year) will be subject to the tax, if they cannot demonstrate, and independently verify on an ongoing basis, that their plastic packaging has more than 30% recycled content, they or the packaging producers will be required to pay £200 per tonne in the Plastic Packaging environmental tax. Whilst there are exceptions, the net of in-scope packaging has wide reach (see gov. uk plastic packaging tax).

Hopefully the legislation's % of recycled content and £200/tonne tax in the legislation, not to mention the very

high 10 tonne production threshold, will be improved in later amendments to increase the amount of recycled content.

Help is at Hand

A new recycled content verification scheme has been launched by Sustainable Certifications Group (SCG) to guide and assist businesses to meet the necessary standard for certification. Sustainably Sourced Plastics (SSP) Certification provides material validation, help and advice, and builds an evidence base for traceability along with the requirement for testing to the new BSI Flex 6228 standard.

SSP Certification independently assures that:

- Recycled plastic materials are 100% post-consumer or post-industrial plastics that meet the requirements of recycled plastic feedstock for the plastic packaging tax.

- Plastic packaging products have an evidence base and testing to independently verify, they contain >30% "post-consumer" recycled plastic content and so provides sufficient evidence that they are exemptible from the Plastic Packaging Tax.

- Supply chain businesses (especially brand owners and retailers) can prove they have taken reasonable action to ensure that tax exemption claims are externally and independently verified to satisfy HMRC requirements.

Some customers enhance their ethical approach by going beyond the minimum 30% recycled content threshold, rather than the minimum requirements by the Plastic Packaging Tax so that they can demonstrate that they are 'doing the right thing'.

So whichever reason you choose, this SSP Certification provides validation for customers throughout the supply and value chain, with certification audits clearly showing legislative compliance whilst demonstrating a commitment to the circular economy and sustainability.

BSI Flex 6228 Standard

SSP Certification incorporates the new BSI Flex 6228 testing of plastic packaging material, enabling customers to clearly claim exemption from the £200 per tonne Plastic Packaging Tax.

The standard is a new and flexible way, both to show consensus based good practice and to dynamically adapt to fast changing markets.

This standard has been designed specifically to provide a testing process that physically tests the recycled content % to validate products and materials. Importantly, this provides a more robust process than simply a document-based

traceability approach which is open to risk of fraudulent activity, especially on a global supply chain basis.

Specifically, BSI Flex 6228 has been developed for the packaging industry through interaction with business experts and public consultation. Rigorously facilitated by BSI, it focuses on techniques that can identify recycled plastic in finished plastic packaging products in both rigid and flexible plastics

Testing

The standard crucially identifies the percentage content of recyclate and is therefore ideal for confirming whether a product contains more or less than the 30% threshold set by HMRC.

The technical methodology is designed to be undertaken using conventional test equipment to ensure it is as accessible as possible. Testing is carried out to identify transmission and absorbance rates at given wavelengths. It is the interpretation of this data that determines the recycled content % and provides evidence of compliance, and the SSP audit process confirms the overarching systems that maintain conformance.

Risk management and the business opportunity

The SSP Certification process (incorporating the Flex standard) has been created to protect the sustainable business philosophy in the UK from fraudulently declared imports. This also enables UK recyclers to take up the opportunity of the potentially huge sales increases they could expect to gain. Increasing the recycling infrastructure in the UK will enable control of the value chain and ethical validation of the supply chain – long awaited aspirations for circular economy developers and many advocates of a 'sustainable UK'.

According to the BSI, 2 million tonnes of plastic packaging is imported into the UK every year. Implementing this standard (and validating it with SSP Certification) will help to ensure that this packaging contains 600k tonnes of recycled product, reducing Green House Gas emissions by as much as 1.2million tonnes of CO2 annually. ■

Below: FLEX 6228 Compliant UV-VIS Testing
Bottom: SCG Team image

Destruction of Climate Regulating Ocean Plants and Animals

Dr. Howard Dryden, Diane Duncan, The GOES Foundation www.GOESProject.com

Climate regulating ocean plants and animals are being destroyed by toxic chemicals and plastics, accelerating our path towards ocean pH 7.95 in 25 years, which will devastate humanity: Report abstract June 2021

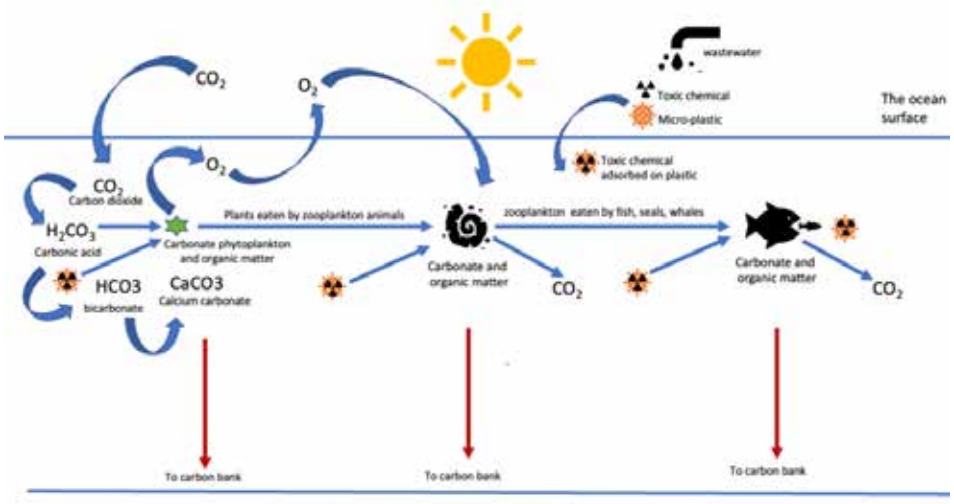
Marine plants and animals should still be thriving in ocean waters, but they are not. We have lost 50% of all marine life over the last 70 years. The GOES team has used its collective professional and academic experience to undertake further analysis of the peer reviewed and published data, to explore the less obvious reasons for this decline and its implications for climate and humanity. In our view, this loss of marine life is directly related to the drop ocean pH and the 'chemical revolution' which began in 1950, a decline which is continuing today at a rate of 1% year-on-year despite there being ideal conditions for growth.

There is no doubt that it is the tiny ocean planktonic plants and animals that regulate our climate, but the planet's largest ecosystem seems to be ignored as one of the tools to address climate change. Every second breath we take comes from marine photosynthesis, a process which also uses 60-90% of our carbon dioxide. If we have lost 50% of the very thing that regulates the climate, surely it is time to stop, take a fresh look at ocean chemistry and biodiversity and ask ourselves some fundamental questions: "Why have we lost this level of marine life? Why is the decline continuing? What does this mean for our climate and humanity?

Microplastics

Micro-plastics act like tiny sponges to concentrate toxic chemicals, which are then eaten by plankton. Even though the chemicals are at an extremely low concentration in the water, they become concentrated on particles and can have a huge impact on marine life. For example: oxybenzone (a photo-active chemical added to sunscreens and cosmetics, but banned by the island state of Hawaii) was found to be toxic and inhibited the growth and reproduction of coral reefs at a staggeringly low level of 62 parts per trillion.

Of particular concern from a climate change perspective is the level of carbonic acid in the oceans, which is the result of atmospheric carbon dioxide being dissolved into the oceans. In the 1940's pH was 8.2, but in 2020, pH had dropped to it 8.04, meaning the ocean is becoming more acidic. If there are no plants to use the 'carbon' for photosynthesis, this leaves unused carbonic acid to move the pH downwards. Reports from respected institutes around the globe, flag an acceleration of the ocean acidification process, which will result in the loss of more marine plants and animals, especially those that have carbonate (aragonite) shells and body structures. (aragonite) based . These same reports forecast that in 25 years, pH will drop to 7.95 (2045) and



The Abyss the worlds primary carbon bank with toxic chemicals and plastic
3 Giga tonnes year of carbon a year, if we had not killed 50% of marine life it could have been 6 Giga tonnes year

with this, they estimate 80% to 90% of all remaining marine life will be lost – that, in the GOES team's opinion, is a tipping point; a planetary boundary which must not be exceeded if humanity is to survive.

NZC Not Enough

Let's be clear: If by some miracle the world achieves Net Zero by 2045, evidence from the Intergovernmental Panel on Climate Change (IPCC) BioAcid report demonstrates that this reduction will not be enough to stop a drop in ocean to pH 7.95. If the level of marine life (both plants and animal) is reduced, then the oceans' ability to lockout carbon into the abyss is depleted. It is clear to the GOES team that if we only pursue carbon mitigation strategies and don't do more to regenerate plant and animal life in oceans, we will reach a tipping point, a planetary boundary from which there will be no return, because all life on Earth depends upon the largest ecosystem on the planet. Humanity will suffer terribly from global warming, but it must be understood that the oceans are already showing signs of instability today at pH8.04, but pH 7.95 represents the tipping point.

Priority Recommendations

1 Industrial and municipal wastewater

2 Green Chemistry

3 Regenerative agriculture

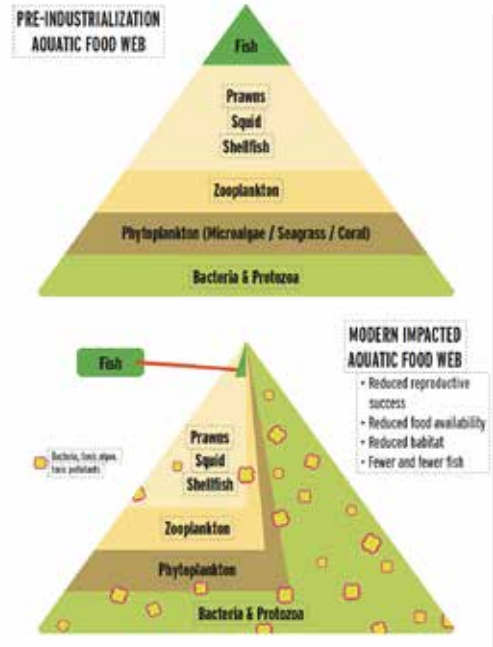
4 Plastic - loss of biodiversity and human disease

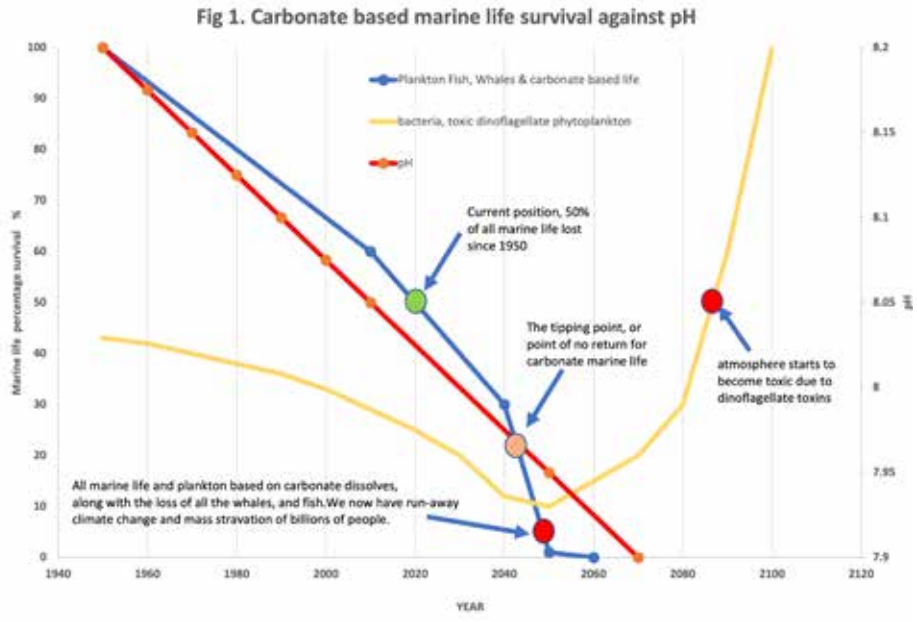
5 Petrochemicals and Carbon

6 Atmospheric pollution

7 Ecosystem regeneration,pandemics and nature as the solution for climate change

All images/graphs below & overleaf credited to The GOES Foundation





PPE Material Flows

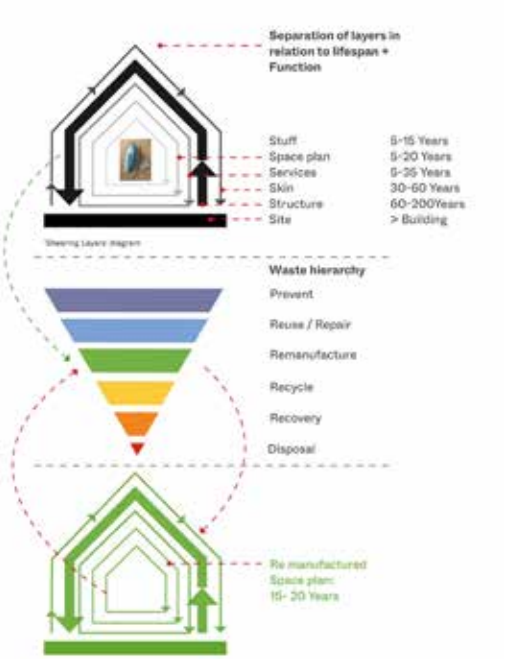
Andy Campbell, Co-founder / Architect, Dress for the Weather, www.dressfortheweather.co.uk
Romain Charlet, r.ph.charlet@gmail.com

In 2021 the Department of Architecture at University of Strathclyde and architecture practice, Dress for the Weather, collaborated on a successful bid to research the material flows of PPE waste with a view to proposing a circular design process.

Our ambition for the benefits of this study was to create opportunities for local material

flows that result in visually attractive, innovative products for the building industry. In doing so we aimed to find proposals that 'lock-in' this waste for a duration of at least 15-20 years before it is likely to enter a waste / recycling stream once more (image 1). The applications and recommendations focus specifically on healthcare interiors with a view that NHS Trusts could create their own recycling and remanufacturing facilities for plastic waste.

The project categorised and quantified the volumes of single use, disposable PPE issued by NHS Scotland in the 'Low Risk' PPE pathway. This alone identified huge volumes of plastics, which are not recycled. By studying the material flows and waste streams associated with the PPE items, the project team were able to propose methods for collecting the waste, processing and then transforming into new building products.(image 2)

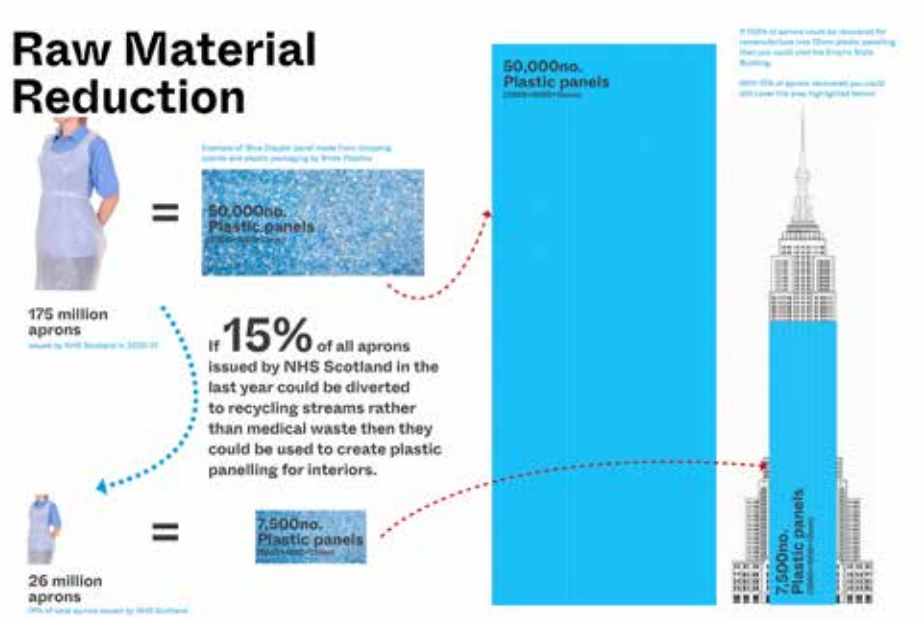


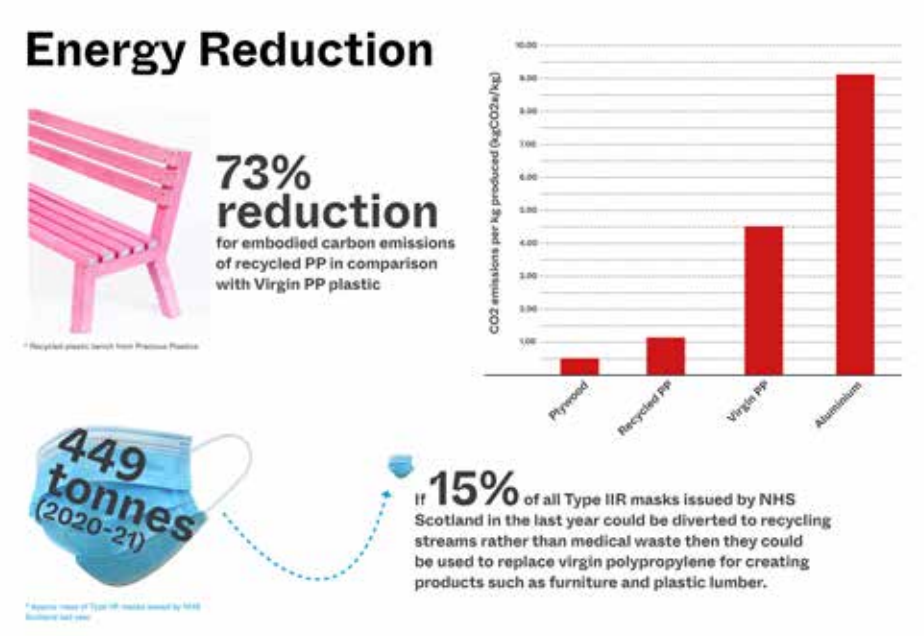
Pandemic PPE

The research call was in response to the huge increase in single-use plastic PPE recorded since the beginning of the Covid-19 pandemic. Our estimates show that there were at least 5000 tonnes of single-use plastic discarded for landfill or incineration by NHS Scotland between March 2020 and March 2021 (Ref. 1). This number, taken from open-source Government data, only includes aprons, goggles, Type IIR masks, face visors and gloves for the purposes of our report, however many other plastic PPE items are issued continually.

There were close to 180 million Type IIR masks (PP plastic type) and 175 million disposable aprons (LDPE plastic type) issued by NHS Scotland in this timeframe. Currently, there is no recycling policy for these items however a report authored by Resource Efficient Scotland and NHS Scotland (pre-pandemic) gave a conservative estimate that 15% of plastic PPE waste could be safely recycled from hospitals (Ref.2). We used this percentage as our baseline figure when visualising how the various plastic types could be transformed into useful building products.

LDPE plastic aprons can be melted down and pressed into plastic panelling, Polypropelene (PP) face masks can be injection moulded to form plastic lumber and furniture components, Nitrile gloves are already recycled and reformed to make rubber flooring and PET, Polycarbonate and HDPE plastic types found in other





PPE items have mainstream recycling processes.

We started to visualise how these applications might be incorporated into a hospital setting. For example, LDPE aprons transformed into wetroom surfaces and PP facemasks transformed into fixtures and furniture. We were also interested in the volume of products, ultimately the reduction in raw material production that could result from a 15% recycling rate. If this was applied to all the single-use aprons issued over the course of the year 2020-21 in NHS Scotland, it could provide enough 12mm plastic panelling to clad one side of the Empire State Building.(Image.3)

We also documented the carbon and cost reductions associated with recycling and remanufacturing in comparison with disposal. There is around a 73% decrease in embodied carbon emissions when comparing recycled PP (1.21 kgCO2e/kg) with virgin PP (4.49 kgCO2e/kg) (Ref.3). With end uses, such as hospital furniture, it could replace many aluminium products (9.22 kgCO2e/kg) (Ref.4) (Image.4)

In tandem with our desktop research, we carried out basic in-house testing, such as heat pressing standard issue plastic aprons, to form rigid LDPE panelling. We then collaborated with Still Life Studio, to create a stool top made from 400no. aprons (Image 5). This proof of concept study has led to the design of a prototype healthcare interior, using products with 100% recycled plastic from PPE items. (Image.6)

Circularity

Identifying the barriers to recycling this waste were key to the report. Buy-in from hospitals, especially Infection Control managers, on the segregated collection of PPE waste is a major barrier to overcome. Similarly, the problem of decontaminating the waste, especially during the pandemic has been found to be another major barrier.

That said, the conversations and case studies analysed show that there are solutions already in operation that could be adopted for healthcare PPE recycling. Recycling firms Terracycle and Reworked already recycle Type IIR facemasks as well as other 'hard to recycle' items. Thermal Compaction Group (TCG), based in Wales, take PP plastics including Type IIR masks direct from hospitals to create blocks, sold to others to make products from recycled plastic (Ref.5). Smile Plastics have been leading the way for attractive plastic panels made from waste materials, while Precious Plastics is an open-source platform providing details on how to set up your own plastic recycling operation.

Our research made clear that, ultimately, reusable PPE would be a much more sustainable solution, however, we were focussed on the task at hand of improving the circularity of the waste currently created. In 2020, the quantity of man-made materials on earth outweighed it's biomass (Ref.6). With the Covid-19 pandemic creating new, unknown problems, the 'better safe than sorry' approach has, somewhat understandably, been taken with many NHS Trusts in terms of disposal of PPE. We hope that with enhanced collaboration we can drive down the need for disposable resources in healthcare whether that be by 'locking in' the waste to a more permanent use or by creating a circular remanufacturing flow. We need to stop making more new stuff!

Making it Work

Since the completion of the report we have been in discussions with various NHS Trusts including NHS Tayside. Here, we have worked with consultants from Ninewells Hospital and their Sustainability Team. Further research through the SSC: Design meets Healthcare Challenge has involved collaboration with medical students from Dundee University who have used Ninewells Hospital as a feasibility study for implementing face mask recycling processes. We aim to continue this work to help create a pilot programme to capture and remanufacture PPE waste in a hospital setting.

Through these collaborative efforts with healthcare professionals we believe the barriers to collection, segregation and decontamination of PPE waste can be overcome. NHS Northumbria has been identified as leading the way with this and we look forward to gaining a further understanding of their processes. As architect partners in this collaborative effort we want to bring skills in connecting large scale systems change with materials and processes that are understandable to all. Prior to this project we generally avoided plastics as a material choice, however, our role in responding to Climate and Biodiversity Emergency can seek solutions for how architecture can 'lock-in' new waste in the first instance and minimise its very notion in the future. ■

The original report can be read here on Architecture + Design Scotland, Materials Library https://materials.ads.org.uk/ppe-material-flows/

[1] https://www.gov.scot/publications/coronavirus-cov¬id-19-ppe-distribution-statistics/

[2] NHS Scotland Waste Prevention and Reuse Guide

[3] British Plastics Federation / Axion Polymers

[4] The Inventory of Carbon and Energy (ICE Database v3)

[5] Recycling: How do you transform old PPE into something new? - BBC News

[6] Human-made materials now outweigh Earth's entire biomass – study | Environment | The Guardian

Plastic-free Buildings

Sam Foster, Architect

Howard Liddell OBE, one of SEDA's co-founders, used to remind us that before the First World War around 50 materials were commonly used for building in the UK and that the skills and knowledge of how to use them effectively had emerged over centuries. In contrast, by the early 21st century that number had increased to over 55,000 – only 3% of which have been tested for toxicity. As a result, we no longer have any generational knowledge of a core set of trusted materials. This puts us at the mercy of architectural magazines and product manufacturers, which take advantage of architects' magpie-like desire for the shiny and the new, and surreptitiously and constantly bombard us with any number of green-washed 'intelligent' membranes, 'high-performance' insulations, 'smart' paints and 'innovative' recycled products.

Beyond the marketing gloss lies the reality that, almost without fail, these are petrochemical products. Plastics. Synthetics. Toxic. Climate-changing.

Happily, there are plenty of alternatives and switching to them is straightforward. A few of the most obvious are listed below for reference, though once you start looking you'll soon find plastics in almost every part of construction.

Insulation and Membranes

There is nothing to stop plastic membranes and plastic insulation from being eliminated from almost all elements of construction. Timber-framed newbuild walls can be insulated with natural materials such as woodfibre, wool, flax, hemp and jute; airtightness can be achieved with timber boards and tape (ok, they usually have some plastic-based adhesive); and external wind-tightness (and reduced thermal bridging) can be achieved using tongued and grooved, taped woodfibre boards.

Suspended floors are essentially walls lying down and roofs are the opposite. Then there's strawbale, hempcrete, massive timber (such as dowel-laminated and cross-laminated timber) and earth building as newbuild options too – none of which require plastic. Solid floors can be constructed from a variety of mineral insulations such as foamglass and LECA with a lime concrete slab over the top. These various combinations have other benefits over plastics too, such as thermal mass, moisture-buffering and significantly lower toxicity.

In refurbishment the non-plastic options for insulation are broad too: woodfibre and cork are standard issue products – both for internal and external insulation – and cork-lime renders are becoming common. The need for membranes can be eliminated as long as a balance is struck with how the build-up of moisture is prevented.

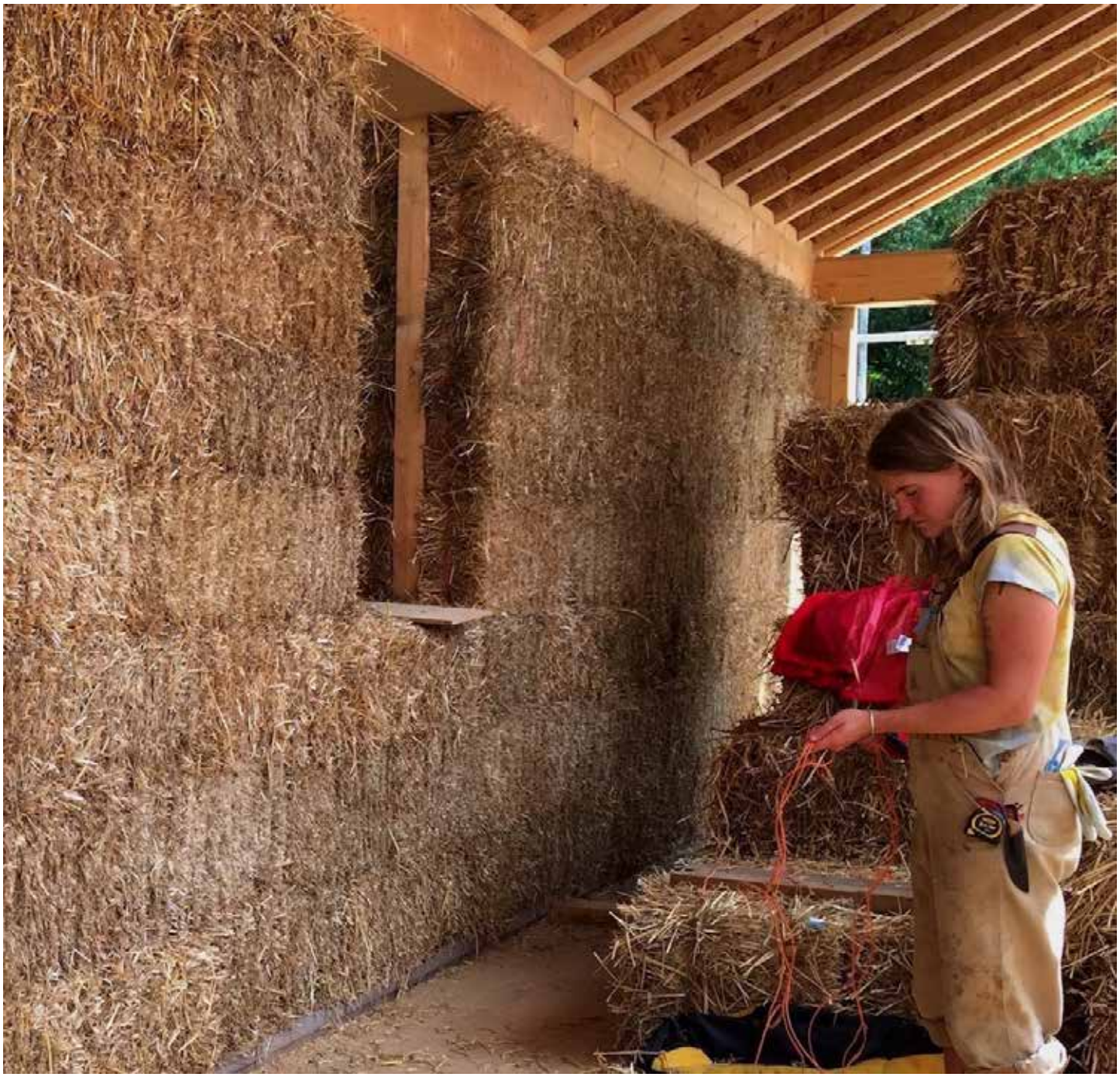
Internal finishes

Typical plastic internal finishes include vinyl flooring, synthetic carpets, wallpaper and – a pet hate – wet wall. Immediate alternatives include wool or plant-based carpets with latex backing (though remember carpets harbour dust mites, whose faeces contribute to asthma, and latex can be an allergen), as well as solid timber flooring with a natural oil/wax finish. Linoleum, natural rubber and tiles all have a place in wet areas such as bathrooms and kitchens. Tadelakt and Marmorino are types of polished non-gypsum plaster that create waterproof surfaces.

SEDA has been very good in the past at sharing information about the risks of exposure to plastics, such as through the screenings of the documentary 'A Plastic Ocean' and the film 'Unterkastelsen' ('Submission'). We know that plastics off-gas a cocktail of chemicals into indoor environments. We also know that scientists are concerned about how these chemicals individually affects our brains and bodies, and that no-one really understands their impact on us when they act together.

Each time we build new or refurbish a building is a golden opportunity to make the conscious – no, essential – decision to create the plastic-free environment we all need. All it takes is commitment, but we can do it.■

Overleaf: Timber & Straw Bale Construction, Sam Foster



Plastics in construction – What are the alternatives?

Richard Broad, Projects & Communications Manager, The Alliance for Sustainable Building Products

In recent years, awareness of the negative impacts of plastic waste and pollution on our environment has heightened. Popular television documentaries, such as the BBC's Blue Planet II, and mainstream media campaigns have played a significant role in bringing these issues to the forefront of the public's consciousness.

The focus of this has largely been on single-use plastics from consumer products and packaging. There has been relatively little attention on the use of plastics in construction, both from a short and long-life perspective.

The sector's use of plastic continues to grow, but there is still much to learn about plastics in construction, such as the volumes and types of plastic used, their applications, lifespans, how they are managed at end of life, and their health impacts.

But if we are to reduce our use of plastic in construction, then what are the alternatives?

Introduction to ASBP and plastics HB conference

At the Alliance for Sustainable Building Products (ASBP) our focus is on accelerating the transition to a healthy, low carbon and resource efficient built environment and provide members and industry with the tools and knowledge to design and build better buildings. One way in which we aim to do this is by organising and hosting topical events and conferences.

Our 3rd annual Healthy Buildings Conference and Expo began to really explore the 'plastics problem' in-depth. Inspirational speakers included environmentalist & yachtswoman Emily Penn, co-founder and director of eXXpedition; an all-female crew research expedition circumnavigating the planet to investigate the causes of and solutions to ocean plastic pollution.

Emily explained that around eight million tonnes of plastic ends up in the oceans annually. Only around a quarter of a million tonnes can be accounted for on the surface, often massing in large systems of swirling ocean currents called gyres. The rest is broken down into smaller fragments by UV rays, wind and waves and can start to sink deep into the ocean.

We also explored the growing problem of 'nurdles', a pellet around the size of a lentil, providing the feedstock for nearly all plastic goods. A 2018 survey by FIDRA revealed that 93% of our beaches have plastic nurdles on them. Nurdles are highly persistent pollutants and will continue to circulate in ocean currents and wash ashore for decades.

Alarmingly, a recent report from research consultancy Environmental Action found that "paint appears as the largest source of microplastic leakage into the ocean & waterways, outweighing all other sources of microplastic leakage such as textiles fibres and tyre dust". ASBP has recently launched a new working group to raise the profile of natural, plastic-free paints and finishes.

Intro to Reducing Plastics Group, aims, members and outputs to date

Continuing the momentum from our conference, we launched the ASBP Reducing Plastics in Construction Group, a cross-sector group, led by ASBP Technical Associate Dr. Katherine Adams which brings together stakeholders from across construction to learn and address plastics in construction issues, both in products and packaging. The Group includes major contractors such as Mace and Morgan Sindall, multi-national product manufacturer Wienerberger, and award-winning architectural practice Cullinan Studio.

The Group does not seek to advocate a completely 'plastic-free' built environment and recognises that plastics have useful applications within the construction industry. We support a reduction in the unnecessary use of plastics and encourage the development and adoption of robust alternative materials.

A cross-industry survey conducted by the Group in summer 2021 identified key drivers for reducing plastic use, with 4/5ths of respondents ranking it as very important that plastic is managed 'appropriately at end of life', and 78% advocating a significant reduction in the 'overall use of plastic'.

Activities include a guide on plastics issues, challenges and solutions; mapping plastic reduction initiatives and information sources, and a 'Dragon's Den' style series showcasing innovative alternative materials.

Below: Emily Penn - https://www.emilypenn.com/about
Bottom: Healthy building 2019 banner, ASBP

Summary of December event and some top alternatives

Our Reducing Plastics Summit in December 2021 showed the latest research, initiatives and solutions in the construction industry.

Expert presenters discussed a wide range of topics including Protec International's closed-loop take-back scheme for temporary plastic protection, Wienerberger's efforts to reduce plastic packaging waste for their building materials, and innovative products manufactured from recycled plastic. We also heard from Carl Taylor, Assistant Director of New Business and Growth at Green Square Accord who are developing 12 'virtually plastic free' houses as part of the EU-funded CHARM research project.

My talk, 'top alternatives to plastic construction products', highlighted substitutes for five commonly used construction products containing plastic. While mainstream products do have some advantages, particularly cost, lightweight, durablility, corrosion resistance and low maintenance. But there are alternatives out there - what are their benefits?

A popular alternative to more commonly used insulation materials is natural fibre insulation (NFI), which provides a range of holistic benefits beyond thermal performance (U-values), such as enhanced moisture control, low embodied carbon and low VOC levels. It is worth noting that most NFI do in fact have some plastic content, commonly a small percentage of MDI or PET as a binder, the benefits of which outweigh the costs. Other alternatives include:

Plastic product	Alternative	Benefits
uPVC windows and doors	Timber windows	Lower embodied carbon Ability to 'lock up' carbon Longer lifespans when routinely maintained High performance
HDPE or PVC pipework and guttering	Copper pipe or aluminium guttering	Infinitely recyclable High performance and durable Corrosion resistance Non-combustible
PVC flooring	Timber, linoleum, stone, cork, bamboo and ceramic tiles	Natural materials are usually from sustainable sources and have lower VOCs. Natural stones and ceramic tiles are durable, retain heat and are low maintenance.
Acrylic paints	Natural, mineral-based paints	Breathable - work well together with other natural materials such as insulation. Free of plastic binders - Alternative binders include linseed oil, clay, lime and potassium silicate. Virtually VOC free – but NOT zero! All contain some trace VOCs, even if minimal.

Architects and specifiers looking for alternative materials can visit our Interactive House of ASBP members' products including windows, services, insulation, flooring, structural elements, guttering and more.

Below: Plastic Paints The Environment Front Cover, Environmental Action
Bottom: The Ecosurety Exploration Fund Logo, Ecosurety

Call to action/outro

The ZAP Project – 'Zero Avoidable Packaging waste in construction' is funded by the Ecosurety Exploration Fund to research and develop scalable solutions to combat avoidable construction plastic packaging waste. Working with ASBP members and client Bankside Open Spaces Trust, the funded project will link with construction projects to create case studies, training and guidance.

ASPB are also engaging with the insurance industry to explore the impacts of failing push-fit plumbing materials in buildings. 'Escape of water' is the leading cause of UK home insurance claims, with insurers paying out £1.8m every day. The project will build upon anecdotal evidence to make the case for robust alternative materials with lower environmental impacts across their whole life cycle.

For more information about the Alliance for Sustainable Building Products and to sign up as a member, please visit https://asbp.org.uk. ■

The Ecosurety Exploration Fund

RIBA Homes 2030

Sam Foster, Architect

Review of RIBA Homes 2030 entry from Gaia Group (in collaboration with Outpost with Propagating Dan, Strawworks, Max Fordham, Milk, Momentum and EcoCocon)

COP26 was, by and large, an utter failure. Instead of the bold and audacious commitments to action needed to avert the worst effects of the climate and biodiversity emergency, we ended up with – in Greta Thunberg's words – *"a global north greenwash festival."*

The summit's conclusions for the construction industry – one of the biggest contributors to greenhouse gas emissions, health impacts and biodiversity loss – focused almost exclusively on the business opportunities that 'net-zero' presents, promoting electrification, heat pumps and low-carbon hydrogen. Not a veggie sausage about using our resources effectively, creating healthy environments and very little about enhancing biodiversity.

As SEDA members, we subscribe to the principle that prevention is better than cure. In construction then, it's a good idea to carefully find local, non-toxic, low-carbon materials and put them together in a way that creates healthy, energy-efficient, new and refurbished buildings that have a positive effect on their occupants and users, and which can be easily changed, maintained and disassembled. Adopting this approach reduces energy use and greenhouse gas emissions, encourages good occupant health and minimises waste and pollution – helping avoid the future refurbishment nightmares that we're currently facing.

New England

Hark, then, to the RIBA's Home of 2030[1] ; a design competition launched in March 2020 and set around four equally-weighted objectives: Age-friendly and inclusive living; Low environmental impact; Healthy living; and Deliverable and scalable. All exactly the type of project those of us in the construction industry should be producing without fail.

In terms of ambition and reward, the competition was bold, each of the six short-listed teams receiving an honorarium of £40,000 and the two competition winners going on to explore the potential to develop their projects on Homes England land.

One of those shortlisted was 'Janus House[2]' by long term SEDA member Professor Sandy Halliday of Gaia Group[3], as part of a collaboration with Outpost architects[4], Propagating Dan[5], StrawWorks[6], Max Fordham[7], Milk[8], Momentum and EcoCocon[9].

Of the Earth

Most entries to the competition represented some eco-fashionable tweaks on modern, architect-led housing developments across the UK, for example with some higher quality landscaping, a bit of modular construction and some natural materials. The difference with Janus House was pretty stark: in an effort to create something that can be sustained within the planet's natural boundaries the design arranges small clusters of homes around a communal greenhouse and garden for growing food and social use. This is high-density low-rise living. Apart from the mineral-based floor construction of foamglas and limecrete and metal roof sheeting all other materials are earth- and plant-based – from the Ecococon modular straw and timber wall panels that achieve Passivhaus levels of energy efficiency to the clay plasters and natural paints. Water (and flood risk) around the site is dealt with by open swales that encourage biodiversity and play time. Cars are pushed to the edges of the development rather than taking centre stage. All good stuff.

The thing is though, in Outpost's words *"We have proposed radical solutions but none without precedent."* And they're right. All of these individual ideas – and their benefits - have been around for a long time: the skill here has been making them all work effectively together.

COP donkeys

For the techno-geeks among us, the haptic form of the clusters increases surface to volume areas, adding plenty of additional heat loss and thermal bridges to resolve. In terms of its layout, inspiration has clearly been taken from some of the 'pioneer' eco-districts, like Vauban in Frieburg and Bo01 in Malmö, Sweden. This isn't a particular dig, though those places have – to varying degrees – become home to the middle classes, rather than addressing arguably the more pressing needs of those on lower incomes.

Overall though, this is yet another pilot project. Housebuilding remains dominated by private multinationals, land remains unaffordable and building regulations are woefully ill-equipped to force the delivery of anything like the standard of homes needed. As a result, such competitions are doomed to have almost no impact whatsoever.

In the end Janus House was considered 'too audacious' by the judges, at a time when audacity – and the leadership to see this through – is precisely what we need. This makes the judges, in my opinion, no better than the donkeys of COP26. ■

[1] https://www.homeof2030.com/professional-design-competition/

[2] http://outpostlondon.com/home-2030

[3] http://gaiagroup.org/

[4] http://outpostlondon.com/

[5] http://www.propagatingdan.com/

[6] https://strawworks.co.uk/

[7] https://www.maxfordham.com/

[8] http://www.splashofmilk.com/

[9] https://ecococon.eu/gb/

Page 29: Project Visuals, Outpost
Right Typology B Axonometric, Outpost

Annie's Loo

Jim Johnson, founding member of ASSIST Architects and SEDA

The following is a brief note which, Jim Johnson, SEDA founding member, previously tutor at Strathclyde University Department of Architecture and founder of the Krystyna Johnson Award for ecological design, wrote in response to the current students' struggle for architecture courses to tackle the climate crisis. Jim also co-founded ASSIST Architects and, along with Raymond Young and many others, helped launch the Community Based Housing Association movement which continues to play such an important part in Scottish refurbished and new build housing.

50 years ago, 27th February 1972, a new bathroom was formally opened by a city councillor in Govan. It was the first bathroom inserted into an existing small tenement flat. The owners had previously had to share a WC on the stairs with 2 neighbours and use the public baths.

This was the beginning of the tenement improvement programme in Glasgow, which went on to improve/rehabilitate hundreds of thousands of similar flats in the city.

The bathroom was the direct result of work by two final year undergraduates in the dept. of Architecture at Strathclyde Uni. In 1969 Peter Robinson had shown that a bathroom could be fitted into the standard sized bed recess of a typical tenement flat. The following year, another Strathclyde student, Raymond Young set out to prove that given accessible local support, owners could do this in their own flats using the grants then available.

This was a huge symbolic demonstration. Up until then official policy was to demolish and build new houses. But this was proving too expensive and too slow a process and disruptive of local communities. The students demonstrated that an alternative was possible.

We now face a different, but not dissimilar challenge – how to retrofit many thousands of homes to reduce CO2 emissions and eliminate fuel poverty. This is a technical, financial and organisational problem. The two Strathclyde students' work was predicated on finding local solutions to large scale challenges, in contrast to the accepted view that large scale problems necessarily needed large scale action, often involving large contractors. This was too often inefficient and carried out with disruption of social networks and disregard of residents' wishes.

This is a challenge to be faced by current students – can they respond with similar creative verve and commitment? ■

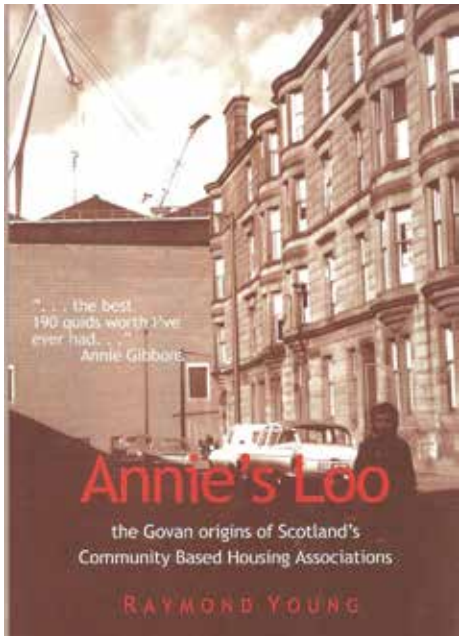


Image: Annie's Loo Cover, Raymond Young

Dowel Laminated Timber (DLT)

Peter Wilson, Founding Director of the Mass Timber Academy Ltd

The world of mass timber design and construction is possibly more extensive than many SEDA members are aware of. What do we mean by mass timber? Essentially a range of engineered timber products, each of which exhibits properties not available from traditional uses of solid wood (large section timbers cut from the log and limited in span by the length of the log and the strength and stiffness characteristics of the species being used), especially softwoods.

Most of the engineered timber products currently in use in the UK are manufactured from softwoods (principally pine and spruce) but, as mentioned in my previous article , (*Winter 2021- Is There Enough? Why We Need to Make Better Use of Scottish-Grown Timber*), only one - Glulam - is in small-scale commercial production by a couple of companies. The other glued systems - cross laminated timber (CLT) and laminated veneer lumber (LVL) are imported, although, the recent takeover of BSW by Binderholz, is likely to deliver full-scale commercial production of CLT here, using home-grown timber in the foreseeable future. The other, non-glued, systems such as dowel laminated timber (DLT) and nail-laminated timber (NLT) are virtually unknown in the UK, with only a handful of examples of DLT buildings so far existing in the UK and none of NLT. Yet both options are eminently suited to small-scale, localised manufacture.

It's important to understand that there are actually five different types of DLT being produced in central Europe, where around 20+ factories exist to (mostly) service their immediate local market. SEDA readers may have heard of Brettstapel*, but are possibly unfamiliar with the other variants - Dübelholz, Diagonal-Dübelholz®, the Thoma® system and the Nur-Holz® system. The first three of these insert long hardwood dowels into drilled holes in stacked softwood boards in which the grain of each board runs in the same direction. In the Brettstapel and Dübelholz versions the dowels are inserted (either manually or mechanically) perpendicular to the boards, whilst in Swiss company Sohm Holzbautechnik's patented Diagonal-Dübelholz® version the ribbed dowels are inserted diagonally, in part to improve each panel's racking performance and in part to reduce separation between the boards as the softwood wood dries and shrinks.

All three systems are based on the difference in moisture content between the softwood boards (generally around 12-14% MC) and the hardwood dowels (usually beech, around 6%MC). When the assembly reaches equilibrium MC in the atmosphere, the hardwood expands and locks the boards together.

The Thoma® and Nur-Holz® systems take a different approach, laying up boards in a similar way to that used in CLT panels but both also introduce diagonal lamellae. In these variants, short dowels are introduced into flat panels - the Thoma® system uses ribbed dowels whilst the Nur-Holz® option employs threaded rods to connect the boards more tightly together.

More about the importance of each of these (as well as the glued systems) will be covered in future articles and, for those seeking in-depth knowledge, in the Mass Timber Academy's online short courses (https://www.masstimberacademy.com). ■

* Brettstapel simply means stacked boards that have been connected with either wooden dowels or nails.

Below: Primary School, Burry Port, Wales, Peter Wilson
Bottom: Dowel types & section through dowelled timber, Peter Wilson

Solar Expert Design, Installation and Maintenance – SEDA Solar Seminar 7

Glo Lo & Colin Porteous

The last seminar of 2021 embraced expertise on specific products employed in Scotland – thermal and electrical – to that of the design holism of a landmark building in Seattle.

Solar Thermal

Dan Gates of Luths Services based in Glasgow summarised its consultative services as: Energy Assessments; Detailed M&E Design; Renewable Technology Assessments.

Dan explained that, although solar-thermal products were now 'poor sisters' to modern photovoltaics (PV), they still had good potential to offset large heating loads. Indeed evacuated tube collectors were now 'very cheap' and better than flat-plate collectors. However, disincentives remain poor quality control and potential breakdown(lack of competent designers/ installers),plus long payback periods (roughly 8-10 years).Dan observed that PV has very little environmental/ carbon benefit, as the grid is, or will shortly be, decarbonised in Scotland, therefore, solar thermal should be better employed as it offsets heating, which is still predominantly from carbon intensive fossil fuels (oil and gas).

Solar PV + Storage

This was the theme of the presentation by Jez Climas, Head of Renewable Heat at Midsummer Energy of Milton, Cambridge, a components supplier. Storage could be thermal– say Sunamp phase-change heat batteries or Mixergy hot water tanks. Or it could be electrical ie. batteries, now potentially interfaced with inverters from PV arrays; and with devices such as in batteries, now potentially efficiently interfaced with Soltaro inverters from PV arrays that specifically use electricity to divert to storage. Thus, although Jez's presentation represents the commercial product supply side, it has resonance with the academic modelling field as in Dr. Manuela de Castro's presentation of Fully Integrated Thermal Storage in our previous June seminar.

In tune with the 'Expert Design' leading this seminar's title, Jez mentioned the aesthetically sensitive roof-integrated Solfit system (comparable with integrated Velux roof-window arrays). With panels DC connected to inverters and home batteries now common, this had led to hybrid inverter/battery set-ups as Soltaro and standards which allow 'component swapping'. Although Jez acknowledged that maintenance tends to be reactive, monitoring is now a normal part of any system.

He also clarified that there is no direct linkage between PV and heat pumps – say 4kW in each case domestically with 1.5kWp for peak use of a heat pump. Nevertheless, heat pumps may increase self-consumption from PV arrays ,by increasing the self consumption of PV generated electricity. Jez referred to typical increases from 30% to 70% for systems with designed-in storage capability.

Bullitt Center case study, Seattle

The third speaker, Steve Doub, is a Senior Associate within the Miller Hull Partnership, architects in Seattle, with a longstanding track record in designing environmentally sensitive buildings (see: David E. Miller, 'Toward a new Regionalism: Environmental Architecture in the Pacific Northwest', University of Washington Press, 2005). Seattle also has a climate with similarities to Glasgow, notably its temperate and rather wet winters.

Steve told us that the Bullitt Center (opened 2013) represented a 'culmination of much of Miller Hull's research and practice'. He also stressed the importance of a 'committed client; in Denis Hayes of the Bullitt Foundation. Hayes is an environmental advocate, including solar power, and refers to the Bullit Center as a 'deep green building'. Steve elaborated with a 'Living Building Challenge' diagrammatic metaphor of a flower with seven petals: site, water, energy, health, materiality, equity and beauty – not prescriptive, but a 'visionary path to a restorative future'.

Occupying a prominent corner site diagonally opposite the Seattle Academy of Arts & Sciences, the most striking visual element of the Center is its dramatically cantilevered PV roof canopy. Steve informed that the final geometry and area of this resulted after numerous modelling studies using 'grasshopper'

Rhino modelling so that approximately 1,300m2 PV (570 modules @ 425 W, 227 kWp output) would provide 230,00kWh/annum to satisfy a net zero energy goal (8). (See building section) There are two key means to achieving this, low thermal transmittance of the generously glazed envelope of the five floors plus ground-floor mezzanine below the canopy (6) (glazed U-value 1.42W/m2K; wall U-value 0.266; roof 0.15), and a system of deep-bore, ground-source heat pumps (1) (26 x 122m-deep Glycol loops). Other energy-efficient tactics are hydronic heating/cooling serpentines in screeds atop structural timber slabs (4), airtightness and occupant-cum-BMS-controlled combined natural/MVHR ventilation (5) (windows open early morning to pre-cool slabs in warm weather), coupled with external shading of adjustable slats (7), and designed to maximise daylight to limit electrical lighting (3) (e.g. windows up to underside of floor slabs; top-floor PV over-shading offset by roof-lights; artificial lighting loads only 75% of that predicted).

All this is complemented by conscious culture of energy-efficiency, including using the prominently located stairs – to encourage users to take them rather than the lift – plus displays of live-metered energy consumption and rental incentives for individual tenants. Perhaps surprisingly, given typical monitoring expectations, the PV, which generates almost exactly as predicted, has produced a surplus relative to demand since completion, with its surplus a windfall in terms of its grid connection.. Steve finished by returning to the significance of Denis Haye's ethos in terms of this landmark 'living' building's success, although it is equally clear that it is due to the right client finding the right architect.

Concluding discussion

The ensuing Q&A session included detailed queries to Steve, such as the influence of occupancy density (30-40 per floor, and built footprint <1,300m2), plus more general conversation on the extent that 'intelligent' buildings were influenced by the occupants (significant in the Bullitt case), and on the influence of meshing with active and passive techniques embraced by all three speakers. There is no doubt that a built case study such as the Bullitt Center, which won the World Architecture News 'Sustainable Building of the Year Award' 2013, exemplifies each aspect of this seminar's title.

2022 SEDA Solar programme

We plan to have a programme of seminars every second Monday from March to June and September to November inclusive. The first will be on Solar Thermal and Green Homes Grant embracing strategies to keep solar thermal relevant beyond grant schemes, and how the government might encourage more holistic designs and installations (passive and active solar thermal) so as to better tackle the climate emergency. ■

Timber Tool Kit

Tom Hay on behalf of SEDA CS (Civil Structural)

Newly Published Online Resource: Timber Tool Kit for Structural Engineers - Sawn and Roundwood Timber

As part of SEDA's expansion of online resources we are keen to promote the recently added Timber Tool Kit for Structural Engineers. The tool kit is a practical overview of the issues to be considered when designing and specifying timber structures using 'homegrown' timber. As Scotland has large tracts of standing timber and a range of temperate species suitable for structures, (surprisingly extensive when only small quantiles are required), we hope this document will assist in promoting appropriate use of this valuable resource.

The toolkit is primarily targeted at structural engineers and the particular questions that they might ask. However, we think the information will be of interest to a more general audience, who are both new to the topic, and those who might find it a useful reference.

Fortunately, we have a good understanding of the structural behaviour and properties of both native and introduced species of timber in Scotland, thanks to over a hundred years of research. The outcomes of this research are disseminated through a range of published documents and informs a grading system fully integrated with Eurocodes and British Standards. Basically, specifying homegrown timber for structural purposes really isn't that daunting.

The Tool Kit also addresses some of the challenges relating to the long term durability of Scottish timber structures and the use of green as opposed to dried timber. As the bulk of Scottish timber is classified as non-durable or moderately durable, this is perhaps the greatest challenge in design, particularly as we aspire to limit chemical preservative treatment. We hope that we can expand information on 'timber durability by design' in SEDAs online resources in the near future and if would be great to hear from anyone who would like to supplement the limited information provided here on designing for timber durability. ■

Below: Sitka Spruce (picea sitchensis) trial plantation from the early 20th century at Corrour Village, Tom Hay

2022 ASBP Awards winners announced

Press release – 21 February 2022

The winners of the 4th annual ASBP Awards have been announced, following a 'hybrid' awards ceremony on Thursday 17th February at the EDGE Showroom in London and online.

The 2022 ASBP Awards are the biggest yet, with entries welcomed across three categories including exemplary sustainable building projects, innovative products and forward-thinking initiatives. Submissions were judged by members of the ASBP Board, who have expertise from across the construction industry, and assessed against the ASBP's "Six Pillars of Sustainable Construction".

The competition was particularly strong this year and our judges had the unenviable task of reducing the longlist of 26 to just 9 finalists, who were invited to present at the ceremony. ASBP would like to thank all those that took the time to enter and hope to receive many more fantastic submissions in 2022-23.

The in-person ceremony was kindly hosted by EDGE in London, a new sustainability-focused design and construction showroom. Both virtual and in-person attendees had the opportunity to vote on their favourite finalists, with the most popular entrants being awarded the 'People's Prize'.

ASBP would like to congratulate the following finalists on winning an award this year:

- Project category (Judges' Award): SNUG Forest Road, Bristol - SNUG Homes Ltd
- Project category (People's Prize): Zetland Passive House - Ecospheric
- Product category (Judges' Award): Accoya Wood - Accsys
- Product category (People's Prize): Agile's Innovative Housing Solution – Agile Homes
- Initiative category (Judges' Award): People Powered Retrofit - URBED and Carbon Co-op
- Initiative category (People's Prize): Structural Carbon Tool - Elliott Wood and IStructE

The ASBP Awards would not be possible without the kind support of sponsors - Back to Earth (Gold sponsor), Ecomerchant (Silver sponsor), Allergy UK, natureplus (Bronze sponsors), Futurebuild (Media partner) and EDGE (Ceremony host).

Sustainable Place Making and Mapping Future Food & Climate Change

Gail Halvorsen, Architect

By definition anything that SEDA Land does has to be interdisciplinary. We try to engage with all sectors involved with land use – from the economy to health and well-being. As a result any pilot project that we run with a community and local landowners will inevitably be fairly large-scale.

This is certainly the case with the two pilot projects which SEDA Land is currently working on. Both projects – Sustainable Place Making and Mapping Future Food & Climate Change – will need to be at least one and possibly as many as three years duration.

Each will be run in a small rural community, with at least one enlightened landowner who is prepared to let the community have a say over the use of some land around them. We will involve other landowners and farmers and -- with the help of scientists, artists and practitioners -- hope to demonstrate that serious collaboration produces imaginative results. We will assess which policies work and which don't. Then we will make recommendations to the Scottish Government on how existing policies might be turned into policies that enable, or even encourage inspired thinking.

Mapping Huntly

In the mapping project, we will be working with the community of Huntly, Aberdeenshire and Jeremy Leggett, owner of the neighbouring Beldorney estate. Huntly Development Trust, a proactive group that already runs successful community projects, is also on-board, along with the supportive and enthusiastic local secondary school, The Gordon Schools.Soon pupils will be carrying out a community questionnaire for us in Huntly, before starting a mapping exercise using the Ian McHarg layering system for all land uses in the environs of the Aberdeenshire town.

Our aim is to inspire Huntly residents to envisage alternative sustainable uses for surrounding land and empower them to take more interest in and control over it. As well as the more obvious agro-ecological solutions, we intend to promote other uses, including vertical farming and crops for a variety of bioproducts such as building materials and bioplastics.

Food & Climate Game

The digital interactive computer game, which we are developing with MA students at Abertay University in Dundee, will be an engaging and fun tool that helps demonstrate the complexities of the inter-relatedness of all factors concerning land use. Indeed a Gordon Schools six former has already contributed to our first design meeting with Abertay University digital gaming department –the only member of the group with much experience of playing digital games!

There is a lot of enthusiasm for this project, particularly from the working group that includes the poet and novelist Sophie Cooke, Mads Fischer-Moller (professor in food policy at the SRUC) and plant biologist and ecologist Pete Iannetta (head of ecological food systems at the James Hutton Institute).

SEDA Land now need to secure funding – no mean task. The first, for the artistic contributions, will be made to Creative Scotland and we will look to a variety of funders for the remaining grants. ■

Below: Food & Climate Game, Abertay University
Bottom: Typical internet 'food' game, stock image

SEDA Assemble...

Catherine Cosgrove, SEDA Chairperson

In the months following COP 26 there was a lot of momentum for pressing on with the actions and changes that are required if we are to have a chance at limiting global warming. Three months on that momentum is fast disappearing. The SEDA representatives at COP 26 came together afterwards and collated our thoughts on what were the most important issues that we identified from attending the conference. We formalised these thoughts into 20 recommendations in an open letter that we addressed to Patrick Harvie, the Scottish Government minister for Zero Carbon Buildings, Active Travel and Tenants' Rights. A copy of our letter was included in the SEDA magazine Winter edition. To date we have received no comment from him or his team.

Assemble

We can't afford to let this momentum dissipate but there is so much that we have to address that we can't do this on our own. The SEDA Directors have had many debates on where we should focus our time and energy but we'd like the SEDA membership to contribute to this conversation. As time is of the essence we are proposing to host a SEDA Gathering, just like in the Marvel superhero films, where we can discuss the options available and on what we should focus for our immediate programme of action. Ideally we wanted to hold this event in Spring and we would like this to be an in person gathering. See below for details..

What we'd like you to think about just now is how we go about delivering on these actions. We can continue to host events and publish guidance but these are relatively small scale and have limited impact. We are keen to collaborate with other groups. Working together to achieve a greater impact was one of the lessons we learned from COP 26. From the SEDA Director discussions we think focussing on two or three topics would allow us to focus in depth on these subjects and bring in a good range of collaborators. But if the SEDA membership show strong support for other options then that is where we will direct our focus.

One thing that is clear is that we cannot sit back and expect others to solve the climate crisis. We have to act now and take the lead if no others are willing to do so. Please let us know if you are keen to help and keep an eye on the SEDA social media posts for more information on the SEDA Gathering;

SEDA Gathering

Saturday, 7 May 2022 from 14:00 to 17:30 (BST)

Greyfriars Charteris Centre, 138-140 Pleasance, Edinburgh, EH8 9RR

https://sedagathering2022.eventbrite.co.uk