

Simon Corbey MSc MRICS

Director at the Alliance for Sustainable Building Products

Delivering Healthy Buildings

Plastics and Construction

1st November, 2018, Bristol

Kindly hosted with the Green Register

Over 60 members and partners

Including architects, product manufacturers, specifiers, suppliers, contractors, research institutions and more...

ASBP





Mission driven

To accelerate the transformation to a sustainable built environment and society, by championing the understanding and use of demonstrably sustainable building products

APPG for healthy homes and buildings
White Paper: Building our Future; Laying the Foundations for
Healthy Homes and Buildings; October 2018



APPG – some 46 recommendations



RCPCH/RCP call for evidence

- ▶ The Royal College of Paediatrics and Child Health (RCPCH), in collaboration with the Royal College of Physicians (RCP), has established an Indoor Air Quality Working Group.
- ▶ Led by Professor Stephen Holgate – speaking again at our Expo 28/2/19 at LSBU. Discount code just for you at 50% off
- ▶ The Working Group's aim is to produce an evidence-based report on the issues affecting the health of infants, children and young people exposed to poor indoor air quality in homes and schools, considering both indoor and outdoor sources of pollution.

Plastics in construction – key learning 2017/18

- ▶ Complex
- ▶ We need support on this journey
- ▶ Expo 28/2/19: we have 15 leading experts confirmed
- ▶ Each product is different
- ▶ 55,000 products – half of which are synthetic
- ▶ Emotive subject – knee jerk reactions
- ▶ Extremely likely to have unintended consequences

Sustainable Bio&Waste Resources for Construction (SB&WRC)

- **The Alliance for Sustainable Building Products (ASBP)** and its French and English partners are undertaking this project as part of the Interreg France (Channel) England programme.
- The aim is to develop prototypes of construction materials from bio-resources and recycled waste.
- University of Brighton and University of Bath
- ASBP is pleased to be co-leader for communication for the project

Find out more at www.asbp.org.uk/sbwrc



Project Partners



This project is supported by the **INTERREG VA France (Channel) England** programme and receives financial support from the **European Regional Development Fund (ERDF)**

My journey with plastics in construction 2017 - What's in my uPVC window frame



- Ineos – fracking for plastic. One of the world's largest manufacturers of chemicals and oil products, with sales of \$54 billion, employing 15,000 people.
- In 2016, it produced 10 million tonnes of plastic worldwide roughly twice the weight of the population of the UK
- Weston, Cheshire – HBCD a brominated flame retardant; Feb 2000
- Manufacturing chlorine is highly energy intensive.. *Such (energy) costs are particularly important for Ineos. Its Runcorn plant, which provides the chlorine for 95% of Britain's water, "consumes as much energy as Liverpool", says Ratcliffe.*



Jim Ratcliffe CEO

No one loves the messenger that brings bad news – Sophocles

TV: Blue Planet 2, Secret Life of Landfill, Drowning in Plastic, Dr Who

Metro Headline 23/10/18.

Plastics in our water and in the air

The tragedy at Grenfell – plastic cladding

2 billion people have no access to municipal waste collection

2/3 of UK waste is exported

London recycling found in Malaysian landfill



Plastic pollution is the gateway issue for us all to take more radical action on climate change, habitat depletion, resource consumption and the rampant clear cutting of our natural world and ocean. It doesn't end at plastic:

Hugo Taghelm SAS.

Plastics in the budget 29/10/18

- ▶ The largest response to a call for evidence on single-use plastics in the Treasury's history was received this summer, with 162,000 responses.
- ▶ The Chancellor announced plans for a new tax on plastic packaging which contains less than 30% recycled plastic, subject to consultation.
- ▶ This forms part of a cross-government package of measures to address single-use plastic waste, including reform of the Packaging Producer Responsibility system and new funding for innovation as part of the government's wider strategy to address plastics waste
- ▶ Further detail is to be set out in the Resources and Waste Strategy later this year.

The UK throws away an estimated **295 billion** pieces of plastic every year



**EVERYDAY
PLASTIC**

Plastics and construction

Plastic invented in East London 150 years ago
8.3bn tonnes of plastic produced to date
30% still in use
70% reached end of life

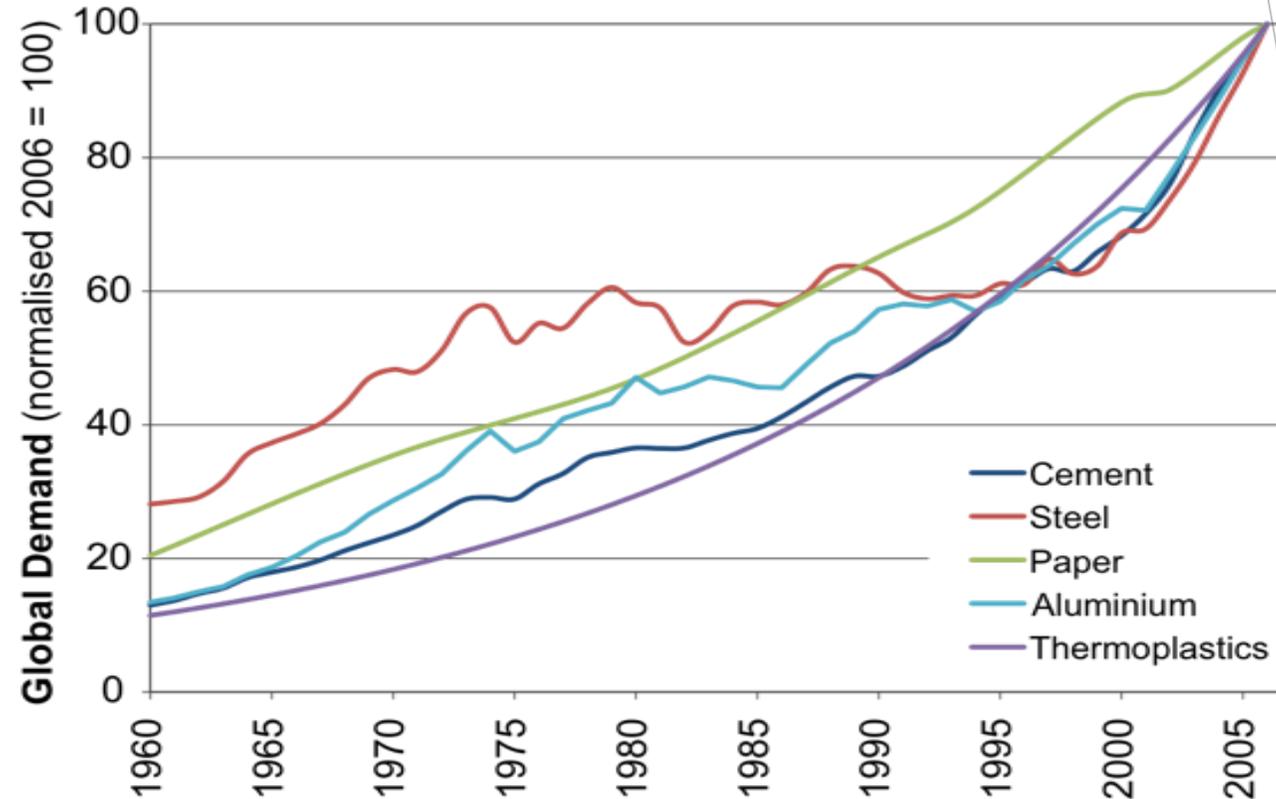
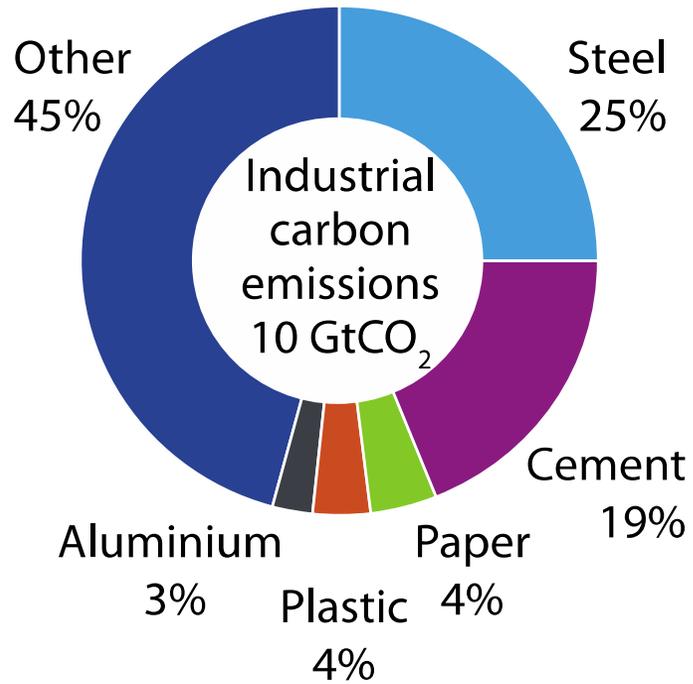
It is estimated only 14% of plastics are collected to be recycled, with just **2% recycled in a close loop**, 8% down-cycled and 4% lost. Of the rest, 14% incinerated, 40% goes to landfill and 32% leaks into the environment.

300m+ tonnes of plastic made each year – 50% single use
Projected to double in next 20 years
20% of global plastic waste is from the construction sector
Construction is the second largest user of plastic behind packaging

Wilmott Dixon: In 2017 approximately one third of our overall waste profile was attributable to plastic and plastic packaging



The big picture; Dr Jon Cullen University of Cambridge



Global demand for materials is expected to more than double by 2050.

Halving absolute emissions by 2050 will require at least a 75% cut in emissions per tonne.



Plastic is not only a versatile material allowing it to be used for a range of uses but it is also has benefits in terms of sustainability.

The plastics industry is working on a range of initiatives to reduce energy, increase recycling and prevent litter. The BPF have a sustainability committee and you can find out more about the work it is doing here.

The environmental cost to replacing plastic with alternatives materials would be nearly 4 times greater ⁽¹⁾

[Annual Review](#)

[Business Conditions Survey](#)

[BPF Members Groups](#)

[Central Committees](#)

[Affiliated Organisations](#)

[Business Support Network](#)

[Industry Topics](#)

[Meeting Facilities](#)

[Join the BPF](#)

[Contact Us](#)

[Join the BPF](#)





Plastics and Sustainability:

A Valuation of Environmental Benefits, Costs
and Opportunities for Continuous Improvement



Rick Lord: Author of Plastics and Sustainability; Trucost

Telecom with me; 22/10/18

Accepted that this report was not an academic report and had not been independently peer reviewed.

Accepted lumping together worst and best alternatives was not really very helpful

Accepted that there was a mistake on the BPF website ***It only uses 4% of the world's oil production - the rest is used for transport, energy, heat or is burnt.*** He has 8 -12%

Accepted that it was not ideal that all the assumptions needed to understand the headline figure were not provided in an 87 page report. *It's because it would then be 250 pages long*

Accepted that methodology in the marine plastics costings was evolving



Costing the Earth on Radio 4

24th October 2018

Richard Mattheson,
Trucost interviewed
here

In Praise of Plastics

- Incredible strength to weight ratio
- Lightweight
- Cost effective
- Durable
- Shatter proof
- Barrier to moisture
- Protects
- Maintenance free
- Keeps food fresh for longer
- Deals with extreme temperatures
- Reduces breakages
- Culturally enabling
- <https://lowcarbonbuildings.wordpress.com/2018/03/15/in-praise-of-plastic/>

The Business of Plastics

- There are 6,200 plastic firms in the UK employing 170,000 people. It is the second biggest direct employer in the UK.
- The UK plastic industry has a turnover of £25.5 billion....one and half % of GDP
- 5m Tonnes manufactured in the UK
- \$180bn investment in plastic factories feeds global packaging binge
- The polyurethane foam industry is projected to reach a worldwide value of up to \$74bn by 2022

Plastics are everywhere

- You can imagine a room with plastic paint on the walls and ceiling, plastic windows, plastic flooring, plastic wiring, plastic junction boxes and plug sockets, plastic coving, vinyl wallpaper, plastic worktops, plastic cupboards, plastic chairs
- Plastics are in timber: 10% of the weight of OSB board is plastic binders
- Plastics in natural insulation: 10% by weight is plastic binder
- Piping and conduit account for 35% of plastic in construction

Whole life Plastics – the issues

Extraction phase: Based upon crude-oil/shale gas of unknown origin - a finite resource, major contributor to climate change

Manufacturing phase: Intermediate chemicals, health impacts of workers, waste from processing facilities

Use Phase: Plastics in our blood and gut. Phthalates, heavy metals, fire and toxicity, VOCs, chemicals, dust levels, moisture, marine plastic

End of life phase: Marine plastic, Re-use challenge often caused by the use of additives, likely to be downcycled, waste, landfill and toxicity

Plastics



PETE

polyethylene terephthalate

soft drink bottles, mineral water, fruit juice container, cooking oil



HDPE

high-density polyethylene

milk jugs, cleaning agents, laundry detergents, bleaching agents, shampoo bottles, washing and shower soaps



PVC

polyvinyl chloride

trays for sweets, fruit, plastic packing (bubble foil) and food foils to wrap the foodstuff



LDPE

low-density polyethylene

crushed bottles, shopping bags, highly-resistant sacks and most of the wrappings



PP

polypropylene

furniture, consumers, luggage, toys as well as bumpers, lining and external borders of the cars



PS

polystyrene

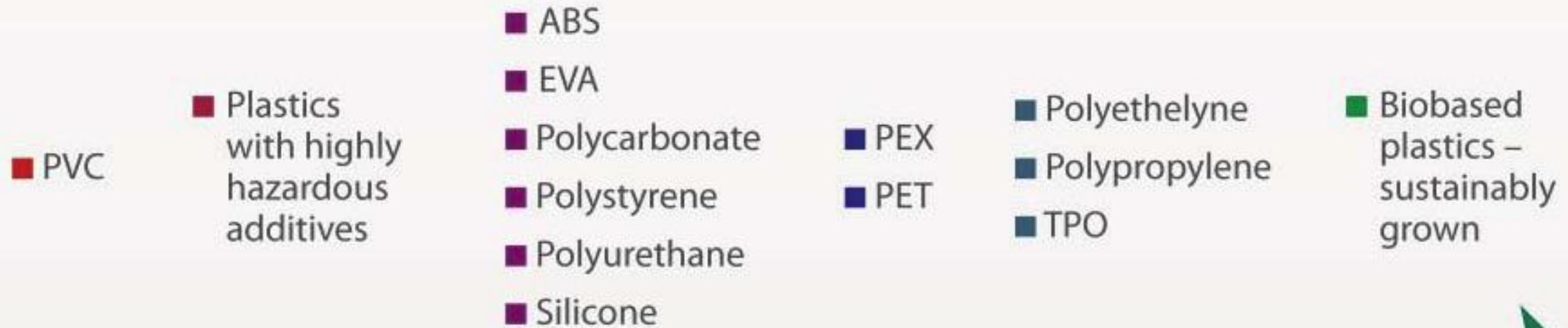
toys, hard packing, refrigerator trays, cosmetic bags, costume jewellery, CD cases, vending cups



OTHER

other plastics, including acrylic, polycarbonate, polyactic fibers, nylon, fiberglass

Figure 1: Plastics: Environmental Preference Spectrum



AVOID

PREFER

ABS = Acrylonitrile Butadiene Styrene

EVA = Ethylene Vinyl Acetate

PET = Polyethylene Terephthalate

PEX = Polyethylene (PE) Cross-linked (X)

PVC = Polyvinyl Chloride

TPO = Thermoplastic Polyolefin

Rossi, Mark & Tom Lent, "Creating Safe and Healthy Spaces: Selecting Materials that Support Healing" in *Designing the 21st Century Hospital*, Center for Health Design & Health Care Without Harm, 2006, page 66 (<http://www.healthvbuilding.net/healthcare/HCVH-CHD-Designing the 21st Century Hospital.pdf>)

Plastics – the issues; Highly energy intensive

PVC – oil/gas and salt water

Demand for PVC products in Europe is close to 5 million tonnes per annum, with window profiles accounting for 28% or 1.4 million tonnes.

PVC is produced by the polymerisation of vinyl chloride monomer, which is in turn derived from ethylene dichloride. Ethylene dichloride is obtained from the reaction of ethylene with chlorine, with the ethylene being obtained by steam cracking of hydrocarbons derived from **fossil oil** reserves.

Chlorine is produced from brine (salt solution) by the chlor-alkali industry. Total chlorine production in Europe was nearly 9.7 million tonnes in 2016, with the largest single end use (33%) being for PVC production.

Plastics – the issues; Nurdles

FIDRA study 2018 – Nurdles (plastic pellets) found on 93% of UK beaches

I'm looking forward to Claire Wallerstein's talk - RAME Peninsula Beach Care



Plastics – the issues: health and wellbeing

Phthalates are a group of chemicals that are often found in PVC sheet flooring, cables, extruded plastics, coatings and other flexible plastic products.

They are released during production and distribution but it is alleged 95% offgas during use and disposal.

Researchers have linked phthalates to asthma, attention-deficit hyperactivity disorder, breast cancer, obesity and type II diabetes, low IQ, neurodevelopmental issues, behavioural issues, autism spectrum disorders, altered reproductive development and male fertility issues.

The EU took action to restrict the use of four of the most damaging ones in July this year

Plastics – the issues: health and wellbeing

Heavy metals are associated with a wide range of conditions, including kidney and bone damage, developmental and neurobehavioural disorders, elevated blood pressure and potentially even lung cancer,

Still often being used in petrochemical building products like plastics, finishes, coatings and acrylic varnishes and paints.

This is then justified with the very low concentration and hence minimal health risk ignoring that these are often bio accumulative and build up in the food chain and organs over time.

Heavy Metals – the issues: health and wellbeing

Some examples of heavy metals used in construction materials as pigments, insecticides, fungicides, flame retardants or stabilisers are:

Antimony	Flame retardants
Arsenic	Timber treatment, PVC
Lead	Paints and lacquers, plastic stabilisers
Cadmium	PVC, pigments
Chrome	Timber treatment, paints and lacquers, plastics, textile treatments
Copper	Synthetic carpets, pigments, timber treatment
Nickel	PVC, pigments
Mercury	Timber treatment, paints and lacquers, leather, plastics, textile
treatments	
Tin	Timber treatment, flame retardants, preservatives, PVC, paints and
lacquers, plastics	

Plastics – Fire and toxicity

Richard Duffy, International Association of Fire-fighters, USA “ *Exposure to a single PVC fire can cause permanent respiratory disease. Due to its intrinsic hazards, we support the efforts to identify and use alternative building materials that do not pose as much risk as PVC to fire-fighters, building occupants and communities*”.

In conditions of uncontrolled burning, uPVC may release dioxins or phosgene, as will any organic material burning in the presence of chlorine.

The main hazard from uPVC in a fire is from the generation of large amounts of hydrogen chloride.

Professor Anna Stec In briefings to senior health agency staff, Stec said she had found “huge concentrations” of potential carcinogens in the dust and soil around Grenfell tower in west [London](#), and in burned debris that had fallen from the tower.

High levels of hydrogen cyanide were also present in the soil she analysed.



Plastics – Fire and Toxicity

Although the inhalation of toxic smoke is the biggest killer and the largest cause of injury in fires, it is very much the neglected area of fire science and fire safety engineering.

14:54, 5 February, 2017

Six crews dashed to Hanbury Plastics centre in Milton, Stoke-on-Trent, at 9.30am yesterday after the service received 78 calls in ten minutes about the blaze.

Graham Shaw, 63, said: "It questions whether the plastic factory should be built so close to residential properties.

"It is the most smoke I have ever seen. The question is whether it is toxic."



Research 1/8/18: Methane and ethylene produced from plastic in the environment

- ▶ the most commonly used plastics produce two greenhouse gases, methane and ethylene, when exposed to ambient solar radiation. Polyethylene, which is the most produced and discarded synthetic polymer globally, is the most prolific emitter of both gases.

Plastics – 12 reasons it's all quite complicated

1) Health and Wellbeing; complexities

Overview of known plastic packaging-associated chemicals and their hazards lists 906 chemicals likely associated with plastic packaging and 3377 substances that are possibly associated.

Our work was challenged by a lack of transparency and incompleteness of publicly available information on both the use and toxicity of numerous substances

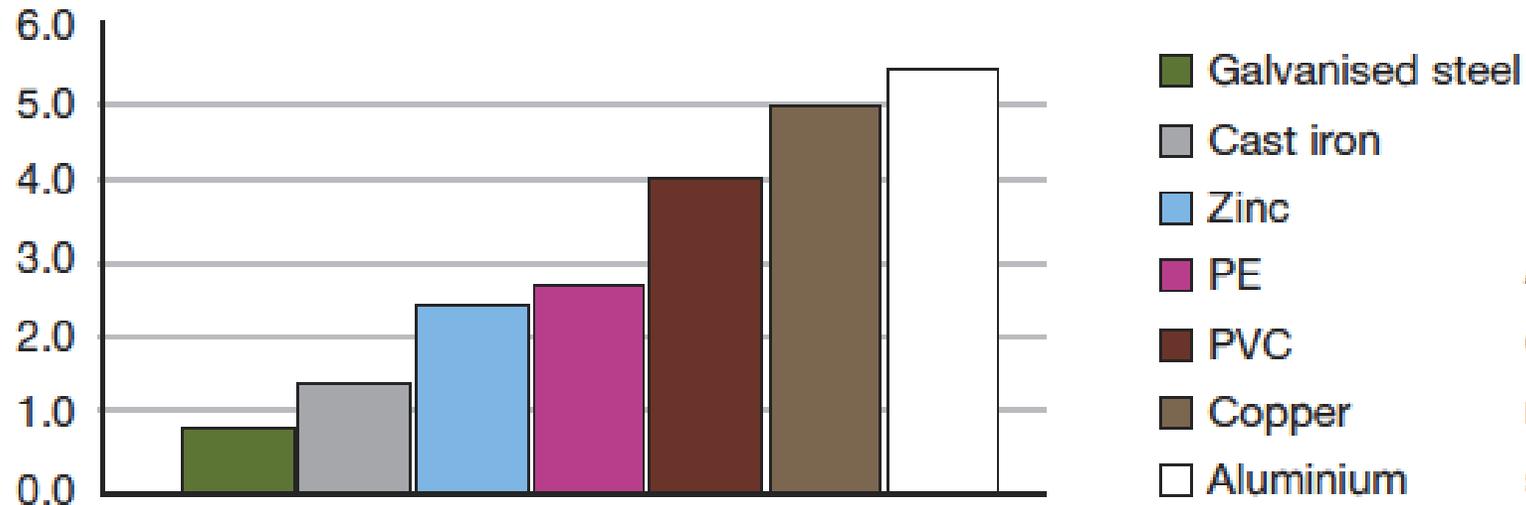
We don't really know the implications of human ingested plastics



Plastics - 12 reasons it's all quite complicated

2) Navigating the Data (bull) e.g. Lindab and BPF

Lindab steel – a green effect on today's environment



As our study shows, all metals in the comparison have advantages over plastic materials when it comes to recycling with steel performing the best of all.

(GRW) Global Warming Potential relative comparison

Plastics – 12 reasons it's all quite complicated



The Alliance
for Sustainable
Building Products

3) BRE Green Guide

- ▶ There is just one **domestic uPVC** window listed on the BRE Green Guide, which scores A, which is detailed here;
<https://www.bre.co.uk/greenguide/ggelement2.jsp?buildingType=Housing&category=13&parent=0&elementType=10110&eid=15639>
- ▶ It scores badly on Climate Change D and Water Extraction E and Fossil Fuel Depletion E and Waste Disposal C...but still ends up with an A rating. It is not clear how this is possible?
- ▶ ASBP would intuitively challenge the A+ ratings for toxicity.



The Alliance
for Sustainable
Building Products

Plastics – 12 reasons it's all quite complicated



The Alliance
for Sustainable
Building Products

4) Some Life Cycle Analysis shows plastic is better

Environment Agency study on plastic bags To do better than a conventional 'single use' carrier bag, a paper bag would need to be reused 3 times, and the equivalent figures for LDPE bags for life and cotton bags were 4 times and 131 times respectively. And this is all assuming that the 'single use' bag was only used once; obviously if it's reused itself, it is environmentally even more advantageous compared to paper, cotton and LDPE.

5) The complexity of LCA

6) The shortcomings of LCA...no human health considerations

7) Comparing EPDs - Setting the functional unit



The Alliance
for Sustainable
Building Products

Plastics – 12 reasons it's all quite complicated

- 8) There are many types of plastics
- 9) Quality concerns with higher recycling rates – performance
- 10) Each product has its own footprint; 15,000 products in building
- 11) What about bioplastics?
- 12) Should plastic be biodegradable?

Material – ICE database	kgCO ₂ /kg
Vitrified clay pipe	0.55
Lino	1.21
Galvanised steel sheet	1.45
PVC Pipe	2.56
Vinyl flooring	2.61
Polyurethane - rigid foam	3.48
Wool	5.53
Aluminium	9.16
Nylon carpet with pile weight 500g/m ²	9.7

?

Case Study - Skanska

- ▶ An example is the decision in 2000 by our Nordic commercial development unit (CDN) to voluntarily phase-out PVC pipes and cables. This was done to avoid the risk of hydrochloric acid generation should a building catch fire since renovation costs are known to be higher where PVC is used.

Possible alternatives

	Pointless	Replaceable	Problem	Harder to Replace	Essential
DPM				✓	
Underground pipework		✓			
Rainwater pipe		✓			
Guttering		✓			
Windows		✓			
Doors		✓			
Cladding		✓			
Insulation		✓			
Coving		✓			
Skirting		✓			
Electrical cables		✓			
Conduit					
ME Plant			✓		
Tile spacers			✓		
Raw Plugs			✓		

Comparing products

Product - Windows	Health	Carbon	Cost	Lifecycle
Aluminium	•	●	•	
uPVC	●	•	•	
Wood	•	•	•	
Product - Guttering				
ARP	No specific info	100% Renewable energy Section 0.9mm No EPD	>5%	30 plus years

Biome Bioplastics; Paul Mines CEO on Costing the Earth on Radio 4 25/10/18

- ▶ Potatoes, Corn starch, Cellulose acetate – from trees
- ▶ Mixed together under heat and pressure
- ▶ Pellets.....bags cups etc
- ▶ 70% bio-based
- ▶ All compostable – fragment completely biodegraded within 3 months. Temp controlled, water controlled
- ▶ No heavy metals or plasticizers.....
- ▶ Will not contribute to marine pollution
- ▶ Plastics v food
- ▶ 13bn plastic bottles used in UK each year

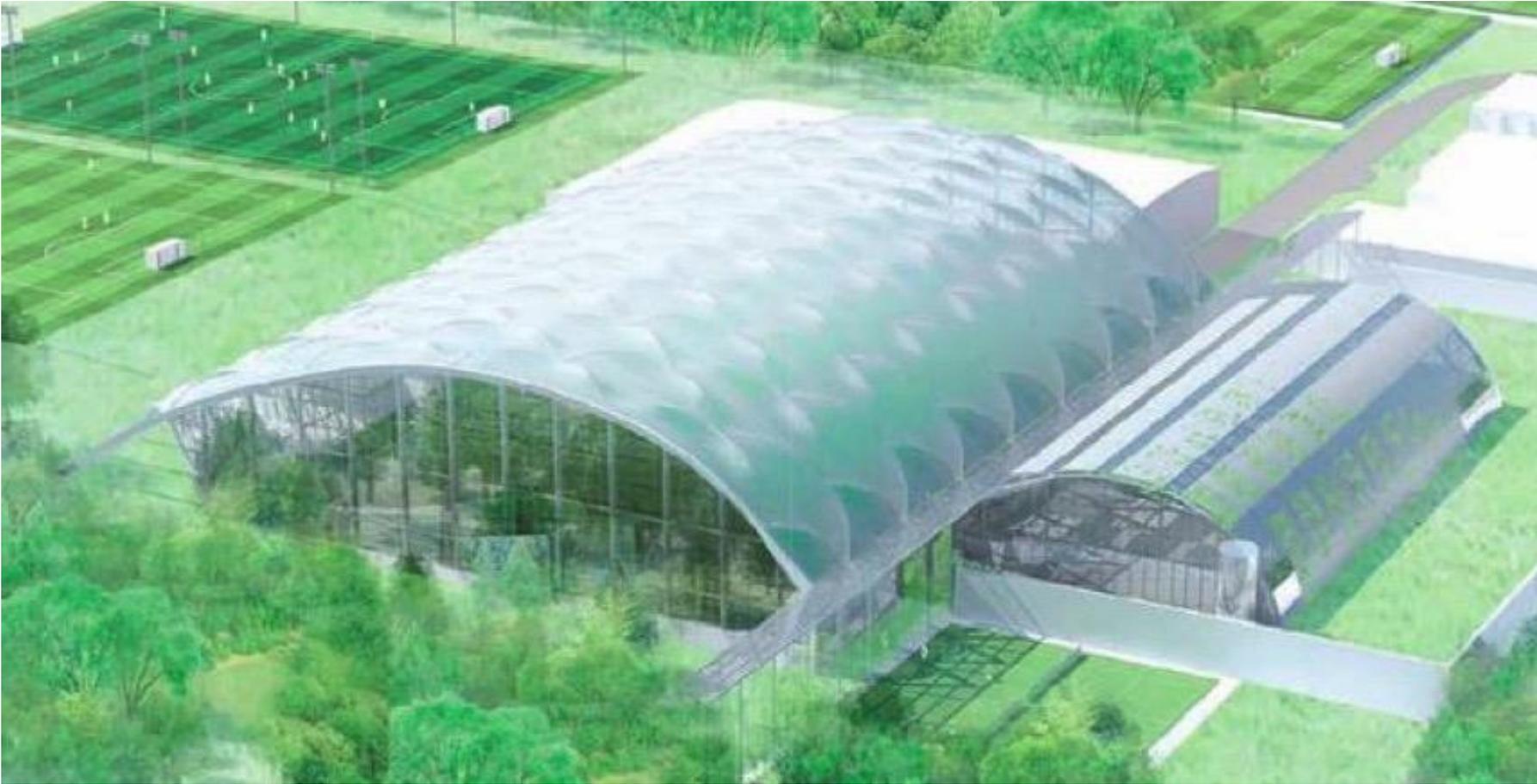
Wooden Laptop





C

Scottish National Performance Centre for Sport at Heriot-Watt University Edinburgh



BIOHM - Mycelium; grow your own insulation



superior insulation qualities, is naturally self-extinguishing, feeds off waste while it grows, and purifies the air once in place.

Plastics in products

Bath University researchers say up to 10% of sand in concrete can be replaced by plastic without significantly affecting concrete's structural integrity.

The rising use of recycled plastic in design is "bullshit"
says Jan Boelen

In conclusion

- ▶ Precautionary Principle
- ▶ Collaboration between Fire and Rescue, demolition and building professionals
- ▶ Journey
- ▶ Next steps; ASBP Technical working group on plastics
- ▶ Expo 28/2 Discount Code 50% off ASBP1NOV

- ▶ Simon Corbey
- ▶ simon@asbp.org.uk
- ▶ www.asbp.org.uk

Discussion

- ▶ What 1 specific product would you say would be best for me to focus on and why

24/10/18 NYTimes: New York Sues Exxon Mobil, Saying It Deceived Shareholders on Climate Change

HEALTHY BUILDINGS

CONFERENCE & EXPO 2019

PRODUCTS • PEOPLE • PLANET

Plastics in Construction Issues, Impacts and Alternatives

Thursday 28th February 2019
London South Bank University



Wood for Good



WOOD. AT THE HEART
OF A GOOD WINDOW
The Wood Window Alliance

Kindly sponsored by

ASBP The Alliance for Sustainable Building Products

We are delighted to announce our keynote speakers; environmentalist & yachtswoman **Emily Penn**, a leading advocate for reducing plastic pollution in our oceans; and **Professor Sean Smith**, Director of Sustainable Construction at Edinburgh Napier University.

Book tickets at www.asbp.org.uk/healthybuildings2019

ASBP The Alliance for Sustainable Building Products