EPD IRELAND
THE ENVIRONMENTAL PRODUCT DECLARATION PROGRAMME

IGBC
IRISH GREEN BUILDING COUNCIL

Towards a circular economy in construction

Assessing low carbon, healthy, responsible products for the construction sector

June 2018

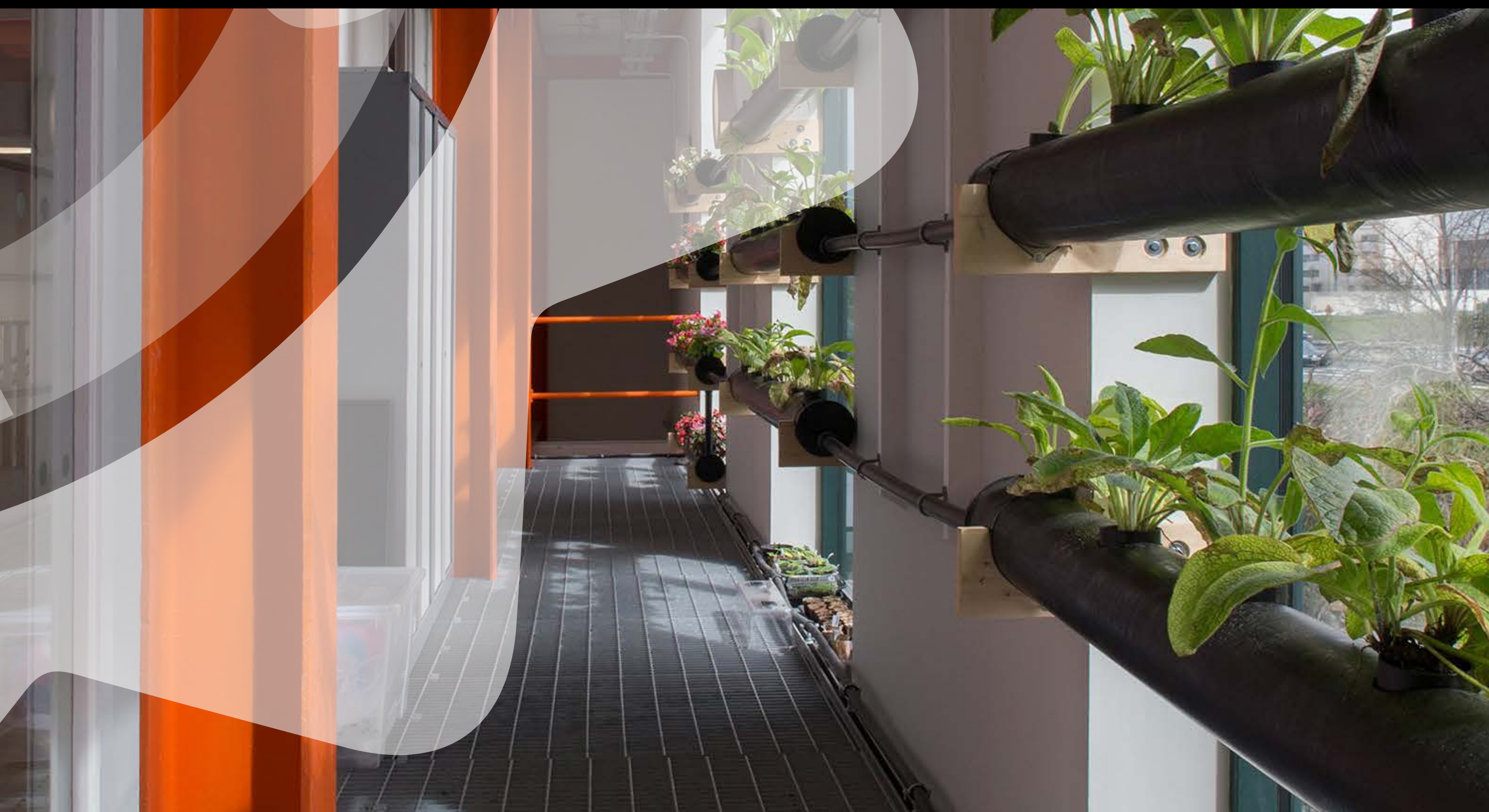

Photo Credit on Cover:
Rediscovery Centre Ballymun
Photo-Paul Tierney

Photo Credit inside Cover:
John Sisk and Co

George's Place Dun Laoghaire:
This scheme of 12 houses certified as Home Performance Index Silver was built for Dún Laoghaire Rathdown County Council. All waste generated on site, as well as all energy and carbon from site operations, were recorded by the contractor John Sisk & son using BRE's SmartWaste tool. The number of products with Environmental Product Declaration (EPD) used on the project was also tracked.

Contents

Definitions and Acronyms

ADPE	*Abiotic Depletion (Elements)*
ADPF	*Abiotic Depletion (Fossil Fuels)*
AP	*Acidification*
BER	*Building Energy Rating*
BIM	*Building Information Modelling*
BREEAM	*Building Research Establishment Environmental Assessment Method*
ECO Platform	*Organisation of European EPD programme operators*
Embodied Carbon	*The carbon emitted during the manufacture of products and construction*
Embodied Impacts	*All the environmental impacts created during the manufacture of products and construction.*
EP	*Eutrophication*
EPA	*Environmental Protection Agency*
EPD	*Environmental Product Declaration*
FSC	*Forest Stewardship Council*
GGBS	*Ground Granulated Blastfurnace Slag*
GWP	*Global Warming Potential*
HCFC	*Hydrochlorofluorocarbon*
IAQ	*Indoor Air Quality*
IEA	*International Energy Agency*
IGBC	*Irish Green Building Council*
JRC	*Joint Research Centre*
LCA	*Life Cycle Assessment*
LEED	*Leadership on Energy and Environmental Design*
NOx	*Nitrogen Oxides*
nZEB	*nearly Zero Energy Buildings*
ODP	*Stratospheric Ozone Depletion Potential*
PEF	*Product Environmental Footprint*
PCR	*Product Category Rule*
PEFC	*Programme for Endorsement of Forest Certification*
POCP	*Photochemical Ozone Creation Potential*
REACH	*Registration, Evaluation, Authorisation and Restriction of Chemicals*
SEAI	*Sustainable Energy Authority of Ireland*
SIN list	*Substitute it Now, list of chemicals developed by Chemsec*
SVOCs	*Semi Volatile Organic Compounds*
TVOCs	*Total Volatile Organic compounds*
VOCs	*Volatile Organic Compounds*

Foreword

This short guide marks the launch of the Irish Green Building Council's EPD Ireland programme and updates the document produced in 2013 - Measuring the sustainability of our construction products and materials. It highlights practical examples where better practices are now happening in Ireland.

On the 1st January 2019, TGD Part L Building regulations - Conservation of Fuel and Energy come into force in Ireland, implementing the requirements of the Energy Performance of Buildings directive for nearly Zero Energy Buildings. This means that the emphasis will finally shift from the energy efficiency and carbon emissions at the operational phase of buildings, to the other life stages.

The European Commission is currently piloting Level(s) a common reporting framework for sustainable buildings, which will bring circular economy indicators such as waste and Life Cycle Assessment into the mainstream over the next two years.

Impacts such as resource efficiency, embodied carbon of the buildings and the potential for construction materials to be reused and recycled will need to be considered and measured.
Construction products form part of a building designed to last up to 100 years. Unlike other products they cannot be considered in isolation. How they impact the longevity of the building, the indoor air quality and human health, as well as the overall carbon foot print of the building must all be considered. Eliminating toxic chemicals from products is now essential if we want to put them into circular closed loops.

The development of the guide was a collaboration with IGBC's members and the Alliance for Sustainable Building Products (ASBP) in the UK. In particular, we would like to thank Simon Corbey of ASBP. Its production was part funded by EPA Green Enterprise as part of developing the EPD Ireland programme. We would like to thank the following contributors who provided content and case studies.

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Environmental Product Declarations – A first step to product transparency

WHAT ARE ENVIRONMENTAL PRODUCT DECLARATIONS (EPD)

Environmental Product Declarations (EPD) are a standardised way of providing data about the environmental impacts of a product through the product life cycle. In Europe, they must conform to the European Standard, EN 15804, which ensures that EPD for construction products use a common methodology, report a common set of environmental indicators and have a common reporting format. This means that EPD can be integrated into building level assessment, and used to compare construction products in a building context. In EN 15804, the impacts of construction products are modelled over four life cycle stages – see figure below:

- The product stage (A1-A3) showing the impacts of manufacture and the supply chain from the “cradle to gate”;
- The construction stage (A4-A5) showing the impacts of transport and construction on site;
- The use stage (B1-B7) showing the impacts of any emissions in use, maintenance, expected repair or replacement and any energy or water consumed in use;
- The end of life stage (C1-C4) showing the impacts of demolition or deconstruction, transport to waste processing and any recovery or disposal processes.

BUILDING ASSESSMENT INFORMATION																
BUILDING LIFE CYCLE INFORMATION																SUPPLEMENTARY INFORMATION BEYOND THE BUILDING LIFE CYCLE
PRODUCT STAGE			CONSTRUCTION ON PROCESS STAGE		USE STAGE							END OF LIFE STAGE				
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational water use	Operstional water use	De-construction demolition	Transport	Waste processing	Disposal	Benefits and loads beyond the system boundary Reuse-recovery-recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D

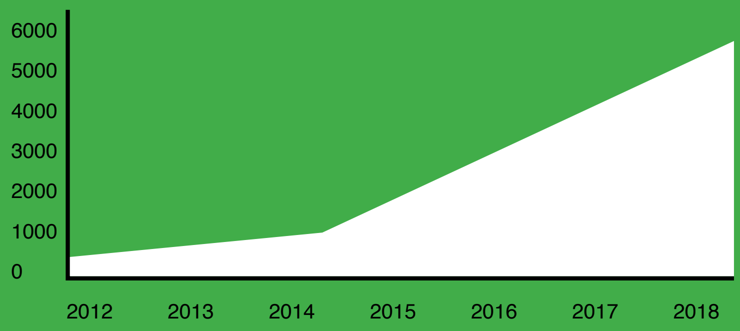
Life cycle stages and modules used in CEN/TC 350 standards such as EN 15804

EPD including all life cycle stages are known as “cradle to grave” EPD. EPD can also show the potential benefits of any reuse, recovery or recycling after end of life in Module D. These modules and stages are standardised across products and building level environmental assessment (using EN 15978, another of the CEN/TC 350 suite of standards for sustainable construction), so that EPD data can be easily used at building level to assess the life cycle impacts.

EN 15804 EPD are all independently verified registered and published within EPD programmes which need to meet the requirements of International Standard ISO 14025. There are EPD programmes using EN 15804 across Europe, America and Australasia.

A product with an EPD is not automatically a product with low environmental impact. The EPD only provides the environmental information about the product. This in turn, allows specifiers to compare its environmental performance to other products at the building level. In obtaining an EPD, the manufacturer receives a Project Report which explains the sources of impacts through the life cycle. This in turn allows manufacturers to consider how they might best reduce them.

Because EPD to EN 15804 have a common methodology, EPD from different programmes can be used outside their country of origin. However, often the data from “gate to grave” may not be representative as typical transport distances or end of life routes may be different in different countries.



Number of verified EN 15804 EPD globally
Source: Jane Anderson – ConstructionLCA

WHAT DO EPD MEASURE?

All EN 15804 EPD report the same environmental impact indicators. These are:

Global Warming Potential (GWP) measures the Carbon Dioxide (CO_2) and all other greenhouse gas emissions associated with the manufacture and use of a product or service, sometimes known as "embodied carbon" or the "carbon footprint".

Further information:

Construction Products Association - Guide to Embodied Impact of Construction Products

Jane Anderson's blog related to EPD, LCA and construction: http://constructionlca.wordpress.com

CEN/TC 350 Sustainable Construction Standards Forum

Eco Platform: http://eco-platform.org/

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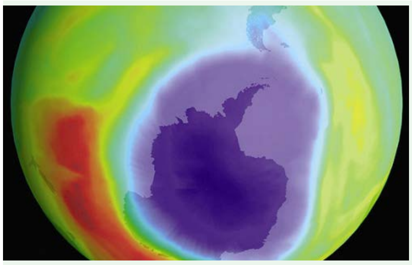
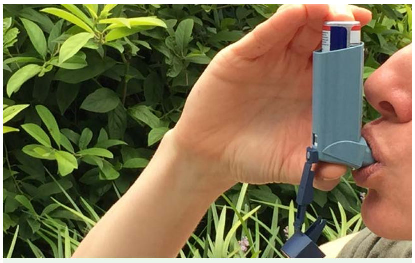
Eutrophication on the Potomac River, Washington, D.C.- Alexandr Trubetskoy
Ozone Layer image - Wikimedia commons
Adult using an asthma inhaler - NIAID, Creative Commons
Gold mining in Otago NZ -Benchhill- Creative Commons
Oil drilling platform – Unknown, Creative Commons

Eutrophication (EP):
Nitrates and phosphates are essential for life, but increased concentrations in water can encourage excessive growth of algae and reduce the oxygen within the water, which can lead to damage of ecosystems, increasing mortality of aquatic fauna and flora. Eutrophication can therefore be classified as the over-enrichment of water courses.



Stratospheric Ozone Depletion Potential (ODP):
Ozone-depleting gases (e.g. CFCs, HCFCs and halons) cause damage to stratospheric ozone or the "ozone layer", reducing its ability to stop ultraviolet (UV) light entering the earth's atmosphere. Growing concern in the 1980s led to world-wide efforts to curb the destruction of the ozone layer, culminating in the Montreal Protocol which banned many of the most potent ozone depleting gases.



Photochemical Ozone Creation Potential (POCP):
In atmospheres containing nitrogen oxides (NOx), a common pollutant, and volatile organic compounds (VOCs), ozone and other air pollutants can be created in the presence of sunlight. Although ozone is vital at high levels of the atmosphere (see ODP), low level ozone is implicated in impacts such as increased incidence of asthma. The most common manifestation of the effects of high levels of POCP-contributing gases is in the smog seen over large cities such as Los Angeles or Beijing.

Acidification (AP):
Acidic gases such as sulphur dioxide (SO2) react with water in the atmosphere to form "acid rain". When this rain falls, often a considerable distance from the original emission, it causes ecosystem damage.

Abiotic depletion indicators aim to capture the decreasing availability of non-renewable resources as a result of their extraction and underlying scarcity. There are two different indicators of abiotic depletion covering firstly scarce chemical elements, and secondly fossil fuels.

Abiotic Depletion (Elements) (ADPE): This impact category indicator is related to extraction of scarce elements (and their ores) and is measured using the Production/(Ultimate Reserve)2 which is compared to the reference case, Antimony (Sb).

Abiotic Depletion (Fossil Fuels)(ADPF): This impact category indicator is related to the use of fossil fuels as fuel or feedstock and is measured using the primary energy of the extracted fuel. In addition, EN 15804 EPD report the amount of primary energy used within the product (as feedstock, for example for plastics and wood) and to manufacture the product (as energy). Primary Energy is also broken down into energy from renewable sources, such as hydro-electricity and biomass, and from non-renewable sources – fossil fuels and nuclear energy. They also provide information on the amount of secondary (recycled) material used and the amount of recovered material, fuel or energy produced at end of life.

PRODUCT ENVIRONMENTAL FOOTPRINT

A Product Environmental Footprint (PEF) is a methodology developed by the European Commission's Joint Research Centre (JRC) which is based on Life Cycle Assessment. Its goal is to provide a common way of measuring and benchmarking environmental performance for companies in the EU. The European Commission completed piloting PEF in 2018 for product categories such as food and beverages, clothing, and some types of construction products. For construction products, the PEF methodology was piloted alongside EN 15804. As a result of the pilots, the EU has mandated CEN/TC350 to amend EN 15804 to align more closely with PEF, to revise EN 15978, and to develop B2C communication standards for product EPD to be the basis of PEF within the construction product sector. It is unlikely that PEF using the new CEN/TC350 standards will be used within the construction sector for some years given the volume of EPD to the existing standards already available and the time for the standards to be developed and published, and for the EPD programmes to incorporate the new standards into their Product Category Rule (PCR).

CASE STUDY

Using EPDs in Specification Clauses

RKD ARCHITECTS

Specifying products with verified Type III EPDs (see table on page 25) is a standard approach to LEED projects in our organisation. EPDs are a verified way of documenting a product's environmental effects, typically from material extraction to manufacturer gate. Materials with validated EPDs are generally from companies who are targeting the sustainable building marketplace. As such, many products have additional preferable environmental aspects such as responsibly sourced raw materials, recyclability and low emissions.

The design team, with the assistance of our inhouse LEED APs, identify a minimum of 20 products at pre-tender stage, utilising our company's product database. A review of potential products with EPDs in conjunction with other project aspects assists the project team in selecting materials with the least environmental impact.

These are listed in our specifications giving contractors early visibility on the proposed materials. They have sole responsibility to specify at least 20 products to achieve the LEED Environmental Product Declaration credit. During procurement and construction, we maintain a close working relationship with the contractor, especially during the submittal process to approve/sign off the products proposed or any alternative products the contractor wishes to propose.

CASE STUDY

Using the EPD Ireland Platform to display existing EPD

GYPROC IRELAND

Gyproc created EPDs in 2014 for all of their key locally manufactured products including Finishing Plasters, 12.5mm Gyproc WallBoard and FireLine. In the absence of a national EPD programme at the time, these were verified and published through international programmes operated by BRE and Environdec.

The development of IGBC's searchable EPD Ireland platform allowed us to easily upload these pre-existing EPDs. Irish specifiers can now find in one place the EPD for products that are available in Ireland to meet the LEED, BREEAM and Home Performance Index criteria. In total Saint-Gobain Ireland have uploaded 15 EPDs representing the Gyproc and ISOVER range of products which is the highest number uploaded by any single producer so far to the EPD Ireland platform. The EPD can be downloaded at www.epdireland.org

EPD IRELAND PROGRAMME

The Irish Green Building Council has established the EPD Ireland programme to allow Irish construction product manufacturers to develop and publish Environmental Product Declarations for their products. This provides specifiers with clear transparent information on the impact of the products which can be used in building level Life Cycle Assessment or embodied carbon calculations.

PROCESS FOR DEVELOPING EPD THROUGH EPD IRELAND

LCA

Manufacturer appoints LCA consultant or in house expertise

Provides all of the data for one year to consultant

Consultant creates a LCA report

Verify

Manufacturer requests verification from EPD Ireland

IGBC appoints independent verifier

Verifier checks LCA report and compliance with EN 15804

Publish

EPD is put into EPD Ireland standard format

EPD published on EPD Ireland and ECO Platform

EPD IRELAND UPLOAD PLATFORM

Manufacturers who have already developed EPD under international EPD programmes can upload these directly to the EPD Ireland platform www.epdireland.org. There are already over 60 EPDs registered on the platform from a range of manufacturers and suppliers such as Saint-Gobain, Dulux, Kingspan, Ecological Building Systems, Ecocem, Smet, Swiss facades, and others.
The platform allows specifiers to search by product type or manufacturer for products that are available in Ireland. It also encourages manufacturers and suppliers to upload information data sheets and certification on VOCs, healthy ingredients, and responsible procurement.

ECO PLATFORM

Eco Platform http://eco-platform.org Membership Organisation which en construction product EPD programmes have the same, high, level of verification and a common interpretation of the EN 15804 standard. Eco Platform has enabled EPD programmes to offer mutual recognition, meaning EPD from one programme can be listed in other programmes. EPD Ireland is recognised as an established programme operator by ECO platform and can carry the ECO Platform EN 15804 verified logo.

First published EPD for Munster Joinery - EPD Ireland. Munster Joinery developed EPD for their Passiv range of windows

CASE STUDY

Developing an EPD

QUINN PRODUCTS

With an increasing number of architects, engineers and specifiers requesting product specific EPD, to meet the criteria in LEED and BREEAM certification, we decided in 2017 to obtain EPDs for four of our building products. At present, there are a limited number of Irish manufacturers that provide EPD, and we saw the opportunity to increase our competitive edge. However, we also value the information in the EPD as it allows us to measure the contribution of the different processes and materials to the overall environmental footprint and gives us a benchmark from which to improve.

The key to producing an EPD is to have clear data on the types and volumes of materials and the energy types and processes that go into making our products. The exercise involves working with a specialist Life Cycle Assessment consultant who collates this data and develops it into product EPD.

On our part, it requires drilling down into details such as source of materials and their chemical constituents, details on energy types (e.g. fuel mix of electricity generated), and allocation (i.e. metering of electricity) across manufacturing processes, details on waste types generated and the end-of-life scenarios for these wastes. In some cases, this requires considerable investigation, but generally we can access the required data from our extensive records.

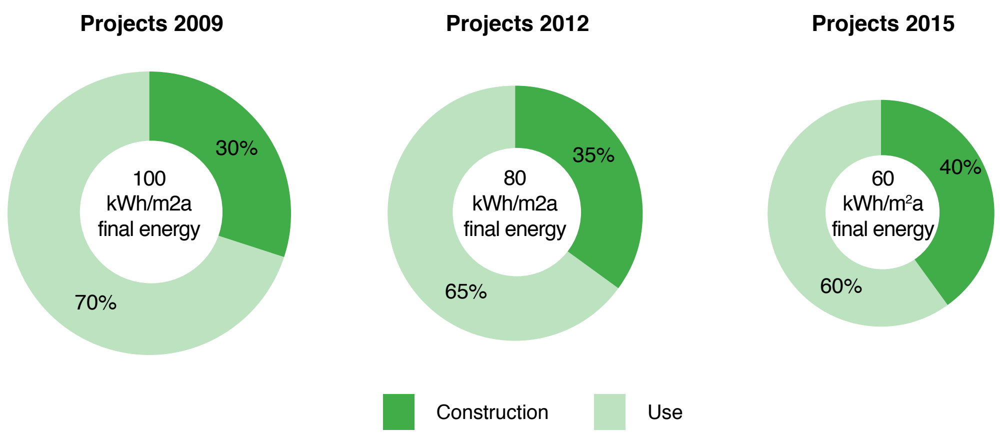
An important aspect of this process is to assign a single employee to interface with the Life Cycle Assessment consultant, giving them full responsibility for the task of providing the requisite data. This also makes it easier for the consultant collecting the data. The process served to bring additional environmental awareness to our own team with the benefit of meeting market demand for quality data on our products.

Why embodied carbon is important?

To date in Ireland we have focused only on the energy and carbon emissions needed to operate buildings, as measured through the BER. However, if we are to reduce overall emissions from new construction we now need to concentrate on all stages of the life cycle. As the operation of the building becomes more efficient with improvement in energy regulations, the construction phase of the building will become even more important.

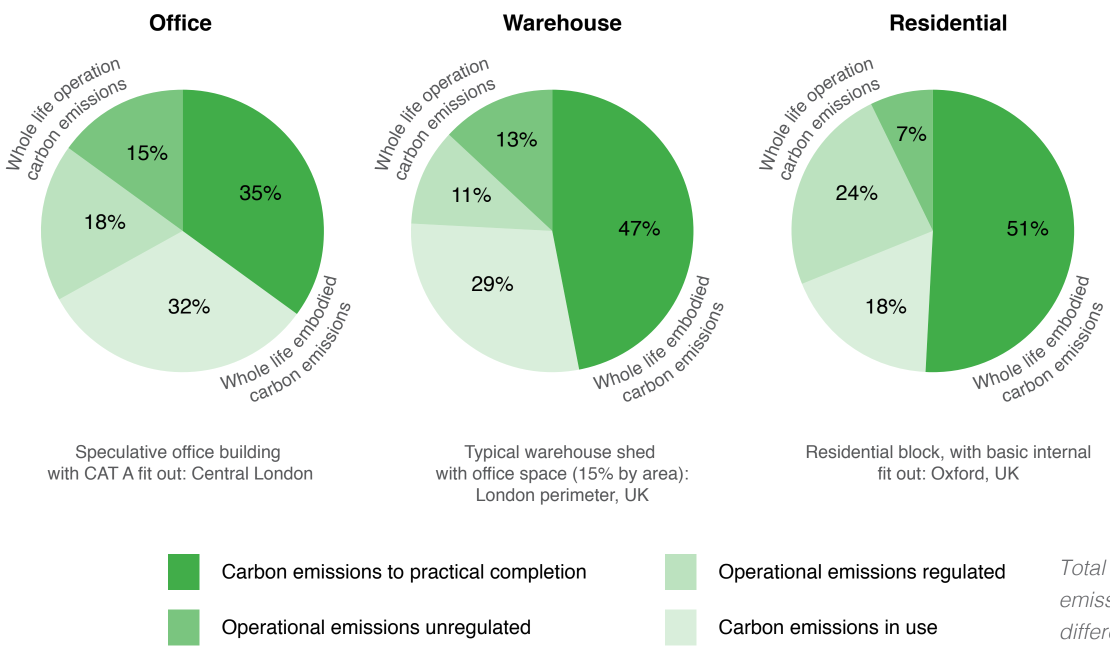
References

[1]Dr Jamie Goggins – Presentation Better Building 2013

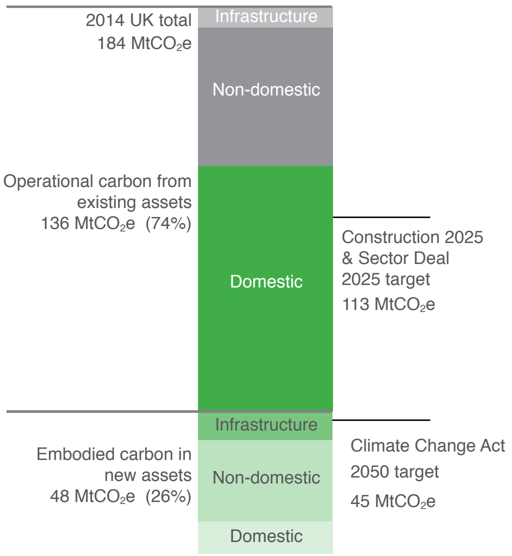


Graph showing the increasing proportion of the construction proportion in comparison with the usage proportion in DGNB projects in Germany - Life Cycle Assessment – A guide on using LCA – DGNB April 2018

The embodied impacts of construction are very significant and growing as an overall proportion for new buildings. A study by Dr Jamie Goggins of NUIG found that embodied carbon accounted for approximately 34% of whole life carbon in a nZEB compliant semi detached house in Ireland. One study by embodied carbon experts Sturgis Associates in the UK, found that for certain residential apartment blocks it could be as high as 51% and as high as 35% for offices.



Total whole life carbon emissions breakdown for different building types (©Sturgis Carbon Profiling, UK)



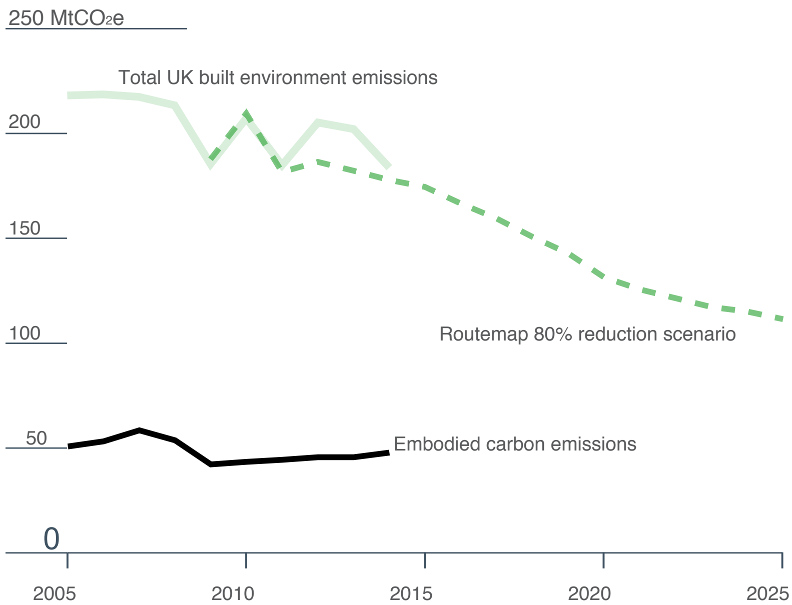
Total carbon emissions from the UK built environment, both in construction and in operation were calculated to be 184Mt CO2e and are broken down as shown.

Source: Giesekam et al. (2018) Aligning carbon targets for construction with (inter)national climate change mitigation commitments. doi:10.1016/j.enbuild.2018.01.023

Further information:

Jannik Giesekam, 2018. Aligning International Carbon targets for construction with (inter) national climate change mitigation commitments.

EPA report for 2017



This graph models the trajectory for reducing carbon emissions from construction in the UK, using data from the UK construction industry. This includes both operational carbon from existing buildings and embodied carbon resulting from new construction. The results show the disparity between current targets and the required trajectories. This disparity is likely to be even greater in Ireland which is on a trajectory for 1% reduction in carbon emissions by 2020 versus the 20% as legally required according to EPA's report for 2017. Jannik Giesekam of University of Leeds is currently modelling the scenarios for Ireland for carbon emissions from operation of buildings and embodied carbon from new construction.

CASE STUDY

Embodied carbon for road and rail infrastructure

TRANSPORT INFRASTRUCTURE IRELAND

Transport Infrastructure Ireland (TII) have developed a country specific calculation tool and associated guidance for assessing embodied and operational carbon for national road and light rail infrastructure projects. The purpose of the tool is to assess carbon associated with infrastructure projects using the best available emission factors and data, while also allowing for it to be flexible enough to be updated with the latest Ireland-specific datasets as they are released.

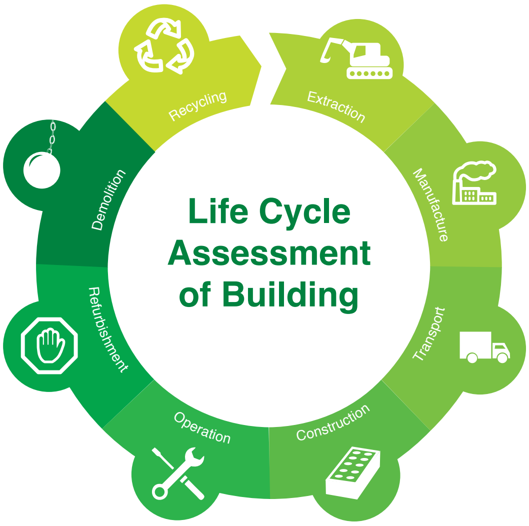
Currently, there are many carbon tools freely available, none of these are built specifically for Ireland, and they often use generic data and work phases that do not align directly with the Environmental Impact Assessment (EIA) requirements for transport infrastructure, or TII's project requirements. By having a tool which follows these requirements and that is flexible enough to capture the data needs at each phase, the process of gathering and collating data can be streamlined throughout the planning cycle. Finally, an Ireland-specific tool, which can be applied consistently across projects, will provide a key role in achieving the wider agenda for Ireland to decarbonise the transport sector by acting as a decision making tool that facilitates and promotes lower carbon infrastructure.

The tool has been built in Excel for ease of use and accessibility. It includes the following characteristics and functionalities:

- Applicable to light rail and road projects: Includes functionality to enable the assessment of both light rail and road projects within one tool;
- Enables lifecycle carbon emission calculation: Enables carbon data to be presented for the different lifecycle stages;
- Aligns with TII project management phases: Useable at the different phases in road and light rail projects, from initial outline design and option selection through to detailed design and final implementation;
- Models multiple scheme designs and a business as usual baseline: Enables modelling of five different scheme designs and a baseline scenario, which reflects business as usual assuming that the scheme is not built;
- Flexibility in inputs and outputs: Allows for different levels of assessment to be carried out aligning with the Phases in TII road and rail scheme projects;
- Captures carbon mitigation measures: Ability to capture where carbon mitigation measures are taken within each design and in later phases capture potential carbon savings attributed to each of the measures;
- Provides exportable outputs: Provides a range of output types and outputs that can be exported for reporting purposes.

The outputs from the tool allow TII and its scheme designers to compare and evaluate the lifecycle carbon impacts of multiple design options for any given road or light rail scheme. It uses a series of Excel calculations, emission factors and assumptions to calculate a carbon footprint for a proposed road or light rail project.

Building level Life Cycle Assessment (LCA)



Buildings have an impact on the environment at every stage of their lifecycle. Materials have to be quarried, mined or harvested, transported to factories and manufactured. The final products have to be transported to site, lifted into place and fixed in position. The buildings have to be operated, heated and cooled. Over a 60 year life cycle, components fail, roof finishes fail and need replacement, finishes spoil and need repainting and replacement. Eventually the building ceases to provide its function and needs to be deconstructed and all its components disposed by landfill, incineration, recycling or direct reuse.
LCA enables architects and engineers to optimise the design so that environmental impacts are not shifted from one stage into another.

EN 15978 – STANDARD FOR CALCULATING BUILDING LEVEL LCA

The European standard EN 15978 sets out the methodology for calculating the LCA at the building level covering each stage of the life cycle. These stages mirror the stages set out for the construction product life cycle assessment standard EN 15804 + A1 as discussed in the first section of the report.

HOW IS A BUILDING LEVEL LCA DEVELOPED?

To calculate the construction phase modules A1 – A3 of EN 15978, also known as the embodied impacts, the LCA practitioner needs to start with the Bill of Quantities (BOQ). This should be prepared in a way that exact quantities for each material or product can be determined. The practitioner then matches the best available environmental data to the quantities of each product and material. This then creates a total environmental impact for the construction of the building.
The construction phase modules A4 – A5 are calculated based on the distances the products are transported to site and from recording all on site energy use or if this is not available by using defaults. Some Irish contractors such as John Sisk & Son already record all on site energy use during construction which can be used to create a more accurate figure for the A5 module.

For the use phase the outcomes from the energy simulation models is used. A period of 60 years is normally assumed as the life cycle of the building though this can vary. If elements need to be replaced such as roof coverings these should be accounted for over the life span of the building. End of life can be calculated based on data if available within the EPD or for waste streams from the building.

SOFTWARE FOR CALCULATING LCA?

Further information:
[Life Cycle Assessment – A guide on using the LCA – DGNB April 2018]

[Embodied and whole life carbon assessment for architects 2018 – RIBA]

[Embodied Carbon - Developing a client brief - UKGBC 2018]

[Whole life carbon assessment for the built environment, RICS, 2017]

[Life Cycle Assessment of Buildings – A Future-proofed Solution in the Digitalised World of Tomorrow – Eurima – September 2017]

[Environmental Performance Regulation in the Netherlands]

[One Click LCA]

There are a number of tools that can be used to carry out Building Level LCA internationally. Some were developed specifically for national use such as eLCA by the German Federal Government or Elodie the French tool which is connected directly to the national EPD database. There are also a number of international tools.

One Click LCA is a commercial tool that allows users to automate their calculations with plugins for Revit, IESVE and other tools. It also allows manual input in the cloud platform. One Click LCA integrates all of the European EPD databases. These include EPD Ireland and generic databases such as Impact and Ökobaudat, hence allowing specifiers to search for the best available data. If a BIM model has been developed it is possible to take quantities directly from the model allowing iteration and optimisation of the design at early design stages.

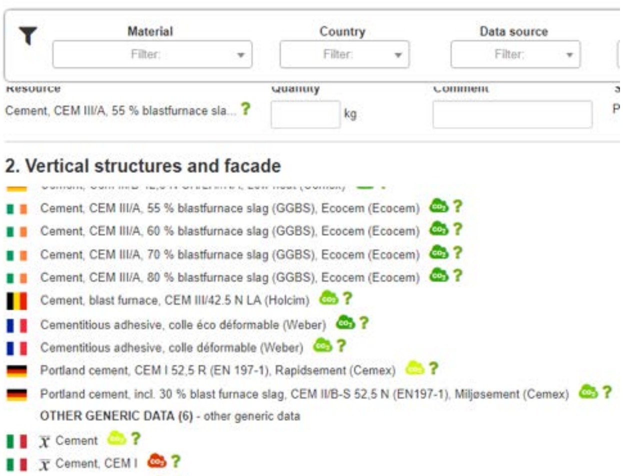
DATA USED FOR BUILDING LCA

LCA at the building level depends on good quality data for construction products. Product specific EPD carried out to EN 15804 provide the most reliable data. If not available for a particular product, generic data may need to be used. In Germany where Life Cycle Assessment has been used for many years, the Ökobaudat database contains information from both EPD and generic data. As there is no dataset specifically for Ireland, LCA practitioners use a combination of EPD and best available European data. These databases are incorporated into a number of different LCA software tools. In all cases it is best practice to state the source of the data.

In Holland where Building level LCA is mandatory for building permits for offices and dwellings an uncertainty factor is added to generic data to allow for the fact that data may be better or worse that the actual product used and to encourage manufacturers to provide EPD.

The EPD Ireland programme will improve the data available in Ireland as more manufacturers develop EPD. However, there may still be a need for Irish generic data to fill the gaps and create one complete comparable set of data covering all common materials. SEAI developed a Carbon database for construction products in 2012. Yet, this was never published and would now need to be updated to comply with the subsequently developed standards EN15804 and EN15978 to be of use.

One Click LCA tool allows you to search for products with lowest Global Warming Potential based on EPD data



CASE STUDY

Building level LCA - Integration with BIM

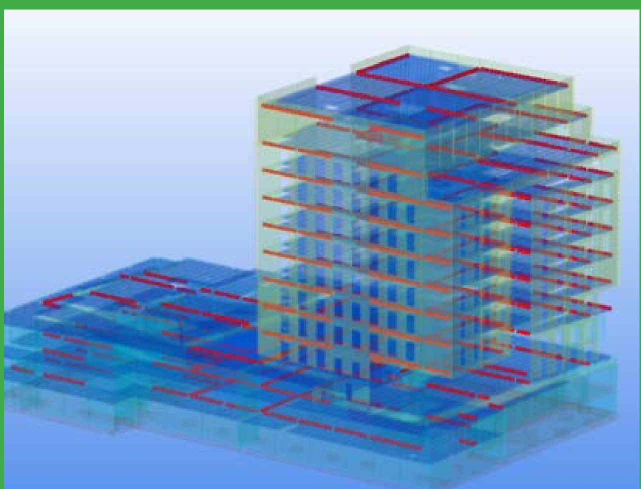
RKD ARCHITECTS

RKD architects has conducted inhouse testing of the One Click LCA software. This can be utilised in conjunction with Revit software. A successful LCA model can be created early in the design phase and requires constructing the Revit model to enable sufficient building material information to be exported into the LCA software.

Success is dependent on the early contributions of the entire design team, ideally at feasibility stage, where potential structural options and materials, including systems, typical spans and member sizes are evaluated. The LCA model should be created in tandem with initial order of magnitude cost exercises to fully understand the buildings potential initial cost and ongoing life cycle costs.

Our methodology involves creating a baseline model, from which various design iterations of alternative schemes are created, until an acceptable, optimised design is achieved. The alternatives can focus on a range of themes such as optimising structural systems, material substitutions, expected material service life and transportation distance from manufacturer to site. Material replacement focuses on alternative low impact materials such as cement substitutes to replace Portland cement, alternative cladding treatments such as stone versus aluminium cladding panels, alternative insulations.

The expected service life of materials to increase replacement interval is also considered such as bitumen asphalt versus EPDM membranes.
To minimise transport distances, local manufacturers are specified where possible noting that being an island nation means the majority of materials are sourced from mainland Europe and UK. Our work flow procedures are being rolled out on future LEED and BREEAM projects where the Building Life Cycle Impact Reduction credit is targeted.



Heat mapping carbon intensity using One Click LCA and BIM model- Image provided by Bionova.

Health impacts of construction products

EPD AND EMISSIONS FROM PRODUCTS IN USE

EN 15804 has a requirement for EPD to provide additional information on emissions to indoor air, soil and water during the use stage, describing release of dangerous substances into indoor air, soil and water which are not covered by Life Cycle Impact Assessment (LCIA). CEN Technical Committee 351 (TC351) is responsible, under a mandate from the European Commission (M366) for developing the horizontal standards (covering all construction products) which individual product TCs then use to develop standards for individual product groups. TC351 has now developed some of these horizontal standards including:

EN 16516:2017 Construction products:
Assessment of release of dangerous substances
Determination of emissions into indoor air and
CEN/TR 17113:2017 Construction products:
Assessment of release of dangerous substances
Radiation from construction products - Dose assessment of emitted gamma radiation.

However, there are still a number of horizontal standards covering the approaches and test methods to be developed. Work should now progress within individual Product TCs to amend their Product Standards to incorporate the relevant testing procedures and approaches to meet the published TC351 Horizontal standards for their individual product group – it is expected to take between a year to 18 months for this to happen.

Once a Product Standard is published including the test methods, then if an EPD is produced for that type of product, it becomes a requirement within EN 15804 to report the test results using the relevant product standard within the EPD. The EPD does not need to give this information if the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available.

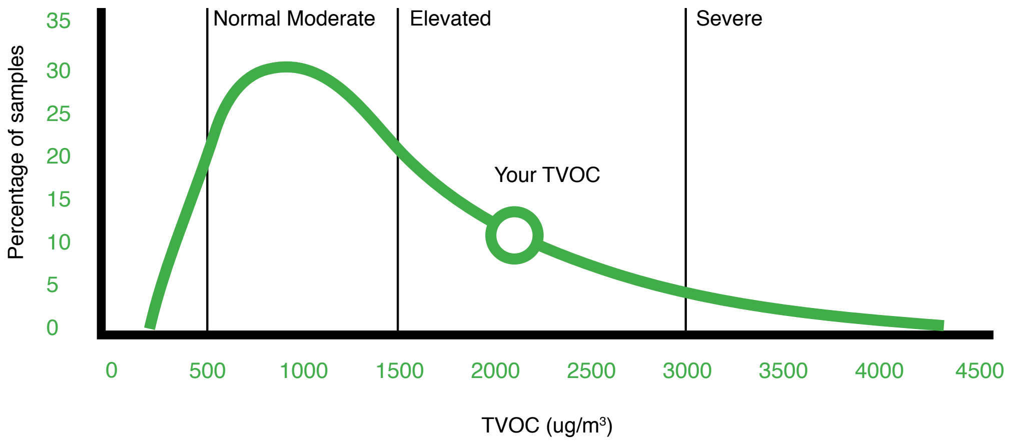
POLLUTION AND INDOOR AIR QUALITY

In a global study published in the Lancet in October 2017, twenty-seven scientists studied the effects of pollution on human health. They concluded that by far the most significant impact to human health is air pollution, with household air on the top of this list[1]. This seems reasonable as the average person spends just 8% of their time outside, with 92% of our time indoors[2].

Mawditt (2017)[3] reported findings indicating that 53% of our total exposure over a 70 year period comes from our homes and another 13% from work and public places. In total just 14% of our pollution exposure is from food and drink that we have ingested (and thus have some control over), the remaining 86% is via our lungs. These chemicals can then enter the blood stream and circulate around the body to different organs. However, indoor air is very complex. We don't know the exposure on people and so we have no idea of the health risks as we currently lack this measured information. WGBC[4] report that better indoor air quality (low concentrations of CO_2 and pollutants and high ventilation rates) can lead to productivity improvements of 8-11%.

WHAT ARE VOCS?

VOCs are organic chemicals that have a high vapour pressure at ordinary room temperature. They are numerous, varied, and ubiquitous. Research demonstrates that once VOCs are introduced into the internal environment, products can continue to off-gas for up to two years[5]. The pollution load can be reduced by careful selection of low VOC emission products, a process known as source control.
VOCs high vapour pressure results from a low boiling point, which causes large numbers of molecules to evaporate or sublimate from the liquid or solid form of the compound and enter the surrounding air, a trait known as volatility. Less volatile chemicals are classified as Semi Volatile Organic Compounds (SVOCs) and defined by a boiling point range of 240-260°C to 380-400°C. These are commonly reported together and described together as a total - TVOCs. The cocktail effect of chemicals harmful to health and mixing with N02, NOx, PM 2.5, 5, 10, moulds, pollen, and biological contaminants, is a particular challenge.



Graph:
Analysis of over 8000 samples of IAQ over 4 years from Waverton Analycs

VOCs occur in wood products - solid wood, binders and resins, in engineered products – e.g. OSB, MDF, Ply, flooring products, coatings – e.g. paints, finishes, sealants, waxes, adhesives, mastics, roofing materials, furniture and insulation. The cumulative effect of emissions from all these different sources needs to be taken into account when considering indoor air quality.

MEASURING VOCS

Monitoring of indoor air quality is now quite simple and cost effective at a basic level. A spot test for a home owner will cost about €150 and installed or portable on-going sensoring is now widely available[6].

These sensors can link as part of a building Information management system to the ventilation system, to boost ventilation as required and can display on smart phones. It won't be long until we all have an app on our phone that alerts us.

Guidance in UK Building Regulations; Part AD(F) - Ventilation relating to safe levels of TVOCs post construction, pre-occupation is 300 μg/m3, measured over 8 hours. The Well Building Standard stipulates 500 μg/m3, which must be proven by indoor air quality monitoring. Results from 8,000 IAQ studies by Waverton Analytics show that the average home is 1,000 μg/m3, the mean is 1,900 μg/m3 and it is deemed critical at 3,000 μg/m3.

References:

[1]Global estimated deaths (millions) by pollution risk factor, 2005-15 Using data from the GBD study (2015) and WHO data (2012). The Lancet Commission on pollution and health. LandriganPJ et al. Published Online October 19, 2017; http://dx.doi.org/10.1016/S0140-6736(17)32345-0

[2]Turner, B. (2017). Better Homes, Better Air, Better Health, UKCIP University of Oxford p.7

[3]Mawditt I. (2017) Human Health: Ventilation and materials for traditional buildings. Presentation at STBA/SPAB Conference Sustainability of Traditional Buildings. June 2017. London.

[4]WorldGBC (2014). Health, Wellbeing and Productivity in Offices [online] Available at: http://www.worldgbc.org/news-media/health-wellbeing-and-productivity-offices-next-chapter-green-building [Accessed: 06th June 2017]

[5]Chuck, Y. and Crump, D. (2002). VOC emissions from building products, BRE Digest 464 part 2, p1.

[6]See Waverton Analytics and PPM technology http://www.ppm-technology.com/ for examples

CASE STUDY

Eliminating VOCs for Well Certification

CUNDALL

The first WELL Building certified in the UK was Cundall's One Carter Lane in 2016.

WELL was developed by integrating scientific and medical research and literature on environmental health, behavioural factors, health outcomes and demographic risk factors that affect health with leading practices in building design and management. WELL Building demands that the VOC rating of all materials must be between negligible and zero, to ensure that office fixtures, fittings and fabric do not expel harmful chemical or organic emissions. This proved to be one of the most challenging elements of our project. It immediately reduces your range of options in terms of what materials you can choose from. Even discovering the VOC content was a challenge because most manufacturers don't commonly list it. However, even though finding one that did, often came at a cost premium, it was also usually a sign that not only would the VOC content be low, but the manufacturer was enlightened enough to share the same kind of sustainability commitment that we were looking for. It is apparent that business is refocusing sustainability through the lens of health; health for both people and planet. What is key with WELL is that you have to undertake and pass indoor air quality monitoring to get certification.

Photo credit:
One Carter Lane Cundall

Photo Credit:
Google

CASE STUDY

Excluding toxic materials from the work place

GOOGLE

Google Dublin is a leader for Google European offices with five LEED certified buildings. Since the average Googler spends up to 90% of their time indoors, creating quality, healthy indoor environments is critical to what we do...you could say it's the "air we breathe". Good science and our experiences tell us that people are healthier, happier and more productive in interior environments with natural light, fresh air and views to the outdoors.

When we think about everything that contributes to the indoor environment, building materials certainly have a significant impact. By using healthier building products free of harmful chemicals, we can actually improve human and environmental health and provide transparency to an industry that historically hasn't had much.

We have been making great strides towards conducting the research needed to better understand human and environmental impacts of building materials so we can make better decisions backed by best-in-class science. The goal of the Google Healthy Materials Program extends beyond our four walls - we aren't doing this in a vacuum. We want all consumers to be able to see what's in the building products they're purchasing to make healthier choices: from the chair they're sitting in, to the paint they purchased for a living room - just like the nutrition labels on the food we buy at our neighborhood grocery store. The Dublin campus was one of the first global Google offices and the first in the EU to implement Google's Healthy Materials Program in 2012. Since then, Dublin projects (and other Google offices around the world) have committed to the Healthy Materials Program, implementing the criteria and educating architects, general contractors, subcontractors and manufacturers and their supply chain on the benefits of sourcing and using healthy building products.

In addition, Google joined the Ellen MacArthur Foundation as a global partner in 2015 with the mission of accelerating the transition to a circular economy. One of the focus areas that has come out of our partnership with EMF is developing a Circular Economy vision for Google's built environment and extensive real estate development, given our scale and impact. Our work on material health is critical to unlocking the circular economy. Products and their ingredients need to be designed to be safe for people and the environment and manufactured to upcycle instead of downcycle - keeping products at their highest utility and value at all times.

ELIMINATING TOXIC INGREDIENTS - REACH

REACH stands for Registration, Evaluation, Authorisation and Restriction of Chemicals. It is an EU regulation which entered into force on 1 June 2007.

REACH requires that producers submit a base set of data for all chemicals produced above 1 tonne per year. This includes carrying out tests to determine if the substance is hazardous. The information is then used to decide whether further measures are necessary. If the required data for a chemical is not presented, the substance will not be allowed in the EU, in line with the "no data – no market" principle. REACH places the burden of proof on companies. To comply with the regulation, companies must identify and manage the risks linked to the substances they manufacture and market in the EU.

Under the EU's chemicals legal framework REACH, the most hazardous chemicals are only allowed for use with a permit – a so-called authorisation. Authorisation should only happen when there are no safer alternatives and when the benefits of continued use outweigh the risks – or when the risks can be managed properly.

The final round of REACH applications closed on 31 May 2018. All companies making or importing chemicals into the European Union now have to register each substance and assess its impact on public health and the environment. A key aim of REACH is to encourage the substitution of hazardous chemicals with safer alternatives. The existence of the REACH Candidate list and the authorisation process sends a strong message to businesses that they should review the chemicals used in their products and start replacing hazardous substances with safer alternatives. REACH has 173 substances of very high concern on candidate list for authorization. Working towards a toxic free future Chemsec have developed the SIN List – Substitute It Now, with 912 chemicals listed - www.chemsec.org. They suggest that all these chemicals will eventually be banned under REACH.

Tools for the Specifier - Ecolabels

The ecolabel index indicates there are 120 ecolabels relating to construction products. The Eurofins website makes some useful comparisons.

The International Standards Organisation (ISO) sets out in its ISO 14000 series of environmental standards three types of labelling. EPD are a type 3 label and have been described earlier. Where the manufacturer believes that their product is environmentally preferable and meets specific criteria within Type 1 labels they can have these verified. Type 2 labels have less value as are self declared by manufacturer.

Type 1 **Ecolabel**	**Type 2** **Self Declaration**	**Type 3** **Environmental Product Declaration**
Third party label Compliant with ISO 14024: 2001 Based on life cycle considerations Set criteria for environmental performance which the product must meet Indicate the overall environmental preferability of a product	Self-declared environmental claims No independent third-party certification or verification But claims must be verifiable Declared by manufacturers, importers, distributors, retailers or anyone else likely to benefit from such a claim Compliant with ISO 14021: 2001	Declaration providing quantified environmental data Uses predetermined parameters and, where relevant, additional environmental information The calculation of predetermined parameters using Life Cycle Assessment compliant with the ISO 14040 series of standards Verified by an independent third party verifier expert in LCA and construction products Compliant with ISO 14025:2006 For Construction products: ISO 21930: 2007
natureplus®		EPD IRELAND THE ENVIRONMENTAL PRODUCT DECLARATION PROGRAMME

THREE TYPE 1 LABELS USED IN CONSTRUCTION

References:
[7] https://www.eurofins.com/consumer-product-testing/information/ecolabels-quality-labels/

EU Flower: Established in 1992, the EU Ecolabel is a third party certified Type I ISO 14024 label aimed to promote products and services which have a reduced environmental impact thus helping European consumers distinguish more environmentally friendly products. The ecological criteria for the award of the EU Ecolabel for indoor and outdoor paints and varnishes can be viewed here[7]. Home Performance Index uses the Ecolabel criteria to minimise VOCs in dwellings.

Natureplus: The label takes an evidenced based and holistic approach and considers product performance and sustainability, as well as impacts on human health in production and use. Exacting VOC emission limits are set down in a product standard by the natureplus criteria commission and only products that meet this level can be certified. The natureplus product database with 600 entries can be found in the procurement tool Baubook (www.baubook.info). Baubook also provides health related procurement clauses for tender documents and links to products that meet these requirements.

Cradle to Cradle: The Cradle to Cradle Products Innovation Institute, a non-profit organization, administers the Cradle to Cradle Certified™ Product Standard, which was gifted to the Institute by its Founders, William McDonough and Dr. Michael Braungart, in 2010. The label covers material health, material reutilisation, renewable energy, water stewardship and social fairness. Michael Braungart spoke at the IGBC's Re-Source Conference on 21st June 2018.

RESPONSIBLE PROCUREMENT

Responsible procurement aims at integrating social, environmental, and ethical policy concerns into purchasing decisions. Organisations practicing sustainable procurement meet their needs for goods, services, utilities and works not on a private cost-benefit analysis, but with a view to maximizing net benefits for themselves and the wider world. The UK's social value act aims at ensuring that the social benefit is considered when awarding public contracts. At European level the commission is working on a strategy for corporate social responsibility.

Building level certification schemes encourage the use of Environmental management systems used in the manufacturing process and procurement of materials such as ISO 14001, EMAS and BES6001, and set criteria for sustainable procurement of timber by encouraging use of chain of custody certification such as FSC (Forest Stewardship Council) and PEFC (the Programme for Endorsement of Forest Certification). In the past five years it has become easier for Irish practitioners to specify and receive chain of custody certification from suppliers of timber products including windows, and timber panels as demand has increased driven by certification schemes.

CASE STUDY

Zero Waste to Landfill

TRINITY COLLEGE-HEGARTY DEMOLITION

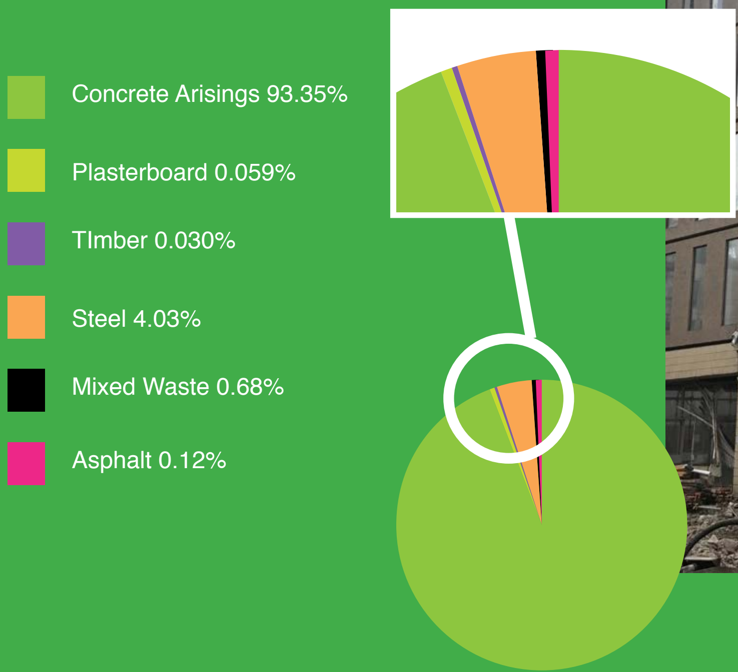
Oisín House was a five-storey 1970’s office block in Dublin City centre. It was set to be demolished as part of Trinity College’s development plan. The building consisted of reinforced concrete floors with lift/stair cores onto load bearing pre-cast panels on all elevations.

For the project the aim was to achieve zero waste to landfill. To do this and to meet Dublin City Council’s planning conditions, a waste management plan specific to the site was developed. This identified eight main waste streams: reinforced concrete,blockwork, timber,steel, plasterboard, ceiling tiles, carpets and glass. This identified eight main waste streams: reinforced concrete, blockwork, timber, steel, plasterboard, ceiling tiles, carpets and glass.

Concrete made up over 90% of the waste on the site. To ensure the concrete arisings were suitable for re-use it was essential to remove non-structural elements of the building through a soft strip demolition phase. The structure was stripped back to shell and core, removing for example, ceiling tiles, carpets, doors, frames, plasterboard, partitions and miscellaneous fixtures and fittings. The materials were separated into appropriate waste bins for recycling purposes.

Once this stage was completed the mechanical demolition could start. All concrete arising was processed on site using pulverizes. Rebar was separated using a magnet and sent for recycling. The concrete could then be crushed and processed further to remove any remaining rebar. All the crushed material was suitable for re-use on site and this was used to provide piling platforms and make up levels for follow on works.

Arising Breakdown



Minimising Waste from site and demolition

The hierarchy for waste management is: Reduce, Reuse, Recycle. Leaner production can reduce the amount of raw materials used. Good architectural and structural design including use of standard sizes can reduce the amount of material needed and resulting waste in construction. Planning for disassembly at end of building life, allows reuse or recycling. The use of site waste management plan encourages the contractors and designers to consider all of these issues from the earliest stages of a building project so long as they are not just paper exercises to comply with a planning conditions as is often the case in Ireland. That is why actual waste monitoring during construction is essential.

Article 28 of the European Communities (Waste Directive) Regulations 2011 sets out how if a waste can be turned into something useful, has no deleterious effects on the environment or on human health and other specific conditions are met, it is given the 'End-of-Waste' certification. Once end-of-waste status has been achieved, waste legislation no longer applies to the material and it can be reused.

The implementation of the directive in Ireland is causing difficulties as once removed from a site and categorised as a waste, materials must receive "end-of-waste" certification to be reusable. The EPA is the relevant decision-making authority for end-of-waste in Ireland.

Pending a decision on end-of-waste status from EPD, high quality crushed concrete from demolition which could be used as replacement for virgin aggregate is often either stockpiled in Irish quarries or sent to landfill.

Further information:

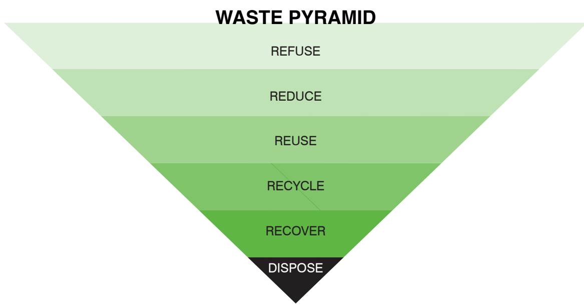
EU Commission CSR strategy

Social Value Act UK

European Communities (Waste Directive) Regulations 2011

EU Construction and Demolition Waste Protocol

Review of Waste/Resource Exchange Systems and Good Practice Guide



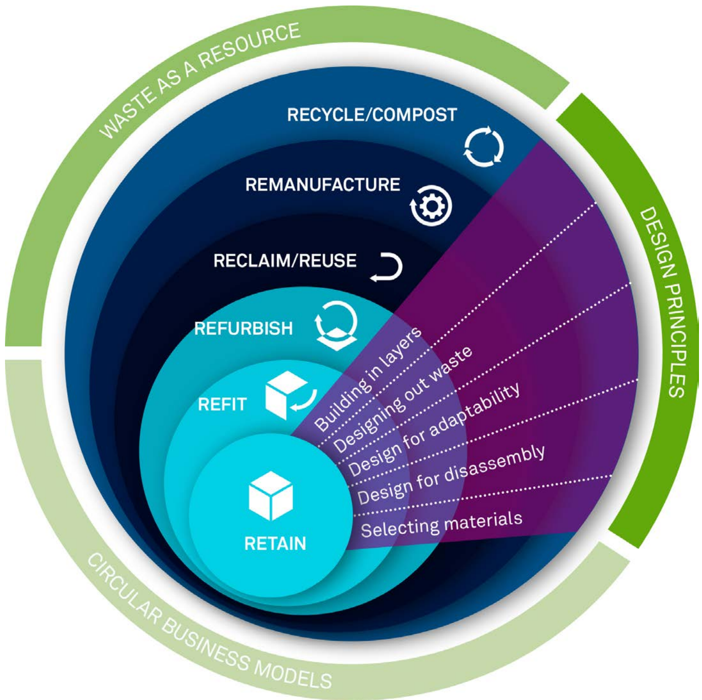
Designing for the circular economy

KATHERINE ADAMS - ASSOCIATE, ASBP; PHD RESEARCHER, LOUGHBOROUGH UNIVERSITY

The term 'circular economy' is becoming increasingly commonplace and in its simplest form it describes how products and materials can continue to be used again once they have reached the end of their 'first' life; as such they are no longer viewed as a waste but as a resource. Materials therefore move in loops within the activities of reuse, remanufacture and recycling - see figure below. The circular economy is the opposite of the 'take-make-dispose' linear economy model. A key principle is that materials should be utilised at the highest value possible, avoiding down-cycling (this is when materials lose their value, for example, crushing and recycling a brick into a fill material). However, currently, much of the waste the construction sector produces is down-cycled. Achieving more value from products, can also be achieved through increasing a product's longevity and ensuring it performs in-use, so it is not replaced earlier than required. This is also highly applicable for buildings which can be adapted and refurbished and therefore continue to be used rather than demolished.

To enable products and buildings to become more circular, it is important to consider how they are designed. Important considerations for products include designing for disassembly, the potential for standardisation and modularity, the use of secondary materials, avoiding the use of hazardous materials and composite materials which may hinder reuse and recycling opportunities. The actual approach will depend on the type of product, for example a high-value, shorter lived product such as M&E equipment may be more suitable for reuse, than a lower-value, longer-lived product such as concrete. A number of manufacturers are investigating how they can be responsible for their products at the end of their life, through for example, leasing and service performance contracts. These models are available for lighting, carpets and M&E equipment. Architects have a key role in specifying; for example, requiring products that are either reclaimed or have recycled content within and products that can be reused and/or recycled at the end of life.

For buildings, the way the products are assembled and connected together is important. Using mechanical fixings rather than bonding is preferable, as is making sure that shorter lived products are accessible and are not enclosed by longer lived ones. Designing for flexibility and adaptability (both in function and form) to enable components and buildings to be used for longer, which avoids the need for new resources is another strategy. Underpinning the move to a circular economy is the need for more data, such as the material composition of products, the residual value, test results and warranties and in-use data where relevant, which may reduce any potential risk from reuse. This data is starting to be collected through the development of material passports. At the building level, BIM is a means to also collect this product data as well as information on disassembly. There is no legislation or standard yet for circular economy in buildings, however there is a generic standard available for circular economy and also for material efficiency within buildings (see further information). Nevertheless, cities such as London and Amsterdam and Governments including the EU are increasing exploring and developing policy within this area.



Further information:

EU Horizon 2020 Funded project 'Building As Material Banks'

Green Construction Board Top Tips and Knowledge Resource

Ellen MacArthur Foundation – case studies in the built environment

The Role of safe chemistry and healthy materials in unlocking the circular economy – Google and Ellen McArthur foundation joint white paper.

Arup – circular business models

Building Revolutions: Applying the Circular Economy to the Built Environment by David Cheshire

BS8895 Series – Designing for material efficiency in buildings

BS 8001:2017 - Framework for implementing the principles of the circular economy in organizations

Diagram:

Circular economy strategies (Source: David Cheshire, AECOM UK)

CASE STUDY

Irish Manufacturers and the Circular Economy

GYPROC – TAKING BACK GYPSUM SITE OFFCUTS FOR RECYCLING

Gyproc offer a plasterboard off-cut recycling service. The company have developed a cost-effective process to recover and recycle plasterboard off-cuts back into their Irish based manufacturing process at their Kingscourt facility. The recycling process has been designed to help reduce the time their customers need to spend handling plasterboard waste.

Gyproc are certified to ISO 14001 and now recycle over 97% of the waste produced from their manufacturing process. To match this internal commitment, 100% of the gypsum waste recovered from building sites is used in the manufacture of new plasterboard. Building owners and designers can earn points under the LEED and BREEAM certification schemes by using the Gyproc recycling service.

ECOCEM – TURNING A WASTE PRODUCT INTO A LOW CARBON CEMENT

Established in 2003 in Dublin, Ecocem Ireland Ltd is a producer of low carbon cement. They produce GGBS (Ground Granulated Blastfurnace Slag) a by-product from the manufacture of Iron. On leaving the iron process, molten blastfurnace slag is rapidly cooled with water and forms Granulated Blastfurnace Slag (GBS). The GBS is then transported to Ecocem's milling plant in Dublin and turned into Ecocem GGBS through a drying and grinding process.

Ecocem developed an Environmental Product Declaration (EPD) for their product and undertook a full life cycle analysis, to verify the low environmental impact associated with its product.

ECOCEL - TURNING WASTE PAPER INTO INSULATION

Ecocel is a cellulose fibre insulation product for use in homes manufactured from recycled newspapers. It is produced in Cork where paper is turned into a non-flammable natural fibre by the addition of salts, providing a lower embodied carbon insulation. As discarded newspapers are turned into insulation and put to use as a long-term application, it allows storage of CO2.

Ecocel is suitable for the insulation of timber framed homes, attics and lofts and can be used to retrofit homes. The components are free from HCFCs, VOCs and other toxic substances.

CASE STUDY

The Rediscovery centre

DARRAGH LYNCH ARCHITECTS

The Rediscovery Centre has several workshops engaged in the circular economy making bikes, furniture, paint and fashion from waste and upcycled materials. When it came to develop our new centre in Ballymun we were keen to use as much waste and sustainable material as possible.

Reusing the existing structure was easy and had a huge benefit in reducing waste and cost. The new walls were made of timber and hempcrete which were cost effective, sustainable, breathable and had a good thermal performance. They can also be dismantled and reused. The walls were clad with reused brick, which has a long-established market; timber, which is sustainable; and reused aluminium fins which were salvaged from the original building. These materials can also be reused in the future. We tried to reuse the existing roof, but it was too badly damaged, and we had to install a new roof.

We were also able to incorporate salvaged windows and reclaimed sheep's wool insulation, but certification of these elements for reuse was difficult. Procurement, storage and funding issues affected our ability to collect and reuse other useful materials.

The key quality to maintain in a material is value. Most building materials are reduced to their lowest scrap value during demolition and many even become a liability. Careful consideration of how materials are sourced and fixed allows these materials to be reused when they are no longer required and to retain the highest possible value. Retaining the data sheets of the materials also makes it easier to certify their future use.

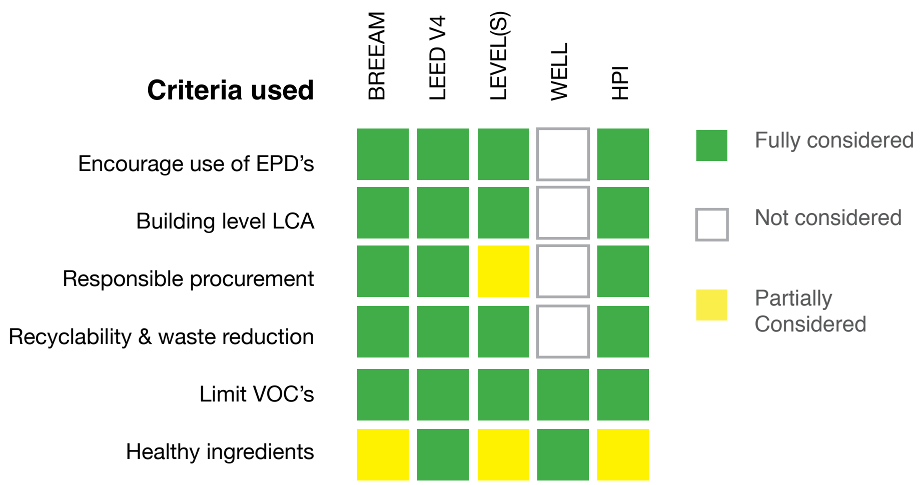
Buildings are long term investments in social infrastructure. By engaging with the circular economy, we can ensure that investment can retain its value, provide employment, reduce waste and provide a more sustainable material resource.

How products are assessed in building certification tools

Building Certification tools such as LEED, Well, BREEAM and Home Performance Index act as the main drivers for construction professionals in Ireland to assess the sustainability or health impacts of materials.

There are 36 LEED projects certified in Ireland, 213 registered for certification, and over 100 Irish LEED credentialled professionals. This is closely followed by BREEAM with 27 certified projects. The Well Building standard is a more recent but fast-growing certification system which focuses on the health impacts of buildings on their occupants. The Home Performance Index is IGBC's own certification system for new homes launched in 2016 with already more than 12 housing developments certified or registered for certification.

The European Commission has now launched and is piloting over the next two years a common European reporting scheme for sustainable construction called Level(s). This is intended to drive circular economy thinking in the construction sector and is for integration into the existing national and international certification schemes, Green Public Procurement and potentially regulations.



CASE STUDY

The ABCs of LEED + WELL

MEEHAN GREEN

As we transition from LEED v3 to v4, the playing field has changed when it comes to sourcing materials that support LEED credits. There has been a shift from tracking single attributes of materials, such as recycled content, to a more holistic, multi-attribute approach. Clients have also quickly embraced WELL certification alongside LEED targets. The WELL Building Standard™ (WELL), launched in 2015, focuses exclusively on the health and wellness of the people in buildings.

From a materials selection standpoint, the focus is on the impact of material choices on the physical and mental health of building occupants. There is substantial overlap with LEED in certain impact areas, especially as related to selecting low-emitting materials and avoiding toxic material ingredients. Here is a quick-reference to the ABCs of selecting materials to support your LEED + WELL goals:

BDPO = Building Product Disclosure and Optimisation – the individual materials' disclosure of impacts related to specific areas of concern and any optimisations related to improving those impacts. The number of points awarded is dependent on the number of materials documented and the types of documentation available for each product.

EPD = Environmental Product Declaration – the declaration of a product's impact on the environment through LCA or other approved method. EPDs can be product-specific or industry-wide and evaluate multiple attributes of a product.

CSR = Corporate Sustainability Report – the declaration of the socially responsible, ethical sourcing and supply chain of a product. Global Reporting Initiative (GRI), Organisation for Economic Co-operation and Development (OECD), U.N. Global Compact, ISO 26000: 2010 and other approved programs are recognized.

HPD = Health Product Declaration – the declaration of a product's impact on human health through disclosure of material ingredients / chemical inventory. Cradle-to-Cradle, Declare, REACH and other approved programs are recognized.

VOC = Volatile Organic Compound – the selection of materials that are low in compounds with adverse effects on the human respiratory system. See quick-reference chart of related ecolabels for common types of building materials on the following page.

LCA = Life-Cycle Assessment – the evaluation of the environmental effects of a product from cradle to grave, as defined by ISO 14040–2006 and ISO 14044–2006.

Green Business Certification, Inc. (GBCI) administers both LEED and WELL certification programs. There are synergies between the two rating systems that have been intentionally aligned to streamline the documentation process between the two programs. In some cases, credits are equivalent and in other cases there are partial alignments. IWBI, USGBC and GBCI have developed a "LEED + WELL Crosswalk" guidance document to show how the two programs complement each other.

1 Windmill Lane a development by Hibernia Reit was certified as LEED Gold in 2018
Photo - Meehan Green

Conclusions

10 STEPS TO THE CIRCULAR ECONOMY

The text and case studies highlight a need for further work in Ireland towards low carbon healthy products and to allow a transition to a truly circular economy.

1

Raise awareness amongst policy makers of the importance of embodied carbon in new construction and infrastructure as a part of Ireland's carbon mitigation strategy.

2

Build capacity amongst construction professionals around building level life cycle assessment.

3

Develop better quality LCA data on products by encouraging Irish producers to develop EPD and generic data for Ireland's construction products to fill the gaps.

4

Develop building level LCA or embodied carbon benchmarks to allow better comparison of buildings similar to the current BER for operational energy.

5

Build capacity in public procurement around inclusion of clauses for life cycle assessment and specification clauses for use of EPD and sustainable materials. Level(s) now offers an opportunity for a common reporting framework.

6

Resolve end-of-waste designation in Ireland to allow waste arisings to be reused.

7

Encourage producers to include full declaration of materials ingredients in their EPD or in separate Health Product Declarations (HPD).

8

Develop standards or material passports to provide confidence as to composition and performance, allowing materials to be reused in future.

9

Develop capacity amongst professionals to design for deconstruction.

10

Develop new business models in construction and property sector such as product leasing or take back schemes.

Platinum Members

Google · seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND · bre

Gold Members

Grafton Merchanting ROI · SAINT-GOBAIN · SISK · Tegral

Silver Members

Canada · Dulux · electric Ireland Smarter Living · hibernia REIT · Kingspan · Schneider Electric

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