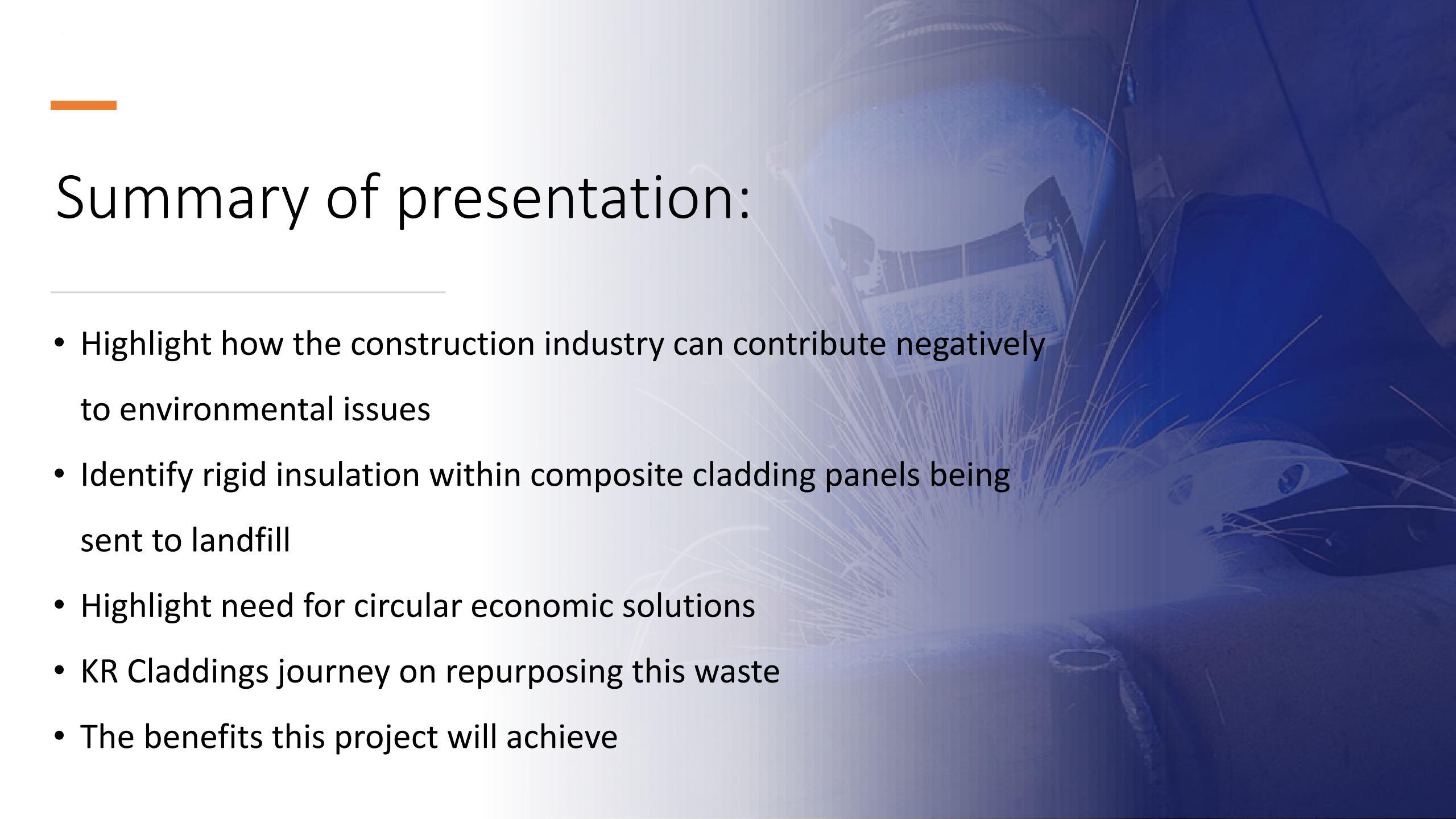


Circular Economic Solution to Composite Cladding Panel Waste

within the construction industry

By Ellen Delph, Product Manager



Summary of presentation:

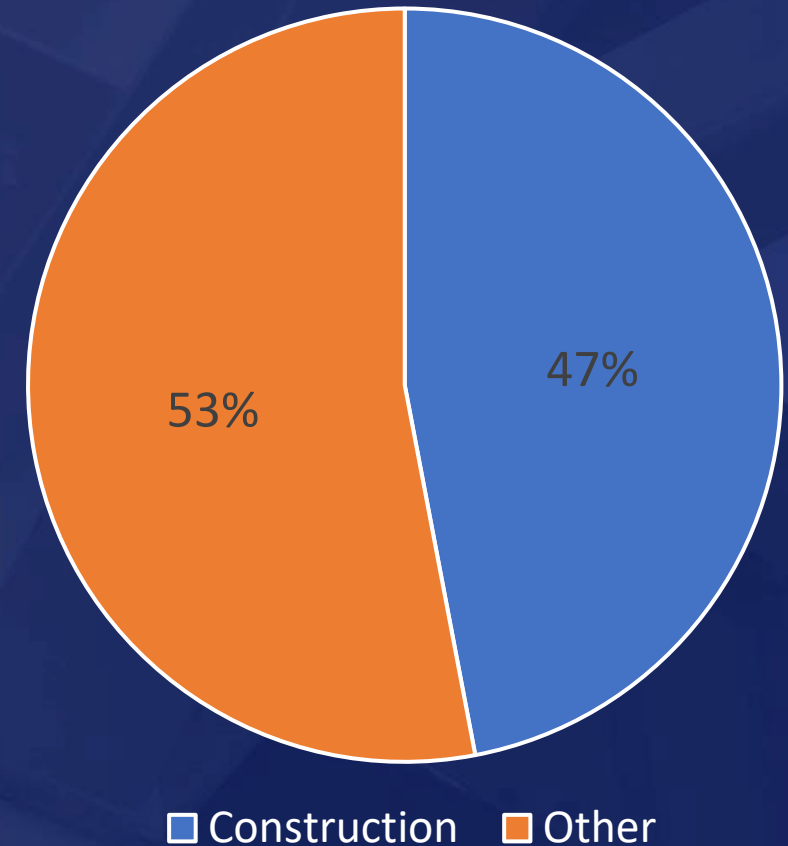
- Highlight how the construction industry can contribute negatively to environmental issues
- Identify rigid insulation within composite cladding panels being sent to landfill
- Highlight need for circular economic solutions
- KR Claddings journey on repurposing this waste
- The benefits this project will achieve

SUSTAINABILITY IN CONSTRUCTION:

Why it's important...

- Creating sustainable solutions within the construction industry is critical due to its impact on the environment
- The life cycle of Construction Projects accounts for approx. 47% of the UK's total CO2 emissions
- 59% of waste generated in the UK comes from the construction, demolition and excavation industry
- As in industry, construction is bad for the environment

Co2 generated in UK, 2010



KR Cladding:

- KR Cladding, formed in 2017 is part of the KR Group, and offer innovative cladding solutions, from initial concept to installation on site
- They follow the ethos of lean construction, to maximize value and minimize waste
- They identified a gap in the market when they found themselves with large quantities of composite cladding panels from a building they were deconstructing, and could not identify any recycling or reuse option for the waste
- Additional info can be found at www.krgrp.co.uk

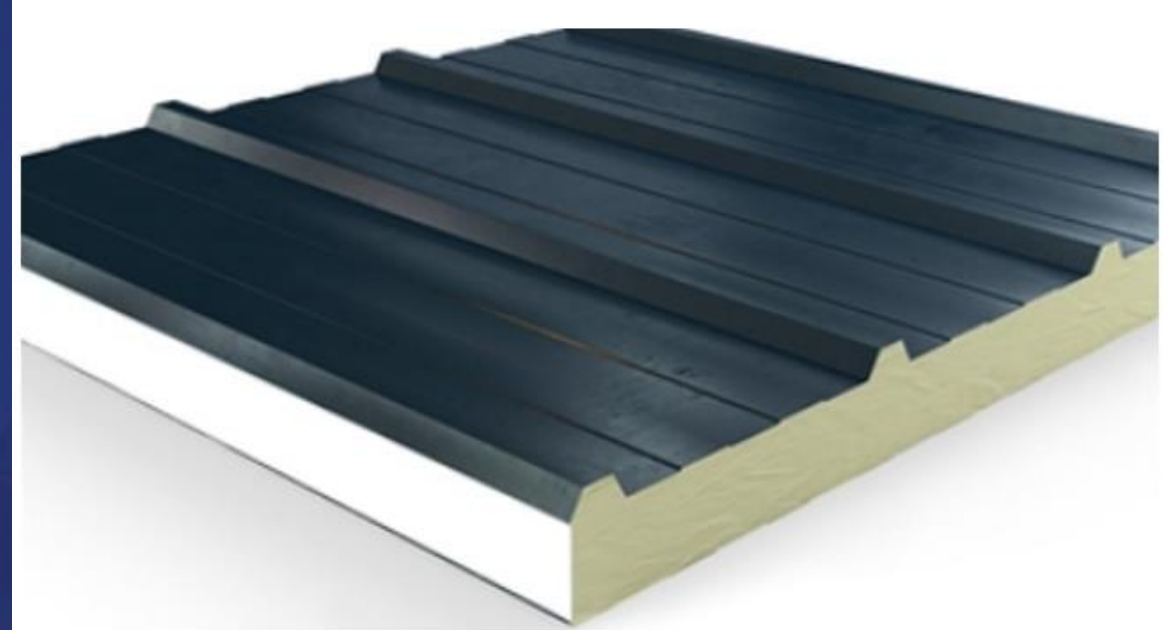
CLADDING SERVICES

Experts in safe and innovative cladding solutions



So what is a Composite Cladding Panel?

- Composite Cladding Panels are fixed to steel framed buildings completing the building envelope
- They comprise of a smooth or profiled external steel skin, a PIR (Polyisocyanurate) rigid insulation board within & are finished with an internal steel liner skin



Polyisocyanurate (PIR) Board Properties...



- The PIR insulation boards are made by mixing chemicals with a blowing agent, forming bubbles to create the thermoset plastic foam
- This creates a closed cell board, as the air bubbles are independent & not linked together, this helps control moisture & condensation
- The lifespan of the PIR board is extensive due to its rigidity, durability & excellent compressive strength, whilst also being effective at low & high temperatures
- PIR boards require approximately half the thickness of traditional forms of insulation to meet the same level of thermal performance, making it the most efficient insulation material used in construction
- It will not rot, sag or decay & will therefore continue to deliver designed insulation values

- [illegible]

R&D : Initial findings...

- This report confirmed that no recycling options were currently available for the PIR & proposed various reuse options which could be explored further
- A second report by RICARDO, published in December 2019, focused on circular economic solutions to the PIR waste
- This report also contained a carbon assessment, which demonstrated that a standard composite panel 'has an embodied carbon factor of 38.2 kg CO₂eq per square metre from its manufacturing stage'
- This was an important figure for calculating the estimated Co₂eq savings for the reuse Project



Product Development: thinking circular

- By May 2021, KR Cladding employed a Product Development Manager full time for 6 months to drive the project forward
- During this time, the reuse options from the R&D were explored further
- The proposals ranged from utilising the PIR as packaging; to shredding to create poly beads; to use in the footwear industry
- These options were not pursued due to lack of expertise in the area and time constraints, so we opted for a circular economic repurposing route, for use within construction
- HOWEVER, we always bear in mind that we'd be open to partnering up with another stakeholder to explore other options if they present
- KR Cladding focused on primarily repurposing the product as a rigid insulation board for use in construction projects between floor, wall, & roof joists, with the steel skins reused as single skin sheets
- It's secondary route, for the smaller/offcuts of PIR Board, is for reuse as insulation to retrofit fishing boat refrigeration areas

Product viability: Thermal Properties...

- To determine the product viability as an insulation board, testing on the panels were required
- Waste sample panels, of various ages and thickness, were sent to BRSUK (Building Regulation Services UK) Glasgow, to determine the k-value (thermal conductivity) of the product
- Below are the k-value test results of the repurposed PIR Boards

Sample ID	Thermal Conductivity (W/mK)
Reference Foam	0.055
A1	0.031
B1	0.032
C1	0.032
D1	0.033
E1	0.032
F1	0.032

Test Results:

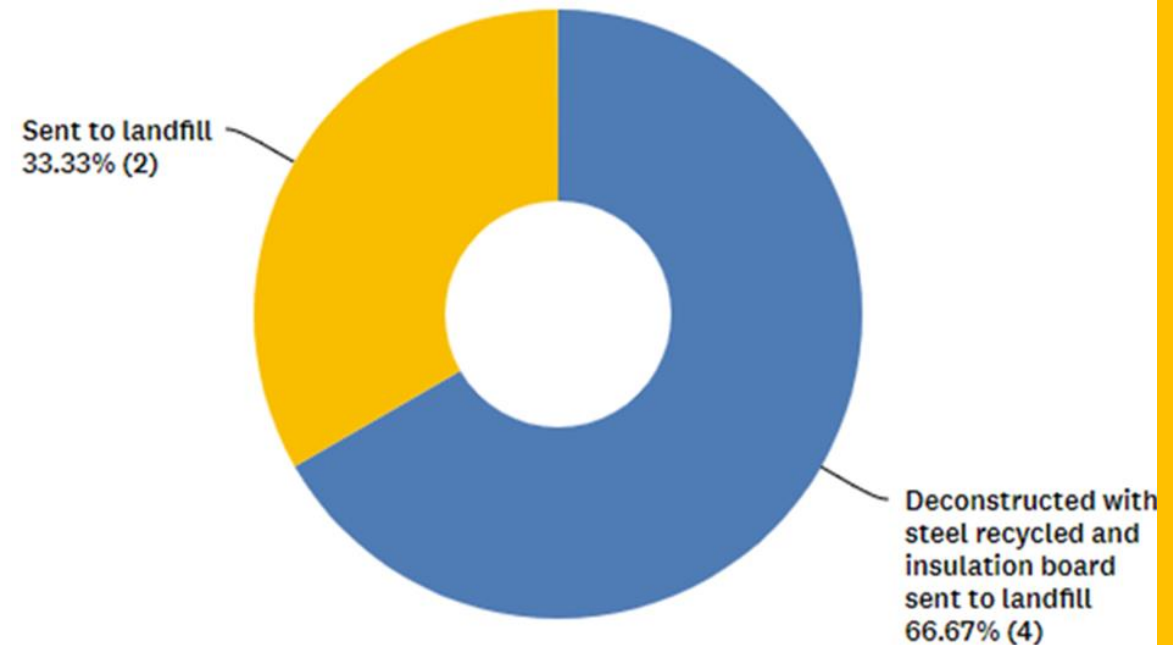
k-Value of repurposed PIR Board...

- The testing demonstrated that the k-value achieved, of 0.032 W/m.K, only differed by 0.009 W/m.K from old to new PIR board
- For comparison a Kingspan TF70 Rigid PIR board has a k-Value of 0.022 W/m.K, the lower the figure the better the resistance for heat to flow through
- This confirmed the material maintained its thermal properties over time with only minor depletion to its performance
- This established reuse as rigid insulation board in construction projects, as a viable environmental and sustainable solution

Industry Engagement:

Construction Firms

- Engagement with construction firms handling composite cladding panel waste was imperative to the project success
- A survey carried out by KR Cladding revealed that 2/3 of PIR panel waste is sent directly to landfill
- In addition, the survey demonstrated that companies would be happy to access a repurposing facility to dispose of this waste to be reused
- If you have any suggestions on how to promote awareness and increase up take of companies giving us their panel waste, please let us know!



Industry Engagement: Architects

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- Architects were also approached to determine interest in the repurposed PIR boards
 - Initial feedback was encouraging with respondents expressing interest in specifying the product once a data sheet had been created
 - It was highlighted that this product would meet demand for use in eco houses too, fitting with the ethos to minimise their effect on environment
 - They appreciated the need for a circular economic solution to this waste
 - With insulation shortages & prices rising exponentially over the last 2 years, the repurposed PIR is a cost effective & eco friendly insulation solution



KR Bon Reduction:

Branding of the Sustainable division of KR Cladding...



- KR Cladding created the subsidiary brand, 'KR Bon', to promote the repurposed PIR product & concept awareness of the sustainability side of the business
 - The logo and name represents the carbon reductions that will be achieved through the implementation of a circular approach
 - We hope to become well known in the industry as the one stop waste solution for all cladding panel waste
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- Construction of a purpose-built unit at our headquarters in Aberdeenshire will commence in July 2022, to process and store the waste
 - An ecommerce site has been created to facilitate online collection / delivery of the waste & to process sales of the PIR product for our clients
 - In addition, the KR Group as a whole, has achieved carbon neutrality through PAS 2060 accreditation for 2021, demonstrating our commitment to carbon reduction

The KR Bon Tree: Benefits of KR Bon

KR BON REDUCTION

An innovative, circular economic solution to cladding waste. 'KR BON Reduction' is KR Group's pilot-scheme initiative, repurposing used construction materials into new product.

To donate your cladding waste, or to buy repurposed products:

Phone: 01358 788907
Email: info@krgrp.co.uk
Website: krbon.co.uk

RETHINK - REFUSE - REDUCE - REUSE - REPAIR - REPURPOSE - RECYCLE

In the next five years,
we aim to:

Reduce Co2 emissions by 7,736 tonnes, equal to removing 4,460 cars from UK roads for one year



Repurpose 202,500m² of PIR panels, which could insulate over 675 new homes, with clients saving up to £2.5Mil



Divert 2,498 tonnes of cladding waste from landfill, equal to 8 Olympic swimming pools



Offset Co2eq emissions to equal planting 7,736 trees and allowing them to grow for 100 years



KR Group

PIR Datasheet: Extract

- A data sheet on the repurposed PIR board has been created following research & discussions with Building Regulations that demonstrate the product performance, specification, Building Standards compliance, applications for use, storage, manual handling, installation etc
- Here is an extract of the data sheet detailing the product sizes, panel thicknesses available, k-Value and weight of panel
- An example of a leading rigid insulation boards k-Value and R-value have been included to provide context on the repurposed PIR performance
- This will allow architects and consumers to compare the performance of KR Claddings repurposed PIR board to others on the market
- A full copy of the data sheet in addition to further information, can be obtained from our ecommerce site www.krbon.co.uk

Specification

Sizes: 550mmx940mm or 275mmx940mm | Corner Finishing: Square Edged | Edge Finishing: Straight Edged

Description	PIR Panel Thickness										
	40	50	60	70	80	90	100	120	135	140	150
Insulation Depth (mm) ±											
Lambda/ K Value (W/m.K) (Thermal Conductivity)	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031
R-Value (m².K/W) (Thermal Resistance)	1.29	1.61	1.94	2.26	2.58	2.90	3.23	3.87	4.35	4.52	4.84
Panel weight ± 0.032 kg/ m2 at stated depth	1.28	1.60	1.92	2.24	2.56	2.88	3.20	3.84	4.32	4.48	4.80
Panel length (mm)	940	940	940	940	940	940	940	940	940	940	940
Panel width (mm)	550	550	550	550	550	550	550	550	550	550	550
Panel weight ±kg / sheet at stated depth & size	0.66	0.83	0.99	1.16	1.32	1.49	1.65	1.99	2.23	2.32	2.48
Panel length (mm)	940	940	940	940	940	940	940	940	940	940	940
Panel width (mm)	275	275	275	275	275	275	275	275	275	275	275
Panel weight ±kg / sheet at stated depth & size	0.33	0.41	0.50	0.58	0.66	0.74	0.83	0.99	1.12	1.16	1.24
Kingspan TF70 Rigid PIR Board for comparison											
Lambda/ K Value (W/m.K) (Thermal Conductivity)	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
R-Value (m².K/W) (Thermal Resistance)	1.80	2.25	2.70	3.15	3.61	4.06	4.51	5.41	6.08	6.31	6.76

- It was critical that the repurposed PIR board was priced competitively
- This table shows price /m2 for the repurposed PIR board compared with similar leading products
- For 100mm core thick board, the repurposed product is 54% cheaper than Kingspan TF70 and 39% cheaper than Cellotex
- This is a clear example of how consumers can achieve large savings when purchasing repurposed PIR board

Repurposed PIR Price Point:

mm Core Thickness	Repurposed PIR £/m2	£/m2 of similar products for comparison		Saving using repurposed PIR V's new	
		KSTF70 £/m2	Cellotex £/m2	KSTF70	Cellotex
40	£5.00	£15.97	£6.65	69%	25%
53	£5.50	£9.11	£7.36	40%	25%
60	£6.00	£11.53	£8.68	48%	31%
73	£6.50	£12.93	£11.25	50%	42%
80	£7.50	£15.22	£11.99	51%	37%
90	£7.75	£16.85	£12.99	54%	40%
100	£8.00	£17.32	£13.10	54%	39%
120	£8.50	£25.74	£16.39	67%	48%
137	£8.75	£29.95	£20.03	71%	56%
150	£9.00	£26.20	£19.98	66%	55%

KR Bon Reduction Project Achievements:

- Various samples of PIR board successfully tested to demonstrate thermal qualities
- KR Bon Brand created
- Data sheet for the PIR board written
- eCommerce site designed & operational
- Industry approval from architects ('MAC Architecture', Newmachar and 'Matthew Clubb Architect', Daviot, actively specifying KR Bons repurposed PIR board)
- KR Groups Newburgh site SEPA (Scottish Environment Protection Agency) approved to store and treat waste PIR panels and the repurposed PIR boards will not be considered waste



SUCCESS

Summary:

Steel & Composite Cladding panels in construction

By thinking circular economically:

- Material can be diverted from landfill
- Co2eq emissions will be reduced
- Extraction of raw materials lessened
- Savings will be achieved for consumers
- Sets KR Cladding apart as a 'Centre of excellence' for cladding
- Ensures our staff training (SVQ etc.) promotes a circular ethos
- Offers clients consult on dynamic design to responsible disposal and end of life consideration of the product

Industry Feedback:

Andrew Dickson, Manager for Business Development, Zero Waste Scotland, said:

"This initiative from KR Cladding is a fantastic example of maximising the value of existing resources. All too often, we label old or unused materials as waste, and it ends up in landfill. However, in a more circular economy, materials are fed back into the production cycle. As a nation, we must dramatically reduce our consumption of raw materials if we want to play our part in combatting climate change. Zero Waste Scotland is proud to support KR Cladding in their innovation journey towards becoming circular."

Jonathan Cheyne, DIRECTOR at MAC Architects:

- "we commissioned SF Energy Ltd to prepare U-Value calculations for our typical Wall & Roof build ups for residential projects based on the repurposed insulation boards from KR Group."
- *This allows the product to be easily specified in their projects*

GGs Architects commented:

"it could soon be legislated that we have to show how ALL materials we use can be re-purposed reused or recycled and this proposal is a first step and one I can see coming more to the front in the future."

Matt Clubb at MWClubb Architecture Design:

"I am the first qualified Retrofit Coordinator in Aberdeenshire, which is a new qualification for carrying out whole-house-retrofit. I've already had lots of interest in this, across the county, and with lots of retrofit projects with granite walls, the best way to insulate them is frequently from the inside. This PIR insulation would be great for that application"

I would be happy to respond to any feedback, comments or questions you may have...