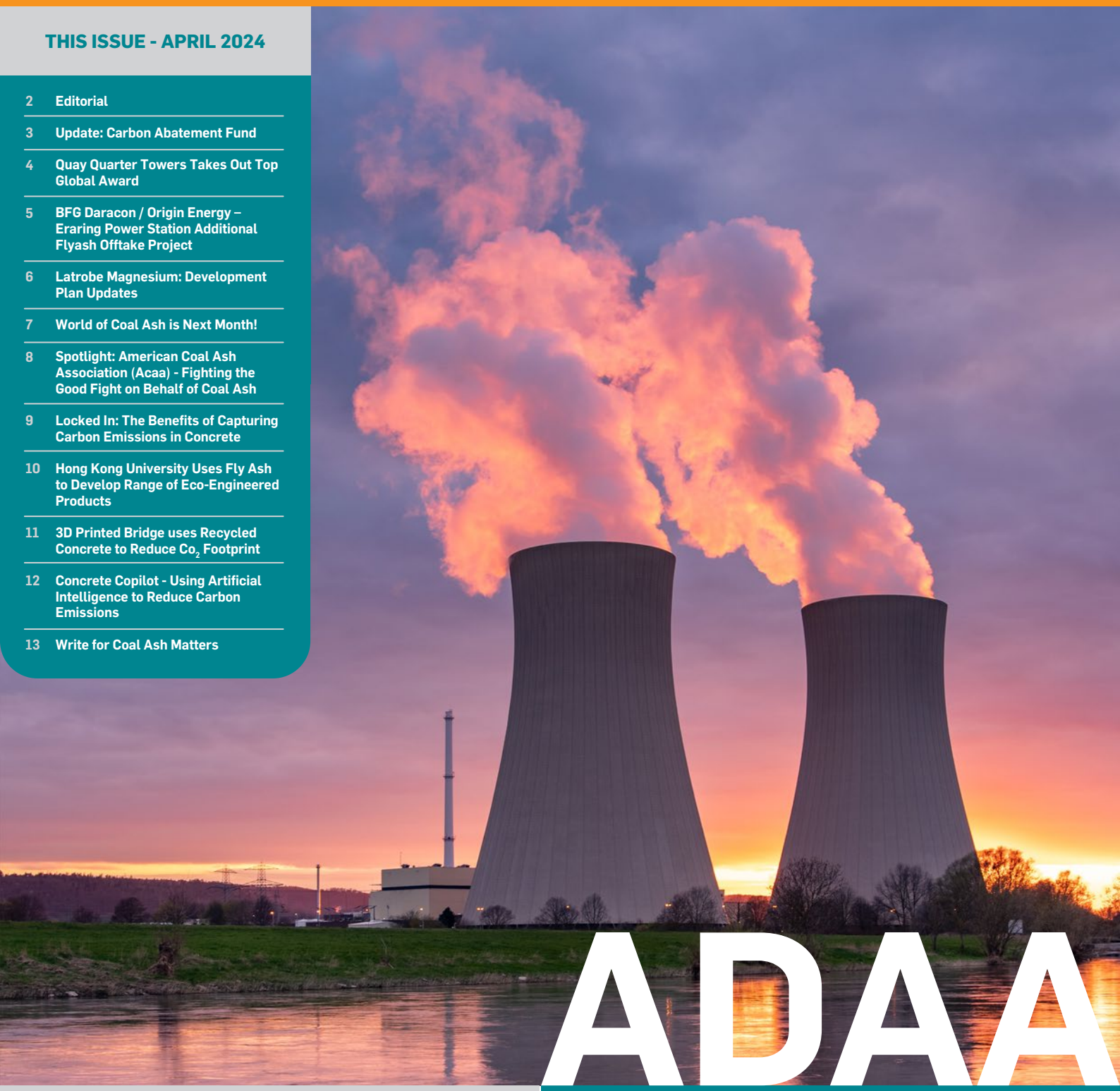
Ash Development Association of Australia

COAL ASH MATTERS

24 APRIL

02 4228 1389 | 02 4258 0169 | info@adaa.asn.au | www.adaa.asn.au | @adaa_info

THIS ISSUE - APRIL 2024



ADAA

COAL ASH EDITORIAL TEAM

Chief Executive Officer: Craig Heidrich

Contributors: Ben Grant, Craig Heidrich, BG&E, Sal Awad (Latrobe Magnesium), Luke Diggins (Daracon), John Simpson(American Coal Ash Association)

Coal Ash Matters is a bi-annual publication

Editor: Ben Grant

Design: 101 Design

Circulation: 2000

MEMBERSHIP

COMPANY MEMBERS

A primary role of the ADAA is to bring together producers and marketers of coal combustion products (CCPs). Our activities cover research and development into CCP usage, advocacy and technical assistance to CCP producers and users, as well as a forum for the exchange and publication of CCP information.

For more information visit us at **www.adaa.asn.au**

CURRENT MEMBERS

- Adbri Limited
  www.adbri.com.au
- BG&E Materials Technology
  www.bgeeng.com
- Bilmar Solutions
  www.bilmarsolutions.com.au
- Boral Quarries & Recycling
  www.boral.com.au
- Cement Australia
  www.cementaustralia.com.au
- CS Energy
  www.csenergy.com.au
- Daracon Constructions
  www.daracon.com.au
- Delta Electricity
  www.de.com.au
- Dr. Jane T Aiken Consulting & Environmental Services
  www.cessoils.com.au
- Energy Australia
  www.energyaustralia.com.au
- Hills Barker Blower
  www.barkblower.com.au
- Independent Fly Ash Brokers
  mflyash.com.au
- Independent Cement & Lime
  www.independentcement.com.au
- Intergen (Millmerran)
  www.intergen.com
- Latrobe Magnesium
  www.latrobemagnesium.com
- NRG Gladstone Power Station
  www.nrggos.com.au
- Origin Energy Eraring Power Station
  www.eraring-energy.com.au
- SA Premium Cement
  sapremium.com.au
- Stanwell Corporation
  www.stanwell.com
- Vecor Australia
  www.vecor.com.au

RECIPROCAL MEMBERSHIPS

- CSIRO
  www.cmit.csiro.au
- European Coal Combustion Products Association (ECOBA)
  www.ecoba.org
- UK Quality Ash Association
  www.ukqaa.org.uk
- American Coal Ash Association
  www.acaa-usa.org
- World Wide Coal Combustion Products Network (WWCCPN)
  www.wwccpn.org

EDITORIAL

Welcome back to another issue of Coal Ash Matters, the first of 2024!

The beginning of 2024 has been an extremely exciting time for the Ash Development Association of Australia, which we are pleased to share with you in our latest edition of Coal Ash Matters.

Firstly, our Ash Development Association of Australia CEO, Craig Heidrich, runs us through the $3.25 million NSW Government Carbon Abatement fund and the progress that has happened over the summer months.

We then congratulate ADAA members BG&E on winning' 2023's Best Tall Building Worldwide' with their involvement in the Quay Quarter Tower in Sydney's CBD.

Staying in NSW, BFG Daracon have joined forces with Origin Energy to increase off take of fly ash generated at the Eraring Power Station. The project began in December of last year, and is expected to be completed by mid-2024.

ADAA members Latrobe Magnesium (LMG) have recently commissioned the first half of their Magnesium Production Plant in Latrobe Valley, Victoria. Project Manager, Sal Awad has provided some insights into the company's progress over the past months.

Taking a trip to the United States, we shine the spotlight on the American Coal Ash Association, who share some insights and current projects that are occurring in the Northern Hemisphere.

Now, for anyone who has forgotten – The World of Coal Ash Conference is next month! Beginning on the 13th May in Michigan, the conference will cover the science, applications, and sustainability of worldwide coal combustion products (CCPs) as well as gasification products.

Moving to Switzerland, a team of scientists are on a mission to create CO2-neutral concrete through the integration of biochar.

Another team of scientists, this time at a Hong Kong University, have developed a range of eco-engineered products using fly ash to transform manmade seawalls into living shorelines.

Over in France, Holcim have created the first of its kind 3D printed concrete bridge, containing 10 tons of recycled materials including fly ash to reduce carbon emissions by 25%.

Finally, looking towards the future, U.S start-up company 'Concrete.ai' has created a revolutionary product that uses patented AI technology to optimise concrete mix designs & reduce carbon emissions.

Lastly, the Ash Development Association of Australia would like to say a big thank you to all members, as well as allof our contributors of this edition of Coal Ash Matters. This issue, like all issues, would not be possible without the support of our members. We are looking forward to working together with members for the next edition of Coal Ash Matters, as well as other upcoming and exciting projects.

Ben Grant

Ben Grant
Editor

UPDATE

CARBON ABATEMENT FUND

Post the NSW Government announcement in March 2023 of $3.25 million allocated from the Carbon Abatement Fund for the partnership proposal from Ash Development Association of Australia (ADAA) to recover coal combustion products to support decarbonisation of the construction industry, progress continues in 2024.

Last October, the Association signed a Memorandum of Understanding (MOU) between the NSW Government [EPA] and ADAA formalising the Partnership agreement prior to commencing more detailed planning phases.

Initial steps will involve a series of investigations with our NSW based members and specialist service providers to capture, analyse and validate characteristics of stored resources [CCPs]. Coincident there will be a series of industry stakeholder workshops, culminating with a symposium in late 2024 drawing together international experts, local industry, and government.

CEO Craig Heidrich highlighted, “the Ash Development Association of Australia partnership with the NSW Government is critical to coordinating and managing key objectives. For example, the symposium will explore international best practice around harvesting protocols and required regulatory reform to enable recovery of CCPs.” “There will also be a high-level review of current and predicted resources.”

For more information regarding these initiatives, visit the EPA website or contact the Ash Development Association of Australia to learn more or get involved.

QUAY QUARTER TOWERS TAKES OUT TOP GLOBAL AWARD

Image: BG&E

The Quay Quarter Tower, a 49-storey vertical village located in the heart of Sydney's CBD, focuses on sustainability, and is widely regarded as the highest and largest adaptive reuse project ever completed.

During this project, a 190-meter tower constructed in the 1970s was upgraded to a 216-meter tower that meets modern requirements, and now has an extended service life up until 2070. The Tower has recently taken top honours, being named 2023's Best Tall Building Worldwide by the Council on Tall Buildings and Urban Habitat (CTBUH).

By evading the wasteful activities of demolition and replacement, the design team managing to retain 65 per cent of the original structure such as beams and slabs, and 95 per cent of the building's core. The project saved approximately 12,000 tonnes of embodied carbon emissions, as well as managed to achieve a 6-Star Green Star rating using recycled materials such as fly ash.

In addition to being crowned best worldwide, Quay Quarter was selected overall winner in six categories: Best Tall Building: Oceania, the Construction Award, the Structure Award, the Repositioning Award, and the Space Within Award.

For the project, ADAA member BG&E offered their services in structural engineering, construction engineering, materials testing and structural monitoring. Two-thirds of the floor plates and supporting columns as well as the entire core wall system of the old structure were kept during construction based on rigorous materials testing and structural design of the structural components.

Through this, BG&E has demonstrated that even older, more complicated structures can be upcycled to both cut carbon emissions and extend a structure's service life for future requirements.

Watch: ACI Excellence Awards – Quay Quarter Tower

BFG DARACON / ORIGIN ENERGY – ERARING POWER STATION ADDITIONAL FLYASH OFFTAKE PROJECT

BFG Daracon are working with Origin Energy at Eraring Power Station to increase offtake of fly ash generated by the operation. The project will increase throughput capacity up to 300,000 tonnes per annum, including the construction of four (4) additional silos, additional loadout facility and upgrade to the blend plant facility to increase versatility and output.

The construction began in December 2023 and is scheduled to be completed in mid-2024. There will be three (3) 130t additional classified storage silos and one (1) 130t loadout silo giving a total of 520t additional ash holding capacity on the site. This will bring the maximum storage capacity to approximately 870t following completion of works.

As part of the upgrade project, BFG Daracon will be installing a state of the art hi-performance CB-150 blendveyor unit with the ability to blend up to 4 constituents. There will be the installation of a blower and generator unit that makes the whole operation “stand-alone” and mobile.

There will be a separate run-of-station (ROS) ash feedline from the current classifying location adjacent to the Daracon classifying plant to connect to the blend plant (installed along the existing alignment and gantry for existing ash conveyor pipelines). This will allow for the ability to run ROS independently to the loadout facility to maximise the recycling of the power stations ash.

origin

BFG DARACON

LATROBE MAGNESIUM: DEVELOPMENT PLAN UPDATES

Since we last checked in with Latrobe Magnesium (LMG) in our previous edition, they have continued to make great progress at their flagship 1,000tpa Demonstration Plant in Latrobe Valley, Victoria.

Stage 1 of the Demonstration Plant Project continues to progress with no reportable health, safety, or environmental (HSE) incidents to date. The Magnesium Oxide (MgO) production strategy is on schedule, allowing LMG to showcase that their patented process can operate on a commercial scale successfully. Over 50+ local trade workers have been plying their trades onsite, with the mechanical erection of the Ferrosilicon, Magnesite Hopper, and Bag Breaker units all complete. The attention will now turn to completing the piping and electrical aspects of the project.

The Fly Ash Beneficiation area is now 100% complete. This area is the first to achieve this construction milestone and will be ready for handover to commissioning.

While challenges arise daily, such as labour availability and weather patterns, LMG's schedule remains on track. Focus is now on the interim MgO production, with a high priority of installing the Spray Roaster, a critical element in the production chain. Targets for the first MgO production is still firmly set for after March 2024.

Late last year, LMG completed a placement of 61 million shares at 5 cents per share, which raised $3.06 million. Two payments of the Regional Development Grant Agreement with the State of Victoria have also been released, ensuring that the progress of the plant is not impacted.

Whilst sights are set tightly on completing Stage 1, planning work has commenced in preparation for Stage 2, 10,000tpa Australian Commercial Plant, activities. A detailed work report will be released in mid 2024, which will include the production capacity of Magnesium metal in the forthcoming years.

LMG has engaged with a number of international investors who have expressed interest in partnering with Stage 3 of the project, a 100,000tpa international mega plant located in Samalaju, in the Sarawak state of Malaysia. LMG expects that third-party involvement will constitute 45% equity in the project, and they will also offer substantial magnesium metal offtake agreements. These agreements will enable LMG to obtain debt funding from government-backed institutions. Memorandum of Understanding's with equity partners are expected to be signed in early 2024.

WORLD OF COAL ASH IS NEXT MONTH!

The 10th World of Coat Ash Conference is next month! World of Coal Ash (WOCA) is an international conference organised by the American Coal Ash Association (ACAA) and the University of Kentucky Centre for Applied Energy Research (UK CAER).

Kicking off on Monday the 13th of May, the 2024 conference is the 10th biennial meeting.

With a focus on the science, application, and sustainability of worldwide coal combustion products (CCPs), along with gasification products, this event is not to be missed!

WOCA 2024 is an exceptional platform that brings together experts, researchers, policymakers, and industry leaders from around the world to share insights, latest research findings, and innovative solutions in the field of CCPs.

This year, the conference aims to delve deeper into the scientific aspects, practical applications, and sustainable practices associated with harvesting of coal ash.

Participation in WOCA 2024 would not only contribute to your professional growth but also significantly benefit your organisation by keeping it abreast of the latest developments in the CCP sector.

The Ash Development Association of Australia is investigating a post conference site tour of a CCP harvesting facility/operation that is working closely with our sister Association, American Coal Ash Association in the US.

Please visit the official website World of Coal Ash Conference for more details on the event schedule, registration, and accommodation options.

STUDENT TRAVEL STIPEND

For Students attending to network with other researchers or present (oral or poster papers) research at WOCA 2024, the Ash Development Association of Australia will support the best two (2) papers submitted with a $1,000 travel stipend.

CONTACT OUR OFFICE FOR DETAILS

If you plan to attend the conference, please indicate your interest in the site tour.

SPOTLIGHT

AMERICAN COAL ASH ASSOCIATION (ACAA)

FIGHTING THE GOOD FIGHT ON BEHALF OF COAL ASH

The American Coal Ash Association (ACAA) was established in 1968 as a trade organization devoted to the beneficial use of coal combustion products (CCPs). Our members comprise some of the world's foremost experts on fly ash, bottom ash, boiler slag, and flue gas desulfurization gypsum.

Among the Association's earliest projects and priorities was to conduct an annual survey quantifying the production and use of CCPs in the United States. Then as now, data was compiled by directly surveying electric utilities and utilizing additional data produced by the U.S. Energy Information Administration. The survey's results are widely utilized by federal agencies, including the U.S. Environmental Protection Agency (EPA) and U.S. Geological Survey.

ACAA operates with a streamlined professional staff, aided ably by members at all levels of their respective organizations who willingly volunteer their time and expertise to work on issues that are of importance to the entire industry.

In this way, ACAA's comparatively small membership has managed to project an outsized voice and influence policies at the federal, state, and local levels that have helped preserve the very existence of the U.S. coal ash beneficial use industry.

ACAA's committees are where much of this activity is focused, including its Technical Committee and Government Relations Committee.

The Technical Committee oversees all programs of a technical nature. Its members serve on industry standards-setting bodies; generate technical commentary on agency rulemakings; and conduct workshops and seminars to help members and external customers understand the practical implications of agency rulings and standards updates.

Among the Committee's recent activities was the development (ably assisted by ADAA's own Craig Heidrich) of a North American Product Category Rule (PCR) for supplementary cementitious materials (SCMs). Developing this PCR is the first step in developing Environmental Product Declarations (EPDs), which will allow cement and concrete manufacturers, as well as other pozzolan users, to evaluate the environmental impacts of SCMs from an "apples-to-apples" comparison that follows ISO International Standards.

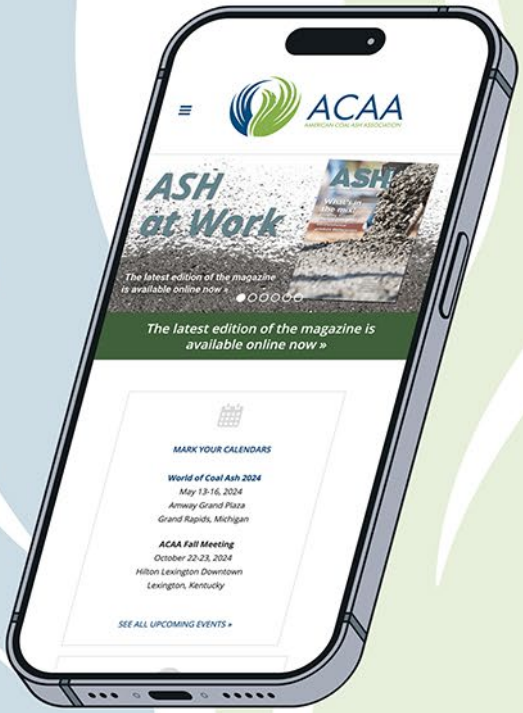
The Committee is currently also working closely with ASTM International to:

- Update standards to support and encourage harvesting of CCPs from disposal in landfills and surface impoundments.
- Revise the ASTM specification for fly ash use in concrete to permit the use of both bottom ash and harvested ash.

ACAA's Government Relations Committee oversees all programs involving interface with federal, state, regional, and local government agencies. The Committee monitors regulatory and legislative developments concerning coal ash beneficial use; coordinates input from ACAA members for comment letters to regulatory agencies; and prepares and delivers testimony before governmental bodies.

Activity with the Government Relations Committee will be on the rise in 2024 as the EPA works to develop rulemakings on "legacy" landfills and surface impoundments, revisions to steam electric effluent limitations guidelines and standards, and revisions to its coal combustion residuals risk assessment. As always, ACAA will be working with other stakeholders to protect beneficial use of CCP from further restriction.

One final note: Every two years, the ACAA co-hosts the industry's most prominent event, "The World of Coal Ash," with more than 1,000 participants from over 30 countries. This year, it will be held in Grand Rapids, Michigan, and we look forward to seeing all of our Aussie friends there!



LOCKED IN:
THE BENEFITS OF CAPTURING CARBON EMISSIONS IN CONCRETE

A team of scientists in Switzerland are on a mission to achieve the climate-neutral goal by 2050 through negative emission technologies (NET). NET is intended to counterbalance the remaining "hard-to-avoid" emissions and ensure the net zero target is reached.

The team at Empa's Concrete & Asphalt lab, led by Pietro Lura is developing a process for integrating biochar into concrete. By replacing conventional aggregates with pellets made from biochar, this technology has the potential to create CO2-neutral or even negative CO_2 concrete.

Around eight percent of global greenhouse gas emissions are caused by cement production. Using carbon to produce building materials, will in turn remove CO_2 from the atmosphere in the long run.

Biochar is a charcoal-like substance that's made by burning organic material from agricultural and forestry wastes. The first concrete products with integrated biochar are already on the market. However, biochar is often introduced into the concrete untreated, which can lead to difficulties.

"Biochar is very porous and therefore not only absorbs a lot of water, but also expensive admixtures used in concrete production," explains Empa researcher Mateusz Wyrzykowski. "Moreover, it is difficult to handle and not completely harmless either."

'Such lightweight aggregates already exist from other materials such as expanded clay or fly ash. The knowhow in handling these materials is available in industry, and this increases the chances that the concept will be put into practice," says Wyrzykowski.

To produce these pellets, a concrete mixer with a rotating pan in which the team mixed biochar with water and cement, and as a result, obtain small pellets between 4 & 32 millimetres. These pellets are used for normal concrete with strength classes of C20/25 to C30/37.

"With a proportion of 20 percent by volume of carbon pellets in the concrete, we achieve net zero emissions," says Mateusz Wyrzykowski. That is, the amount of carbon stored offsets all the emissions produced in the production of both the pellets and the concrete.

For instance, an admixture of 45 percent by volume of carbon pellets in the concrete leads to total negative emissions of minus 290 kg CO_2/m^3. By comparison, conventional concrete emits around 200 kg CO2/m3.

Image: Replacing conventional aggregates with pellets made from biochar to reduce CO_2.

Image: Empa researchers Mateusz Wyrzykowski (right) and Nikolajs Toropovs (left).

HONG KONG UNIVERSITY USES FLY ASH TO DEVELOP RANGE OF ECO-ENGINEERED PRODUCTS

A Hong Kong University has developed an eco-friendly concrete mix, comprising of 40% waste material, including fly ash from incineration of sludge. This mix has a high compressive strength of 39 MPa and a low surface pH of 10.

The City University of Hong Kong (CityU) has won the prestigious Gold Award at the Hong Kong Green Innovations Award for transforming manmade seawalls into living shorelines using this eco-friendly concrete mix.

Conventional seawalls, typically made of concrete and granite boulders, lack the necessary structure to support the settlement and growth of marine organisms. Led by Professor Kenneth Leung Mei-yee, the team at CityU have created eco-tiles with water retention capacity and various microhabitats, such as grooves, holes and crevices of different sizes.

After a 12-month trial period, the eco-tiles significantly reduced the average surface temperature by 2 °C and increased species biodiversity by 80% compared to conventional seawalls.

“By utilising waste materials in our eco-tiles, we minimize cement usage and reduce the carbon footprint. Transforming waste into useful products for ecosystem restoration also helps reduce waste disposal and extends the service life of landfills,” said Professor Leung.

The team has established a start-up called ‘**afterNATURE**’, which contains a range of eco-friendly tiles, panels, tidal pools, and eco-blocks to enhance marine biodiversity and ecosystem services. These products have already been used in seawalls and coastal restoration projects in Korea, China, and the United States.

Image: (From left) Dr Lo Chi-chiu, Professor Kenneth Leung Mei-yee, Thea Bradford and Dr Juan Carlos Astudillo

3D PRINTED BRIDGE USES RECYCLED CONCRETE TO REDUCE CO_2 FOOTPRINT

Holcim has created the first of its kind 3D printed concrete bridge. The 'Phoenix' bridge contains 10 tons of recycled materials including 100% recycled ECOPlanet cement, which features waste materials such as fly ash, calcined clay, and demolition waste.

First debuted as part of the 2021 Venice Architecture Exhibition, Phoenix demonstrates how circular construction combined with 3D concrete printing can enable low carbon infrastructure applications.

The project was completed with a 25% overall reduction in Co2 footprint compared to the first bridge developed in 2021.

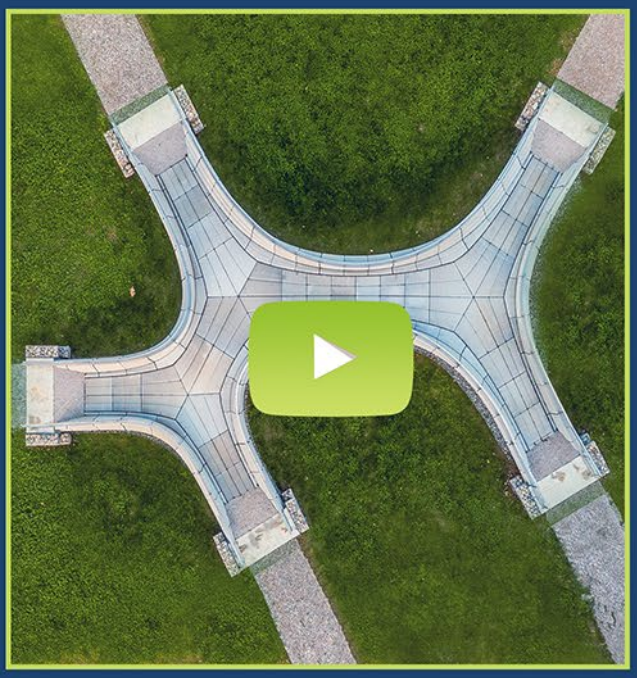
Shajay Bhooshan, head of Zaha Hadid Architects' Computation and Design Group shared: "Phoenix is a significant milestone in technology readiness. It showcases the maturation of integrated design to construction technologies that were initiated with Striatus (previous design in 2021)."

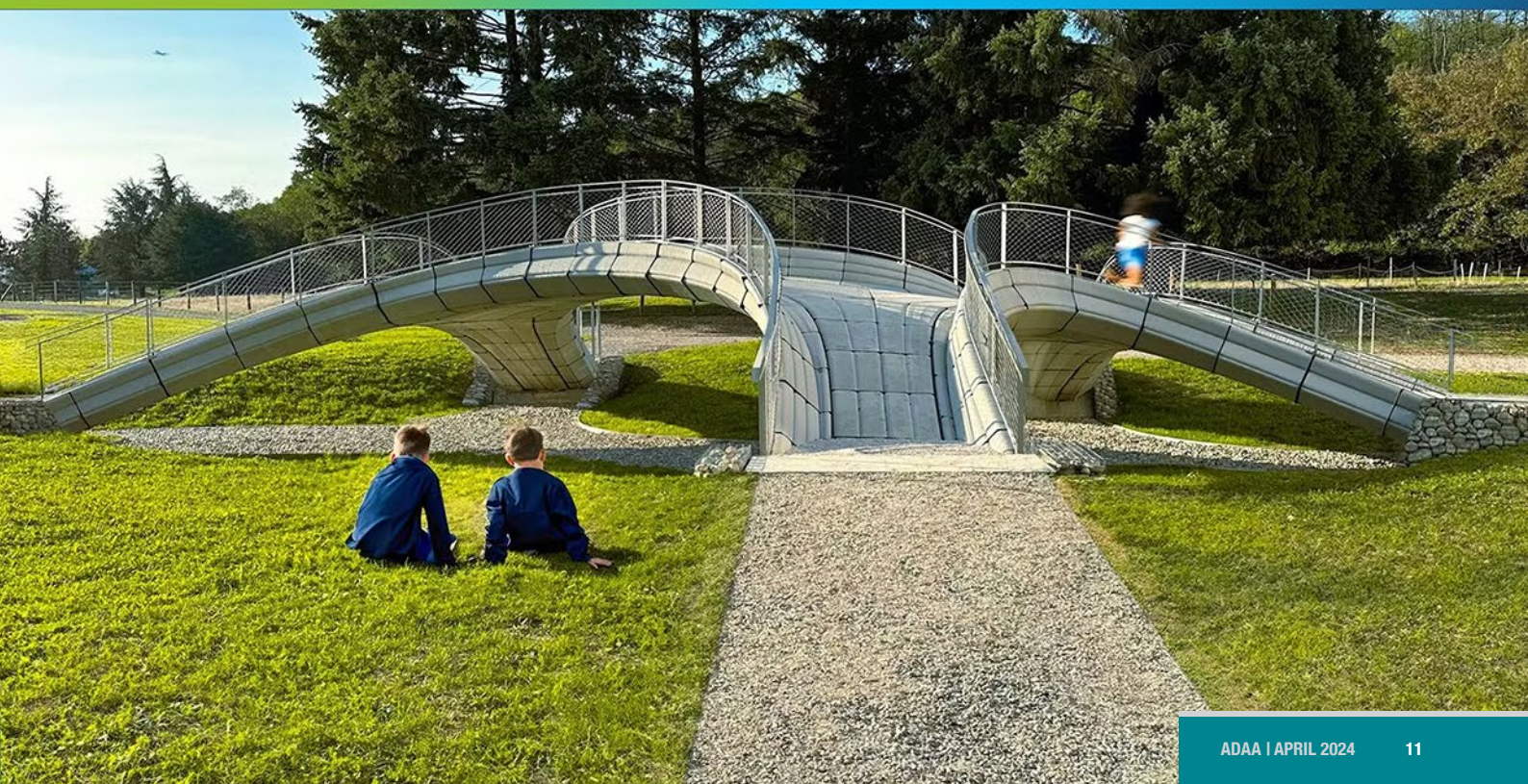
Block Research Group at ETH Zürich and incremental3D were both partners in the project. The method they facilitated to employ in the bridge's construction does away with the need for concrete reinforcement or post-tensioning. The project was accomplished without the creation of any waste, and can be disassembled for later use as a pedestrian crossing at different locations.

Holcim says the method can also be used to construct floor slabs of high-rise buildings, offering further low-carbon solutions for builders and architectural designers.

The construction was completed in Lyon, France, on the grounds of Holcim's Innovation Hub.

Watch Timelapse of Construction





CONCRETE COPILOT

- USING ARTIFICIAL INTELLIGENCE TO REDUCE CARBON EMISSIONS

Concrete.ai, a start-up company that uses patented AI technology to optimise concrete mix designs, predict concrete performance within seconds, save money and reduce carbon emissions by up to 30% has announced the commercial availability for their product: Concrete Copilot.

So, how does Concrete Copilot work?

The technology first is integrated with a producer's current and historical data. Producers can then select their optimisation criteria based on their specific needs and objectives, and include supplementary cementitious materials such as fly ash, into the mix. The platform then creates millions of mix designs in seconds and presents the optimal one to the user to approve or modify based on their judgment and experience, streamlining the design process from months to minutes.

Concrete Copilot uses the materials in a producer's current supply chain, and when there are shifts in a material's availability or cost, producers can rapidly create new mix designs. The platform also allows for quick evaluation of the many new sustainable materials entering the market each year, helping them to enter production quickly for an immediate environmental impact.

The company undertook extensive field testing with producers across the United States to ensure the technology met and exceeded industry standards. The platform optimised mix designs for over 2,000,000 cubic yards of concrete, equivalent to filling 681 Olympic-sized swimming pools. On average, the material savings were $5.04USD/cubic yard, along with an average reduction in carbon emissions by 30%.

"We built Concrete Copilot, so producers don't have to choose between cutting cost and carbon. Our ultimate goal is to reduce the annual global carbon footprint of concrete by ~500 million tons just by optimizing concrete mixes with materials already in supply chains" said Alex Hall, CEO of Concrete.ai.

WRITE FOR COAL ASH MATTERS

Coal Ash Matters is the ADAA's main educational publication that is produced twice a year for the benefit of ADAA members and readers. Before each publication is drafted, an email is sent out to all members, urging them to contribute stories that they think are of interest. The types of content we are looking for include:

- **NEW DEVELOPMENTS**
- **TECHNOLOGICAL INNOVATIONS**
- **NEW PROJECTS**
- **NEW EMPLOYEES**
- **INDUSTRY RESEARCH**

If you have an idea or some content that you think should be shared with the CCP community, get in contact with the editor, Sam Patane at publications@adaa.asn.au

SUBSCRIBE TO

COAL ASH matters

www.adaa.asn.au