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## **Executive Summary**

Over two days, the ADAA International symposium brought together industry leaders, researchers, and policymakers to explore crucial themes of Coal Combustion Product (CCP’s) management.

Hosted at the UNSW Roundhouse, Day 1 opened with insightful discussions on stewardship, circular economy opportunities, and global approaches to resource management. The technical sessions covered advancements in coal ash harvesting, decarbonisation and innovative carbon reduction technologies, setting the tone for impactful solutions.

The Symposium was developed to bring together relevant stakeholders and hear from international and national experts sharing information and understand the changing landscape of CCP production. Speakers discussed the emerging issues and future drivers for investigating the harvesting potential of stored CCPs that can contribute towards to reducing carbon in construction materials and opportunities in the NSW circular economy.

The Symposium, which was invitation only, brought together over 110 delegates including leaders, technical experts, engineering practitioners and key policy makers from around the world to share their knowledge and experience in harvesting Coal Combustion Products (CCPs).

Day one (1) concluded with a lively networking event at the Coogee Bay Hotel Seaview Room — an excellent way to continue conversations on these critical topics in a more relaxed setting, accompanied by a touch of magic to end the evening on a high note.

Day two (2), the spotlight turned to energy producers, government regulators and infrastructure users, who examined the future of sustainable infrastructure and strategies for recovering valuable resources from landfilled materials. Engaging group discussions fostered collaboration, allowing participants to explore real-world applications of cutting-edge technologies. These sessions delivered actionable insights and practical solutions to address some of today’s most urgent environmental challenges.

The symposium provided an invaluable platform for knowledge sharing and networking, inspiring participants to advance sustainability initiatives. Engaging discussions among diverse stakeholders fostered a rich exchange of ideas and practical strategies, empowering attendees to implement actionable solutions within their organisations. The enthusiasm and commitment displayed throughout the event highlighted a collective drive to address pressing sustainability challenges and CCP management solutions.

We are looking forward to seeing how these ideas take shape in the months and years ahead!

We extend our heartfelt thanks to all of our incredible speakers, both international and domestic. Their expertise, insights, and dedication to advancing sustainability, resource management, and innovation were invaluable to the success of this symposium. These contributions have sparked meaningful discussions and laid the groundwork for future collaboration.

A huge thank you to our sponsors — this symposium would not have been possible without your generous support and invaluable contributions. Your partnership has been instrumental in bringing together leaders and innovators to drive meaningful discussions on sustainability and the future of our industry

## **Symposium Organising Committee**

* Geoff Hines, Stanwell Corp
* Anthony Callan, Delta Electricity
* Prof. Stephen Foster, UNSW
* Bill Martin, UniqueCem
* Mitchell Keetels, EPA
* Prof. Ali Kashani, UNSW
* Jodi Milne, Stanwell Corp
* Jane Piotrowski, Energy Aus
* Dr. Daksh Baweja, DMC Advisory
* Dr. Warren South, Valkoviki
* Alex Heidrich, HBM Group
* Craig Heidrich, HBM Group
* Anushree Malaviya, Studio NUA

## **Event Summary**

ADAA International Symposium 2024, 8th – 9th October, 2024 -- UNSW Roundhouse

Over the Symposium, two days of presentations were shared on harvesting case studies, potential challenges for stored CCPs, technologies that could contribute to reducing carbon in construction materials, and opportunities in the NSW circular economy. Invited industry stakeholders included coal power asset operators, CCP processors and value adders, engineers and designers, construction material companies, researchers, major transport agencies, and policymakers who were invited to share insights, perspectives, and challenges. Invited international speakers included;

* ASHCOR Technologies
* Attritor, UK
* Coomtech Clean Technologies, UK
* Electric Power Research Institute, USA (EPRI
* EP Power Minerals, UK & USA
* European Coal Combustion Products Association (ECOBA)
* University of Kentucky, USA
* Southern Company, USA
* WG WatershedGeo, USA

## **International Symposium Sponsors**

Sponsors for the 2024 International Symposium included:

* NSW EPA
* UniqueCem
* UNSW
* Delta Electricity
* Sustainable Future By Design

## **Social and Networking Events**

Day 1 of the symposium concluded with a lively networking event at the Coogee Bay Hotel Seabreeze Room from 6:30pm – 9:30pm which was attended by over 60 delegates. It was an excellent way to continue conversations on critical topics discussed during the day in a more relaxed setting, accompanied by a touch of magic to end the evening on a high note.

Overall, the International Symposium offered a vital platform for exploring sustainable solutions in energy, infrastructure, and resource recovery. Participants left with actionable insights on coal ash management, innovative technologies and policy advancements, fostering future progress in sustainability

## **Participants Q&A and event feedback**

During day 2 presentations attendees were encouraged to engage our speakers using tools such as Slido. Q&A sessions were captured and inserted below the respective presentation session.

Post the event participants were invited to complete the following survey about their respective experience about the International Symposium. 95% Respondents rated the vent as being either an excellent and great discussion about coal combustion products.

A screenshot of a survey

Description automatically generated

In terms of engagement by attendees. 76 of the 107 (71%) registered attendees scaned the Slido QR code and submitted or responded to the Q&A sessions.

A screenshot of a survey

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## **Symposium Presentations**

Coal Combustion Products (CCPs) – often referred to as “coal ash” and including “fly ash” and “bottom ash” – are solid materials produced when coal is burned to generate electricity. There are many good reasons why the 12 million tonnes of CCPs generated annually and the ~ 250 million tonnes in storage should be viewed as resources. Beneficiating and utilising CCPs conserves natural resources, saves energy and reduces associated carbon emissions contributing towards an efficient and sustainable circular economy.

With a background of accelerating change in the electricity market in New South Wales, the issue of supply and management of coal combustion products has been identified as an emerging long-term management issue for the NSW Government. In 2019, the NSW Parliament Legislative Council – Public Works Committee established and inquiry into and report on the costs for remediation of coal ash repositories in New South Wales. The Ash Development Association of Australia (ADAA), representing major industry stakeholders, recommended the recovery and use of stored CCPs would best address the terms of reference for the PWC, namely;

* economic and employment opportunities associated with coal ash re-use, site remediation and repurposing of land;
* adequacy and effectiveness of the current regulatory regime for ensuring best practice remediation of coal ash repositories;
* risks and liabilities associated with inadequate remediation including community and environmental health impacts.

Applications incorporating CCPs have been long proven to show the superior performance characteristics of these materials. Historically coal has been the largest reliable energy source for electricity, however with forecast changes in the Australian electricity market, securing CCPs suitable for use in low carbon construction applications will need to evolve and innovative solutions will need to develop in using these materials, in particular harvesting of stored materials has become an increasing priority.

The aim for the Symposium was to bring together relevant stakeholders - Industry, Government and Community - to hear from international and local experts, to share information and understand the changing landscape of CCP production, and the emerging issues and future drivers for investigating harvesting potential of stored CCPs that could contribute towards to reducing carbon in construction materials and opportunities in the NSW circular economy.

**Speaker Presentations can be downloaded** [**HERE**](https://www.adaa.asn.au/news-and-events/2024-adaa-international-symposium)

## **Day 1 Opening Remarks, Prof. Stephen Foster & Anthony Callen**

Prof. Stephen foster’s opening remarks outline the key challenges and strategies for achieving net-zero greenhouse gas emissions in the cement and construction sectors by 2050. It highlights that cement production contributes significantly to global CO₂ emissions—8% of total emissions—with 2.6 gigatons of CO₂ equivalent emitted in 2019, making up 4.4% of global greenhouse gas emissions.

For the construction sector, achieving net-zero by 2050 will require responsive codes, accelerated standardization of new materials, and close cooperation between governments, industry, and researchers. The presentation emphasizes the need for substantial investment in low-carbon industries, innovative materials, and clear policy support. It notes that recent findings from the International Energy Agency's Breakthrough Agenda Report 2024 indicate the cement sector is still off-track to meet these goals, underscoring the urgency for more aggressive regulatory, standardization, and innovation efforts.

## **Name:** Richard Wrightson, **Organisation:** Delta Electricity**, Presentation Title:** Energy transition: Progress and Perspective

This presentation by Richard Wrightson provides an overview of Delta Electricity's operations, energy industry transitions, and challenges facing Australia's power sector. Here are the key findings:

1. History & Operations:
   * Delta Electricity, formed in 1996, went through multiple ownership changes, most recently acquired by Sev.en GI in 2023. The company owns Vales Point Power Station, a black coal-fired facility, with an output of about 6.5 TWh annually sold in the National Electricity Market (NEM).
2. Renewable Transition Challenges:
   * The transition to renewable energy faces political and operational barriers, with Australia excelling primarily in household solar installations. Renewables remain variable and difficult to integrate reliably, particularly during winter or low-wind periods.
   * Battery storage is increasingly viable but limited for long-term storage needs.
3. Future Energy Mix & Gas:
   * The transition plan emphasises renewables complemented by gas and batteries to ensure stability. However, gas development faces regulatory hurdles, ESG (Environmental, Social, Governance) constraints, and market shortages, hindering progress.
4. Coal Phase-Out:
   * Vales Point is set to close by 2033, and the Australian Energy Market Operator (AEMO) projects nearly all coal plants phased out by 2035. Gas is essential to replace coal, but political and corporate influences challenge its integration into the energy mix.

This summary reflects Delta's goals of growth and diversification amidst the energy sector's challenges in Australia.

## **Name:** Hans-Joachim Feuernborn, **Organisation:** European Coal Combustion Products Association, **Presentation Title :** International Perspectives

This presentation by Joachim Feuernborn addresses the global trends and environmental strategies for reducing coal reliance and increasing the sustainable use of coal combustion products (CCPs). Here are the key findings:

1. Global Phase-Out Goals:
   * A significant reduction in coal usage is projected, with >90% phased out by 2050. Key climate commitments, like those from COP 28, push for net-zero emissions, focusing on reducing fossil fuel use and doubling renewable energy capacity by 2030.
2. Coal Phase-Out by Region:
   * Coal phase-outs vary by region. Europe is leading with several countries already coal-free, while Australia aims for 2040 and Annex II countries like China and India have extended timelines due to current coal dependency.
3. Sustainable CCP Utilisation:
   * Global CCP production is stabilising at 1.2 billion tons annually, with 750 million tons used in construction. With declining coal usage, attention is shifting to stockpiled CCPs as sustainable resources for the circular economy, especially in construction.
4. Environmental Product Standards:
   * Tools like Product Category Rules (PCRs), Life Cycle Assessments (LCAs), and Environmental Product Declarations (EPDs) are essential in promoting CCP reuse, offering standardised measures for sustainability.

These points underscore the transition challenges and efforts toward sustainable resource management amidst global coal reduction efforts

## **Name:** Bruce Hensel, **Organisation:** Electric Power Research Institute, **Presentation Title :** Overview of EPRI Environmental and Sustainability Research on CCPS’s

The presentation by Bruce Hensel at the ADAA International Symposium 2024 summarises the Electric Power Research Institute's (EPRI) environmental and sustainability research on Coal Combustion Products (CCPs). Key findings include:

1. CCP Management and Research Scope:
   * EPRI’s research focuses on CCP characterisation, groundwater (GW) transport and risk, remediation, beneficial use, and quality impacts.
   * Significant advancements have been made in geotechnical studies of CCPs, especially for managing ash ponds and landfills with a shift toward composite-lined systems for environmental safety.
2. Regulatory Background:
   * EPRI's work has supported regulatory determinations that classify CCPs as non-hazardous, enabling beneficial reuse and providing evidence for sustainable disposal methods.
3. Sustainability and Beneficial Use:
   * There is a strong emphasis on recycling harvested CCPs as supplemental cementitious materials (SCM) in construction, which offers environmental benefits and supports sustainable construction practices.
   * EPRI has developed technologies and methodologies to quantify the sustainability impact of using CCPs in various applications, especially in construction and soil stabilisation.
4. Groundwater and Environmental Protection:
   * EPRI employs high-resolution site characterisation, including isotopic and geochemical analysis, to assess and mitigate potential groundwater contamination.
   * Geophysical methods are used to locate buried coal ash deposits, supporting more effective environmental management.
5. Decision Support Tools:
   * EPRI introduced a Holistic Decision Support Tool for remediation, helping industry stakeholders make environmentally sustainable decisions on CCP management, focusing on factors like monitored natural attenuation (MNA) and reactive media for in-situ treatment.

Overall, EPRI’s efforts aim to enhance CCP management through research and innovation, promoting environmental protection, regulatory compliance, and sustainability in energy production.

## **Name:** Ben Gallagher, **Organisation:** Electric Power Research Institute, **Presentation Title:** Harvesting and Beneficiating Coal Ash: Advancing From An Idea To A Commercial Activity

The presentation "Harvesting and Beneficiating Ash: Advancing from Idea to Commercial" covers the strategic, technical, and regulatory considerations for ash harvesting and beneficial use in the United States. The key findings were:

1. Motivation for Ash Harvesting:
   * The U.S. faces a decline in coal combustion products (CCP) production, particularly fly ash and gypsum, due to energy transitions. This decline coincides with increased demand in industries like cement, which raises greenhouse gas (GHG) emissions and import reliance.
   * Harvesting existing ash stockpiles (over 2 billion tons in the U.S.) is necessary to address these environmental and industrial needs.
2. Utility Approaches to Harvesting:
   * Two main approaches are competitive (Request for Proposal) and collaborative (Request for Qualifications), each suited to different market maturity and technology levels. Utilities like Dominion Energy and Duke Energy have explored these methods in developing beneficial ash use projects.
3. Objectives of Harvesting:
   * Key drivers include risk reduction, regulatory compliance, governance (sustainability), and cost savings through revenue from ash sales and reduced closure costs.
4. Beneficial Use of Ash:
   * Regulated uses include cement, concrete, synthetic aggregates, fillers, and engineered materials, which substitute virgin materials and meet safety standards. Uses are divided into encapsulated (e.g., concrete) and unencapsulated (e.g., structural fill) applications.
5. Development of New Harvesting Projects:
   * Essential components include market evaluation, resource assessment, technology selection, and regulatory compliance. Each component requires extensive testing and data interpretation to ensure safety and environmental protection.
6. Market and Use Specifications:
   * Markets are driven by demand growth, alternative material pricing, and transportation logistics. Use specifications in construction, for instance, are evolving, with potential for new testing methods to validate ash for specific applications.
7. Technology and Environmental Challenges:
   * Key challenges include variability in ash quality, absence of established beneficiation technologies, dewatering issues, and the need for better technology for sulfur separation. Pilot testing and progressive scaling are often necessary to validate new technologies.
8. Environmental Considerations:
   * These include management of dust, groundwater impact, and wastewater. Guidelines, like ASTM standards, offer frameworks for environmentally compliant harvesting.
9. Example and Future Directions:
   * A thermal beneficiation plant is highlighted as a case study, showing a 300,000-ton annual processing capacity for concrete-grade ash. The presentation underscores the need for continued innovation and regulatory support for large-scale commercial ash use.

In conclusion, the presentation outlined a roadmap for advancing ash harvesting to meet environmental and industrial demands, emphasising the need for standardised practices, regulatory compliance, and ongoing innovation in technology and market strategies​

## **Name:** Brett Mitchell & Nortey Yeboah, **Organisation:** Southern Company, **Presentation Title:** Southern Company Coal Ash Management and Beneficial Use

The presentation on Southern Company's coal ash management and beneficial use outlined several key findings and initiatives:

1. Company Overview: Southern Company, a major utility provider in the U.S., manages coal combustion residuals (CCR) through its subsidiary, Georgia Power. The CCR is regulated under both federal and Georgia state laws.
2. CCR Pond Closure and Management: Georgia Power initiated the closure of all its ash ponds in 2015, ceasing ash placement in these ponds by 2019. The closure strategy involves excavating 20 ash ponds while securing nine others in place with advanced engineering techniques.
3. Beneficial Use Initiatives:
   * *Plant Bowen Facility*: Scheduled to become operational in January 2024, this facility will process approximately 600,000 tons of harvested ash annually, transforming it for commercial uses.
   * *CCR Beneficial Use R&D*: Research efforts focus on new markets and improving the economic feasibility of ash processing, supporting Southern Company’s long-term CCR management strategy.
4. Coal Ash in Concrete: Utilising coal ash in concrete improves durability and reduces the amount of Portland cement required. Southern Company aims to maximise ash usage in concrete products as a sustainable option.
5. Cost Reduction and New Technologies:
   * *Froth Flotation*: A low-energy process demonstrated by a UK-based company to treat ash for use in geopolymers and standard concrete.
   * *Alternative Applications*: Research and pilot projects explore uses in construction aggregates, decorative stone, agriculture, and even as feed for green fuel production.
6. Critical Mineral Recovery: The presentation highlights the strategic potential of coal ash as a domestic source for rare earth elements (REEs), critical for national defence and the energy transition. Pilot projects funded by the Department of Defence have shown promising results, with high-purity REE recovery efforts in Alabama and Georgia.

In summary, Southern Company’s coal ash management strategy includes closing ash ponds, investing in facilities for beneficial use, and exploring innovations in recycling coal ash into sustainable materials and rare earth elements for national needs.

## **Name:** Barb Bosh, **Organisation:** ASHCOR Technologies, **Presentation Title:** Circular Solutions: Ashcor’s Guide To Coal Combustion Product Harvesting and Beneficiation

This presentation by Ashcor outlines key findings and strategies for circular solutions in coal combustion product (CCP) harvesting and beneficiation, with a particular focus on their patented RAM technology. Here are the key takeaways:

1. RAM Facility and Technology: Ashcor’s RAM technology reclaims and processes coal ash from ponds and landfills, offering an environmentally friendly alternative that meets Canadian (CSA A3000) and American (ASTM C618) standards. The RAM process reduces greenhouse gas emissions by up to 90% compared to traditional cement manufacturing.
2. Regulatory and Market Challenges: The project faces regulatory challenges, including a need for development and environmental permits, DOT acceptance, and adapting to updated Australian Standards. Market acceptance has required educating stakeholders on the benefits and quality of reclaimed ash as a substitute for Portland cement.
3. Greenhouse Gas and Environmental Benefits: Using reclaimed ash as a supplementary cementitious material (SCM) can reduce GHG emissions significantly. RAM ash is a preferred product for concrete producers because of its consistent quality and environmental benefits, supporting global efforts toward net-zero targets.
4. Circular Economy Impact: Ashcor’s initiatives contribute to a circular economy by creating local jobs, fostering community partnerships, reducing waste, and allowing for the reuse of ash dams. This approach aids in revitalising areas affected by coal ash disposal, setting benchmarks in environmental practices.
5. Expansion and Innovation: Plans for a full-scale RAM plant in the U.S. Midwest and mobile RAM units indicate Ashcor’s focus on expanding its ash beneficiation services, including new markets accessed via barge distribution.

The presentation highlights Ashcor’s role in advancing sustainable practices in ash management and recycling, promoting community benefits, and reducing the environmental impact of coal combustion products.

## **Name:** Rafic Minkara, **Organisation:** EP Power Minerals, **Presentation Title:** Production of Low-GHG SCM’s from Legacy CCP Deposits

The presentation, *Production of Low-GHG Supplementary Cementitious Materials (SCM) from Legacy CCP Deposits*, by Rafic Minkara, explores strategies for producing low-carbon SCMs using legacy coal combustion product (CCP) deposits. Here are the main findings:

1. Overview of EP Power Minerals:
   * EP Power Minerals, part of EP Holding, specialises in managing coal combustion products and slag, focusing on SCMs for the cement and concrete industry. They have a global presence and pioneered landfill ash recovery and processing for concrete.
2. Decarbonisation in Cement and Concrete:
   * Cement and concrete production contribute 7-8% of global CO2 emissions. To reduce this, the industry seeks alternatives like SCMs, which have lower carbon footprints than Portland cement. Emerging methods also include carbon capture and sequestration (CCS) and concrete carbonation techniques.
3. SCM Production Technology and Global Sourcing:
   * EP Power Minerals sources SCMs from various global locations, including fly ash, ground granulated blast-furnace slag, and natural pozzolans. They also explore legacy fly ash deposits in the U.S. and Europe as a viable source of SCMs despite regulatory and quality challenges.
4. Conversion Process for Legacy Ash:
   * Processing involves pre-screening, drying, and advanced treatment to reduce impurities like unburned carbon. Technologies include thermal and electrostatic separation, flotation, and grinding for particle fineness. Challenges involve moisture control, feedstock variability, and environmental by-product management.
5. Drying Technologies and GHG Emissions:
   * Various drying technologies (flash, rotary, fluid bed) are assessed for energy efficiency and emissions. Flash dryers, for example, demonstrate high energy efficiency, reducing the carbon footprint compared to traditional methods, and all SCM production processes studied have a lower footprint than Portland cement.
6. Future and Legacy Ash Re-Processing:
   * As coal-fired generation declines, sourcing SCMs from legacy ash deposits is becoming essential. Projects underway include re-processing ash from closed landfills and using advanced carbon reduction methods to repurpose high-quality SCMs.

In essence, this presentation highlights the pathway to low-GHG SCM production by repurposing legacy coal ash, emphasising technological advancements, regulatory navigation, and market alignment for sustainable construction material alternatives

## **Name:** Phillip Jarvis, **Organisation:** Coomtech Clean Technologies, **Presentation Title:** Keeping The Carbon Out of Decarbonisation

The presentation *"Keeping Carbon Out of Decarbonisation"* by Philip Jarvis, CEO of Coomtech, emphasised Coomtech’s innovative, low-energy drying technology aimed at reducing the carbon footprint in industrial processes. Here are the key findings:

1. Environmental Impact of Traditional Drying:
   * Conventional thermal drying processes, essential in industries such as cement and lime production, are highly energy-intensive and contribute significantly to CO₂ emissions. Coomtech highlights that drying alone can account for 63% of the energy consumption in manufacturing.
2. Coomtech’s Kinetic Drying Solution:
   * Coomtech's kinetic drying technology offers an alternative by reducing energy use by up to 94% compared to traditional drying, achieving near-zero emissions. This technology avoids thermal drying’s drawbacks, such as potential material damage from high heat, making it suitable for sensitive materials like fly ash, aggregates, and other cementitious materials.
3. Comparison with Traditional Drying Technologies:
   * Unlike fluidised beds and rotary drums, Coomtech’s drying process lowers energy consumption significantly, utilising only 8.3–13.8 kWh per metric ton compared to 73–244 kWh in traditional methods. Additionally, the Coomtech system can integrate waste heat more effectively, enhancing energy efficiency.
4. Market and Industry Applications:
   * Coomtech’s drying technology is flexible and scalable, making it viable across various industries, from construction and mining to chemicals and battery manufacturing. The “plug-and-play” design enables modular, real-time adaptation for efficiency improvements and minimal operational downtime.
5. Strategic Partnerships and Industry Adoption:
   * Holcim, a leader in sustainable construction, has partnered with Coomtech to leverage its low-emission drying technology as part of its decarbonisation strategy. This partnership reflects a broader market shift towards circular economy practices, where industrial by-products like fly ash are reclaimed and repurposed efficiently.

In summary, Coomtech’s kinetic drying technology represents a scalable, energy-efficient alternative to conventional drying methods, aligning with industry goals for decarbonisation and sustainable materials management​

## **Name:** Rutu Joshi, **Organisation:** Watershed GEO, **Presentation Title:** Planning For The Future of CCP Beneficial Use

The presentation titled *"Planning for the Future of CCP Beneficial Use"* by Rutu Joshi, PE, focused on strategies and innovations in managing Coal Combustion Product (CCP) sites and supporting sustainable, beneficial use (BU) of CCPs. Here are the key findings:

1. Challenges of Current CCP Supply and Demand: With the decline of coal-fired power, fresh fly ash production is decreasing while demand for ash in concrete production is increasing. Harvesting stored CCPs can help meet this demand, but regulatory constraints on closure timelines pose challenges.
2. Regulatory Framework: Current regulations lack flexibility for extending deadlines for closing CCP units. Future strategies include working with regulatory bodies like the US EPA Smart Sectors to clarify rules, allow harvesting, and reduce post-closure care requirements.
3. Innovations for Sustainable Harvesting:
   * Engineered Turf Covers (ETC): ETC technology improves stormwater management, reduces maintenance, and preserves CCP quality by directly covering CCPs without soil.
   * Closure Planning: Designing closures with future harvesting in mind, using innovative closure technologies, and ensuring infrastructure like rail access and stormwater management for efficient CCP retrieval.
4. Forward-Looking Strategies: Recommendations include ash quality sampling, resource mapping, proactive market engagement, and 3D modeling dashboards for CCP monitoring.
5. Sustainability and Reuse: Materials like ETC can be reused in other closure projects or recycled at the end of their service life, enhancing sustainability in closure and harvesting processes.
6. Challenges and Solutions: Key challenges like regulatory compliance, cost, and complexity are addressed through industry collaboration, integrating harvesting plans into closure applications, and considering innovative technologies such as ETC to streamline operations.
7. Conclusion: To ensure effective CCP use, the presentation calls for engaging regulators, working with technology providers, and incorporating harvesting plans into CCP closure processes.

This presentation emphasises a strategic, forward-thinking approach to CCP management, combining regulatory flexibility, innovative technologies, and sustainability practices to support future beneficial use.

## **Name:** Craig Heidrich, **Organisation:** Ash Development Association of Australia, **Presentation Title:** Innovations, Challenges and Opportunities in coal Combustion Products (CCP’s)

The presentation by Craig Heidrich, CEO of the Ash Development Association of Australia, titled *"Innovations, Challenges, and Opportunities in Coal Combustion Products (CCP) Harvesting"* discusses the status, potential, and obstacles for CCP beneficial use in Australia. Here are the key findings:

1. Australian Context and CCP Demand: Australia’s shift away from coal is impacting CCP production and availability, widening supply gaps and creating market challenges. Despite this, demand for CCPs, particularly in concrete, remains high.
2. Drivers for Change:
   * Energy Policy: The transition to cleaner energy sources drives the need for alternative CCP applications as traditional coal production declines.
   * Circular Economy: CCPs are being increasingly promoted for their recycling potential within a circular economy framework.
   * Supply Chain Challenges: As coal plants close, distribution gaps emerge, pressing the need for innovative storage, transportation, and repurposing solutions.
3. Standards and Market Adaptation: Maintaining strict Australian standards for concrete use and ensuring compliance with standards (AS3600, AS1379) is crucial. These standards help drive adoption in major infrastructure projects like roads and buildings, where CCPs are applied to achieve durability and sustainability goals.
4. Innovations in CCP Use:
   * High-Volume Fly Ash (HVFA) Concrete: Precast panels using >80% fly ash in concrete reduce carbon emissions and benefit the construction industry.
   * Agricultural Benefits: Research has shown that CCPs can improve soil quality, providing potential applications in agriculture.
   * Infrastructure Projects: Applications like bottom ash compaction in roads (e.g., M1 Motorway) showcase CCPs’ durability and efficiency.
5. Future Pathways and Priority Areas:
   * Political and Economic Support: Policy backing and funding for CCP initiatives are essential for scaling usage.
   * Technological and Environmental Factors: Emerging tech in gasification, carbon capture, and regulatory pressures are shaping CCP processing and adoption.

This presentation highlights the need for innovative CCP applications, standards compliance, and cross-sector collaboration to secure CCPs’ role in Australia’s future sustainable infrastructure.

## **Name:** Dr.Warren South, **Organisation:** Ash Development Association of Australia, **Presentation Title :** The NSW Carbon Abatement Fund Project (CRAF)

The *NSW Carbon Recycling and Abatement Fund Project (CRAF) – Pathways to Maximise Stored Coal Combustion Products* presentation, led by the NSW Government and Ash Development Association of Australia, outlined a project aimed at harnessing coal combustion products (CCPs) as coal-fired power stations are phased out. Key findings include:

1. Project Objectives:
   * Promote circular economy approaches for efficient CCP management.
   * Develop insights on CCP repository potential to aid in reducing carbon emissions and supporting the cement sector.
2. Funding and Phases:
   * The NSW Government allocated $3.25 million to the CRAF initiative.
   * Phase 1 involves characterising stored CCPs and identifying future applications through site investigations and desktop studies.
   * Subsequent phases will focus on implementing protocols for CCP utilisation, updating material standards, and piloting projects for job creation.
3. Expected Outcomes:
   * Creation of a comprehensive CCP data library to inform stakeholders on potential applications and support regulatory improvements.
   * Development of resources to guide the beneficial reuse of CCPs, fostering industry and environmental alignment.
4. Project Timeline and Key Milestones:
   * Desktop studies, site investigations, stakeholder mapping, and regulatory reviews are scheduled through 2025.
   * Stakeholder engagement is central, involving government agencies, CCP processors, and end-users.

This initiative aims to drive CCP reusability in construction, address supply chain issues, and align with environmental regulations to create sustainable applications for CCPs in NSW.

## **Day 2 Opening Remarks, Prof. Stephen Foster & Anthony Callen**

The presentation discussed key developments in low-carbon cement and alternative binder concrete, with a focus on the application of geopolymer concrete (GPC) across various large-scale projects in Australia. Highlights include:

1. Notable Projects:
   * Wellcamp Airport (2014): 40,000 m³ of geopolymer concrete.
   * Pinkenba Wharf, Brisbane (2018): 252m x 16m wharf structure using GPC.
   * University of Queensland Global Change Institute: 330 m³ of geopolymer concrete used for three suspended floors.
2. Standards and Design:
   * SA TS 199:2023: This standard covers the scope, specifications, design properties, durability, fire resistance, and testing of geopolymer and alkali-activated binder concrete.
   * A performance-based approach supports the adoption of innovative materials by reducing regulatory obstacles.
3. Creep Performance:
   * The presentation compares the creep performance of ordinary Portland cement (OPC) and geopolymer concrete (GPC) over periods of 56, 90, 180, and 365 days.
   * References recent research findings and comparisons with established models to highlight GPC's potential in maintaining structural integrity over time.
4. Final Remarks:
   * Advocates for a balanced approach to regulation that supports public safety while encouraging innovation, with a science-based and performance-oriented standardisation process.

## **Name:** Peter Griffiths, **Organisation:** Mt. Piper , Energy Australia, **Presentation Title:** Mt. Piper Power Station

The presentation covered the management, challenges, and potential uses of coal ash from Mt Piper Power Station's ash repositories. Key areas addressed include:

1. Ash Placement and Repository Capacities:
   * Mt Piper Ash Repository (MPAR): Spanning 92 acres, it can hold over 22 million tons of ash, including a specific brine-conditioned section.
   * Lamberts North Ash Repository (LNAR): Covering 114 acres, it currently holds 5.5 million tons, with additional capacity under review.
2. Repository Design and Leachate Management:
   * Repositories include dry landfill features, water-conditioned ash layering, and leachate management with captured leachate averaging 1.8-2 ML per month. Leachate is repurposed for dust suppression and treatment.
3. Challenges in Coal Ash Beneficiation:
   * The absence of “washing” for ash at Mt Piper results in added wastewater, requiring alternative options.
   * Developing alternative markets for ash in construction is challenging due to R&D and manufacturing adaptation costs.
   * Transport logistics are impacted by the lack of rail options and reliance on trucks.
   * Regulatory limitations exclude brine-conditioned ash from the coal ash order, complicating agricultural testing.
4. Opportunities for Ash Use:
   * Research into alternative cements and geopolymers, including unreinforced concrete applications, shows promise for using brine-conditioned ash.
   * Other potential applications include engineered decking, flooring, gyprock, plaster molding, and various building materials.
   * Increasing interest in ash sales aligns with the planned 2042 closure of the Mt Piper Power Station.
5. Case Studies:
   * A 2012 road base trial on Back Cullen Road and a trial on classifying furnace bottom ash as aggregate illustrate practical applications of ash in construction.

These insights reveal both the constraints and innovation opportunities associated with coal ash management at Mt Piper Power Station.

## **Name:** Anthony Callen, **Organisation:** Vales Point, Delta Electricity, **Presentation Title:** Vales Point Power Station

This presentation focused on the operations, innovation, and future outlook for Vales Point Power Station under seven Global Investments. Key findings include:

1. Operations Overview:
   * Vales Point generates 1,320 MW, meeting around 10% of NSW’s energy demand, and consumes 3 million tons of coal annually.
   * Ash production includes 25% reused fly ash, over 90% reused bottom ash, with the remainder stored in landfills.
2. Technological Developments:
   * U-Panel Wall System: A modular, low-carbon wall system using over 50% recycled fly ash, requiring minimal skilled labour and meeting Australian building standards for strength, fire resistance, and thermal and acoustic ratings.
   * UniqueCem Low-Carbon Cement: Made from blast furnace slag and fly ash, this alkali-activated binder has a lower carbon footprint than traditional cement and can be a drop-in replacement for ordinary Portland cement.
3. Sustainability and Circular Economy Opportunities:
   * Increased use of stored ash aligns with sustainability goals and offers economic opportunities. Collaboration across transitioning industries is encouraged to support innovation and reuse of industrial byproducts.
4. Challenges:
   * Regulatory frameworks need to adapt to keep pace with innovation to attract investment.
   * Other challenges include scaling costs, supply chain risks, and ensuring circularity in material use while meeting market demand.

The presentation concluded by emphasising the need for a strategic approach to ash reuse and low-carbon product development, recognising both challenges and significant opportunities. Key concluding points include:

* Collaboration and Innovation: The transition of both energy and construction industries offers a unique chance to collaborate on sustainable solutions, leveraging existing standards and policies to support new products.
* Regulatory Support and Scalability: For innovations like UniqueCem and U-Panel systems to succeed, regulatory frameworks must evolve to support development capital and facilitate market access, especially with the upcoming coal plant closures.
* Focus on Circularity: Ensuring the circularity of materials is essential. This means continued focus on product design, resource recovery, and recycling technologies to maintain a sustainable lifecycle for these industrial byproducts.

Overall, the conclusion highlighted the potential for Vales Point to lead in ash reuse and sustainable cement solutions, provided that regulatory support, strategic partnerships, and scalable innovation are aligned.

## **Name:** Brett Murphy, **Organisation:** Eraring, Origin Energy, **Presentation Title:** Eraring Power Station, Ash Recycling and Closure Planning

This presentation outlined Eraring Power Station's ash recycling activities, closure planning for its ash dam, and the feasibility of resource recovery. Key findings include:

1. Eraring Power Station Overview:
   * Eraring is Australia’s largest coal-fired power station, supplying about 25% of NSW’s energy needs. Operating since 1982, it has a capacity of 2,922 MW and an operational guarantee through August 2027, with a possible extension to April 2029.
2. Current Ash Recycling Efforts:
   * Ash production reached 1.5 million tons in FY24, with 43% recycled.
   * Key customers, such as Flyash Australia and Boral, use various types of ash for concrete and mine rehabilitation projects. All bottom ash is currently recycled.
3. Ash Dam Closure Planning:
   * A rehabilitation plan submitted in early 2024 outlines potential "cap and close" or resource recovery strategies for the ash dam. The final approach will depend on regulatory, community, and commercial considerations.
4. Feasibility of Resource Recovery:
   * Origin is exploring commercial recovery options through partnerships, trial processing, and engaging with technology providers. An expression of interest (EOI) for commercial recovery operations is expected in 2025.
5. Challenges:
   * Operational challenges include managing water after station closure, while commercial challenges stem from NSW's low fly ash prices.
   * Quality concerns due to high chloride levels and non-compliance with Class 1 standards will require advanced processing, and existing technology may not be sufficient for all needs.

In summary, while Eraring is actively pursuing ash recycling and closure options, significant technical, regulatory, and economic hurdles remain for effective long-term resource recovery.

## **Session Questions**

Q. What is the ratio of Fly Ash/bottom ash in your repositories? Is it homogeneous?

Q. If unlined ash ponds are problematic, isn't using ash as road-base or as fill material also problematic?

Q. Is there any appetite by NSW CFPS for conducting own research like Southern Company USA?

Q. What is the expected range of chloride levels in pond ash? Are there other ions in pond ash, such as sulfate?

Q. Anthony Callen does Delta undertake an Environmental Classification prior to use bottom ash as backfill material ?

Q. How much work has been done to characterize the materials in repositories with co-disposed wastes?

Q. What are the future land use considerations? Do they influence plans to access ash repositories for reuse?

Q. For the policy makers in the room, will there be a carbon credit scheme that incentivises generators (ash producers) to make available its stored product.

## 

## **Name:** Mars Capasso, **Organisation:** Hallett Concrete, **Presentation Title:** Harvesting “salt water sluiced” Flyash in SA : Our Experience So Far

This presentation outlined Australia’s approach to sustainable cement production, highlighting new standards, South Australia’s SCM resources, and innovative processing methods at Port Augusta to meet rising SCM demands and reduce CO₂ emissions.

1. Growing Demand for Supplementary Cementitious Materials (SCMs):
   * Australia's demand for SCMs is expected to increase from 5.7 million tonnes in 2020 to 7.6 million tonnes by 2050.
   * Traditional SCMs like fly ash, slag, and silica are limited in supply in Australia, with 100% of the fly ash and slag used in South Australia being imported.
2. Development of New SCM Standards:
   * In response to global and national pressures to reduce CO₂ emissions, a new Australian Standard (AS 3582.4) for "Manufactured Pozzolans" was created, enabling the inclusion of alternative SCMs sourced from industrial byproducts and natural minerals.
3. South Australia's Upper Spencer Gulf SCM Sources:
   * Key resources include a 20-million-tonne stockpile of fly ash at Port Augusta and a 3-million-tonne fume slag stockpile at the Nyrstar Port Pirie Polymetallic Smelter.
4. Port Augusta SCM Processing Hub:
   * This site includes a large leased area and a 260-hectare ash dam, along with plans for a logistics and distribution hub, a 400 MW battery, and supporting infrastructure. The hub is conducting R&D on fly ash characterization, focusing on processing methodologies to maximize quality and sustainability.
5. Pilot and R&D Initiatives:
   * A pilot plant was established to test fly ash processing, which involves drying, classification, and chloride washout methodologies. The R&D aims to address the brine chemistry and manage heavy metals in the material.
6. Collaboration and Testing:
   * Partnerships with universities have been established, supporting PhD research and an extensive two-year concrete testing program to evaluate the technical performance of new SCM materials.
7. Major Insights and Recommendations:
   * Key learnings include the importance of understanding material variability, optimizing washing and dehydration to reduce energy use, managing brine chemistry, and reconsidering chloride content limits in SCMs for environmental and durability standards.

In conclusion, Australia's sustainable cement production strategy is advancing with new SCM standards, leveraging South Australia’s local resources, and establishing an innovative processing hub at Port Augusta. These initiatives are vital in meeting the rising SCM demand and achieving CO₂ reduction goals, positioning Australia as a leader in eco-friendly construction materials.

## **Name:** David Farah, **Organisation:** Adbri Group, **Presentation Title:** Pond Ash Beneficiation Australian Considerations

The presentation focused on the Australian market for supplementary cementitious materials (SCMs) and the considerations for using pond ash as an SCM in concrete. Here are the key findings:

1. Current SCM Market in Australia: Materials like slag (GGBFS) and fly ash are well-established in the industry, but their availability is projected to decrease over time. Emerging SCMs, including aluminosilicate-rich materials and calcined pozzolans, are gaining interest, with limestone mineral additions also increasing.
2. Pond Ash Context: In Australia, unused fly ash is often stored in ponds, mixed with brackish or salt water, leading to high chloride levels and, in some cases, trace elements that make it unsuitable for concrete applications.
3. Challenges in Pond Ash Use: The beneficiation (purification) of pond ash faces several roadblocks:
   * Chloride Removal: Requires fresh water leaching or high-temperature volatilisation, both of which are costly and environmentally taxing.
   * Trace Element Removal: Potentially achievable through chemical scrubbing, but complex.
   * Carbon Burnout & Milling: Processes are expensive, increasing the carbon footprint.
   * High Costs: The technology for beneficiation has high capital and operational costs, making it less viable compared to emerging SCMs.
4. Future Outlook: Given these challenges, Australia may shift towards lower-cost, lower-carbon SCMs before pond ash beneficiation becomes economically feasible.

The conclusion suggested that while pond ash beneficiation offers a potential SCM source, its high costs, environmental challenges, and technical complexities make it a less viable option in the near term for Australia. Instead, the market is likely to embrace alternative SCMs with lower embodied carbon and more sustainable production processes. This shift could reduce reliance on pond ash, as the country focuses on more accessible and eco-friendly materials to meet its construction industry's evolving demands

## **Name:** Olivia Alexis, **Organisation:** Cement Australia, **Presentation Title:** SCM’s in the Cement Industry

The presentation by Olivia Alexis covered the evolving role of Supplementary Cementitious Materials (SCMs) in Australia’s cement industry, with a focus on sustainability and regulatory impacts. Key findings include:

1. Industry Evolution: Over the past 15 years, the industry has incorporated more SCMs, such as slag, and increased limestone additions, while exploring alternative fuels and improved kiln technology to enhance efficiency.
2. Safeguard Mechanism Impact: The Safeguard Mechanism, reformed in 2023, targets CO₂ reduction across major emitting facilities, including clinker kilns. This regulation aims for a 43% reduction by 2030 and net zero by 2050, driving a greater reliance on SCMs to reduce emissions.
3. SCMs' Role: SCMs have traditionally helped lower CO₂ in concrete, and increased use of SCMs is vital for emissions targets. Conventional SCMs may face supply constraints due to rising costs, logistics, and power station closures, creating a need for alternative, locally sourced SCMs.
4. Alternative SCM Viability: A Viability Assessment Matrix evaluates alternative SCMs, like dam ash, based on quality, cost, availability, embodied carbon, and social responsibility. Dam ash, in particular, could be a valuable SCM if processing challenges are addressed.
5. Challenges with Dam Ash: Dam ash lacks standardised processing in Australia, with moisture and logistical issues complicating its use. Collaboration across industries is needed to make dam ash a viable SCM option.
6. Future Direction: Conventional SCMs will remain essential in the short term, but as supplies wane, alternative SCMs will be crucial to achieve carbon reduction targets and meet evolving industry standards.

In summary, the cement industry is moving towards lower-carbon solutions by increasing SCM usage and optimising alternative sources like dam ash to align with environmental goals and regulations.

## **Session Questions**

Q. David Farah, can you elaborate on the trace element concentrating effect you mentioned in some ponded ash locations?

Q. Is Cement Australia looking into carbon capture to address the 60% of carbon generated that cannot be changed through your processes?

Q. From a cement/concrete producer point of view, what is the role of government specifications in enabling a wider use of SCMs such as recovered ash?

Q. Perhaps for the ADAA - has there been consideration to map all ponded ash repositories in Australia for trace and rare earth materials?

## **Name:** David Kelly, **Organisation:** TfNSW, **Presentation Title:** Sustainable Infrastructure Program

The presentation by David Kelly outlined the Sustainable Infrastructure Program (SIP) led by Transport for NSW, aiming for net-zero emissions across infrastructure projects. Key findings include:

1. Transport Net Zero Targets: Major goals include achieving 100% renewable electricity for rail and metro by 2025, fully electric passenger vehicle fleets by 2030, and net-zero operational and embodied emissions by 2045, with net-negative emissions by 2060.
2. SIP Workstreams:
   * Net Zero Procurement: Integrates carbon as a key consideration in procurement.
   * Net Zero Engineering & Innovation: Focuses on sustainable design and material use.
   * Decarbonising Development Phase: Embeds carbon values in business cases.
   * Decarbonising Construction Phase: Promotes zero-emission equipment.
   * Cross Cluster Alignment: Harmonises carbon and circular economy goals across NSW clusters.
3. Near-Term Focus Areas: Upcoming efforts include developing a comprehensive carbon and cost library, establishing carbon management systems, and creating climate risk assessment tools.
4. Common Data Model for ESG Integration: A standardised data model enables consistent tracking of carbon and other sustainability metrics throughout the infrastructure lifecycle.
5. Carbon Management System: Transport for NSW is implementing a carbon management system to guide emissions tracking and reduction across projects.

This program establishes a clear path for sustainable infrastructure in NSW, prioritising long-term net-zero goals, collaborative industry standards, and integration of carbon considerations into all project stages.

## **Name:** Samuel Henwood, **Organisation:** TfNSW, **Presentation Title:** Fly Ash Usage on TfNSW Projects

The presentation by Sam Henwood focused on the usage, challenges, and opportunities of fly ash and other coal combustion products in Transport for NSW (TfNSW) projects. Here are the key findings:

1. Fly Ash Applications: Fly ash is used across various applications in road and rail earthworks, pavements (both rigid and flexible), and structural concrete.
2. TfNSW Specifications: Several standards are set for using coal combustion products:
   * R44: Covers earthworks, specifying requirements for general fill, including unsuitable materials and conditions.
   * QA 3051: Governs granular pavement base and subbase materials, outlining material and performance criteria.
   * QA 3211: Pertains to cementitious materials and binders, particularly for fly ash as a supplementary cementitious material.
3. Challenges and Opportunities in Earthworks:
   * Categorising unsuitable materials (e.g., inherently unsuitable like peat or "unsuitably wet" after rain).
   * Addressing earth fill quality, slope stability, and batter tolerance.
4. Granular Materials: The specification QA 3051 highlights constituent and performance requirements, with commercial considerations for viability.
5. Cementitious Materials:
   * Fly ash is valued for its durability and sustainability benefits in concrete.
   * The presentation stresses the importance of material characterisation and acceptance criteria to ensure long-term performance.
   * Changes in acceptance criteria come with risks that must be managed across the supply chain.
6. Risk Management: Clear communication of risk responsibility across clients, contractors, and suppliers is essential for maintaining quality, commercial feasibility, and environmental outcomes.

The presentation concluded with acknowledgments to TfNSW team members who contributed to the development and management of these guidelines.

## **Name:** Dr. Daksh Baweja, **Organisation:** DMC Advisory, **Presentation Title:** Industry Perspectives With Ash: Past, Present and Future

The presentation by Daksh Baweja outlined the evolution, applications, and future of coal combustion products (CCPs) and fly ash in concrete construction, highlighting sustainability and performance needs. Key points include:

1. Historical Context: The presentation discusses the history of fly ash use in Australian concrete standards, dating back to its inclusion in the 1940s and 1950s. Fly ash has since become integral in infrastructure due to its durability and sustainability benefits.
2. Concrete Standards: Over time, standards have evolved to improve concrete's durability, with fly ash contributing to the strength and resilience of concrete structures in both Australia and globally.
3. Advantages of Fly Ash: Fly ash reduces chloride diffusion, resists sulfate and chemical attacks, lowers shrinkage, and enhances constructability. Its use has grown due to benefits like lower cracking potential and increased service life of concrete structures.
4. Decarbonisation Goals: Low-carbon concrete and decarbonisation pathways are essential for reducing the carbon footprint of the cement and concrete sector. Efforts focus on innovative designs, alternative fuels, CO₂ uptake, and sustainable cement alternatives.
5. Future of CCPs: The presentation emphasises the need to rethink CCPs in construction. It advocates for broader applications of ungraded fly ash, especially in non-structural fill, road bases, and lean mix concrete, to reduce waste and support sustainability.
6. Challenges Ahead: Optimising CCP usage requires revising industry practices and encouraging collaboration among stakeholders, including power producers, construction companies, and regulatory bodies.

The conclusion calls for innovation and policy changes to meet future construction and environmental goals, ensuring CCPs are efficiently integrated into sustainable building practices.

## **Session Questions**

Q. Sam Henwood which specifications have precedence, ATIC or TfNSW? How can they be made more dynamic and innovative?

Q. Sam Henwood has TfNSW considered alternatives to LOI testing, like foam index testing? In US ash deposits LOI includes hydrates and carbonates that do not impact AEA.

Q. Why is it that globally infrastructure can be built successfully with the use of Fly ash under various lesser specs such as ASTM C618?

Q. Dr Baweja - would performance based specifications be the best option for the implementation of alternative SCMs such as harvested CCPs?

Q. What are your thoughts on there being a significant amount of fly ash not being used due to the LOI restrictions considering concrete mixes using AEA is low.

Q. David Kelly, what level of interstate cooperation do we have on Transport (DoT) carbon reduction goals….what role does Austroads play?

Q. Does NSW allow the use of fly ash in asphalt pavements?

Q. For TfNSW, how do you balance commercial vs sustainable decision making in road construction? i.e. utilising a sustainable material may be more expensive?

## **Name:** Alison Scotland, **Organisation:** Australian Sustainable Built Environment Council (ASBEC), **Presentation Title:** Decarbonising Australia’s Built Environment

The document, presented by Alison Scotland from the Australian Sustainable Built Environment Council (ASBEC), highlights the critical role of decarbonising Australia’s built environment. Key findings include:

1. Carbon Emissions and Resource Demand: Buildings contribute to 39% of global carbon emissions and 50% of material use. By 2050, energy demand will rise by 50%, stressing the importance of sustainable resource management.
2. Health and Wellbeing Concerns: Poor air quality and housing conditions are linked to respiratory issues, with 91% of people exposed to pollution exceeding WHO limits.
3. Sustainability Reporting Requirements: Australia mandates climate disclosures for large companies starting in 2024/25, expanding further by 2027/28. The initiative requires financial transparency on climate risks, pushing companies toward effective emissions reductions instead of relying on carbon offsets.
4. Electrification as a Decarbonisation Strategy: Electrification is emphasised as essential for achieving net-zero buildings. It is part of the pathway identified in ASBEC’s report to address the asset lifecycle's carbon footprint, particularly upfront embodied carbon.
5. Supplementary Materials for Cement: Utilising alternative materials in construction, like supplementary cementitious materials, is proposed to reduce carbon in the built environment.

These points illustrate the urgent need for systemic changes to achieve net-zero targets within Australia's built environment.

## **Name:** James Logie, **Organisation:** Infrastructure NSW, **Presentation Title:** Decarbonising Infrastructure Delivery Policy

The presentation by James Logie, titled *Decarbonising Infrastructure Delivery Policy*, outlined the New South Wales (NSW) government's strategy to reduce embodied carbon in infrastructure projects. Here are the key findings:

1. Policy Framework:
   * The policy incorporates international standards, such as PAS 2080, to integrate carbon considerations into infrastructure decisions.
   * It mandates a consistent approach to measuring embodied carbon, specifically targeting projects over $50 million (buildings) and $100 million (other infrastructure).
2. Core Principles:
   * Key principles include assessing carbon impacts upfront, following a Carbon Reduction Hierarchy (avoid, switch, improve), and engaging with market actors.
   * Projects should implement a Carbon Management Plan to address these requirements.
3. Measurement Guidance:
   * The NSW government provides guidance on measuring embodied carbon at three project stages: business case, planning/design, and construction, increasing accuracy at each phase.
   * Data quality requirements vary by stage, from preliminary estimates to final construction data.
4. Implementation Program:
   * A structured program is underway to build industry capability, develop compliance tools, and create an emissions factor library.
   * Stakeholder engagement is planned through surveys, webinars, and training collaborations with institutions like TAFE NSW.
5. Monitoring and Reporting:
   * A reporting framework will be operational by Q2 2025, underpinned by NSW EPA’s Protection of the Environment Policy (PEP).
   * The framework will streamline compliance and establish policy KPIs for consistent monitoring.

These initiatives emphasise collaboration, phased implementation, and standardised measurement as NSW aims to decarbonise its infrastructure sector.

## **Session Questions**

Q. James the policy look complex and dense will there be further education about how to achieve low carbon outcomes

Q. James what is the longer term goals for the thresholds, reducing to penetrate into other smaller scale infrastructure?

Q. Harvesting ash dams for concrete makes benefits beyond GHG, like reduced env risk. Can we recognize these benefits in policy if lifecycle analysis excludes EOL?

## **Name:** Dr. Bob Jewell, **Organisation:** University of Kentucky Centre For Applied Energy Research (UKCAER), **Presentation Title:** The Recovery and Pozzolanic Testing of Ponded and Landfilled Fly Ash

The presentation on the recovery and pozzolanic testing of ponded and landfilled fly ash highlights several key findings:

1. Research Objectives: The study aimed to evaluate the use of landfilled and ponded fly ash as pozzolanic material, compare current testing standards, and explore enhanced testing methods.
2. Test Materials: The fly ash samples included landfilled and current production ash from various U.S. regions. Tests involved sieving and air classification to assess the impact of particle fineness on performance.
3. Standard Comparisons: The presentation compared ASTM C 618 and EN 450 standards for pozzolanic materials. Findings indicated ASTM's testing methods may yield false positives for non-pozzolanic materials, while EN standards are more selective.
4. Resistivity Measurements: Resistivity was tested at standard (25°C) and accelerated (50°C) conditions. The accelerated condition improved reactivity and reduced latency, suggesting a potential 7-day test for reliable results.
5. Key Conclusions:
   * ASTM C618 may not accurately measure pozzolanic activity as it largely assesses physical effects.
   * Increasing fly ash fineness does not necessarily enhance pozzolanic performance.
   * Accelerated curing at 50°C boosts reaction rates, improving test reliability.

These findings underscore the need for refined testing methods and support the viability of using reclaimed Class F fly ash as a concrete additive if particle fineness and LOI meet standards.

## **Name:** Prof. Stephen Foster & Dr. Ali Kashani, **Organisation:** University of New South Wales (UNSW), **Presentation Title:** Low Carbon Cements and Alternative Binder Concrete

The presentation titled "Low Carbon Cements and Alternative Binder Concrete" explored advancements in sustainable concrete alternatives, specifically geopolymer and alkali-activated binder (AAB) concretes. Key findings include:

1. Project Applications: Notable projects using geopolymer concrete include Wellcamp Airport, Pinkenba Wharf, and the Global Change Institute, showcasing the versatility and scalability of low-carbon concrete in infrastructure.
2. Standards Development (SA TS 199:2023): A new standard outlines specifications for geopolymer and AAB concretes, addressing design, durability, fire resistance, strength, and field testing, facilitating faster adoption of these materials.
3. Performance Insights: Creep resistance of geopolymer concrete (GPC) was tested over 56, 90, 180, and 365 days, indicating performance comparisons with ordinary Portland cement (OPC) concrete.
4. Model Comparisons: The presentation compares various creep models and performance for AAB and OPC concretes, suggesting that AAB concretes perform comparably under certain conditions.
5. Principles for Innovation: Emphasis on balancing regulation, standardisation, and innovation encourages solutions that advance sustainable practices without stifling development.

Overall, the presentation underscored the potential of low-carbon concretes in reducing environmental impacts while meeting engineering and regulatory standards.

## **Name:** Prof. Vute Sirivivatnanon, **Organisation:** Smartcrete & University of technology Sydney (UTS), **Presentation Title:** Roles of Fly Ash In Sustainability: A Concrete Engineering Viewpoint

The presentation by Prof. Vute Sirivivatnanon covered the role of fly ash and supplementary cementitious materials (SCMs) in promoting sustainability within concrete engineering, emphasising the reduction of carbon emissions. Here are the key findings:

1. Historical Context and Advancements: The use of fly ash in concrete has progressed from enhancing workability and durability to being recognised for its lower carbon footprint, particularly since the 1980s.
2. Environmental Impact of Concrete Materials: Compared to general-purpose (GP) cement, fly ash has significantly lower embodied carbon (CO₂ emissions per kilogram). This reduction becomes even more pronounced with the use of high-volume fly ash (HVFA) and triple-blend mixes (e.g., combinations of fly ash, slag, and other SCMs).
3. Benefits of Fly Ash and SCMs:
   * Compressive Strength: Fly ash in appropriate percentages (25-50%) maintains structural integrity while reducing embodied carbon.
   * Triple-Blend Mixes: Using 30% fly ash and 40% slag can reduce carbon emissions by nearly half, achieving both structural and environmental performance.
   * Geopolymer Concrete: SCMs, particularly fly ash, are vital for developing low-carbon geopolymer concretes that perform well under challenging conditions, such as marine environments.
4. Pathway to Sustainability: SCMs are essential for achieving low-carbon concrete structures. Future efforts should focus on securing SCM supplies, optimising mix designs, and integrating structural efficiency with low-carbon strategies.

The presentation concluded with a forward-looking perspective on the need to advance SCM usage to meet net-zero carbon goals in concrete construction.

## **Name:** Craig Peden, **Organisation:** Trailblazer for recycling & Clean Energy (TRaCE), **Presentation Title:** Fast Tracking Net Zero

This presentation outlined a strategy to accelerate Australia's transition to a net-zero economy through the commercialisation of clean and circular energy technologies. Key initiatives include:

1. Mission and Purpose:
   * Aiming for significant emissions reductions and a net-zero economy by fast-tracking technology from lab research to global markets.
   * Fostering collaboration between universities and industries, especially small to medium enterprises (SMEs), to drive innovative research commercialisation.
2. Economic and Environmental Impact:
   * Projected contributions to GDP and job creation, with the potential to support 5,200 jobs and reduce greenhouse gas emissions by 180 million tons over 20 years.
   * Expected to support regional development, notably in the Hunter region, essential for Australia’s clean energy goals.
3. R&D and Technology Focus:
   * Investment in R&D projects, particularly in solar technology, green fuels, circular economy solutions, and energy storage.
   * Key technologies include ultra-low-cost solar, printed solar, green hydrogen, carbon capture, and sustainable material production (e.g., green ceramics and fly ash transformation).
4. Skills Development and Industry Support:
   * Bridging the skills gap through pathways such as TAFE partnerships, micro-credentials, and work-integrated learning.
   * Support includes R&D vouchers, seed funding, industry PhDs, and secondments to enable a robust workforce skilled in clean technologies.
5. Commercialisation Pathways:
   * Emphasis on de-risking R&D and scaling up innovations via initiatives like Tech Transfer Rapid Response and industry placements.
   * Support for startups and scale-ups through accelerators, seed funding, and commercialisation training.

The presentation highlighted that this initiative aims to rapidly advance clean technology adoption and strengthen Australia's clean energy ecosystem through comprehensive industry partnerships and tailored support mechanisms.

## **Session Questions**

Q. Steve Foster have Sydney City continue / adopted the use of low carbon concrete following the trials?

Q. Do you think fibre concrete can be an option for high chloride coal combustion products use in concrete ?