ASX ANNOUNCEMENT

5 July 2021

Companies Announcement Office
ASX Limited
Level 6, 20 Bridge Street
Sydney NSW 2000

CFOAM SUPPORTS THE MOVE TOWARDS A CLEAN ENERGY ECONOMY BY DEVELOPING CARBON PRODUCTS FROM COAL

- **Urgent need to meet growing construction demand and create new products**
- **Disruptive technology process could create significant market opportunities for a price competitive carbon product**
- **Continuous atmospheric process aims to increase production rates and reduce costs by over 90%**
- **CFOAM to target construction panels and aggregates**

CFOAM Limited, CFOAM Corp (74.34% owned by CFOAM Limited, 25.66% owned by CONSOL Energy Inc) and its operating entity CFOAM LLC, Triadelphia, West Virginia, (CFOAM) wish to provide the following update on the US Department of Energy (DOE) project and its objectives as it moves towards the commissioning of its 68' long belt continuous kiln and associated equipment at its Triadelphia facility.

DOE Project

The DOE project[1] is focused on developing technology that is capable of capitalising on the two greatest market opportunities envisioned for carbon foam:

- Construction panels
- Lightweight aggregates

The goal of the 24 month DOE project, which commenced on 1 January 2021, is to design a process that can ultimately reduce panel production cost by over 90%, enabling a significant expansion in market size and utilisation of a much larger volume of coal.

[1] The United States Department of Energy's (DOE) Office of Fossil Energy (FE) has awarded the CFOAM proposal for "Continuous Processing of Carbon Foam Products Made from Coal at Atmospheric Pressure" (or CFOAM Project) for a total project value of **US$2,421,802 commencing 1 January 2021**, including DOE funding of US$1,923,680 with CFOAM being approximately US$1.523 million and cost share from CFOAM and CONSOL Energy Inc of US$498,122.

Carbon foam panel (left, 2x18x38 inches) and lightweight carbon foam aggregates - coarse and fine.

The table below shows the use of coal in each potential market by producing coal via the continuous kiln atmospherically:

Application	Potential market - Tons of Coal
Construction Panels	106,250,000
Lightweight Aggregate	448,717,949

The 24 month DOE project has a number of key targets and objectives:

– Installation and Commissioning of Continuous Kiln (Months 1-7)
– Carbon Foam Panel Manufacture Optimization (Months 7-12)
– Carbon Foam Panel Process Development and Characterization (Months 7-12)
– Applications Development of Carbon Foam Panels (Months 7-12)
– Installation of Carbon Foam Aggregate Forming and Sizing Equipment (Months 12-15)
– Carbon Foam Aggregate Manufacture Optimization (Months 15-22)
– Carbon Foam Process Development (Months 15-22)
– Characterization of Carbon Foam Aggregate (Months 15-22)
– Application Development of Carbon Foam Aggregate (Months 15-22)
–Techno-Economic Studies and Market Analyses (Months 12-24)

Project objectives in detail:

The objective is to create a continuous manufacturing process for carbon foam that operates at atmospheric pressure and can generate well-formed carbon foam panels and lightweight aggregates.

A successful outcome would:

1) significantly lower the cost to manufacture carbon foam through reductions in capital and labour costs,
2) significantly reduce the cycle time to manufacture carbon foam from weeks to hours, and
3) enable the manufacture of much larger carbon foam volumes.

Carbon Foam Panels for Construction

One of the first intended uses of CFOAM carbon foam was as a fire-resistant panel. When the organics have been stripped from the coal, the residual carbon foam displays excellent fire resistance. In addition, carbon foam is resistant to UV rays, corrosion, mold, mildew and rot.

Several companies have considered using carbon foam as a fire-resistant panel in buildings, aircraft, and ships, but turned away primarily due to price. Given plywood has a current commercial price of almost US$50 per cubic foot for a typical 4 x 8' panel, we believe CFOAM could capture a tremendous market share in this market if a similar price or lower price could be achieved.

It is predicted that the world will need to build over 2 billion homes over the next 80 years (25 million per year on average) and this will soon become one of the most pressing issues governments will face.[2]

Innovations in materials and usage will be required to meet this demand and CO_2 generation tied to this construction will need to be regulated. The use of coal to manufacture carbon foam for construction could help address both of these issues.

We estimate a moderately-sized modern house utilising carbon foam would use an estimated 42.5 tons of coal, delivering over 12,000 ft^2 of panels assuming a thickness of 1-inch. If carbon foam could be utilized for 10% of this projected home building demand, over 100 million tons of coal would be utilized annually.

[2] World Economic Forum, Mar 2, 2018, "The world needs to build 2 billion new homes over the next 80 years," https://www.weforum.org/agenda/2018/03/the-world-needs-to-build-more-than-two-billion-new-homes-over-the-next-80-years

Carbon Aggregates

Average pricing for conventional lightweight aggregates is approximately US$67.50 per ton[3], which is by far the lowest pricing of products discussed here, but also represents the greatest potential for very high volumes and high value.

Carbon aggregate would be a very unique product in this space. Much of the cost and utilisation of lightweight aggregate depends on transport; manufacture of carbon aggregate could be located strategically.

Long term, we envision manufacturing would be very similar to methods currently used for conventional lightweight aggregate. If 5% of the aggregate supplying the markets described below could be displaced by carbon foam aggregate, the annual coal demand would be over 400 million tons.

Refractories

Design of refractories often include carbon to enhance properties for use in molten metal processing, such as MgO brick in the steel industry. Carbon addition improves performance by inhibiting slag and metal ingress, as well as improving thermal shock resistance.[4] [5] Supply of engineered carbon foam aggregate can allow an engineer to include a relatively clean form of carbon at a specific size range in the refractory design.

Proppant

The global proppant market is projected to be over US$10 billion in 2023. In 2018, 115 million tons of proppants were supplied [6], with sand being most often used. Proppant ideally has a high strength-to-weight ratio. Its strength prevents it from being crushed, while its low weight enables the proppant to more easily reach the outer limits of the fissure into which it is pumped, increasing the yield from a given well. Carbon aggregate with 50% porosity would have a density of only 0.8 g/cc, less than half that of the lightest commercial proppant.

Concrete

About 10 billion tons of concrete is produced every year, more than one ton per person on the planet; it is the second most used material next to water.[7]

Approximately 70% of the volume in concrete is composed of aggregate, putting its demand at several billion tons per year (which matches global coal production of 7-8 billion tons).

The spectrum of concrete products is quite broad for construction applications and a wide variety of designs exist.

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[3] R. Liu, E. Appelbaum, A. Shakoor, "Cost-Effective Use of Lightweight Aggregate Made from Dredged Material in Construction," State of Ohio Job Number 135327, Final Report, Jan 2018.

[4] Lee, W.L. and W.M. Rainforth, Ceramics Microstructures, pp. 480-483 (1994).
[5] de Luz, A.P. et al., Refractory Castable Engineering, pp. 593-664 (2015).

[6] The 2018 Proppant Market Report, https://apnews.com/f6541520aefd4e60855720214d2fade8
[7] Expanded Shale, Clay and Slate Institute, https://www.escsi.org/structural-lightweight-concrete/

One well-engineered product is Structural Lightweight Concrete, a concrete design that uses lightweight aggregate to achieve certain property improvements over those of heavier, more conventional concrete designs; these include better insulation, fire ratings, freeze/thaw durability, blast resistance, shock and sound absorption, skid resistance, and placement via concrete pumping. Examples of specific applications include parking garages, heat insulation for roofs, water pipes, and walls, and manufactured stone veneer.[8]

CFOAM aggregate has certain properties that set it apart from conventional low-density aggregates:

1) the density of solid vitreous carbon is only 1.6 g/cc, which is much lighter than the silicate-based materials making up more common lightweight aggregates,
2) the danger of alkali silica reaction would be eliminated given its carbon composition,
3) the ability to choose aggregate size for a given mix design is easily provided given its forming process is engineered, and
4) water tends to be highly wetting to conventional lightweight aggregates, whereas it is relatively non-wetting to vitreous carbon, having a wetting angle of about 86 degrees[9], providing several potential advantages pertaining to water content, freeze/thaw durability, internal curing for more complete concrete hydration, and permeability.

Asphalt

The National Asphalt Pavement Association states, "The US has more than 2.7 million miles of paved roads and highways and 94 percent of those are surfaced with asphalt. The nation has around 3,500 asphalt plants, at least one in every congressional district. Each year, these plants produce a total of about 400 million tons of asphalt pavement material worth in excess of US$30 billion. The industry supports employment for more than 400,000 Americans in the asphalt production, aggregate production, and road construction sectors. Asphalt pavement material is a precisely engineered product composed of about 95 percent stone, sand, and gravel by weight, and about 5 percent asphalt cement, a petroleum product".[10] The aggregate size must be precisely engineered to achieve good properties and performance[11], which is easy to attain with engineered aggregate.

[8] The Constructor–Civil Engineering Home for Civil Engineers, https://theconstructor.org/concrete/lightweight-aggregate-concrete/6734/
[9] Torrisi, L. and C. Scolaro, "Blood Wettability of Haemocompatible Carbon-Based Materials," Journal of Advanced Chemical Engineering, Vol 7, Issue 2 (2017).
[10] National Asphalt Pavement Association, https://www.asphaltpavement.org/index.php?option=com_content&view=article&id=14&Itemid=33
[11] Equipment World's Better Roads, "Size Matters in Mix Grades and Aggregate Shapes," https://www.equipmentworld.com/size-matters-in-mix-grades/, May 6, 2014.

Carbon Foam Panels for Other Markets

The smaller, but potentially nearer-term markets, include composite tooling, which is currently the most common commercial application for CFOAM produced via the batch manufacturing process, as well as several others for which CFOAM is being considered.

Tooling board for carbon fibre composites is one of CFOAM's most successful products.

CFOAM products are competitive in this space. We estimate CFOAM still has less than 1% penetration into this market. If cost could be further reduced to a point that enables direct competition with polymer foam, CFOAM could conceivably capture more than 50% of this market and consume ~133,000 tons of coal annually.

Finally, CFOAM panels have shown promise as a blast resistant material for use in lining the walls of buildings to absorb the impact of explosions and flying debris. Blast resistant structures represent a US$2-3 billion market. Crash resistance in vehicles is another application that could find widespread use as composites continue to find their way into autos and trucks. Fire resistant, lightweight CFOAM is an ideal material to pair with carbon fibre composite. We believe these applications could consume over 300,000 tons of coal annually.

All of these opportunities described above can be pursued in sequence as cost is reduced and capacity expanded, with the ultimate goal of attaining widespread use in construction and infrastructure.

This ASX release has been approved for release by Gary Steinepreis on behalf of the Board of Directors.

For further details, please contact:

Gary Steinepreis
Director
E: gsteinepreis@CFOAM.com

Todd Hoare
Director
E: thoare@CFOAM.com

About CFOAM Limited

CFOAM® products are an inorganic carbon material that is manufactured from coal, pitch or lignin feedstock. CFOAM® products manufactured in this process have a rigid foam structure, similar in appearance to pumice stone, but with entirely different properties. CFOAM® products are currently used across a wide variety of markets including composite tooling for the aerospace sector, energy absorbing applications and defence applications. Additional markets such as automotive applications for energy absorption and fire resistance are also expected to become significant to the Company over time.

CFOAM® products were developed to meet the growing demand for ultra-high-end performance engineering materials in the industrial, aerospace, military and commercial product markets.

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