The international journal of science / 4 November 2021

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Glass is the hidden gem in a carbon-neutral future

Recycling glass does not degrade it, and manufacturing it can be carbon-free. So why are countries still burying glass in the ground?

Glass can be recycled infinitely without losing any of its properties. Why, then, are most countries — with the exception of those in Europe — still burying most of their glass as landfill by the tonne? In 2018, the United States alone offloaded almost 7 million tonnes of glass into landfill sites, accounting for 5.2% of all solid municipal waste, according to the US Environmental Protection Agency.

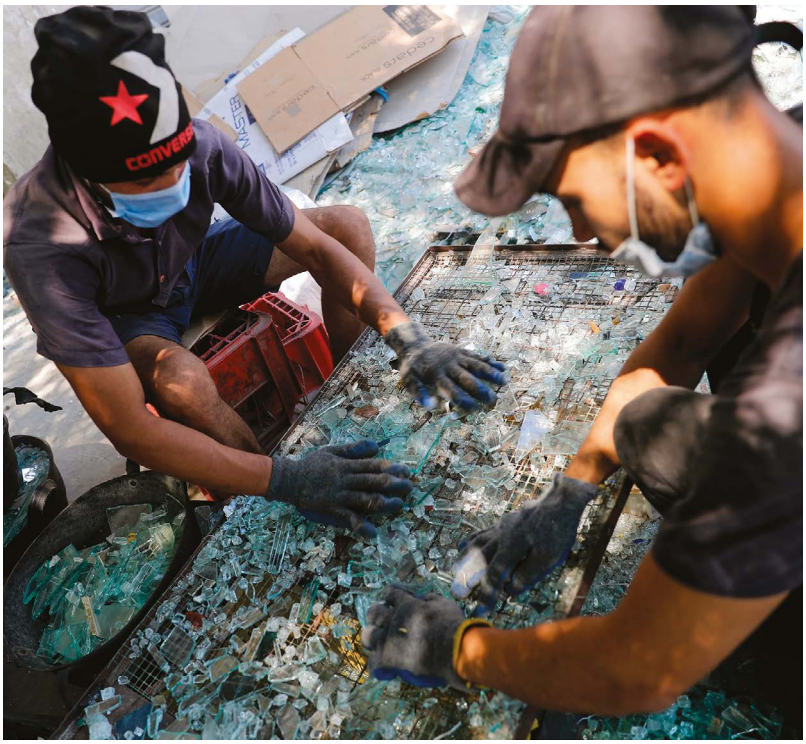
The push to cut plastics use is accelerating the search for new materials, especially for containers that can hold liquids. But glass is an existing material that could be the star of a net-zero carbon economy.

Worldwide, glass manufacturing produces at least 86 million tonnes of carbon dioxide every year. But most of this can be eliminated when glass is recycled, and existing technologies could turn glass manufacturing into a mostly carbon-free process. What needs to happen is for countries to stop sending glass to landfill sites, and to make glass recycling mandatory.

Glass is made by heating limestone, sand and soda ash to 1,500 °C. This heat comes from natural gas, and it accounts for between 75% and 85% of the carbon emissions from glass manufacturing. The remaining emissions are a by-product of the chemical reactions between the raw materials. But some of these materials can be replaced with crushed recycled glass, known as cullet. When cullet is melted, no CO_2 is released. And furnaces don't have to burn so fiercely to melt glass as to melt the raw materials, offering further carbon savings. According to the European Container Glass Federation (FEVE), an industry group based in Brussels, 10% more cullet in a furnace lowers CO_2 emissions by 5% compared with making glass entirely from raw materials.

As with most forms of recycling, some caveats apply. The type of glass used to make windows — known as flat glass — cannot contain impurities, unlike glass used in many other applications. So it's not possible to melt down jam jars to get a window pane. But flat-glass cullet can be used to make more flat glass.

Some questions will need further research. For example, governments will need to know the monetary cost of boosting systems for glass collection and recycling, so that they can allocate appropriate resources. Furthermore, glass is heavier than plastic, so using it as a replacement will probably add to transport costs and emissions, and that, too, needs to be understood.



JOSEPH EID/AFP/GETTY

Shattered glass from an explosion in Beirut in 2020 is sorted for recycling.

> **"Communities and companies should be helped to create infrastructure to collect glass and recycle it."**

When it comes to glass recycling, Europe is the world's most advanced region by some margin, and has ambitions to be even better. Researchers could study how Europe's recycling scheme came about, its strengths and weaknesses and whether there are lessons for other countries. Three-quarters of glass used for containers such as bottles is collected for recycling across all 27 member states and the United Kingdom. As a result, new glass made in the European Union already contains some 52% recycled material. The glass-container industry has set itself a target of collecting 90% of all waste container glass in the EU by 2030.

But other countries are not where they need to be. Moreover, data on glass recycling are difficult to find, partly because most countries are not reporting what they are doing. There seems to be no international body that collects glass-recycling data. That needs to change.

That said, national efforts are under way to improve collection and recycling rates. The United States recycles, on average, just 31% of its glass containers, but the Glass Packaging Institute, a trade association based in Arlington, Virginia, is pushing to increase that to 50% by 2030 (to achieve that, 56% of all waste glass must be collected). Similarly, a project run by the Glass Recycling Company in Johannesburg increased the recycling rate across South Africa from 18% in 2005–06 to 42% in 2018–19, including boosting the use of returnable bottles. But elsewhere — in Brazil, China and India, for example — authorities are silent, or, at the very least, are not reporting their plans and ambitions.

More countries need to pass laws to reduce waste and

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eventually stop sending glass to landfill. That will automatically create greater incentives for glass to be recycled. Europe already mandates that 70% of waste building and construction materials are recycled. The remainder currently ends up being used as aggregate for road filling or other basic building processes; this is a huge waste of a valuable resource.

Carbon can also be saved by decarbonizing the process of melting the chemical mix during manufacturing. A demonstration project called Furnace for the Future, run by FEVE, makes glass using electricity instead of natural gas to heat recycled glass cullet. If the electricity source were fully decarbonized, it would mean that the entire process of glass-making would effectively be carbon-free.

Glass is an essential material. And it is possible for its manufacture to become almost carbon-free in a relatively short time. But legislation is required to ensure that it is properly collected and recycled, and that it doesn't end up in landfill. Communities and companies should be helped to create infrastructure to collect glass and recycle it. The answers are there, and they are relatively simple. They need to be put into practice – and we can all raise a glass to that.

African Academy of Sciences needs support, not rejection

The pan-African science academy is in turmoil. Funders and fellows must jointly own the crisis, and work to stop it happening again.

The African Academy of Sciences (AAS) is facing its worst crisis since its foundation 36 years ago. The Nairobi-based organization has lost more than half of its staff after key international funders, including the Bill & Melinda Gates Foundation, the UK government and the UK charity Wellcome withdrew from a flagship funding partnership. African researchers and scientific institutions are horror-struck at the resulting devastation of the continent's apex science academy. This did not need to happen.

Funders say they have lost confidence in the academy's governance. This follows internal tensions that led to the suspension of senior staff members. The basis of the disagreement has not been made public, but it does concern the academy's relatively new role as a funding body. In 2015, it was given the extra responsibility of disbursing large amounts of money on behalf of regional and international sponsors. The role is unusual, because academies do not generally process large grants on behalf of other funders. This is partly because they also award their own funding – which is often highly sought-after and prestigious – and partly to avoid conflicts of interest.

> "Good leadership involves learning from failure and accepting responsibility for mistakes."

Where academies are involved in grant-making, it tends to be on a modest scale, focusing for example on funding for early-career researchers. There are good reasons for this: an organization that represents the interests of scientists should not be responsible for distributing large amounts of funding to people who would include its own members and fellows. To prevent potential bias, many countries have set up separate grant-funding agencies, which operate at arm's length from both academies and government ministries.

For most of its existence, the AAS was largely responsible for capacity building and science advocacy. But in 2015, the AAS, the African Union and international funders agreed that the academy would host and manage a new and significantly more ambitious funding platform, called the Alliance for Accelerating Excellence in Science in Africa (AESA), to help shift "the centre of gravity" for African research funding closer to Africa.

The platform included schemes such as the US$176-million Human Heredity & Health in Africa (H3Africa) project, a consortium that undertakes fundamental research into diseases in Africa. Another is a $100-million initiative called Developing Excellence in Leadership, Training and Science in Africa. Thus, in just 5 or so years, the AAS changed from an organization of 22 staff members doing the work of a conventional academy, into an agency employing almost 70 people and disbursing multi-year grants worth hundreds of millions of dollars.

Some science academies were once much more involved in distributing research grants than they are today. But over time, independent grants agencies have been set up, and are designed such that clear boundaries separate funders and grant recipients; governance and peer review, especially, need to be independent. It's not that the staff of science academies couldn't do the work of a grant-making organization – but that scientists and policymakers agreed that it was not appropriate.

Questions need to be asked about whether this arm's-length principle – which all the AAS funders know well from their home countries – was considered when they set up AESA. Ultimately, of course the fellows who make up the AAS's governing council should never have allowed internal disagreements between members of the leadership to get in the way of the organization's functioning. But funders need to accept their share of responsibility, too.

Good leadership involves learning from failure and accepting responsibility for mistakes. All parties must therefore stay engaged, not walk away, and together assess what has happened and why. That includes determining whether forgoing the arm's-length principle in science funding contributed, even if in a small way, to the present crisis.

This all needs to happen quickly. All those involved have a responsibility to make sure that Africa's premier science academy succeeds and fulfils its mission to represent and boost science on the continent.