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# Glasgow – from ambition to impact?

## Glasgow can have a material impact on global deep decarbonization, but a pragmatic approach is critical.

**By Ernest J. Moniz and Melanie A. Kenderdine**

As the world turns its attention to the UN Climate Change Conference in Glasgow, it's clear that the difficulty of facing dramatic reductions in global greenhouse gas emissions — the science calls for net zero emissions by mid-century — is exceeded only by the environmental, economic, and security risks of failure. World leaders at COP26 — President Biden is among them — need to match their climate ambitions with a sharp focus on high-impact solutions and collective actions.

There are some successes on this difficult pathway of emission reductions, enabled by the interplay of technology advances and supportive policies. For example, the US electricity sector has reduced emissions by nearly a third in less than two decades because natural gas, wind, and solar displaced half of coal generation. However, electricity is only about a quarter of total US emissions, whereas industrial emissions are comparable and those from transportation are greater. Progress in battery performance and lower costs have led to increased electric vehicle sales, with major automakers leaning into an electric future, but heavy trucks, ships, and airplanes remain a challenge. The reality is that transportation and industry (like cement factories) — as well as buildings and agriculture — are difficult to decarbonize, and electrification, where possible and economic, is important but insufficient.

This provides context for our hopes for Glasgow. There will almost certainly be the familiar final communique with many pledges but fewer committed actions. The wealthy, middle-income, and poor countries will have markedly different priorities, but some practical actions could spur collective efforts beyond Glasgow to effectively combat climate change.

Importantly, the focus for measuring progress falls squarely on emissions reductions, not on favored or disfavored technologies. We've often heard that weather-dependent wind and solar, supplemented by batteries, would be adequate for decarbonizing the energy economy. While critically important, over the last few years a more sensible consensus has been building around three important, scalable additions.

First, low-carbon "firm" power — available whenever the grid needs it – will be needed for the future reliable, resilient, and affordable grid. Firm power could have many sources: nuclear; fossil fuels together with carbon dioxide capture and storage underground or in products (called CCUS); advanced geothermal systems; long-duration electricity storage, not for the hours available with batteries, but for weeks and even seasons.

For hard-to-decarbonize sectors, there needs to be low-carbon fuel, which could include advanced biofuels, hydrogen, and, for some time, natural gas. Fuel is needed most acutely for industrial decarbonization, such as for high-temperature-process heat, and for important transportation uses, such as long-distance aviation. In most cases, considerable innovation is needed to reduce the "green premium" reflected in high prices for advanced fuels.

A third need is large-scale carbon management — that is, the ability to manage billions of tons of carbon dioxide by preventing release into the atmosphere now and in the future (the aforementioned CCUS) or by legacy carbon dioxide removal from the atmosphere and upper ocean layers. We will not reach net zero — which is now policy, law, or under active consideration in 130 countries and will certainly be a centerpiece of Glasgow discussions — without CDR.

Environmental organizations have been split on these technologies, but there are multiple benefits. CCUS can address emissions from both power plants and industry, enable a hydrogen future, and support various CDR

approaches, including direct air capture and biomass utilization. Substantial policy support and infrastructure buildout are needed. Large-scale carbon management also draws on conventional energy skill sets, preserving high-quality — often union — jobs and the regional communities they support. An added benefit: building broader political coalitions for a more rapid low-carbon energy transition.

A second hope for Glasgow is a robust innovation agenda accompanied by the rich countries making good on their decade-old pledge of providing $100 billion annually to the poorest nations to help ensure they can develop their economies and industrialize in sustainable ways. Together, these actions address the energy transition for middle-income and poor countries. Africa alone will add about a billion people by mid-century; its sustainable development is clearly critical for the planet and core to the environmental justice agenda, and the wealthiest countries can afford it — the Organization for Economic Cooperation and Development alone has a collective gross domestic product of about $50 trillion.

However, the bulk of humanity lives in middle-income countries, and the rich countries have neither the resources nor the will to provide the level of direct assistance that would be needed to speed them along the path to net zero. Reducing the green premium through robust innovation, especially in the difficult-to-decarbonize sectors, is the only credible pathway.

A third hope for Glasgow is that world leaders will focus more on the massive private sector investments needed for the energy transition. The scale is easily $100 trillion by mid-century, equal to the entire annual post-COVID global GDP. The 2015 Paris COP21 meeting advanced governmental commitments to expanded innovation funding, with Bill Gates coordinating a parallel initiative by private investors to promote early stage investment in breakthrough technologies — measured in billions of dollars.

However, deployment of green technologies and systems at the scale needed for deep decarbonization quickly moves the discussion from billions to trillions of dollars, and that can come only from the private sector. At Glasgow and beyond, the discussion needs to focus on reducing policy and regulatory barriers that impede massive private investments in each country. Investment risk reduction over the timescales needed to justify large private capital allocations must be systematically addressed, with international cooperation appropriately aligned with global financial systems.

Glasgow can have a material impact on global deep decarbonization, but a pragmatic approach is critical. We need to move beyond posturing to the practical steps that can and must be taken to accelerate the energy transition. Time is running out.

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