Make greenhouse-gas accounting reliable — build interoperable systems

Amy Luers, Leehi Yona, Christopher B. Field, Robert B. Jackson, Katharine J. Mach, Benjamin W. Cashore, Cynthia Elliott, Lauren Gifford, Colleen Honigsberg, Lena Klaassen, H. Damon Matthews, Andi Peng, Christian Stoll, Marian Van Pelt, Ross A. Virginia & Lucas Joppa

Global integrated reporting is essential if the planet is to achieve net-zero emissions.

In March, the United Nations took its first meaningful step to hold investors, businesses, cities and regions accountable for reducing greenhouse-gas emissions, when UN secretary-general António Guterres asked an expert panel to develop standards for 'net-zero' pledges by these groups. A challenge now is how to count emissions coherently.

Nations, companies and scientists each use different, disjointed methods to tally

and methane that cause climate change. The atmospheric concentration of greenhouse gases is the bottom line. It holds humanity to account for how we use our remaining 'carbon budget' — the total amount of CO_2 that can be emitted over a period of time while avoiding a dangerous rise in global temperatures above a certain threshold.

Scientists monitor global carbon sources and sinks. For example, the Global Carbon Project measures, analyses and reports flows of CO_2, methane and nitrous oxide into and out of the atmosphere from human activities (such as transport, industry and land use) and natural environments (such as forests, soils and oceans)[1].

At the national level, governments follow UN guidelines to self-report emissions from human activities in their territories. Most rely on tables of 'emissions factors' for these calculations. These factors give typical rates of greenhouse-gas emissions for various activities, such as using different energy sources or producing particular farm crops.

Businesses, cities and other non-state actors follow other standards adapted from UN guidelines (such as ghgprotocol.org). These also rely on emissions factors to count direct and indirect emissions from supply chains and the use of products. For example, when a company makes

this year, the US Securities and Exchange Commission proposed a rule mandating that corporations disclose information on their emissions; the United Kingdom and European Union are advancing similar rules.

And scientific uncertainties are narrowing. Satellites can now provide measurements of atmospheric greenhouse-gas concentrations almost in real time. Remote sensing and advanced analytics help to track terrestrial emissions more accurately, with increasingly global coverage [12].

Digital tools that automate greenhouse-gas accounting are proliferating. Platforms are

Interoperability. Protocols and principles for enabling the interoperability of a digital infrastructure for greenhouse-gas accounting need to be agreed. This should be done in an open and inclusive process overseen by an independent governing body, such as the ISSB in partnership with the UN.

Three sets of protocols will be needed. First, technical and syntactic rules are required that specify how information is to be read by humans and machines. Data must be formatted for seamless exchange between ledgers, platforms and data libraries. A starting point could be the Sustainability Accounting Standards Board's proposed XBRL-based guidelines for corporate sustainability reporting.

Second, there need to be clearer definitions of the myriad metrics and terms used so that systems can unambiguously exchange information — known as semantic interoperability. Examples include how uncertainty is quantified, how offsets are classified and how emissions are parsed between managed or unmanaged lands. An ontology will be required to align the meanings of terms. A common set of metrics must be agreed, which will provide the greenhouse-gas record of any entity. This would mirror the US health sector's Common Clinical Data Set for any patient.

Third, protocols and principles for institutional interoperability are needed. These include policies and regulations to facilitate data exchange across borders and between companies. Different frameworks need to be harmonized. Decisions need to be made on how to govern AI and distributed digital ledgers (such as blockchain) within the system.

Trust. Greenhouse-gas reports must be trusted by decision-makers, regulators and12 Tc [(tru5Tc 0 Tw 8o6 e(oc)5. s)5 (y2 Tc [cteiu)-0.035 Tw 8.4975 0c 0.01318 Tc 0.019 Tw 8.4975.5 (b