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The Climate Fix: make what's important measurable …

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Abstract

Climate change is the priority, global concern that has received substantial funding for reduction efforts and makes demands on governments for change. The first climate treaty, the Kyoto Protocol (2008), was founded on the aim of reducing greenhouse emissions to at least 5% below 1990 levels, however the last decade saw a 15% increase in CO_2 emissions. Achieving 1990 levels should be the first target in Net Zero Emissions, equating to a reduction in annual CO_2 emissions by 12.8 Gt, which this paper accepts as a definition of the "Global Target".

In this paper we assert that three key actions are necessary if this target is to be achieved: First, the use of Absolute Emissions, not Emission Intensity, as the key metric. Absolute Emissions provide transparency and facilitate responsible investment, whereas Emission Intensity is misleading because it creates an illusion of lower emissions whilst allowing increases in actual Greenhouse Gas (GHG) emissions. Second, measurement and reporting of Absolute Emissions should be compared with the Global Target for any GHG-producing process, and against the respective country, sector, and industry targets. Thirdly, data-based solutions should be implemented by identifying significant emission contributors and designing reduction or elimination protocols based on this identification. An example is given of removing inefficient motor vehicles to achieve 14% of the Global Target, together with examples of targetting other key emissions sources.

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Introduction

The launch of the Kyoto Protocol in 2008 was a global response to the impending climate crisis, with an agreement to reduce annual emissions to at least 5% below 1990 levels[1]. In 2019, the global emissions estimate was 33.3 Gt CO_2 per annum compared to the 1990 baseline of 20.5 Gt (Figure 1). To equal the 1990 level would therefore require a 12.8 Gt, or 38%, reduction. Against this requirement, the past decade saw a 15% increase in CO_2 emissions.

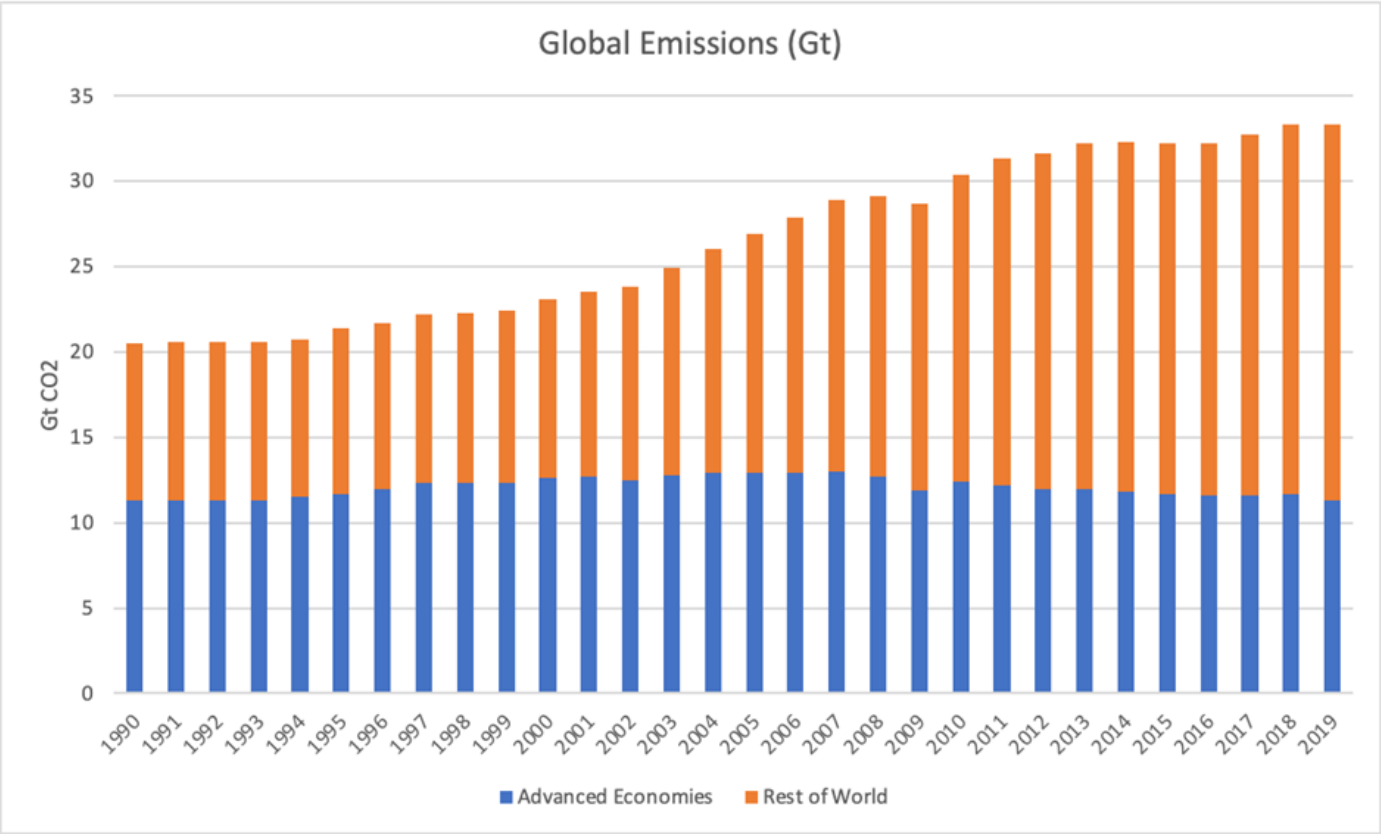

Figure 1. Global energy related CO_2 emissions, 1990-2019

Source: IEA (International Energy Agency) Energy related CO_2 emissions, 1990-2019[2]

Countries, regions, and sectors have put forward targets for emissions reduction that vary from aspirational to firm commitments. However, the impact of individual actions and their specific contribution to the Global Target is far from clear. Specific and measurable reduction targets are needed where each target element is clearly defined in terms of what will be achieved and how that will contribute to the Global Target.

This paper outlines a data-based solution to identify, quantify, document, and monitor targets for specific emission sources, including how each source reduction fits within a country, sector, and company plan, and what each reduction contributes to the Global Target. The process would entail documentation and monitoring of actions at every step with a view to adapting to unforeseen changes and adjusting emission targets accordingly, either up or down.

Measure absolute emissions, not intensity, against the global target

Carbon and GHG emissions, are commonly measured as *Intensity*, that is, the carbon emitted per unit of industrial production, fuel consumed, distance travelled, animals farmed, etc. Emission Intensity has been used to demonstrate a decrease in emission per unit of activity and thereby bolster GHG “credentials” of industries or governments.

However, the climate crisis is an outcome of the total amount of greenhouse gases in the earth’s atmosphere, meaning

the only valid reduction measure is the total GHG emitted. This makes Emission Intensity targets irrelevant. More importantly, industrial processes normally become more efficient as production rates increase, so Emission Intensity will decrease, however, there is almost always a concomitant increase in the total GHG emitted as production volumes rise. Emission Intensity targets allow business-as-usual because increasing production will normally result in lower Emission Intensity, while increases in Absolute Emissions remain hidden. Emission Intensity is a profoundly misleading measure.

The GHG impact of every entity should be transparent to investors. Any new activity, new production system, existing facility expansion or production increase should consider the impact on *Absolute* Emissions early in the approval process by defining any changes to Absolute Emissions and the impact relative to the Global Target. Ideally this should be applied to changes in every sector, and in consideration of sector and country specific reduction targets. Any change that results in an absolute GHG increase should be evaluated and require specific approval by the respective country, sector, or company. Changes resulting in no increase or a net decrease in emissions would not require such approval but should be independently audited.

Implement Data-Based Solutions

Global GHG emissions are reasonably well understood, with substantial data available, but a lack of comparability between data sources is common. Analysing and interpreting the data to provide simple, straightforward, and easily understandable solutions is a challenge. Data-based solutions require understanding GHG emissions to a high degree of precision to enable identification of specific emission sources where reduction actions that will contribute meaningfully to the Global Target can be designed, documented, measured, and tracked.

Example – Removal of Inefficient Vehicles

An example of this concept that can be applied globally is the removal of inefficient motor vehicles, with 1.14 billion motor vehicles distributed across the 7.7 billion global population[3]. The IEA's Tracking Transport 2020 Report[4] showed that while CO_2 emissions from transport increased by less than 0.5% in 2019, the target was a 3.7% reduction. The sector target is the improvement of new vehicle efficiency from 7.2l/100km (33 mpg) to 4.4l/100km (53 mpg) by 2030[5] however, there is no clear, practical "roadmap" to achieve the target. Potential solutions would benefit from the existing high degree of consolidation of vehicle manufactures and owners (Figure 2), noting:

- Half the world's motor vehicles are manufactured in 3 countries; 75% in 7 countries
- Half the world's motor vehicles are owned in the same 3 countries; 75% in 10 countries
- The highest vehicle-producing countries have the highest motor vehicle ownership
- Half the motor vehicles are manufactured by 5 companies; 75% by 9 companies[6]

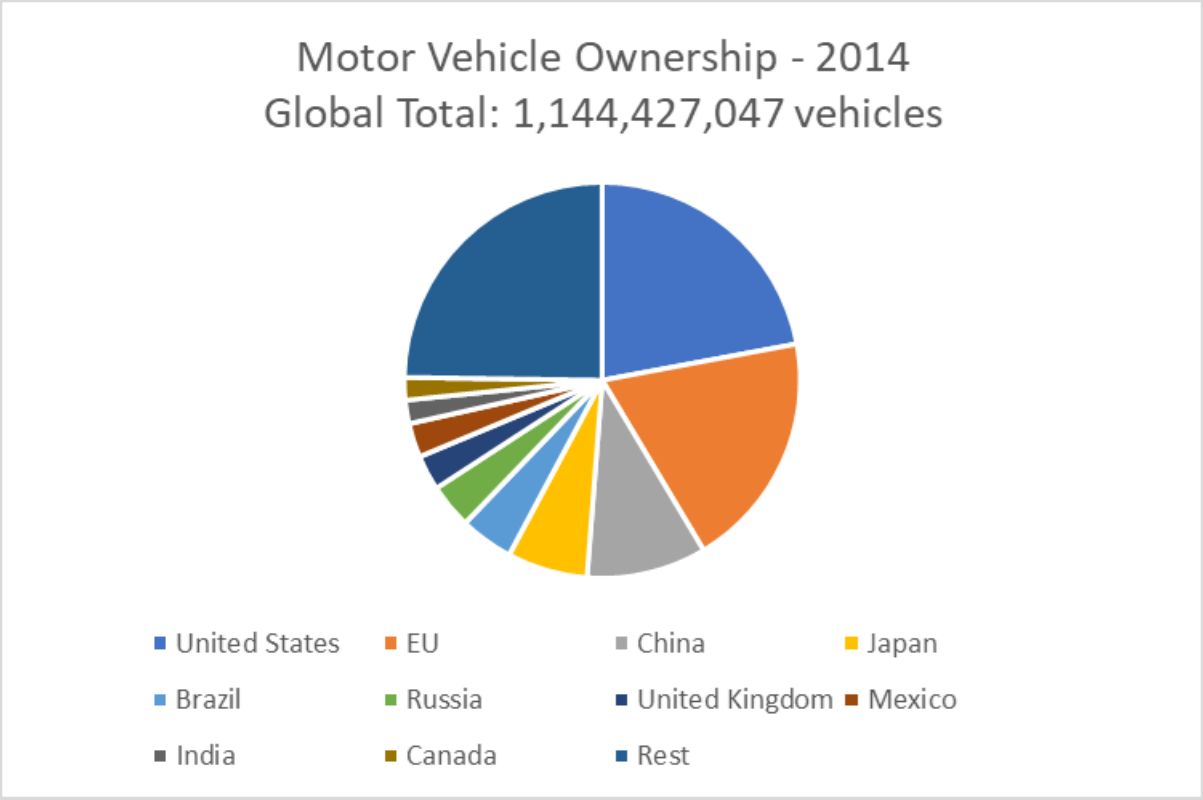

Figure 2. Motor Vehicle Ownership by Country

Derived from: OICA (International Organization of Motor Vehicle Manufacturers) [7]

**Av. Age is approximate from multiple internet sources*

Note: for this analysis, EU (European Union) has been considered as a single "country"

Table 1 shows that improving the efficiency of all vehicles to a moderate 6l/100km (39mpg) would achieve up to 14% of the global target. To achieve that, the top three countries of ownership (which are also the top three countries of manufacture), should regulate to disallow the sale of any new passenger vehicle for which the fuel consumption exceeds 6l/100km. Ideally, other high ownership countries would support this through similar regulation. Such regulation would not be overly disadvantageous as manufacturers already have vehicles in their ranges that achieve 6l/100km. The transition could follow natural attrition of motor vehicles, which is estimated at 11 years (Figure 2), or governments could regulate for a faster transition depending on their circumstances and the need to protect vulnerable groups or individuals, for example, poorer communities, specific needs in communities such as farming, vintage automobile enthusiasts.

Global CO_2 reduction to 1990 levels: 35,158 - 22,135 (Mt) 13,023

CO_2 cars @73% transport* 4,574

	REDUCTION IN CO_2 EMISSIONS			YEAR 1 estimate**	
	CO_2 Mt	% vehicle reduction	% Global Target	% vehicle reduction	% Global Target
7.2 to 6 l/100k (33-39mpg) (17%)	778	17%	6%	1.4%	0.5%
10 to 6 l/100k (24-39mpg) (40%)	1,830	40%	14%	3.2%	1.1%

Notes: IEA 2018 average for new vehicles = 7.2 l/100km
Estimate to include old vehicles = 10 l/100km

Table 1. CO_2 Transport Emissions by Country

Derived from: OICA (International Organization of Motor Vehicle Manufacturers) [7]

**Of 91,786,861 total vehicles produced, 67,149,196 were motor cars (73% of emissions)*

***based on the ratio of 92M cars produced annually: 1,144M cars owned*

While the proposal is achievable, full transparency would require significant improvements upon the current scope and quality of data, together with the need for campaigns to inform and convince populations of the feasibility and benefits, which are discussed below.

Similar approaches would be applicable for other key examples in all sectors. The highest omitting sectors are listed as Transport; Electricity & Heat; Buildings; Fugitive emissions; Other fuel combustion; Aviation and shipping[8]. The accuracy and usefulness of this breakdown would need to be confirmed, followed by sector-specific emission targets with an analysis of how each reduction would contribute to reaching the Global Target. Every aspect of every sector is likely to have GHG reduction opportunities. The task is to identify, prioritise and conceptualise those opportunities, and then provide data collation, cleansing and accuracy to give realistic reductions. Following this is the cycle of measure, monitor and report. Reduction commitments, whether made by governments, sectors or companies, should not be static but reviewed and adjusted to track advances in efficiency.

There are myriad opportunities for sector reductions in absolute emissions, for example:

- Efficiency improvement in energy use for the comminution processes in the mining industry, noting crushing and grinding accounts for 1/3 of the energy used in the sector[9]. A review of renewable energy in the mining sector indicates that a 10 -20% efficiency improvement would be significant for the sector[10], and likely contribute 0.5% to the Global Target.
- Animal farming is thought to contribute 10-15% of global CO_{2eq} emissions, and control strategies through dietary supplements, feed alternatives and stock management are expected to provide 10-20% reduction, which could be a very large contributor the Global Target[11].
- Replacing commercial and residential lighting with LED technology is estimated as a 44 GW saving in the USA[12]. Based on 294 GW fossil fuel capacity in the USA[13], a 15% reduction may be possible that repeated globally would be

a major contribution to the Global Target.

- The Aluminium production process is of very high energy intensity, accounting for 2% of global emissions, of which 99% comes from electricity generated using coal, gas, and oil[14]. Switching or moving all aluminium production to hydroelectric or other renewable power sources wherever possible would tap into a CO_2 reduction opportunity of 530 Mt[14][15] contributing up to 4% of the Global Target and reducing global emissions by 2%.

Early 'wins' such as these would deliver major improvements, but, at least as important will be the large number of small efficiency gains, to engage global interest and participation, and create a broadly based impact.

Plan, Measure, Monitor, Report

Critical elements for success are collecting and consolidating data; and influencing government and industry leaders. This may be best achieved through collaboration of existing efforts or through the establishment of a new entity to provide project management; collate accurate data; select projects; measure, monitor and report successes; and to provide media & marketing capabilities. The key to success will be the ability to influence government and industry leaders and to engage a broad group of stakeholders for funding and technical support.

The data provided in this paper is publicly available but it is often in disparate databases, with variation in metrics, often from different years, with a consequent lack of comparability. A team of data analysts is needed to ensure data currency, accuracy and comparability. As the number of opportunities multiplies, so the data collation and analysis needs will increase.

Project management will be critical, particularly as the complexity of reduction opportunities increases, and would identify opportunities, influence governments and industries to change, and provide the measure, monitor, and report cycle to track and publish achievements.

Public relations and communication will be key factors as the world needs to be brought on this journey to the maximum extent possible through a strong media presence to influence public perceptions and to facilitate governments and industries to achieve targets. Global and regional monitoring and the publication and advertising of progress will be essential to create buy-in from many areas. Demonstrating the market advantages of low carbon options will be crucially important.

A core feature of the effort will likely include a network of global teams to allow collaboration on a rolling basis, with a formal leadership/strategy group to identify priorities and form teams across global centres to collaborate and develop solutions. The processes need to ensure that no single person controls an area being studied, for example, each opportunity could have teams working in different regions to form a collaborative network and avoid undue influence or pressure by countries, companies or even individuals with vested interests.

A Board may be required to provide oversight and coordination of efforts, supported by an independent assurance function to ensure process integrity. Sub-committees might be formed for specific functions such as identification of

opportunities, advice to government or industry, data collection and analysis, progress audit and reporting.

A Way Forward

Governments are taking a collective stand on climate change, but they need to be shown how practical examples can lead to meeting emissions targets, that have been set based on absolute emmisions rather than emission intensity. Motor vehicles would provide a platform where the effort would be shared proportionally and globally, with potentially dramatic, positive results. The same logic is applicable to other key emission sources. A key element in the climate battle will be data availability and accuracy to enable strong and positive interventions from concept to delivery.

By coordination of the efforts of data analysts, subject matter experts, and those implementing change on a local or global scales, new activities, projects, production systems, or changes to existing systems would be more transparent and demonstrate how the change will facilitate reaching the Global Target. Most important will be helping government and industry sectors to identify practical improvement opportunities that can be measured, monitored, and reported using the common metric of *Absolute Emissions*.

The ultimate purpose is to make what's important measurable, rather than what's measurable important.

About the authors

- Phil Turner is a sustainability executive from the global resources sector.
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- Ross Barnard is a Professor Emeritus and immediate past Director of the Biotechnology Program at the University of Queensland.

Author contributions

- Phil Turner conceived the topic and drafted the paper
- Ross Barnard provided review and input on content, quality, and key messages

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