Principles of the GRN Measurement System

M Aherne – 04/11/21

Introduction

GRN stands for Global Respect Number and is conceived as the foundation for an International Standards mechanism and measurement scale to combat Green House Gas (GHG) emissions.

The measurement system leverages currently deployed commercial software based process and product modelling costing methods, combining these with Industry Standard methods for determining Risk Probability and Mean Time Between Failure (MTBF).

As with any measurement scale system such as weight or volume, the purpose of the GRN measurement unit is to apportion a GHG emission value to each and every product or process. In combining products or processes, GRNs can be summed together to form a total GRUN (Global Respect Unification Number), representing the total GHG emission value for the final assembly or complete process.

Thus, for a car, every component within the vehicle will have a GRN value in the same way as it will presently have a cost value. The total cost of the car is readily determined and hence the total GRN cost of the car is also readily determined, resulting in a total GRN cost, or GRUN.

Manufacturers and consumers alike will naturally favour low GRUN items by virtue of social conscience, marketing and tax based pricing scales, hence the system provides a self-driving mechanism toward better products, processes and choices in the market place, while removing the present ambiguity as to what NET-ZERO really means.

Explanatory example

<u>We will compute for 1kg of copper and 1kg of PVC in order to make some electrical cable.</u>

To calibrate the GRN scale, we need to determine a baseline datum. This might simply be the best guess modelled amount of GHG Mega Tonnage required to raise the planet by 1°C from a single point in time. This also has the advantage that the system can be quickly rescaled if global models change over time.

Next, we analyse and compute the emission content (CO2 + CH4 + O3 + Flouroform + Hexalfluorethane + Sulfar Hexaflurid + anything else) used to make 1Kg of Copper and 1Kg of PVC.

It is important to consider every aspect of the process as clearly an electrically powered mine running from a fossil fuel source, will result in 1Kg of Copper with a higher GRN than a mine powered by hydro-electric. This immediately introduces supply chain interest and optimisation principles all the way through the process, from every Joule of electrical energy used, to every aspect of preparing the Copper or PVC for shipment.

All of these process costs will currently be known in terms of hard currency, so the GRN system simply sits alongside this, acting as a commercial scaling factor to get from hard currency to GHG damage.

In starting from the bottom (lowest level component) and working up, the process to make anything essentially defines what is generally known as a costed Bill of Materials (BOM).

A BOM identifies all of the component parts for any given assembly along with the process routes by which they are brought together. Process routes transform parts and assemblies into other parts and assemblies, consuming the materials and labour as they progress upward toward the final output.

This bottom up approach is currently used globally, everywhere. It simply adds up the material and labour costs for just about every man-made item on the planet. Hence in exactly the same way, the GRN cost can be calculated and summed up to determine a final total GRN figure.

In the example case of a cable, the 1Kg of Copper will have GRN figure as will the 1Kg of PVC.

The cable manufacturer now has a choice of supplier, based on both currency cost and GRN. In combining the pultruded copper with PVC to make a cable, the cable manufacturer will add further GRNs into the process, resulting in a reel of cable that can be defined by the GRNs per metre and published in the product datasheets and marketing.

Again, depending upon the processes used, source of supply and so on, the cable manufacturer will find new ways to compete in the market with GRNs, driving supply chain diligence and Green choices.

Where a manufacturer fails to provide a GRN, International tables of worst case GRNs can and should be assumed by the receiving party, in much the same way as a designer looks for the data in a datasheet and where it is not published, will seek a worst case estimate from other sources.

Quality

To complete the concept, we also need to consider the Quality level. In all processes there is an element of risk and an element of process/product longevity.

Globally, Mean Time Between Failure (MTBF) figures are calculated to assess the likelihood / risk of a failure for a product, usually based upon operational hours and operating conditions.

To relate risk back to quality, we need to view the GRN principle as measuring the long term risk to the planet. Thus, as well as looking, feeling and smelling nice, a good quality product should have a recycling factor associated with it, that defines the ease by which the item might be readily re-used or repaired.

Combining our GRN totals with calculated MTBFs and QL (Quality Level), we can derive a final GRUN (Global Respect Unification Number) for any given product, project or process, simply from :-

GRUN = (Sum of GRNs) x MTBF x QL

In some cases, the MTBF and QL figures will simply be set to 1, for example in the supply of 1 KWh of electricity, although of course, the Sum of GRNs may well differ.

In other cases, the MTBF and QL figures may have a marked effect on the overall GRUN value by virtue of their design and application.

In bringing these aspects into the equation, product, project and process design methodologies will naturally begin to alter in a measured way, in favour of reduced GHG emissions.

Low GRUN products will bias design for greater longevity, repairability or ease of recycling etc..

Low GRUN processes will bias toward Green energy sources (defined by GRNs) and recycling.

Low GRUN projects will bias toward a full appreciation and GRN budget in favour of long term GHG reduction.

Hard Currency and Negative GRUNs

As a consequence of the GRN measurement principles, hard currency can quickly be scaled to GHG emissions. It is a simple to envisage the GRUNT i.e. Tax on a GRUN.

In doing so, financial markets can use the principle to invest in low or negative GRUN technologies without the current ambiguity of what that really means.

Planting an orchard to grow apples will consume some fuel and equipment in order to plant the trees. Conversely the trees themselves will have a GRN number which is likely to be negative. i.e. The tree absorbs GHGs. Clearly various tree types will have varying abilities to absorb GHGs, so a computational figure can be quickly derived to determine the GRUN figure for an apple tree and hence an orchard.

Since this will very likely be negative, the choice to plant the orchard in the first place takes on a completely different commercial picture in terms of investment, tax and the final product.

Such calculations would equally apply to say a solar farm. The capital equipment itself, it's installation and likely lifetime will all compute to determine the final positive level GRUN (NET POSITIVE). If that solar farm is never used, then the planet has been damaged.

If, however it is switched on, it will start producing KWh output in terms of Zero GRNs per unit and thus, an accurate proper payback value assessment can take place which automatically factors in the lifetime and reliability of the whole project from cradle to grave, while making the output more commercially attractive.

Benefits

The GRN principle is readily understood, globally scalable and relatively easy to implement with current systems. The UK is well placed to lead on this via COP26, academia and relative independence as a consequence of Brexit.

The principle provides an enhanced means of applying proper scientific measurement and engineering principles to existing knowledge bases, while removing the large swathes of GHG language and action ambiguity currently enacted.

The principle positively drives GHG reduction in an easily understood way, promoting best practise in practically every arena throughout the cradle to grave supply chain cycle.

Conclusion

When NASA engineers set out to put a man on the moon, they anticipated, deduced and calculated pretty much every technical scenario for every second of the journey there and back.

To achieve a successful Earth Shot, mankind must do the same.

Talking of NET ZERO without a proper measurement scale and model, is simply just talking hot air.

Mark Aherne

4th November 2021