



**Carbon Foot  
Printing for  
novices:**

**Step 1, Lies,  
Damned Lies and  
Scopes 1,2 & 3**

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**Biogen Systems Limited**

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# Section 1 Biogen Systems Limited: Some Context

Biogen Systems Limited (BSL) manufacture Biomass fueled Gasification systems to produce Heat and Power also known as Biomass CHP Systems, from a site near Chester in the Northwest of England. The majority of production goes for export to the Far East and to the E.U. We are a small Manufacturing Business employing 10 staff with sister companies in Germany and Japan. Operating from a fabrication facility on a compound our energy consumption is arguably not typical of most UK businesses.

## Carbon Footprint at Scopes 1 to 3: What's are the differences<sup>1</sup>?

**Scope 1:** Fuel combustion for heating, Company vehicles, Fugitive emissions from onsite processes etc.

**Scope 2:** Purchased electricity, heat, and steam

**Scope 3:** "The rest"

- Purchased goods and services
- Business travel
- Employee commuting
- Waste disposal
- Use of sold products
- Transportation and distribution (up- and downstream)
- Investments
- Leased assets and franchises

At face value assessment against Scopes 1 and 2 is for most businesses is a relatively straight forward, if rather meaningless exercise and a potential for Companies , should they wish, to Green Wash their actual performance and Corporate commitments. However, the addition of Scope 3 is where things get both more complex and open to at best misunderstandings and at worst sleight of hand.

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<sup>1</sup> Definitions taken from the Carbon trust Website <https://www.carbontrust.com/resources/briefing-what-are-scope-3-emissions>

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The key issues for Biogen as the initial analysis in section 3 will show are

1. As a manufacturing business we are dependent on our component and material suppliers knowing their own carbon footprint. Unfortunately, this information is not readily available and has forced me into making a number of “back of a fag packet” assumptions. This being necessary to enable us to make any progress towards giving some sense of our “direction of travel” and indicate what we should do next.
2. As a business with an export focus and one where our systems are relatively “bulky” and heavy e.g., a 20’ shipping container weighing 7.5 t, typically being shipped to Japan, freight is a major component of our “conventional” footprint.
3. Biomass CHP systems during their Life Cycle have conflicting CO<sub>2</sub> production/sequestration capabilities i.e.
  - a small CO<sub>2</sub> footprint per KW generated that reflects carbon linked to Biomass planting, harvesting, transportation and preparation<sup>2</sup>
  - carbon sequestration in the form of the Biochar produced.
  - the net impact of the 2 Carbon vectors above is a small positive carbon foot print of 14 t per system per annum
4. The impact of OPTICS and who pays for Carbon Tax’s/Offsetting over the whole Product Life Cycle is crucial and potentially very confusing e.g.
  - If I view the issue as an operator then my system produces 14 t of carbon a year
  - However when expressed in terms of Life Cycle over a 20 year asset life we have 280 t net after allowance for Biochar sequestration .
  - However the actual carbon requiring offsetting per annum, per system (14 t.p.a.) and its associated tax/offset cost is arguably negligible at \$560 ( assumed Carbon Cost of \$40.00 per ton<sup>3</sup> ) relative to the annual carbon savings generated of 326 t.p.a. . Hence when switching from Fossil fuel to Biomass the net saving in Carbon taxation would be \$12,459 per annum. So as an operator, subject to the sales cost of the system, I am likely to be

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<sup>2</sup> Underpinning Data taken from the Carbon Trust website [www.carbontrust.com](http://www.carbontrust.com)

<sup>3</sup> Widely quoted likely “externality” cost of Carbon : The Spirit of Green , Nordhaus 2021

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happy with the Carbon and financial performance realised and could easily afford to offset.

- However, if the optic used is that of the Manufacturer's responsibility for the Carbon produced by the systems over their life cycle, then taking Budgeted production figures of 46 systems for 2022, Biogen have
  - i. A total Scope 1, 2 & 3 production of 14,011 t.
  - ii. The component of which due to Operation over the period 2022 to 2041 is 12,874 t with an associated offset/tax liability of \$514,960 or put another way a price increase per system of \$11,194 or a 3% price supplement. Whether the owners of Biogen should be prepared to fund this in aggregate as a sales cost is arguable.
  - iii. The Carbon emissions saved over the period by switching from Fossil Fuel to Biomass over the period 2022 to 2041 of operation for 2022's production is however 299,920 t !

The above points hopefully start to illustrate how potentially confusing trying to assess an individual manufacturing companies position can be and how easy it is to portray the "glass as being either half empty or half full" or in "eco speak", "Brown/Blue or Green" It also raises commercial opportunities/problems with regards to how the carbon foot print is costed and who shares the burden. These I suspect will not be resolved until the balance and arrangements between Carbon Taxes and Trading are resolved both globally and within individual National markets.

## **So What are the Implications for Our Continuous Carbon Improvement Initiatives?**

The conclusions I have come to in the short term are to

1. seek to use the lowest carbon footprint Biomass as feedstock i.e. locally sourced, waste or coppiced Biomass.
2. Fine tune reactor optimization for energy output whilst harvesting as much biochar as possible. It is worth remembering that Biochar returns carbon back "underground" and the 2022 production of systems over their Life Cycles will "Drawdown" 6,624 t of Carbon Dioxide or put another way this is equivalent to 2,500t of coal being reformed and buried.

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3. Focus on the “normal/mainstream conventionally assessed” carbon footprint of our business, section 3 provides the detail identified to date.

Points one and two help reduce the operational Life Cycle carbon of which energy production systems are extreme versions whilst point three involves the more mundane drivers of carbon footprints including embedded manufacturing carbon. You could of course think that the above conclusions are obvious and didn't need me to wrestle with trying to establish Biogen's approximate Carbon Footprint !

## **Section 3 Carbon Footprint V 1: “Back of a Fag packet” Carbon Foot Printing.**

### **Overview**

I chose several scenarios to express different “takes” on our actual performance that hopefully illustrate the reporting challenges present.

### **Scenario 1: Conventional Scope 1 and 2**

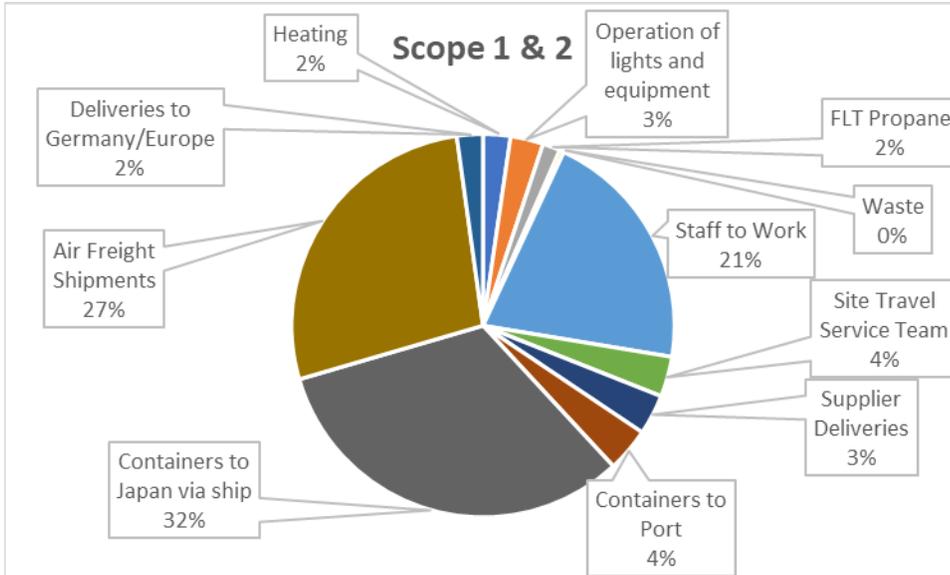
The pie chart below illustrates how the identified 242 t of our “conventional Scopes 1 & 2 Carbon<sup>4</sup>” emissions produced, are distributed. This approach and its preparation illustrate several points

1. More effective Planning to avoid air freight and encouraging staff to buy EV's are the main areas for improvement.
2. Footprint Data availability and applicability was patchy, and I suspect that the smaller categories are probably larger than stated

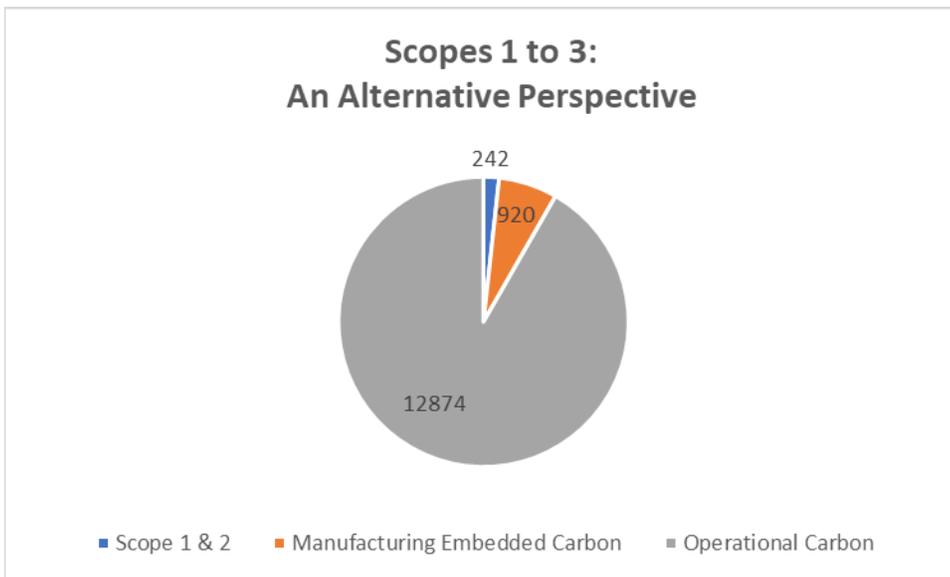
There is scope to improve performance via switching to established technology e.g. replacing our Fork lift truck with a renewably powered electric truck, similarly switching Service vehicles to Electricity and introducing more effective waste recycling initiatives will contribute to reducing the reported Carbon Footprint. However, as Scenario 2 shows this is not the “whole story”.

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<sup>4</sup> i.e. non reporting of embedded manufacturing component and materials Carbon footprint.



**Scenario 2: The “Spirit rather than the Letter” of Scope 1,2 and 3 Assessment.**



The above Pie Chart moves into the more complex and uncharted waters of adding in embedded manufacturing carbon plus the associated operational carbon over a 20-year life span. In seeking to estimate the embedded carbon I made several assumptions based on quoted information for the manufacturing of raw steel and light trucks. I suspect it is probably still too low but gives an order of magnitude relative to my earlier Scope 1 & 2 assessment and that of the “Operational Life Cycle Carbon”. The Operational Carbon for our products is not typical of most products and services so i consequently paint an extreme version of this Scope 3 element.

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The conclusions from this initial attempt at getting a first grasp on our Scopes 1 to 3 emissions are

1. Beware any Business making a commitment for Net Zero on its Scope 1 & 2 carbon footprint by 2030, it's probably a meaningless commitment and pure Greenwash.
2. Adjustment of our process parameters gives us the opportunity to increase the Biochar percentage produced. This reduces the energy output somewhat but over a 20-year asset life would sequester the individual systems current carbon footprint and move to a position where in addition to producing Carbon neutral energy, also Drawdown's historically produced Carbon Dioxide. This is an option that until carrying out this exercise had not occurred to me.

## Section 4: Biogen's Carbon Offsetting Approach

In the short term whilst Carbon Taxes are clarified and the wider understanding of the Public and Business Community Carbon increases, the main commercial focus will be on energy output and "Biochar balancing" is unlikely to be a significant factor. Hence which approach should we as a business take to Offset the carbon emissions of our production process?

Biogen have opted to provide a Geographical offsetting approach  
i.e.

- **Sales within the UK and Irish Markets:** Quotations will include for full offsetting of Biogen's production footprint i.e. The Site, Logistics and Embedded components. We will also offer Customers the opportunity to include within their service contract the option to offset their annual Operational Carbon Footprint.
- **Export sales:** quotations will offer clients the opportunity to pay a surcharge covering the Site, Logistics and embedded components.

Carbon Offsetting will be provided by a mix of UK and Developing World Carbon offset schemes. These are provided by

- In the UK by Gentle Farming Limited
- In the Developing World by Climate+Care

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## Section 5: Summary

The approach adopted has sought to establish the main areas of Carbon production and to do this I have had to make a number of assumptions and apply numerous engineering “guesstimates” .These I have no doubt do not yield an accurate Carbon Footprint , however they do start to provide clues of where we need to focus both on

1. Practical measures to reduce our Footprint
2. The Commercial and Marketing opportunities/challenges that Net Zero presents.

I will close by presenting this initial attempt in a different way, rather than quoting tonnages per annum or per Life Cycle across the different components of Scopes 1,2 and 3 . It has struck me that the perspectives of

- **Internal** Company Operations
- **External** Manufacture/Services, Raw Material Extraction and Freight
- Product **Use** and support

may be of helpful. In this context and based on the first outlines visible through the “mist” that is shrouding our understanding of Biogen’s Carbon Footprint . Then the ratios are approximately as below

**Internal** = 1 Unit

**External** = 4\*Internal

**Use** = 12\*External

Or put another way, the likely total Carbon Footprint is 50 times higher than that which can be relatively easily measured and claimed as Scopes 1 & 2 ....

