The carbon footprint by scopes applied to a Port

Dr. Ingrid Mateo-Mantecón and Prof. Dr. Pablo Coto-Millán. Department of Economics-University of Cantabria. Spain

Preamble

As a starting point, it is important to note that the European Union's transportation policy seeks to create transportation systems that meet the needs of society from an economic, social and environmental point of view. Various studies reveal that the transportation sector generates around 5% of European GDP and more than 10 million jobs, but this economic development must be attached to an increase in technological development to achieve a more environmental friendly transport sector.

In particular it must incorporate the international environmental agreements such as the Kyoto Protocol. Taking into account that the transportation sector accounts for 28 % of the EU's energy consumption, achieving the objectives contracted regarding CO_2 emissions becomes a major challenge (COM, 2011/114).

Since the implementation of the White Paper on European transportation policy in 2001, the aim has been to restore the balance between the various modes of transport as a strategy for achieving sustainable development. Therefore, readdressing the importance of the role that ports should play to support sustainability in the movement of both people and goods is needed.

To obtain CO_2 emissions the Compound Method based on Financial Accounts (MC3) methodology is used, and this method allows us to get the correcting measures for reducing those emissions applied for the case of a port.

Conceptualization

Human-induced climate change is now recognized as the greatest environmental threat of the 21st century. Climate forecasts issued by the Intergovernmental Panel on Climate Change (IPCC, 2014) have led to several initiatives designed to achieve regional, national and international agreements (Alvarez, 2014). In this context, corporate carbon footprint (CCF) offers a new scheme for reporting direct and indirect greenhouse gas emissions.

It is relevant to indicate that for ports, as for any other enterprises, the economic income statement is a necessary, but not sufficient, variable to guarantee their sustainability. To assure it, is essential as well, to take into account the environmental and social income statements. In response to this need, Port Authorities, in their role as managers of the port activity, establish standardized integral environmental management systems as a tool to establish an environmental protection and sustainability policy (eg:ISO14001 or EMAS).

The European Sea Port Organization (ESPO) highlights the relevance of the calculation of the Greenhouse Gases (GHG) for ports and continues developing the action lines designed in 2007. Alongside this, ESPO even urges ports to promote the reduction of these emissions also in transport from the port to its hinterland and foreland.

For example, the Port of Oslo determined its emissions on the basis of the ISO 14064-1 standard, by including direct emissions (456 t), indirect energetic emissions (49 t) and other indirect emissions related to subcontracts, business and trips from home to work (199 t). The total amounts to a 704 t CO_2/year. Applying the same methodology, the Port of Rotterdam showed direct emissions of 8,960 t CO_2/year, indirect energetic emissions of 7,230 tCO_2 and other indirect emissions of 20,100 t (total: 36,290 tCO_2/year).

However, CO_2 accounting is not only a European trend, for example, the Port of New York has determined carbon direct emissions derived from their activities and operations that accounted for 298,000 Tons of CO_2. So, they have developed a plan to reduce their emissions.

The communication is organized as follows. Section 2 shows a brief resume of the methodology employed. Section 3 presents the results of the application of the MC3 to a Spanish port. Finally the conclusions and main recommendations are offered.

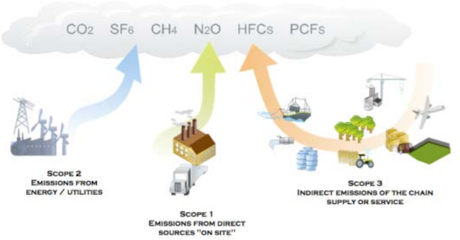
CCF-Scopes-and MC3

The definition of the corporate carbon footprint (CCF) given by Carbon Trust states that *"the total emission of greenhouse gases in carbon equivalents from a product across its life cycle from the production of raw material used in its manufacture, to disposal of the finished product"*.

The CCF allows us to establish specific environmental sustainability objectives; it allows the incorporation of indicators, such as the lifecycle and eco-labelling, in a single tool and provides a new method to help port managers to fight climate change more accurately since it allows implementing the corrective measures to minimise CO_2 emissions.

The Greenhouse Gas Protocol Corporate Standard classifies emission sources in three 'scopes'. See Figure 1:

Figure 1: Emissions by Scope
Source: Cagiao et al., 2012



-Scope 1 accounts for direct emissions that are produced by sources owned or controlled by the organization as a result of burning fossil fuels directly when performing their economic activity.

-Scope 2 relates to indirect emissions from the generation of purchased electricity, heat or steam consumed by the organization.

-Scope 3 refers to all other indirect emissions that are consequence of the activities of the Company not included in scopes 1 and 2 (Alvarez, 2014).

Empirically, common methodologies for calculation of CCF include: 1) Input-output techniques; 2) PAS 2050; and 3) The Compound Method based on Financial Accounts (MC3). Next, we will describe briefly the method applied in this communication, the MC3.

The Compound Method based on Financial Accounts (MC3), is one of the most practical methodologies that correctly assesses the amount of direct and indirect greenhouse gas emissions (the three scopes). Also, MC3 was built under the premise of being fully consistent with ISO standards.

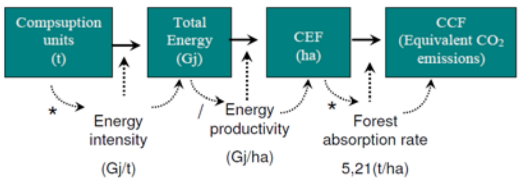
The original MC3 methodology, including guidelines for assessing the CCF of enterprises, was published by the Spanish Association for Standardisation and Certification (AENOR). This method has been improved through the co-operation with five Spanish universities, and the results of this work have been published in several journals. This methodology is supported by the Technical Committee of the Carbonfeel Initiative, recognized by the Spanish Sustainability Observatory, and it is approved as a valid approach for assessing CCF within the framework of the Spanish Voluntary GHG Reduction Agreement (Alvarez, 2014).

The necessary information to determine the CCF though the MC3 is mainly obtained from accounting documents such as the balance sheet and the profit and loss account, so all activities linked to each organization are perfectly defined. The MC3 calculates the footprint for all goods and services included in the accounts. Additionally, waste derived from the acquisition of such goods and services, and the occupied space by the company which are included in the accounts.

Obtaining CCF using MC3 methodology is estimated on the basis of the calculation sheet, which works as a consumption land use matrix (CLUM) which applies the consumption of goods and services needed by companies. The rows of the CLUM matrix show the footprints for each category of good/service consumed. Columns include, amongst several other elements, relevant categories of productive space, according to the Ecological Footprint analysis.

Figure 1 presents the outline for the calculation of the CCF applying MC3:

Figure 1: Calculation of CCF applying MC3



In MC3 the consumption is obtained mainly from the company accountability. Then the TARIC classification is used to change monetary units into physical units (metric tons, Tm). Those consumptions units are multiplied by the energy intensity (the amount of energy/ton used to produce it in GJ/t), to obtain total energy used to produce each product category considering a standard life cycle. Once total energy is obtained, we divide it by the energy productivity, (where energy productivity shows how many tons of each fuel were needed to generate the CO_2 volume which can be absorbed per hectare on an annual basis), to get ecological footprint of the company. Finally, CCF is obtained after multiplying the ecological footprint by an absorption rate per hectare/year.

Application to obtain CO_2 emissions of Gijón´s Port

Spanish port authorities have established standardised comprehensive environmental management systems as a tool for implementing environmental protection and sustainability policies (ISO 14001, EMAS, etc). This communication focuses on the particular case of Gijón Port Authority since it has been the pioneer in the use of CCF indicator within the Spanish port system.

We have calculated Gijon´s port CCF for the period from 2004 to 2008 using MC3. In other to accomplish this task, data provided from accountability documents such as the trial balance, the tangible fixed assets and the general ledger were requested from the Financial Department. Other data such as electricity, fuel, water, and paper consumption were obtained from those responsible for these services. The main results by good/service category (in tons of CO_2 emitted) and scope are presented in Table1:

Table 1: Evolution of PAG's CCF broken down by categories and scopes (tCO2/year and %)

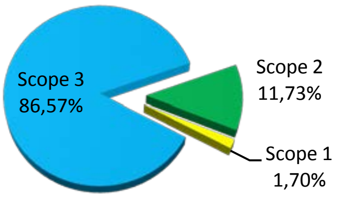
Category	2004	2005	2006	2007	2008
Electricity-Scope 2-Indirect emissions	5,040 (16.5%)	3,909 (12.2%)	3,893 (12.9%)	3,815 (12.8%)	3,801 (11.7%)
Fuels-Scope 1-Direct emissions	676 (2.2%)	705 (2.2%)	839 (2.8%)	578 (1.9%)	550 (1.7%)
Scope 3-Other indirect emissions:	24,769 (81.21%)	8,554 (85.63%)	25,514 (84.33%)	25,504 (85.28%)	28,109 (86.57%)
Materials	4,036 (13.2%)	3,916 (12.2%)	3,795 (12.5%)	3,728 (12.5%)	3,756 (11.6%)
Building materials	16,281 (53.4%)	19,000 (59.1%)	19,113 (63.2%)	19,411 (64.9%)	22,772 (70.2%)
Services and contract services	786 (2.6%)	1,447 (4.5%)	1,197 (4.0%)	1,247 (4.2%)	863 (2.7%)
Waste	1.143 (3.7%)	1.250 (3.9%)	10 (0.0%)	59 (0.2%)	27 (0.1%)
Agricultural resources	410 (1.3%)	521 (1.6%)	449 (1.5%)	490 (1.6%)	159 (0.5%)
Forest resources and water	2,113 (6.9%)	1,401 (4.4%)	950 (3.1%)	569 (1.9%)	532 (1.6%)
Gross CCF	**30,485**	**32,148**	**30,245**	**29,896**	**32,460**
Counter Footprint	59	51	51	51	52
Net CCF	**30,426**	**32,097**	**30,194**	**29,845**	**32,408**

According to Table 1 we may identify two different patterns in the evolution of net CCF for Gijon's Port. The first one, from 2005 to 2007, shows a decrease of around 7.5%, while in 2008 this trend was disrupted presenting an increase of 8.6%.

Focusing in 2008 the major contribution to CCF corresponds to materials footprint (70.2% of them being building materials and 11.6% the rest of the materials) followed by electricity footprint –scope 2–, with an 11.7%, and fuel –scope 1– with a 1.7% (Carballo-Penela et al., 2012). Since net CCF derived from direct emissions (those derived from fuel combustion, scope 1) are insignificant it is crucial to focus on indirect emissions in order to become a carbon neutral port. For the case of Gijón's port, indirect emissions from electricity or scope 2, and other indirect emissions or scope 3 (materials, building materials, services, wastes, agricultural resources and forest resources, and water), reached 28,659 t CO2 in 2008 (98.3% of the CCF; where an 86.3% is due to scope 3). Several researchers have also commented on the importance of indirect CCF.

Other methodologies proposed in the literature to account for the CCF focus only in scopes 1 and 2. However, as we have highlighted here, these scopes represent only an average of 13.43% of the CCF for 2008. In other words, carbon neutrality requires measures beyond scopes 1 and 2, so measurement of scope 3 is vital (see Figure 2).

Figure 2: Total CO_2 emissions in % by scope in 2008



The Port of Gijón should pay attention to reduce the CO_2 emissions. Improving Efficiency in the use of materials, building materials, and replacing the electricity supplier for one producing renewable energy would contribute to the reduction of the CCF of the port.

Conclusions

An eco-efficient port must aim to achieve the *zero carbon* goal, reducing its energy consumption, investing in self-produced renewable energies, purchasing green materials, subcontracting ecological civil works or even investing in natural capital (carbon sinks, protection of the biodiversity, etc.); this aim should be compatible with an increase in cargo handling at port facilities.

Nowadays, control of greenhouse emissions is a key tool in order to measure the environmental impact of organizations and freight. The application of this measure to all ports and for every logistic agent involved in the supply chain would make possible to plan the reduction of emissions, aiming to minimize emissions in the whole network.

Sharing responsibility for emissions among producers and consumers could facilitate international agreements on global climate policy. These agreements should be reached with the most possible consensus.

References

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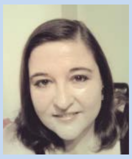

Ingrid Mateo-Mantecón. Department of Economics. University of Cantabria

Ingrid Mateo-Mantecón is a researcher and lecturer Professor of the Department of Economics at the University of Cantabria since 2005. She obtained her PhD in Economics from Cantabria's University and has a Postgraduate Degree in Trade, Transport and International Communications.
Previously, from 2003 to 2005 he worked at Santander's Port Authority.
Her research has focused on: Transport Economics and Port Infrastructure: Regulations, Industrial economy, microeconomics, economic Impact of Port Authorities, and environmental economics.
She is also co-author of book chapters, books, and articles in national and international journals.

Pedro Pablo Coto-Millán. Professor and Dean of the Faculty of Economics and Business at the University of Cantabria.

Pedro Pablo Coto-Millán is the Dean of the Faculty of Economics and Business at the University of Cantabria. He holds a degree and Ph.D. in Economics. He is currently Professor of Foundations of Economic Analysis.
He has written 21 books, 27 papers in journals with scientific impact in Journal Citation Report of ISI and over 50 articles in other journals.
He is part of the editorial board of the scientific journals: International Journal of Transport Economics; International Journal of Shipping and Transport Logistics; Maritime Economics and Logistics (International Journal of Maritime Economics) and Principios.
His areas of specialization are: microeconomics, transport economics and Port Infrastructures, and environmental economics.

Acknowledgements

The authors acknowledge contributions from Adolfo Carballo-Penela and José Luis Doménech, and comments from Valeriano Martínez-San Román.