Evaluating the contributions of the CO_2 Performance Ladder to improved energy management practices

Martijn G. Rietbergen, Institute for Engineering & Design, Utrecht University of Applied Science, Oudenoord 700, 3513 EX, Utrecht, the Netherlands

Abstract

The CO_2 Performance Ladder is a certifiable scheme for energy management and carbon reporting that is used by several Dutch public authorities as a tool for green public procurement. Achieving certification gives companies a competitive advantage in awarding contracts. This paper aims at evaluating the effectiveness of implementing the CO_2 Performance Ladder as a management system for improving energy efficiency and CO_2 emission reduction in the construction industry sector which is the main target group of the scheme. The implementation of the CO_2 Performance ladder will be evaluated by using methods for evaluating policy theory, programme process evaluation and impact assessment. Data were mainly collected through document research (e.g. energy management plans, monitoring reports and CO_2 footprints) and interviews with various representatives of firms and other stakeholders. The research results show that 1) the CO_2 Performance Ladder contributes significantly in improving energy management practices in the involved firms; 2) that additional energy saving measures were taken because of the CO_2 Performance ladder and 3) that the majority firms show sufficient progress towards reaching their CO_2 emission reduction goals. This research concludes that at least in the short term the CO_2PL is an effective tool for tapping the energy efficiency potential in firms in the construction industry sector.

Introduction

Many organizations are adopting energy management schemes (Stechemesser & Guenther, 2012) nowadays. Energy management schemes enable organizations to follow a systematic approach in achieving continuous improvement of their energy performance. The CO_2 Performance Ladder is a certifiable scheme for energy management and GHG reporting introduced in the Netherlands. The scheme is used as a tool for green procurement by several Dutch public authorities, particularly for awarding contracts in the construction and civil engineering sector. The adoption of the CO_2PL is often seen as a major stimulant for energy efficiency improvement and CO_2 emission reduction for firms in these sectors, since they are generally not subject to other specific energy or climate policies and programs.

Various stakeholders, including the scheme owner SKAO, the commissioning parties and the participating companies, are particularly interested in the question whether the CO_2PL is really contributing to improved energy management practices in firms. The aim of this research is therefor to evaluate the impacts of adopting the CO_2PL on energy management practices in firms in the construction and civil engineering sector. The questions is whether the CO_2PL has really changed the way companies are managing and controlling energy use and CO_2 emissions, whether CO_2 performance of the participating companies has improved and whether energy efficiency barriers have been reduced.

This paper is organized as follows. Section 2 briefly introduces the CO_2PL as a certifiable scheme for energy management and carbon accounting. Section 3 addresses the research

methods and data collection. Section 4 presents the main findings of our study. The results of this study are discussed in Section 5, and in Section 6, we will draw the conclusions.

CO_2 Performance Ladder

In 2009, the CO_2PL was introduced as a certifiable scheme for energy management and carbon accounting by ProRail, the company responsible for the railway network infrastructure in the Netherlands (ProRail, 2009). In 2011 SKAO (the independent foundation for climate friendly procurement and business) became responsible for managing the CO_2PL to make the scheme suitable for other commissioning parties as well (SKAO, 2011).

The CO_2PL is built on a certifiable standard for energy management and GHG reporting, which is strongly linked to existing international standards for reporting GHG emissions (see, e.g. ISO, 2006) and energy management (see, ISO, 2011). The underlying certification scheme discriminates among five 'certificate levels' that indicate the evolutionary stage of a company as it moves towards achieving optimal CO_2 management. The certificate levels relate to four key process areas that a company should focus on to improve its GHG management. These four key process areas are (A) drawing up CO_2 emission inventories, (B) setting and achieving CO_2 emission reduction targets, (C) transparency and communication of the company's CO_2 footprint and energy policy and (D) participation in (supply chain) initiatives.

Each key process area contains an audit checklist with the certification requirements a company should meet for each certificate level. **Table 1** shows the general certification requirements for each key process at each certification level. A third party organization conducts an independent certification audit to verify whether the requirements, linked to the certificate level aspired by the company, are met. If a company fulfils all the requirement, a 'CO_2 certificate' is awarded indicating the achieved certificate level. A certificate is valid for three years, but compliance assessment must be performed every year. After three years re-certification is required.

Companies that hold a CO_2 certificate can qualify for a competitive advantage in the awarding of procurement contracts. The competitive advantage depends on the achieved certification level. For more information about the certification process, the use of CO_2PL in public procurement procedures and the competitive advantage in awarding contracts, the reader is referred to Rietbergen & Blok (2013).

Research methods, data and case collection

This study is rooted in the field of evaluation research. 'Evaluation' is defined as the systematic and objective assessment of an on-going or completed project, programme or policy particularly aimed to determining the needs, design, implementation process, outcome, impact, and efficiency (OECD, 2012; Rossi et al, 2004). This study specifically focusses on the implementation process, outcomes and impacts of the program. Process evaluations assess how well a program is being operated, implemented and adopted (i.e. formative evaluation). Outcome evaluations assess the extent to which a program achieves its objectives (i.e. the gross impact of the programme or goal achievement). Impact evaluations aims to determine what changes in the programme outcomes can be attributed to programme intervention (i.e. the effectiveness or the net impact of the programme), see EREE (2006).

A non-experimental research design was chosen to evaluate the impact of the CO_2PL on

changing corporate energy management practices. A 'participant group self-report design' approach was used, evaluating the participant's behavior before and after the implementation of the CO_2PL (EREE, 2006).

The number of companies participating in the CO_2PL scheme is growing rapidly. In less than 5 years, starting in 2009, more than 500 companies have been registered. The target population to which we want to generalize the research findings is however limited to firms that meet the following conditions. Companies should have participated in the CO_2PL at least two years or more, because companies must have had sufficient time to implement the CO_2PL as a management system for energy and CO_2 emission reduction. Furthermore, only companies with a CO_2 footprint larger than 5000 tons of CO_2 emissions in scope 1 and 2 are included, since these companies are roughly responsible for about 80% of the total emissions covered by the CO_2PL scheme.

Thirty-three companies, which were randomly selected from the target population (66 firms), were contacted and asked to participate in the research. Finally, a sample of twenty-five firms was selected for conducting the interviews; six firms were rejected because a new CO_2PL coordinator was recently appointed and two firms were not willing to participate. Table 2 shows the company profiles of the sample. Most of the involved companies have construction and civil engineering as their main activity (NACE codes 41, 42 and 43)[1]. In total twenty-seven interviews with thirty-one representatives of twenty-five different companies were conducted in the period from March 2014 until July 2014.

The data on the outcome and goal achievement were mainly collected by reviewing relevant company documents, such as corporate energy management plans, energy policy plans, annual reports and CO_2PL progress reports. A spreadsheet programme was used for further data analysis. Semi-structured interviews with corporate representatives, responsible for coordinating the implementation of the CO_2PL, were conducted to identify the impact of the CO_2PL on improving corporate energy management practices. The interview guide, that primarily contained open-end questions, was based on a literature review of the CO_2PL, energy and environmental management systems. The interviews, that typically took 100 to 120 minutes, were tape recorded, fully transcribed and sent back to the interviewees for review and approval.

[1] NACE is the statistical classification system of economic activities in the EU (EC, 2008).

Table 1. General audit requirements for each key process (A-D) for the different certificate levels (1-5). Source: SKAO (2011)

Level	1	2	3	4	5
A Insight	The company has partial insight into its energy consumption.	The company has an insight into its energy consumption.	The company has converted its energy consumption into CO_2 emissions.	The company reports its carbon footprint in accordance with ISO14064-1 for Scope 1, 2 & 3.	The company requires that its A-suppliers have a Scope 1 & 2 emissions calculation in accordance with ISO14064-1.
B Reduction	The company investigates opportunities for reducing energy consumption.	The company has an energy reduction target, described in qualitative terms.	The company has quantitative CO_2 reduction objectives for its own organisation.	The company has quantitative CO_2 reduction objectives for Scope 1, 2 & 3 CO_2 emissions.	The company reports on a structural and quantitative basis the results of the CO_2 reduction objectives for Scope 1, 2 & 3.
C Transparency	The company communicates its energy reduction policy on an *ad hoc* basis.	The company communicates its energy policy internally (to a minimal degree) and possibly externally.	The company communicates about its carbon footprint and reduction objectives both internally and externally.	The company maintains dialogue with government bodies and NGOs about its CO_2 reduction objectives and strategy.	The company is publicly committed to a government or NGO CO_2 emission reduction programme.
D Participation	The company is aware of sector and/or supply chain initiatives.	The company is a passive participant in initiatives aimed at reducing CO_2 emissions in or outside the sector.	The company is an active participant in initiatives aimed at reducing CO_2 emissions in or outside the sector.	The company initiates development projects that facilitate reductions in CO_2 emissions in the sector.	The company takes an active part in setting up a sector-wide CO_2 emission reduction programme in collaboration with the government or an NGO.

Table 2. Profiles of interviewed companies

#	CO_2PL level	Certified since	SBI	CO_2 emission reduction target					CO_2 footprint		
				type	Start-end	target (%/a)	achieved (%/a)	last year reported	CO_2 Footprint (tons)	Year	emission reduction (%/a)[1]
1	5	1/2010	71	CO_2/FTE	2008-2015	-1,2%	-6,2%	2013	6718	2013	-8%
2	3	4/2010	42, 43	CO_2/FTE	2009-2015	-2,7%	-4,3%	2013	4191	2012	-10%
3	5	4/2009	41, 42	CO_2/M€	2008-2020	-2,9%	-3,8%	2013	50000	2013	-9%
4	5	4/2010	41, 42	CO_2/M€	2009-2015	-2,7%	#N/A	#N/A	4895	2012	-16%
5	5	2/2010	41-43, 71	CO_2/M€	2009-2015	-2,7%	#N/A	#N/A	15670	2010	#N/A
6	5	2/2010	42	CO_2	2009-2012	-0,4%	-5,8%	2012	6272	2013	-9%
7	5	1/2012	38, 43	CO_2/M€	2010-2013	-2,7%	1,7%	2013	14814	2013	24%
8	5	4/2010	41, 42	CO_2/M€	2009-2015	-1,7%	-3,7%	2012	5346	2012	-5%
9	5	2/2011	42	CO_2/M€	2009-2020	-0,5%	-3,8%	2012	64958	2012	-15%
10	3	3/2011	38, 42, 43	CO_2	2009-2014	-1,7%	-10,1%	2012	5458	2012	-11%
11	3	1/2011	42	CO_2	2010- [1]	-2,0%	0,3%	2013	7202	2013	0%
12	5	1/2011	41, 42, 43	CO_2/M€	2009-2015	-4,1%	-7,6%	2013	14490	2013	1%
13	3	3/2011	38, 42	CO_2/FTE	2011-2020	-2,0%	2,8%	2013	14800	2013	8%
14	5	4/2010	41, 42, 43	CO_2/M€	2009-2016	-2,5%	-7,9%	2012	45964	2013	-7%
15	5	1/2010	42, 43	CO_2	2008-2012	-2,6%	-1,0%	2012	8549	2013	-2%
16	5	1/2011	41-43	CO_2/M€	2009-2020	-2,0%	-7,3%	2012	11230	2013	-3%
17	5	1/2011	41-43	CO_2/M€	2009-2014	-2,1%	3,5%	2012	10687	2012	-6%
18	3	3/2011	62	CO_2/FTE	2010-2020	-2,2%	0,2%	2013	15281	2013	-3%
19	5	4/2009	41-43, 71	CO_2/M€	2009-2020	-1,5%	-3,8%	2013	36708	2013	-1%
20	5	4/2009	42	CO_2/M€	2008-2020	-1,3%	-2,9%	2013	15919	2013	0%
21	3	2/2011	27, 35	CO_2/M€[1]	2009-2015	-4,7%	-4,3%	2013	9761	2013	-2%
22	5	3/2011	42, 43, 71	CO_2/FTE	2010-2015	-1,7%	-11,4%	2013	8100	2013	1%
23	5	4/2010	41, 42	CO_2	2009-2015	-1,0%	0,0%	2013	4466	2013	1%
24	5	1/2011	41	CO_2	2009-2015	-2,1%	-4,2%	2013	8196	2013	-3%
25	4	1/2010	43	CO_2	2010-2013	0,0%	-9,8%	2013	5273	2013	-9%

[1] annual emission reduction based on linear least square method for the data available (in most cases for the period 2009-2013); [2] rolling base year; [3] Production value.

Research findings

Motivation for adopting the CO_2 Performance Ladder

Almost all the companies primarily adopted the CO_2PL because of the (expected) competitive advantage in the awarding of procurement contracts, either through the fictitious discount or pre-qualification. Other reasons for adopting the CO_2PL were improving public image, seeking confirmation of previous efforts on energy efficiency improvement or CO_2 emission reduction, broadening of existing CSR policies and strategies, complying with requirements of the holding company, clients or customers. Six of the initial 66 firms did not continue their certification because the CO_2PL did not bring further assets, compared to other existing CSR policies.

Changes in energy management practices

During the interviews with firm representatives we discussed whether energy management practices have changed since the introduction of the CO_2PL. Therefor we asked firms to evaluate to what extent key energy management practice were existent already before and after the introduction of the CO_2PL. We discussed the following topics 1) the involvement of the company's management in energy issues and the visibility of their leadership on this topic; 2) the available procedures to monitor energy use and CO_2 emissions; 3) the proper analysis of monitoring data; 4) the evaluation of the impact of energy saving measures; 5) the availability of an effective Plan-Do-Act-Check cycle; 6) whether energy is routinely part in corporate processes, such as procurement, management reporting, investment decisions; 7) whether CO_2 emissions is a corporate strategy; and 8) whether employees are stimulated to contribute to energy saving. Figure 1 reveals that almost none of the energy management practices were even partly implemented in the daily business operations prior to the introduction of the CO_2PL. Since the introduction of the CO_2PL this has changed drastically. Firms especially valued the improved insight in CO_2 emissions and the introduction of the PDCA cycle.

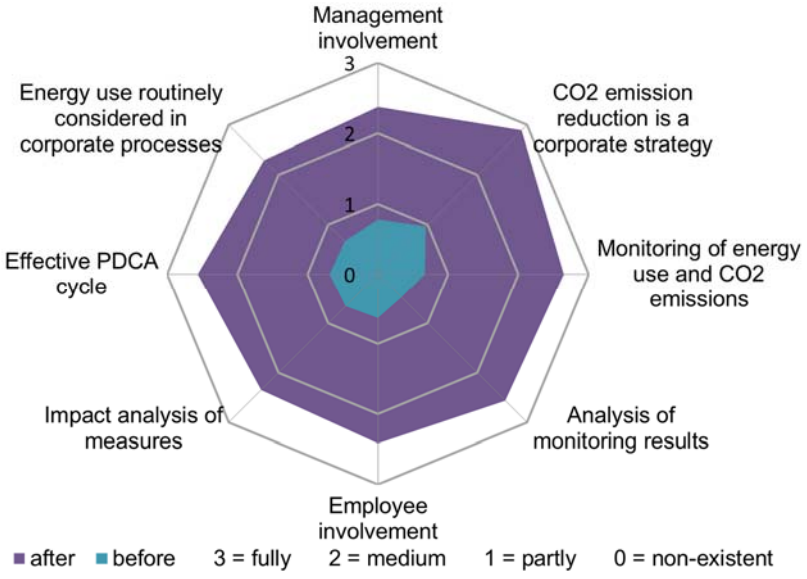

Figure 1. Changes in energy management practices (n = 25)

Implemented measures for energy efficiency and CO_2 emission reduction

Companies can reduce their CO_2 emissions by implementing energy efficiency measures, through technological innovation or by changing the type of energy sources. Companies cannot reduce their emissions through carbon offsetting. Figure 2 shows the measures for energy efficiency and CO_2 emission reduction that were implemented by the firms involved in our research. The majority of the CO_2 emission reductions measures (66%) are targeted at reducing emissions in scope 1. Around 30% of the measures can be categorized as 'green mobility'. Almost all firms adopted measures for the reduction of CO_2 emissions of business travel by cars, such as capping CO_2 emissions of lease cars, requiring maximum allowable fuel economy labels of lease cars, eco-driving instructions and training, and electric cars. A lot of firms also started buying green electricity instead of grey electricity to reduce their CO_2 emissions. The category 'machinery' includes measures such as the more efficient use of machinery, buying more efficient machinery and energy metering of machinery. Companies producing (raw) materials such as asphalt or concrete implemented various measures to reduce energy use in their production facilities. Energy efficiency measures in office buildings were also often taken, such as energy efficient lighting, insulation, energy efficient equipment for heating and cooling, and introduction of renewable energy technologies like solar panels. Finally, there is a wide range of other measures classified under the category 'other', including for example behavioral measures, energy efficient office equipment, more efficient project management, alternative workplace strategies, etc.

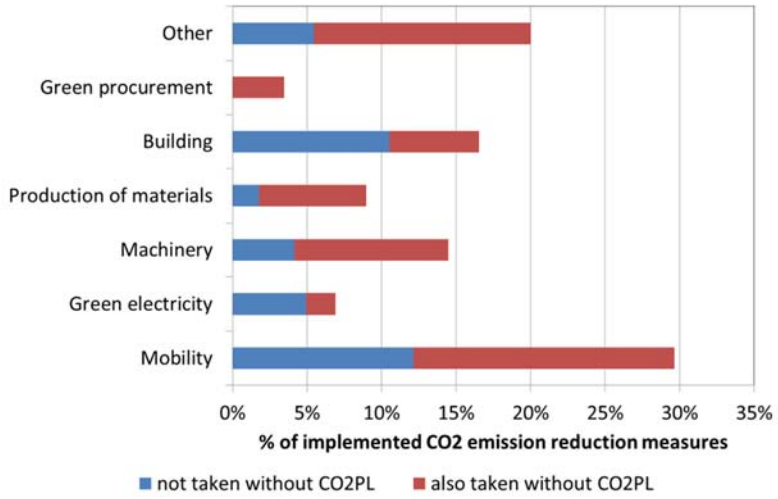

Figure 2. Adopted **CO_2** emission reduction measures

According to the interviewees, about 40% of the measures would not have been implemented without the CO_2PL. Green electricity was especially stimulated by the introduction of the CO_2PL. Although green electricity sometimes costs money, it can easily reduce the CO_2 footprint drastically, and as a result firms may be classified in a different size category, making compliance to the CO_2PL more easy. Various behavioral measures in the category 'green mobility', 'machinery' and 'other' have also been stimulated by the CO_2PL considerably. The

capping CO_2 emissions of lease cars and maximum allowable fuel economy labels of lease cars have been stimulated by national fiscal policies to a large extent as well.

CO_2 emission reductions

Figure 3 shows the cumulative CO_2 emissions of the firms that were involved in our research. A decreasing trend (-7% per year) in the CO_2 emissions can be observed, however, this trend was mainly the result of the loss of activity of large companies in the construction industry and civil engineering sector, that faced a serious economic decline in this specific period.

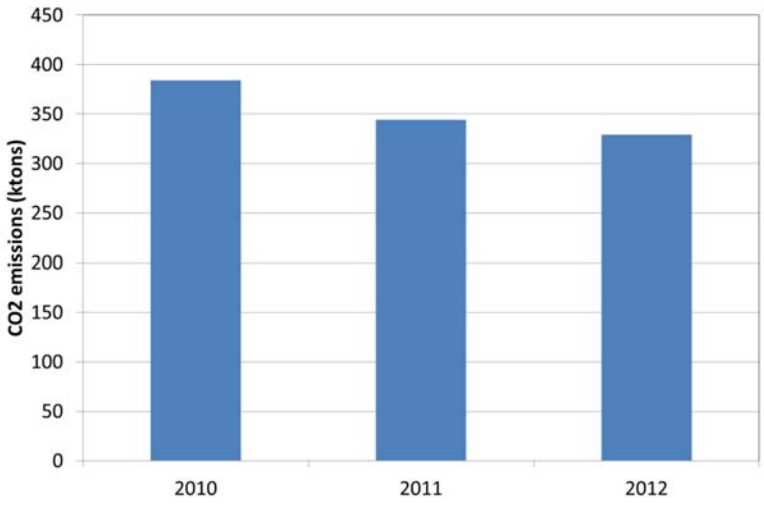

Figure 3. CO_2 footprint (scope 1 and 2 emissions) of companies researched

CO_2 footprints for 2013 will become available soon and will be included. The cumulative CO_2 footprints will also be broken down to evaluate emission reductions in scope 1 and 2.

Goal achievement

Setting CO_2 emission reduction targets is a key element in the CO_2PL. Companies must choose a type of CO_2 emission reduction target that is relevant for their business operations. The main types of CO_2 emission reduction targets are volume targets for CO_2 emission reduction, targets for CO_2 emission reduction measured against FTE, targets for CO_2 emission reduction measured against turnover, targets for improving CO_2 efficiency indexes and targets for CO_2 emission reduction measured against a physical indicator (e.g. ton product). The results in Table 2 show that 60% of the companies, for which data are currently available, comply with the annual reduction rate required to reach the agreed target level. 28% of the companies did not manage to improve their CO_2 performance; the CO_2 intensities expressed in CO_2/FTE or CO_2/turnover increased during the measures period.

Discussion

In this study a non-experimental research design was chosen to evaluate the impact of the

CO_2PL on corporate energy management. This type of research design does not use a comparison group to evaluate programme or policy impacts. The introduction of a comparison or control group would further strengthen the validity of the research. Since, the top ten of largest construction companies are all holding a 'CO_2 certificate', the control group would mainly include construction companies with a turnover in the range of 50 – 500 million euros. In this latter category there are still quite a number of companies that do not hold a certificate yet.

In addition to the previous point, it is also difficult to separate impacts of the CO_2PL from other contributing factors, such as 1) the increased attention in the society on sustainability issues in the last couple of years; 2) the influence of quality management systems, such as ISO-9001 and ISO-14001 that were already in place; 3) other contributing energy and climate policies and measures, such as long-term agreements on energy efficiency; and 4) general strategies for cutting costs. Though, the majority of the firms related effects on energy management practice to the CO_2PL for a large extent.

Research that is depended on data collection via interviews always includes the risks of respondent and interviewer bias. The main type of respondent bias may include social desirable answers. To prevent this type of bias, full anonymity was promised to the participants. Interviewer bias was reduced by carrying out interviews in alternating couples of interviewers.

The evaluation of CO_2 emission reductions and the goal achievement was based on the reported CO_2 emissions in the base year and the most recent CO_2 emission data. Though, CO_2 emissions in the base years must be updated, the quality and completeness of these base year emission might be questioned. Especially in the early days of the CO_2PL data gathering, monitoring and registration was less advanced than nowadays.

Conclusions

The CO_2PL was introduced as a certifiable scheme for energy management in the Netherlands in 2009. The scheme is especially adopted by firms in the construction industry sector. The aim of this research was to evaluate whether the CO_2PL really changed energy management practices of involved firms. The main conclusions are the following. First, energy management practices have changed considerably since the introduction of the CO_2PL. Firms especially claim that insight in the CO_2 footprint improved and that the CO_2PL is an effective tool for steering energy management. Second, the CO_2PL has an additional impact on the CO_2 emission reduction measures taken by firms. Firms claim that 40% of the measures would not have been taken without the CO_2PL. Third, the analysis of the goal achievement shows that the majority of the firms comply with the annual reduction rate required to reach the agreed target level. Based on these results we may conclude that at least in the short term the CO_2PL is an effective tool for tapping the energy efficiency potential in especially firms by awarding green practices when procuring contracts in the construction industry sector. This research implies that the wider adoption of the CO_2PL in other economic sectors could be considered.

References

DOE, 2006. EERE Guide for managing general program evaluation studies. U.S. Department of Energy.

EREE, 2006. EERE guide for Managing General Program Evaluation studies: Getting the information you need. United States Department of Energy.

ISO, 2006. ISO-14064-1: Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals. International Standardization Organization.

ISO, 2011. ISO-50001: Energy management systems – requirements with guidance for use. International Standardization Organization.

OECD, 2002. http://www.oecd.org/development/peer-reviews/2754804.pdf

ProRail, 2009. CO_2 Performance Ladder 1.0 [CO_2 Prestatieladder 1.0. / Het certificeren]. ProRail. Utrecht.

Rietbergen. M.G., K. Blok. 2013. Assessing the potential impact of the CO_2 Performance Ladder. Journal of Cleaner Production 52, 33-45.

Rietbergen. M.G., K. Blok. 2014. The target-setting process in the CO_2 Performance Ladder: Does it lead to ambitious goals for carbon emission reduction? Submitted for publication.

Rossi, P.H., M.W. Lipsey, H.E. Freeman, 2004. Evaluation, a Systematic Approach, 7th ed., Sage, Thousand Oaks, CA.

SKAO, 2011. Handbook CO_2 Performance Ladder 2.0 [Handboek CO_2 Prestatieladder 2.0]. Stichting Klimaatvriendelijk Aanbesteden en Ondernemen. Utrecht.

SKAO, 2014. www.skao.nl. Website 'Stichting Klimaatvriendelijk Aanbesteden en Ondernemen'. Utrecht.

Stechemesser, K., E. Günter, 2012. Carbon accounting: a systematic literature review. Journal of Cleaner Production 36, 17-38.

Sullivan, R., 2011. An assessment of the climate change policies and performance of large European companies. Climate Policy 10(1), 38-50

Wortmann, C., 2012. Nut en noodzaak van de CO_2 Prestatieladder. Primum. Driebergen.