PeSCoS

State of the Art

Version 1.0 – 14/10/2011

Project	Personalised Sustainability Coaching for SMEs - PeSCoS		
Author(s)			
Reviewer(s)			

This project has been funded with support from the European Commission.
This document reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Education and Culture DG
Lifelong Learning Programme

Circulation List

Person Name	Organization Name
Pepijn DUIJVENSTEIN	Wij Zijn Koel
Tim MANSCHOT	Wij Zijn Koel
Gianluca COPPOLA	EUROCREA MERCHANT
Ireneusz ZBICINSKI	Technical University of Lodz
Agnieszka TRZUPEK	Technical University of Lodz
Grzegorz KIERNER	Technical University of Lodz
Maciej JASKULSKI	Technical University of Lodz
Nikolaos SKARMEAS	AVACA Technologies S.A.
Spiridon GIDAROS	AVACA Technologies S.A.
Maria CHRISTODOULOU	FAVINOM Consultancies LTD.
Dimitris DIAMANTIS	FAVINOM Consultancies LTD.
Tiago GAIO	AREANATejo
Cristina FIGUERUELO	FUNDITEC
Isaak MATAMOROS	FUNDITEC
Claudia PANI	FUNDITEC

Revision History

Version	Date	Author	Description	Action	Pages
0.1	10/02/2011		Creation of the document	C	10
1.0	02/04/2011		Update of the document	U	15
1.1	14/10/2011		Update of the document	U	15

(*) Action: C = Creation, I = Insert, U = Update, R = Replace, D = Delete

Referenced Documents

ID	Reference	Title
1	510344-LLP-1-2010-1-GR-LEONARDO-LMP	PeSCoS Proposal
2	510344-LLP-1-2010-1-GR-LEONARDO-LMP	Evaluation Comments
3	Meeting_Minutes_Content V1.1	Content Meeting Minutes

Applicable Documents

ID	Reference	Title
1	FAVINOM Consultancies QMS	Quality Management Procedures

.

Executive Summary

This document forms the State of the Art for the Implementation of the PeSCoS Project (henceforth, "Project").

The PeSCoS project concerns the implementation of a personalised training system for SMEs to be able to eliminate their unsustainable ways and embrace new, greener habits. The aim is to offer personalised training to SMEs on the amount of carbon, energy, Euros and other resources they expend through hundreds of choices and daily actions in an effort to diminish their negative impact on the earth. Following the completion of the training, SMEs will have a personalised unsustainable ways withdrawal plan.

The content that will be developed to support the training system that will be designed will offer businesses practical advice for cutting down energy and water usage and reduce their environmental impact. At the hart of the training system will be an environmental "genie" which will guide the SMEs so as to provide the necessary inputs with respect to the characteristics of their business (e.g. recycling system, heating system, etc.). Following the provision of all the necessary information, the "genie" will produce a detailed report explaining to the SME how to cut costs and turn its business greener. The training system will be geared to small and medium businesses looking to save money, be less harmful to the environment and create a "strong environmental brand ethos" amongst customers and staff.

The PeSCoS project is co-funded by the Education and Culture DG under the Lifelong Learning Programme, LdV Multilateral Project, Development of Innovation

The present document contains information regarding:

- The purpose of the State of the Art work and the Scope of the PeSCoS project and objectives
- The definition of the Ecological footprint
- The methodology for evaluating the most popular calculators currently available
- The conclusions from the evaluation of the footprint calculators
- The Global list of items to be measured for the calculation of the carbon footprint

Document Glossary

Term	Description
AT	AVACA Technologies
ATejo	AREANatejo
CBT	Computer Based Training
CIS	Communication Information System
Consortium	The various entities that have partnered for the current project
CPM	Coordinator's Project Manager
EAC	Education, Audio Visual and Culture
EM	Eurocrea Mercant
EU	European Union
FC	FAVINOM Consultancies
FT	FUNDITEC
PKO	Project Kick-Off
PM	Project Manager (Coordinator)
PQP	Project Quality Plan
QA	Quality Assurance
TBD	To Be Defined
TUL	Technical University of Lodz
WBS	Work Breakdown Structure
WD	Working day(s)
WZK	Wij Zijn Koel

TABLE OF CONTENTS

LIST OF TABLES

1. Introduction

1.1. Purpose of the State of the Art

The purposes of the current State of the Art are the following:

- Study the existing footprint calculators and the methodologies and technology behind them to produce a SOA highlighting the strengths and weaknesses of the current measurement methods
- Populate the global list of items to be measured for all sectors
- Break down the sectors to sub-sectors
- Identify the local factors that will filter the global list
- Generate generic (all sectors) and specific questions. The questions will guide the data entry process which will be divided into three layers, Usage, Situation and Behavioural.

1.2. Scope of the project

The PeSCoS project concerns the implementation of a personalised training system for SMEs to be able to eliminate their unsustainable ways and embrace new, greener habits. The aim is to offer personalised training to SMEs on the amount of carbon, energy, Euros and other resources they expend through hundreds of choices and daily actions in an effort to diminish their negative impact on the earth. Following the completion of the training, SMEs will have a personalised unsustainable ways withdrawal plan.

The major tasks of the project are the:

- Sustainability auditing, needs analysis and the unsustainable ways withdrawal planning;
- Development of the training material;
- Implementation of the PeSCoS training system;
- Pilot operation and assessment of the project;
- Dissemination and exploitation of the project results.

1.3. Project Objectives

At the core of the training system will be a carbon footprint calculator capable of utilising regionally specific datasets reflecting the types of energy, money and other resources businesses consume because of their choices and operational ways.

The process will start by calculating the current carbon footprint and producing a detailed report comprising all the appropriate actions that will turn the business greener. The actions will be divided into categories such as the ones below:

- Simple actions that can be implemented immediately without requiring an investment;
- Simple actions that can be implemented immediately, but require an investment;
- Actions that have prerequisites (other actions need to be implemented first), but require no investment;

- Actions that have prerequisites and require an investment.

Each action will be explained in detail, it will include a time plan and cost estimate (if applicable) for its implementation and a detailed description of the associated reduction in energy consumption or otherwise and costs.

The SME will be prompted to select the actions that they wish to implement and the time frame for the implementation indicating the size of the business and whether cost or total return on investment is more important.

The software will enable SMEs to develop highly customized energy-reduction plans with many different options and the curriculum will be divided in modules depending on the energy consumption category being tackled.

PeSCoS strategy is to reach its target audience (small and medium sized businesses) mostly by going though influential institutional intermediaries, especially utilities, which can reduce overall energy consumption and possibly avoid having to build new power plants by offering the training system to their customers.

2. Footprint Calculators

2.1. Ecological Footprint

The term "Ecological Footprint" denotes a human demand for natural resources of biosphere, measured in hectares of land and sea area, that are utilized for consumption and waste absorption. "Ecological Footprint" is measured in global hectares per capita. The difference between the footprint and production capacity shows whether a country is a creditor or an ecological debtor. It has become customary to present the Ecological Footprint in two ways:

- carbon footprint
- water footprint

Carbon footprint is the total "set of greenhouse gas emissions caused directly or indirectly by a person, organization, event or product". The carbon footprint includes emissions of carbon dioxide, methane, nitrous oxide and other greenhouse gases expressed in CO2 equivalents. The measure of carbon footprint is tCO2 - ton of carbon dioxide equivalent. Different greenhouse gases in an unequal degree contribute to global warming, while carbon dioxide equivalent allows comparing emissions of different gases on a common scale. For example, tons of methane is equivalent to 25 tons of CO2e.

The carbon footprint includes emissions from the organization through all its activities, including the power consumption of the buildings and means of transport. The carbon footprint of the product includes emissions caused by the extraction of raw materials, used for its production, by the production process, as well as usage and disposal or recycling after usage.

When calculating the carbon footprint of each country, not only emissions on their own territory, but also emissions associated with the production of imported goods, must be taken into account. According to the report of the Carnegie Institution for Science in early 2010 (based on data for 2004), European countries 'export' of approximately one third of their emissions. In the case of Switzerland emissions, which the Swiss economy abroad is responsible for, are bigger than domestic emissions.

Water footprint - for individuals, business communities or enterprises, it is defined as the total capacity of potable water used to produce goods and services consumed by individuals, communities or manufactured by the enterprises. Water consumption is measured on the basis of water capacity drawn and / or polluted in the unit of time. The water footprint can be calculated for each defined group of consumers (e.g. individuals, family, village, province, state or nation) or producers (eg. public organizations, private companies or sector of the economy).

The water footprint is a good geographical indicator, determining the regions of increased water demand and the production of liquid pollutants. The water footprint, however, does not provide information on the impact of water consumption and pollutants production on the local environment systems, water resources and livelihood. [5]

2.2. Calculators

2.2.1. Calculator Survey

At this point in time there does not appear to be a standard method, commonly acceptable by all, for calculating CO2 emissions. The guidelines for reporting CO2 emissions were introduced in 2006 with the ISO standards 14064-1, 14064-2, 14064-3 and ISO 14065. Nevertheless, these guidelines do not provide any specific method for calculating GHG emissions.

The most prominent carbon estimate methods are widely available over the Internet via websites with functionality to make the calculations.

In the context of the current study we surveyed 10 business footprint calculators. These calculators were mainly found by a desk research utilising search engines and back links from related websites. The outputs from these calculators differed in relation to the amount of electricity consumption. This seems logical since the amount of CO2 emissions as a result of electricity depend on the source used for the production of electricity which depends also on the location. Along the same lines, the CO2 emissions calculations did not differ with respect to oil consumption.

The methodology for filtering the calculators is described in the subsequent section.

2.2.1.1. Methodology

The methodology for filtering the calculators was based on three distinct phases, as follows:

1. Preliminary list of calculators: A list of all the calculator websites was created as the result of a desk research which followed a structured approach comprising three steps:
    a. *Determine where to look and what to look for*: Core to any desk research is obtaining a list of sources. Search Engines provide sources, but most links will typically lead to a dead end. We utilised our experience to find links to the appropriate sources looking at a minimum for information in:
        i. Scientific papers
        ii. Journals
        iii. Conferences
        iv. Workshops
        v. Seminars
    b. *Assess the quality of the source material*: Different sources get their information in different ways and consequently it is necessary to reconcile different pieces of information and to judge which the best sources of information are. We applied the necessary care when using published reports as a source of information as it is important to understand the way in which the data was collected.
    c. *Ensure the information is correct for the task*: There is lots of information out there that will be interesting, but unless the information is important in terms of determining the most appropriate data for assessing the available calculators, it will sidetrack the research and slow down the process.

2. Standard set of input values: A set of input values to be used as input for the calculators of the preliminary list. The list was prepared with care in order to be usable by all calculators. The input set data comprised values in response to questions belonging to the following categories:
    a. Building & Human resources (type of building, age, square meters, number of people, etc.)
    b. Energy inputs (oil, gas, coal, LPG, etc.)
    c. Transport (air travel, public transport, car, distance covered, type of fuel, etc.)

    To cater for the different units used by the calculators the appropriate conversions were made. In the process of establishing the standard set of input values, a number of calculators from the preliminary list were excluded from further assessment. Most of the calculators that were excluded asked a big number of questions involving out of scope aspects such as dietary habits.
3. Locality information: A final filtering rule was applied by retaining for a final assessment the business calculators that utilise at least a minimum amount of locality information, such as province or area code

2.2.1.2. Preliminary list

Table 1 - Preliminary List of Footprint Calculators

No	Title	Address
1	Cool Climate Network	http://coolclimate.berkeley.edu/business-calculator
2	Carbon Footprint	http://www.carbonfootprint.com/sme.html
3	Footprinter	http://www.footprinter.com/
4	Tru Green Globe	http://www.trugreenglobe.us/[1]
5	Carbon Manager	http://www.loreus.com/web/Software/CarbonManager/tabid/62/language/en-GB/Default.aspx
6	ERA	https://carboncalc.eraecosystems.com/
7	Terrapas	http://www.terrapass.com
8	Carbon Fund	http://www.carbonfund.org/business/calculator
9	Acco2unt	http://www.greenstonecarbon.com/software.php
10	SERAM	http://www.seram-ability.com/Home/SERAMSoftware/tabid/56/Default.aspx

2.2.1.3. Standard set of input values

- Business characteristics:
    - Number of employees: 5
    - Type of building: Warehouse
    - Age of building: 1980
    - Area in square meters: 160 square meters
- Energy sources:
    - Electricity: 100 kWh per year
    - Natural gas: 100 m^3/year
    - Heating oil: 10 m^3/year
    - Coal: 10 tons per year

[1] Web site no longer available

  - LPG: 100 dm^3/year
  - Propane: 10 m^3/year
  - Wood / biomass: 20 tons per year
  - Diesel: 100 dm^3/year
- Transportation
  - Number of vehicles: 3
  - Type of fuel (petrol/diesel/LPG/hybrid)
  - Year or efficiency: 2004
  - Type: FORD Focus C-Max
  - KM travelled: 12,000
  - Bus: 1200
  - Train: 600
  - Subway: 800
  - Taxi: -
  - Air travel: ATH to BRU, 3 times in the past year, Economy class

2.2.1.4. Locality information

- Province
- Area Code
- Post Code

2.2.2. Conclusions

The survey of carbon emission calculators has produced the following conclusions:

- There is currently no standard method for the calculation of CO2 emissions
- The calculators are most consistent at calculating CO2 outputs of natural gas and oil rather than electricity. When measuring the consumption of electrical energy, the difference between the estimates for CO2 emissions increases linearly as consumption increases. The four business calculators that were studied demonstrated a linearly increasing deviation as the electricity consumption increased (up to a factor of 7). This is attributed to the fact that the sources of electricity depend on the location of the user and national or at best provincial averages are used by the calculators.
- The number of questions asked had a partial effect on the result (e.g. 30 questions yielded a large spread in CO2 output). This conclusion in particular, proves the fundamental claim behind the PeSCoS initiative that it is necessary to develop calculators that take into account specific industry characteristics in order to provide the best possible advice to SMEs with the minimum possible cost.
- Natural gas inputs provide the most inconsistent results.

3. Global List of items to be measured

3.1. Preliminary assumptions of the PeSCoS platform

The first step in an advisory platform for SMEs is an initial indication of the CO2 equivalent emissions of the company by filling out the "Footprint" questionnaire. A questionnaire based on information provided by the entrepreneur, will automatically provide a calculation of CO2e emission value in kg / year. The questionnaire must be clear and ask for the information readily available to entrepreneurs. Too many and too detailed questions could discourage from further answers.

3.2. Preparing questions for the "Footprint" questionnaire

The "Footprint" questionnaire has been divided into two parts: introductory and main. The introductory part includes 3 statistical questions providing information about the country and the branch of business activity, as well as the number of employees determining whether a company belongs to SME sector.

Country selection adjusts factors calculating CO2 emissions characteristic of the given region. The answers to the questions in the introductory part do not give the result indicating the mass of the emitted CO2 equivalent.

The main part of the "Footprint" questionnaire focuses on the calculation and providing the approximate mass value of the CO2 emitted by the enterprise.

Analysis of the questionnaires for individuals and statistics (DEFRA - Department of Environment Food and Rural Affairs, KASHUE - National Administration of the Emissions Trading Scheme, KOBiZE - National Centre for Emissions Balancing and Management), available on the Internet, shows that over 95% of CO2e emissions are associated with the following issues:

- electric and thermal energy consumption,
- transportation,
- waste production and recycling
- water consumption and wastewater production

Not to let the "Footprint" questionnaire repeat questions and in order to make it user friendly, it was decided that the calculation of CO2e emissions will be made by asking general questions related to the topics listed above.

The specific questions, necessary to consultancy related to reducing CO2e emissions, will be asked later in additional questions available for those interested in the subject. Questions in the "Footprint" questionnaire will not give detailed information about business activity, but will allow the calculation of CO2e emissions and will determine the direction of asking more detailed questions in the next part of the platform. Calculating factors have been found in the documents listed in the bibliography, items 1-4.

It was therefore decided that the "Footprint" questionnaire includes 9 questions needed to estimate CO2e emissions for the given enterprise.

3.2.1. Questions

Question 6 - How much electric energy does your enterprise consume per year? - This question will determine electricity consumption in the enterprise, whose value can easily be converted into CO2e emission. To give details regarding what electricity is consumed for and to reduce consumption, the user will be asked in further detailed questions such as: (Do you have electric heating or air condition? How do you light your premises? etc.).

Question 7 - How much fuel does your enterprise consume for heating per year? - Amount of fuel consumed (LPG, fuel oil, coal and wood and biomass) allows the calculation of CO2e emissions as a result of its combustion in the heating system. If the enterprise is connected to the heating network, the user is asked to indicate the quantity of purchased energy in GJ / year. This quantity can be found on the electricity bill. In that case, the GJ is converted into an equivalent measure of the electricity consumed expressed in kWh (GJ is multiplied by 277.78 to obtain kWh) and converted into CO2e emissions, as in the first question. If you have electric heating, CO2e emissions associated with such a heating system is included in the first question.

Question 8 - Does your enterprise own any road vehicles? If yes then: How much fuel does the enterprise consume annually? - CO2e emissions associated with transport, depends largely on the amount of fuel burned. The answer to this question contains information about the engine type, number of kilometres driven etc. CO2e emission associated with the rental of the transport company has been omitted. It is included in the emission of the transport company, not the enterprise employing them.

Question 9 - How many employees commute to work by vehicles not owned by your enterprise (buses, trams, own cars), aircraft or rail and subway? Provide the average distance covered per year. - The question will allow the estimation of CO2e emissions associated with the enterprise impact on the public transport and car traffic.

Question 10 - How many of provided materials does your enterprise utilize per year? - The question relates to the following materials: paper, plastics, metals, glass and others. Production of each material requires energy input, which results in the emission of CO2e. These values are not related to utilization, but with the production of the material. Factor converting tons of material into kg of CO2e in the "other" item, is adopted as the average value of the factors for the earlier materials.

Question 11 - How much solid waste does your enterprise produce per year? - This value is multiplied by the average factor for the solid waste management.

Question 12 - Does your enterprise provide waste for recycling? If so, what and how much? - selection between: paper, metal, glass, plastics and electronics. These materials are not disposed but re-used, so the amount of CO2 obtained from the calculation will be deducted from the final result.

Question 13 - How much water does your enterprise consume per year? - Question will allow the estimation of the CO2e emission associated with the treatment of water used in the enterprise.

Question 14 - Other CO2e emissions.- If the enterprise has a significant source of CO2e emission not included in any of the previous questions, the user is asked to provide an approximate annual CO2e emission from this source and its short description. This information will be found useful in the next, more detailed and developed for consultancy reasons, part of the questionnaire.

The amount of kg of emitted CO2e, obtained by filling in the questionnaire, signals to the user, whether it should be of interest to its reduction. For this purpose, the user will be able to access the rest of the questionnaire, whose task will be to collect the necessary information and then give some advice that will help reduce the environmental footprint and save energy.

Annex I

Bibliography:

1- http://ww2.defra.gov.uk/- DEFRA - Department of Environment Food and Rural Affairs
Document: "DECC's GHG Conversion Factors for Company Reporting."

2- http://www.carbontrust.co.uk/Pages/Default.aspx
Document: "Conversion factors: "Introduction"

3- http://www.kashue.pl/
Document: "Poland's National Inventory Report 2010 -Greenhouse gas Inventory "
"Calorific values (CV) and CO2 emission factors (EF) for the year 2010"

4- http://www.eumayors.eu/home_en.htm
Document: "Technical annex to the SEAP temple instruction document: The emission factors."

5- http://pl.wikipedia.org