Trucost Methodology Overview

Measuring company environmental impacts

April 2008

Trucost Plc
100 Pall Mall
London
SW1Y 5HP
United Kingdom

Telephone: +44 (20) 7321 3833
Fax: +44 (870) 607 2210
www.trucost.com

TRUCOST
taking the environment into account

Evaluating the Environmental Performance of Companies

Trucost produces environmental profiles which provide a snapshot of companies' direct and indirect environmental impacts.

Trucost has analysed the environmental performance of over 4,000 companies worldwide and applies a single methodology to conduct environmental benchmarking.

All companies have an impact on the environment through their operations and through their supply chains. Trucost's profile provides quantitative data on a company's environmental impacts. Quantitative measures illustrate how efficiently a company uses resources and how well it manages its environmental performance and procurement.

Since many companies do not comprehensively disclose their environmental impacts in quantitative terms, Trucost has developed a unique methodology based on an input-output model to calculate companies' environmental impacts and allow for comparisons between all companies, regardless of disclosure levels.

Environmental impacts

Direct: Pollutants released or natural resources used by operations that are owned or controlled by a company. For example, direct CO_2 emissions to air are measured as the amount of CO_2 released due to fuel use or manufacturing processes. CO_2 emissions are typically from sources such as natural gas burned for heating, petrol used to fuel company vehicles, and industrial processes such as concrete manufacturing. This is defined as Scope 1 emissions according to the Greenhouse Gas Protocol.[1]

Indirect: Pollutants released or natural resources used due to activities owned or controlled by the company's suppliers. Indirect impacts result from a company's purchases. For most companies, key indirect impacts include CO_2 emissions from electricity supplied by power utilities (Scope 2 according to the GHG Protocol), emissions from aircraft used for business travel, and water purchased from utility companies.

Modelling environmental impacts

Trucost has conducted extensive studies of industries to identify the quantities of over 700 environmental indicators per unit of output. These indicators cover the use of resources such as water, as well as waste production and pollutants such as mercury and greenhouse gas emissions. The system is consistent with the United Nations Millenium Ecosystem Assessment.

Trucost's input-output economic model analyses business activities at a global level. The model includes data from the US Toxic Release Inventory, Federal Statistics Office of Germany (Destatis), the UK Environmental Accounts, Japanese Pollution Release and Transfer Register, Australia National Pollution Inventory and Canada's National Pollutant Release Inventory.

Quantitative data on industrial facilities' pollutant releases are combined with economic data from sources such as the US Bureau of Economic Analysis to analyse interactions between economic productivity and the environment. **Trucost calculates the environmental impacts of 464 sectors.** The sector classification used is

Input-Output Modelling

This form of modelling has been a branch of economics for over 50 years, and earned Wassily Leontief the 1973 Nobel Prize for Economics.

Input-output models show the amount of resources required (the inputs) to produce a unit of output and where this output is sold. Trucost has adapted the standard model by integrating the use and emissions of over 700 environmental resources. Trucost uses a global input-output model based on detailed government census and survey data on resource use and pollutant releases, industry data and statistics and national economic accounts.

[1] http://www.ghgprotocol.org/standards/corporate-standard

the North American Industrial Classification System (NAICS).

The environmental impacts modelled for each sector are allocated to a company according to the proportion of its revenues in each sub-sector. Trucost primarily uses data from Thomson Financial and company accounts to identify segmental revenue data and map each company to a set of sectors. The input-output model estimates the amount of resources a company uses (the inputs) to produce goods or services (outputs), and the related level of pollutants.

The model incorporates sector level inflation data to adjust calculations in line with annual inflation and movements in commodity prices.

Examples of sectoral activity breakdowns

Oil and gas	Utilities: power generation
Crude petroleum and natural gas extraction	Hydroelectric
Natural gas liquid extraction	Coal
Drilling oil and gas wells	Natural Gas
Support activities for oil and gas operations	Petroleum
Tar sands extraction	Nuclear
Petroleum refineries	Solar
Industrial gas manufacturing	Wind
Petrochemical manufacturing	Geothermal
Petroleum lubricating oil and grease manufacturing	Wave & Tidal
Gas stations	Biomass
Natural gas distribution	Landfill gas
Pipeline transportation	Other
All other petroleum and coal products manufacturing Pipeline transportation of natural gas	Power distribution
	Power transmission

The model also describes the economic interactions between each sector. Trucost's analysis takes into account both direct and indirect (supply chain) impacts. Within indirect impacts, the Trucost model can distinguish between any level of the supply chain from the first-tier of suppliers all the way through to total upstream supply chain requirements. The input-output methodology models the purchases a company makes and the resultant environmental impacts. This analysis can be extended to include first tier suppliers that the company buys from, as well as their suppliers, and so on until reaching the supplier of the raw material. In this way, Trucost can cost the upstream impacts of purchases. This provides a means to differentiate between low impact supplied goods, such as renewable energy, and high impact supplied environmental goods, such as fossil fuel energy.

This analysis can be used to assess the direct and indirect environmental impacts of a company of any size, industry sector or geography.

Company disclosures

Trucost will review and incorporate information from a company's Annual Reports and Accounts, Environmental Reports, Sustainability or Corporate Social Responsibility Reports, company websites, and other publicly disclosed data into a company's specific environmental profile. The database will indicate the data source for each data point. For example, profiles highlight where an impact value is derived from fuel use data provided in an Annual Report.

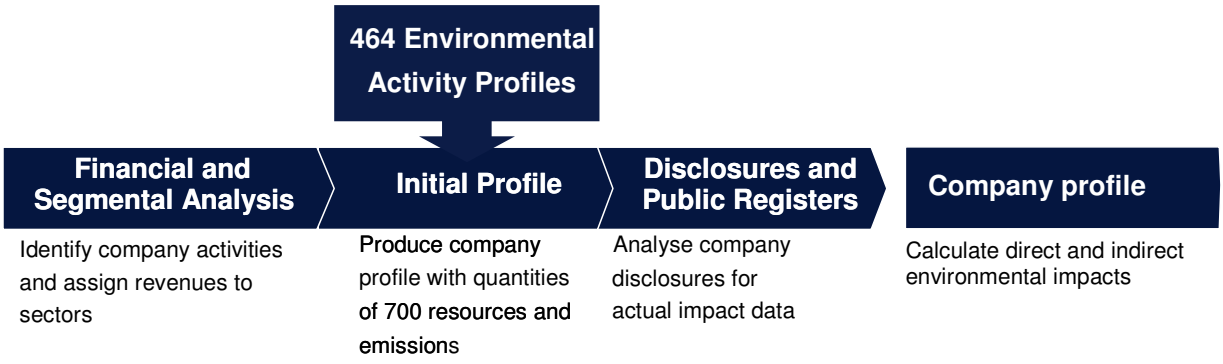
Where a company only discloses data for part of its overall activities, Trucost may attempt to normalise quantities in order to estimate the environmental impacts of the business's entire operations. If this is not possible due to insufficient disclosure, Trucost may have to exclude the company's publicly available data altogether from its environmental profile.

Trucost standardises the quantities of resources used or pollutants emitted using metric tonnes or cubic metres to allow for direct comparison across companies, industrial sectors and geographies. For example, greenhouse gas emissions are quantified as metric tonnes for the entire company's operations in line with the Greenhouse Gas Protocol, the international standard for reporting GHG emissions.

Trucost has the largest database of company greenhouse emissions. The model includes the six main greenhouse gases regulated by the Kyoto Protocol – Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur Hexaflouride (SF_6).

All quantities must correlate with the company's relevant fiscal year to allow the costs associated with environmental impacts to be compared with the company's financial results. Companies are given the opportunity to review and verify their data.

Quantifying emissions and resource usage



For an example of a company profile, see appendix 1.

External Damage Costs

Once the quantity profile of a company has been calculated, a damage cost is applied to each resource and emission to generate an external environmental cost profile. The costs represent the quantities of natural resources used or pollutants emitted multiplied by their environmental damage costs to society.

External costs are incurred whenever a natural resource is used or emissions are made to air, land or water. The external cost of using an environmental resource, such as water, or emitting a pollutant, such as carbon dioxide, is the cost that is borne by society through the degradation of the environment but which is not borne by the firm that uses the resource or emits the pollutant.

For example, the European Commission estimates that dust and particles from sources including fuel cause the premature deaths of almost 370,000 people every year and reduce life expectancy by 8 months. Air pollutants could result in €189-609bn in health costs by 2020. Measures to reduce pollutants could cost the market economy around €7.1bn annually, saving at least €42bn in health costs.

What are externalities?

Ecosystems, and the biological diversity attached to them, provide essential services for our economic and social welfare. In economic terms, a "cost" reduces the economic welfare of agents. So if inputs needed to produce a certain product are reduced, this reduces the full cost of production to the customer, supplier and society. Conversely, if the necessary inputs increase, then so do the costs. The full costs of production can be divided into two parts:

- Costs which are recorded in market transactions, contributing to the market price of the product or service.
- Costs which are not included in markets, and therefore do not contribute to market prices.

The latter category of costs is external to the market, and so they are called "external costs".

The fact that external costs are not included in market prices means that the prices used in markets are generally too low, but not all in the same proportion. For example, burning diesel for road transport generates particulates which have an adverse effect on human health and the environment. Since the market price does not account for the total social costs associated with this product, these are borne by health services. Fuel duties apply a cost to diesel in the UK, to at least partially reflect the social costs of this product in the market price so that downstream users pay towards the damage done. In contrast, no taxes are applied to jet fuel kerosene, which has a significant global warming effect.

Valuing environmental impacts

Trucost prices the damage that is done to society and human capital by pollutants and natural resource use, including quantifying associated human health costs. Trucost, and many leading academics, believe that pricing these resources and pollutants in financial terms provides the most suitable weighting factor to differentiate the relative damage of a range of impacts. The same approach was applied by the Stern Review on the Economics of Climate Change, a study commissioned by the UK government in 2006. By applying a price to each environmental resource, based on the environmental impact of that resource, the model is able to analyse, in financial terms, the productivity and environmental performance of each sector.

Trucost's external costs-based system addresses a significant gap in rigorous, comparable and quantified environmental research. Trucost has compiled a library of prices for over 700

different natural inputs and outputs. For example, Trucost uses the marginal social damage cost of US$31 for each tonne of greenhouse gases in its analysis.

The prices in Trucost's model are based on external cost principles derived from a review of environmental economics literature. Valuations draw on extensive international academic research into the pricing of environmental externalities and are overseen by an independent International Advisory Panel of leading academics (see Appendix 2).

Trucost's damage costs differentiate between methods used to manage resources or emissions to reflect relative damage. For example, process water has a higher damage cost than cooling water used by power utilities. Similarly, damage costs for waste sent to landfill are higher than for waste incineration. Trucost can tailor its model to provide bespoke pricing for impacts, for example, by applying the cost of carbon allowances under the EU Emissions Trading Scheme to a company's emissions.

Expressing all impacts in financial terms enables comparison between a company's external costs and traditional financial performance measures. Damage costs can be measured against revenues to compare the impacts of companies of any size or industrial sector.

The costs provide a good proxy for potential exposure to policy measures that seek to apply the "polluter pays" principle. Companies are increasingly required to contribute to external costs through regulations or economic instruments, which often "internalise" costs per unit of resources used and emissions released (i.e, through carbon taxes or allowances).

The external environmental costs of a company's operations give a good long-term indicator of the environmental sustainability of the company's activities.

Applying a cost to environmental impacts

Trucost's input-output model calculates the size of a company's environmental impacts relative to its financial performance, and provides measures of materiality.

Direct and Indirect Impacts	Valuation techniques	External Cost Profile
Emissions and resource usage by the company and its supply chain	Relative weighting of impacts according to Damage Cost	Apply external cost prices to the resources and emissions to allow comparison on a variety of issues

Appendix 1: Example of a company profile

Sample data sheet: Utility power generation company

Direct Environmental Impacts		
Resource	**Source**	**Quantity**
Water Abstraction (Cubic Metres)		
Direct Water Withdrawal	OTH	1,949,000,000
Greenhouse Gases (Tonnes)		
Carbon Dioxide To Air [Scope 1 GHG Protocol]	OTH	15,545,084
Dinitrogen Oxide (Nitrous Oxide) To Air	TC	3,000
Acid Rain Precursors (Tonnes)		
Sulphur Dioxide To Air	OTH	47,790
Nitrogen Oxide To Air	OTH	33,700
Metals (Tonnes)		
Barium To Land	TC	2,870
Chromium To Land	TC	153
Mercury To Air	AR*	0.5
Arsenic To Land	TC	94
Mercury To Land	TC	0.78
Manganese To Land	TC	490
Vanadium To Land	TC	450
Smog Precursors (Non VOC) (Tonnes)		
Particulates To Air	OTH	1,699
General Waste (Tonnes)		
Landfill	TC	103,000
Volatile Organic Compounds (Tonnes)		
Sum of VOCs To Air	AR	2,587

Indirect Environmental Impacts		
Resource	**Source**	**Quantity**
Carbon Dioxide To Air (Tonnes)		
Supplied Electricity [Scope 2 GHG Protocol]	TC	4,462
Business Air Travel [Scope 3 GHG Protocol]	TC	3,630
Water Consumption (Cubic Metres)		
Purchased Water Consumption	TC	5,499,000

Source: TC = Trucost Estimate ; ENV = Disclosure in Environmental / CSR Repo Accounts ; * = Derived from labelled source ; OTH = Other source / Communicati from previous year.

Appendix 2: Trucost International Advisory Panel

Trucost's methodology is supported by an International Advisory Panel of leading academics in the fields of economics and the environment.

Dr. Robert Costanza . Panel Coordinator

Director of the Gund Institute of Ecological Economics and Gund Professor of Ecological Economics at the University of Vermont. Co-founder and former president of the International Society for Ecological Economics (ISEE) and chief editor of the Society's journal, *Ecological Economics*.

Dr. Robert U. Ayres

Emeritus Professor at INSEAD, Fontainebleau, France, visiting Professor at Chalmers University, Gothenburg, Sweden, and Adjunct Professor of Mineral Economics at Pennsylvania State University. He was a founder of the Centre for the Management of Environmental Resources (CMER) at INSEAD.

Dr. Stephen Farber

Director of Environmental Policy Studies, Director of the Public and Urban Affairs programme, and a Professor in the Graduate School of Public and International Affairs at the University of Pittsburgh. He has contributed to the World Bank's Green National Accounting workshop and the US Forest Service's Ecological Stewardship programme.

Dr. Robert Goodland

Independent Environmental Commissioner for the EIR, a World Mining Commission, for the 2002 UN World Summit on Sustainable Development. He advises H.E. Emil Salim, Chairman of the Summit's PrepCom. Previously Environmental Advisor to the World Bank for 25 years.

Dr. Glenn-Marie Lange

Senior Research Scientist at the Institute of Economic Analysis, Robert F. Wagner Graduate School of Public Service at New York University. Her research focuses on economic input-output modelling and the pricing of, and accounting for, environmental resources.

Dr. Robert Repetto

Professor in Economics of Sustainable Development at the Yale School of Forestry and Environmental Studies. Until 1998 he was Vice-President and senior economist at the World Resources Institute in Washington, DC. He has served on EPA's Science Advisory Board and National Advisory Council on Environmental Policy and Technology, and on the National Research Council's Board on Sustainable Development. His work on environment and finance was awarded the Moskowitz Prize for 2000.

Dr. Hamid Sabourian

Reader in Economics and Game Theory at the University of Cambridge, a Fellow of King's College Cambridge and a visiting Professor of Economics at Birkbeck College, University of London.

Dr. Kerry Turner CBE

Director of CSERGE (Centre for Social and Economic Research on the Global Environment) and Professor in the School of Environmental Sciences at the University of East Anglia. Previously a member of the UK government's Climate Change Impacts Review Group.

Dr. Peter Victor

Professor of Environmental Studies at York University, Toronto, Vice-President of the Council of the Royal Canadian Institute for the Advancement of Science and Chair of Environment Canada's Science and Technology Advisory Board. Previously Assistant Deputy Minister of the Environmental Sciences and Standards Division with the Ontario Ministry of Environment and Energy.

Appendix 3: About Trucost

Trucost Plc is an environmental research organisation which helps companies and investors understand the environmental impacts of business activities. Trucost provides data and analysis on company emissions and natural resource usage. It presents these in financial as well as quantity terms, providing the basis for an improved dialogue between companies, investors and other stakeholders. Trucost offers expert advice and research to major corporations, both public and private, institutional investors and to Government departments and associated agencies.

Research for investors

Over the past eight years, Trucost has built a database of the environmental impacts and disclosures of over 4,000 companies, making it the world's largest record of greenhouse gas emissions. Coverage includes the FTSE All-Share, S&P 500, Russell 1000, Nikkei 225, DJ STOXX 600, MSCI World Developed, MSCI Europe, MSCI Asia ex-Japan and ASX 200 indices.

Investors, fund managers and analysts increasingly need to understand how environmental issues could affect companies' future earnings and be able to compare companies in a given sector. Institutional investors use the information to assess the carbon or environmental footprints of their portfolios, to identify differences in performance and to better understand where environmental risks lie in portfolios. Trucost's investor clients include BlackRock, CCLA Investment Management, Crédit Agricole Asset Management, Environment Agency Pension Fund, Fond de Réserve pour les Retraites (FRR), Fortis Investment Management, GLG Partners, Governance for Owners, Henderson Global Investors, Hermes Pensions Management Ltd, Morley Fund Management, VicSuper and Merrill Lynch.

Tools for companies

Trucost has considerable experience and expertise in the area of environmental performance, analysis and reporting, having researched and written the UK Government's environmental reporting guidelines for business, released in January 2006.

Elliot Morley, former UK Environment Minister *"These guidelines seek to set a standard which will give business some assurance that it has reported its environmental performance to an appropriate minimum level of accuracy and detail."*

The company has worked with leading multinational companies in a range of business sectors including Avis, Bloomsbury Publishing, BSKYB, Burren Energy, Pace Micro Technology, Compass Group PLC, LogicaCMG, Legal & General, Prudential, Ryanair, Total SA, Gate Gourmet and Williams Lea.

Trucost's supply chain environmental assessment enables companies to understand the scale and significance of the environmental impacts of their suppliers. It provides a tool to engage with suppliers and encourage them to improve their environmental performance in areas that are most relevant to the company's business and sector. Supply chain analysis establishes key reporting measures which a company can use to demonstrate that it is taking steps to reduce indirect environmental risks and impacts through its suppliers.