



# DELIVERING TOMORROW

**Towards Sustainable Logistics**





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## **Towards Sustainable Logistics**

How Business Innovation and Green Demand  
Drive a Carbon-Efficient Industry

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“There are no passengers on Spaceship Earth. We are all crew.”

*Marshall McLuhan, 1911–1980*

*Canadian philosopher and communications theorist*



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## AMAZING FACTS AND FIGURES

“Climate change” leads the list by far of the most prominent global challenges among respondents in Asia (China, India) – **70%** of end consumers surveyed there say it belongs to the most serious problems facing the world. (*Green Trends Survey*, p. 46)

The number of *GoGreen* CO<sub>2</sub> neutral shipments by Deutsche Post DHL almost quintupled from 2008 to 2009 – from 145 million to **704 million**. (p. 48)

Starting in January 2012, aviation will be the first transport-related industry to be included in the EU Emissions Trading System. (p. 65) Additionally, the European Union’s “Single European Sky II” package is expected to deliver carbon emissions savings of up to **12%**. (p. 70)

Companies rated best-in-class in terms of environmental, social and governance practices outperform low-sustainability companies by up to **8%**. (p. 61)

**63%** of business customers believe that logistics will become a strategic lever for CO<sub>2</sub> abatement. (*Green Trends Survey*, p. 46)

**253 million** tons of packaging is used annually in the consumer industry – half paper, half plastic. Production of the paper requires 7 million trees to be felled. (p. 84)

Please see main text for reference to external sources.

**84%** of consumers in China, India, Malaysia and Singapore say they would accept a higher price for green products – compared to only 50 % in Western countries. (p. 78)

Aerodynamic drag is responsible for **40%** of the fuel consumption of heavy duty trucks at motorway speeds. (p. 114)

Out of **1.62 billion** tons of truck emissions in Europe, roughly one quarter are caused by trucks running empty – often due to legal requirements. (p. 94)

In 2009, the logistics industry generated roughly **10%** of Europe's GDP. (p. 33)

While trucks represent just **20%** of the entire Deutsche Post DHL vehicle fleet, they account for 80 % of the Group's road emissions. (p. 110)

**38%** of risk managers consider the availability and price of fuel and power as one of the top future risks for companies. (p. 58)

Up to **80%** of warehouse energy consumption is due to lighting. (p. 122)

# Dear Reader,



Deutsche Post DHL touches the world. With our network of almost half a million colleagues, we span the globe, reaching nearly every corner of our planet. As a global logistics company, we are a vehicle for market and trade growth from Asia to the Americas, from Europe to Africa. Our company influences and affects the world in which we operate. But we are equally affected and influenced by trends and developments around the globe, be they economic, political or societal in nature. This is why, at Deutsche Post DHL, it has always been vital that we understand and address factors that form the future.

This report, “Delivering Tomorrow: Towards Sustainable Logistics,” is the second publication from Deutsche Post DHL to look to the future and follows the publication of the global Delphi study – “Delivering Tomorrow: Customer Needs in 2020 and Beyond” – last year. It focuses on what shapes not only the logistics industry, but decisively influences our common future. And this report will very likely not be the last publication of this kind.

But why focus on sustainable logistics? In a global survey commissioned parallel to this report, we found that climate change is the most prominent concern of citizens around the globe when asked about the most pressing challenges we face. In short: sustainability matters a lot to people. And it is important to us – so important that providing sustainable solutions has been integrated into our corporate strategy (“Strategy 2015”). We are also confident that this will increase our – and our customers’ – competitiveness.

Sustainability – with an emphasis on reducing carbon emissions – is in fact already a central aspect of how we do business. Under our *GoGreen* label, Deutsche Post DHL was the first logistics company to offer carbon-neutral shipping services, and to publicly commit to a clear-cut carbon efficiency goal.

I am sure that the pursuit of sustainability will transform the logistics industry. At the same time, the logistics industry, with its unique position all along the supply chain and its expertise, can offer important assistance to many sectors as they progress towards a low-carbon economy. Logistics can help foster sustainability.

The pledge to make a positive contribution to the societies in which we operate is an integral part of Strategy 2015. We want to be part of the solution when it comes to lowering carbon emissions. This report shows that this will not be without challenges. There is no “silver bullet” technology that will solve all the problems overnight.

Change is never easy to achieve. Beyond showing the challenges and possible solutions, one goal of this report is to stimulate debate, be thought-provoking and, yes, at times, controversial.

I am particularly happy to see many customers and external contributors – all of them renowned experts in their fields – sharing their points of view in this publication. My sincere thanks to them – and to my colleagues within Deutsche Post DHL who have dedicated their knowledge, time and resources to produce this report.

You can react to change, or you can proactively shape the future. Given its special role in local and global economies, the logistics industry has a lot to offer societies calling for sustainability. I hope this publication is an enjoyable and stimulating read, and also makes its own contribution to moving forward towards a more sustainable future.

With best wishes,

A handwritten signature in black ink, appearing to read 'Frank Appel', with a stylized, flowing script.

Frank Appel  
CEO Deutsche Post DHL

# Introduction and Executive Summary

“Towards Sustainable Logistics” addresses business and opinion leaders, but also anyone interested in the question of how to reach a more sustainable logistics industry. In this present report, we seek to get a deeper understanding of the challenges and create awareness of what can and should be done in the pursuit of sustainability. No doubt, climate change is a serious challenge. At Deutsche Post DHL, we recognize that the logistics industry is part of the problem, but we are sure that the sector will also be part of the solution – given that it is a strategic sector both in terms of wealth creation and carbon abatement.

This publication was developed with the support of numerous experts from across Deutsche Post DHL and its divisions. Many authoritative external experts have contributed their viewpoint on topics that are closely connected to the objective of mitigating climate change and promoting sustainable logistics. Deutsche Post DHL customers supported the report, providing their stories of success in significantly reducing CO<sub>2</sub> emissions.

To broaden the focus of this paper, we also commissioned the *Green Trends Survey*. This representative survey examined the expectations of two important stakeholder groups – business customers and end consumers – and revealed a great deal of readiness to make choices in favor of sustainability (see p. 46/47 for details). And, the survey showed that a change in mindset is taking place not only in industrialized countries, but also in emerging markets like Brazil, China or India.

# Sustainability – A Word About the Word

According to the 1987 Brundtland Report, sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” The authors of “Towards Sustainable Logistics” are mindful of the fact that sustainability is a broad concept, one which encompasses environmental, economic and societal aspects. But in common usage, sustainability generally refers to being environmentally responsible, and this aspect is the one the present report focuses on. Certainly, climate change, driven by man-made greenhouse gas emissions, is the most pressing challenge we face.<sup>1</sup> Therefore, the authors concentrate on the aspect of how carbon emissions can be reduced. What might not appear satisfactory from a broader perspective on sustainability, is a deliberate editorial choice.

## 1 The Point of Departure

Two essays on the nature of the very concept of “sustainability” launch the debate – highlighting the challenges it poses to common sense, the mindset it requires and the strategies we have to make it possible.

Clemens Beckmann, until recently Head of Inhouse Consulting at Deutsche Post DHL and now Head of Innovation at the Group’s MAIL division, explores in the opening essay the idea of “sustainability.” While the concept was first outlined in the early 18<sup>th</sup> century in the context of forest management, in today’s complex societies, it needs to be discussed as a threat management approach: how to avoid risks that imperil the existence of future generations.

Sustainability can only be attained by optimizing seemingly conflicting targets – not by maximizing a single target, Beckmann points out. He moves on to describe four potential challenges that acting sustainably poses to the human mind: the problem of measurability, the discrepancy in time between incurring costs and reaping the benefits, the diverging probability assessments, and the asymmetric distribution of benefits of and damages due to unsustainable behavior.

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*Sustainability can only be attained by optimizing seemingly conflicting targets – not by maximizing a single target.*

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<sup>1</sup> In this report, the term emissions refers to carbon emissions.

Sustainability equals approaching challenges through holistic, contextualized thinking, which, however, has become alien to today's short-term orientation in both politics and business, writes Otfried Höffe, Professor of Philosophy at the University of Tübingen. As a remedy, he sees the need for leading personalities to be equipped with prudence, esprit de finesse and a strong capacity for good judgment. Höffe proposes three strategies to deal with the sustainability challenge: the "Genesis strategy" of increasing human knowledge and capacities; the "Noah strategy" of taking all necessary precautions to avoid a worst case; and finally the "prophetic strategy" of calling forth fundamentally new ways of behavior and living. Adapting to this way of thinking, Höffe concludes, would lead to a cultural change towards an energy-saving lifestyle and, eventually, could bring about the implementation of a stable and efficient worldwide legal system.

## 2 The Logistics Industry's Role in Sustainability – and Vice Versa

The concrete, manifold relations between logistics and sustainability are explored by Katharina Tomoff, who heads Deutsche Post DHL GoGreen activities, the central environmental department of the Group. Along with the worldwide web provided by the Internet, logistics – the material web spanning the globe – provides the key drivers of increasing participation, employment and growth in today's globalized economy. As a result, logistics create roughly 9% of global GDP.

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*The logistics industry is of equal strategic importance in achieving lower CO<sub>2</sub> emissions as it is in terms of economic development.*

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Given that supply chain and logistics processes are deeply embedded in value creation throughout different sectors and industries, it is clear that the logistics industry is of equal strategic importance in achieving lower CO<sub>2</sub> emissions as it is in terms of economic development. The way

forward begins by recognizing that the logistics industry is a major source of CO<sub>2</sub> emissions, accounting for 13.1% of global greenhouse gas emissions, according to the Intergovernmental Panel on Climate Change (IPCC, 2007) – although, this figure also includes passenger transportation.

As the logistics industry is expected to continue growing, so will its energy consumption and GHG emissions, unless changes are made. The sector needs to improve its energy efficiency and develop viable alternatives to fossil fuels, otherwise it will also



find itself ever more vulnerable to the uncertainty of oil supplies, as well as the increasing price volatility of fossil fuels.

However, low-carbon logistics solutions and flexible transport modes are not yet widely available. There are few market-ready technologies or solutions today that can meet the specific needs of the transport and logistics sector. And, while moving towards a low-carbon economy also requires cultural change within companies, it is equally true that governments are still having a hard time reaching global political agreements.

Nevertheless, numerous business initiatives are underway that show that emissions reduction also improves cost structures. For instance, Deutsche Post DHL has committed to improving its carbon efficiency by 30 % by the year 2020, and is transforming the way it does business along the way.

In future, for most companies, long-term success will be strongly linked to more sustainable business concepts. Major trends and developments in this regard are already shaping the way towards a more sustainable logistics industry.

### 3 Trends Towards a Sustainable Logistics Industry

In the *Green Trends Survey*, respondents identified climate change as one of the most serious problems currently facing the world; the results show that environmental concerns are shared by people in Europe, Asia and the Americas, alike. Already today, citizens around the world are not only concerned about climate change, but are taking action in favor of more environmentally responsible behavior. Sustainability is becoming a key buying criterion.

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*Sustainability is becoming a key buying criterion.*

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Consequently, there is growing demand for sustainable logistics products, e.g., offering carbon offsetting. As it turns out, however, information about energy consumption and eco-friendliness of products is often not easily accessible: there is a lack of transparency. Both end consumers and business customers expect eco-labeling to become standard over the coming years. Similarly, companies are establishing carbon accounting schemes – an effort entailing a series of challenges, as Michael Lohmeier, Senior Expert from Deutsche Post DHL *GoGreen*, points out in a special section dedicated to this topic.

While many still see a contradiction between economic growth and environmental protection, it turns out that sustainability-oriented business policies contribute to long-term value creation. Not only does growing customer demand translate into more sales, sustainability has become a key success factor in shaping the reputation of a company. National and local governments are increasingly demonstrating their willingness to tackle climate change by procuring “green” products. For business customers, cost savings are already the second most important reason to use green transport and logistics services. Once there is a real price tag attributed to carbon emissions, the environment will be an integral part of investment decisions. Additionally, financial markets’ expectations are changing. Since the recent financial crisis, long-term horizons are experiencing a revival among investors as companies with “responsible” business practices even tend to outperform their peers.

Besides consumer behavior and economic drivers, the public policy framework is, of course, a key influencing factor on the path towards a low-carbon economy. Various regulatory measures could contribute to “decarbonizing” transport and logistics in the future. Eliminating legislation that causes inefficiencies within logistics processes – e.g., restrictions that prevent the seamless flow of cross-border transport by road, rail or air – is a first and much needed step in the direction of enabling more sustainable transport. Beyond these low-hanging fruits to achieve higher efficiency, economic incentives (such as R&D funding, on the one hand, and carbon pricing schemes, on the other) are needed to encourage the necessary changes in the transport/logistics business. Political solutions with international reach are widely considered as vital to ensure a level playing field and prevent “carbon leakage” through the relocation of carbon intensive industries to countries with lax regulation.

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*Eliminating legislation that causes inefficiencies is a first and much needed step.*

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In an excursus comparing different political approaches to greenhouse gas reduction, A. Denny Ellerman, the former Executive Director of the Center for Energy and Environmental Policy Research at the MIT, advocates market-based instruments. Not only will they be more efficient and more effective, concludes Ellerman, but they will also reach every corner of economic activity and not just those that the regulators designate, however well-informed and well-intentioned they may be.

In his essay, Detlef Sprinz, a Senior Scientist from the Potsdam Institute for Climate Impact Research, reviews the history of climate conferences aimed at achieving a “global deal.” These were marked most recently by more assertive emerging market countries defending their economic interests and by reluctance on the part of Western countries to commit unilaterally to tough abatement goals. This raises the question of how climate change can be limited to achieve the so-called 2 °C target. Sprinz presents an innovative approach to climate change policies, which he calls the “sandwich solution.” This combines “bottom-up” private sector initiatives based on innovation, with “top-down” regulation through joint overall goals, reporting and evaluation tools, and smart investment strategies.

In a joint contribution, Robert de Souza, Executive Director and Chief Executive of the Logistics Institute – Asia Pacific, and Professor at the Georgia Institute of Technology, together with Zhou Rong, a research fellow at the Logistics Institute, and Laura Bolton, the Sustainability Director of DHL Supply Chain, outline the rapidly growing awareness sustainability-related topics enjoy among consumers in Asia. The authors reckon that, while China recently committed itself to reducing energy consumption per unit of GDP by 40 %–45 % by 2020, more stringent emissions requirements are set to be imposed on the transport sector. Similar trends can be observed across Asia given that four of the ten countries in the world with the highest CO<sub>2</sub> emissions from fossil-fuel consumption are located in Asia. The authors review ongoing legislative projects in those countries and take stock of the growing consumer readiness to act more ecologically. Considerable financial incentives are already being used today to decrease the continent’s CO<sub>2</sub> footprint.

## **4 Sustainable Logistics Solutions**

Enriched by a number of customer experiences and further expert contributions, the fourth chapter reviews both conceptual and operational logistics solutions with a view to their carbon abatement potential.

Reporting on his frontline experience, Sander van den Berg, Director of Supply Chain Consulting and Network Design at DHL Supply Chain, points out a number of challenges he has encountered when putting CO<sub>2</sub> reduction efforts into practice with customers. While the recent economic crisis shifted attention from carbon emissions to cost cuttings, the renewed focus on liquidity also hampered investments with a longer payback

period. Van den Berg points out that the responsibility regarding sustainability in many companies is not clearly allocated and that departments dealing with it often measure success using different Key Performance Indicators. Urgency will increase, however, once a price tag is attached to carbon emissions, he argues.

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*Urgency will increase once a price tag is attached to carbon emissions.*

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Sourcing, manufacturing and distribution strategies (such as the optimal network design or the appropriate modal mix) are then analyzed in detail. To reduce their carbon footprint, companies can switch to regional sourcing and also alter their manufacturing processes, for instance, by transporting only the basic product and customizing it later on demand, near the customer.

Furthermore, the way a distribution network is set up directly impacts CO<sub>2</sub> emissions, making distribution strategies a crucial factor in the set of climate-friendly solutions. Firstly, in order to achieve a minimum level of carbon emissions, the optimal mix between transportation and warehousing needs to be found. Secondly, effective modal planning can decidedly lower carbon emissions. However, important trade-offs need to be recognized between sustainability and other objectives that also influence the decision on transportation modes – such as cost and speed. Finally, effective route and capacity management helps logistics companies to become more sustainable and at the same time save costs by better utilizing their own vehicle fleet.

This important section on sourcing, manufacturing and distribution strategies is followed by an in-depth presentation of the Group’s advanced “City Logistics” concept by Petra Kiwitt, the Head of the DHL Solutions and Innovations unit. Given that, since 2007, more people live in cities than rural areas, new logistics concepts are needed that avoid congestion, pollution, low supply chain reliability and growing cost.

Huge strides forward can be made if some systemic changes can be realized, such as night transportation using noise-free electric vans or consolidating freight in dedicated consolidation centers. Dedicated “monopolies” and much stronger collaboration models are more radical approaches that would need to be aligned from the start with all public and private stakeholders. A totally novel idea is the “Bring Buddy” concept, in which city inhabitants – by delivering parcels on their way through the city – become logistics partners, as part of a “Bring Buddy” network. Using smartphones as identification and tracking devices, in future, social networks powered by Web 2.0 and location-based

services could transform into real life networks, where every member can contribute to a low-carbon lifestyle.

The view that collaboration will open up huge carbon reduction potentials is also a central insight of the contribution by Frank Straube, Professor and Head of the Logistics Department of the Tech-

nische Universität Berlin, and Stefan Doch, Project Manager at the International Transfer Center for Logistics at the Technische Universität Berlin. Comparing a sustainability-oriented business policy to the widely accepted concept of total cost orientation, the authors advocate that companies should take an integrated view of optimizing carbon emissions along the entire supply and distribution chain. Standardization initiatives, as a prerequisite to full-blown business cooperation, will help to build trust and foster a more collaborative business environment, Straube and Doch believe.

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*Collaboration will open up huge carbon reduction potentials.*

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Taking a closer look at a wide array of operational solutions, the report focuses mainly on road transport technologies, given that road transport makes up a major part of CO<sub>2</sub> emissions caused by logistics. While hybrid and electric vehicles have already reached the state of road testing, fuel cell-powered propulsion still seems to be decades away for logistics applications.

And, while Deutsche Post DHL sees the strong need for alternative fuels, there are no such fuels available that meet the Group's strict sustainability criteria. Therefore, the Group does not support the usage of currently available liquid biofuels, the production of which often competes against cultivating food crops, or leads to deforestation, among other downsides.

Before game-changing powertrain systems are ready for mass production, and due to slow fleet turnover, increasing the efficiency of existing means of transportation is key. Improving the aerodynamics of trucks, for instance, can bring up to 20 % better fuel efficiency. And, while weight reduction using lightweight materials reduces fuel consumption, increasing capacity of trucks, leading to fewer vehicles on the road, can also be beneficial.

The trend towards dematerialization, as witnessed by hybrid letters in the area of mail, continues with 3D printing as a new way of desktop manufacturing of even complex objects that once needed to be transported from far-away sites. While the impact that 3D printing will have is hard to assess at present,

logistics companies can adapt by operating local and regional production facilities to ensure the availability of high-end 3D printers, to organize the transport of raw materials and to secure the last-mile delivery of final products.

Complementing innovations in actual transportation, increasing warehousing efficiency is also key to reducing carbon emissions. Given that up to 80 % of the energy used in warehouses is consumed by electrical lighting, the savings potential becomes evident.

## 5 How the Logistics Industry Will Change as it Becomes More Sustainable: Seven Key Developments

The concluding chapter distils seven forward-looking developments as the logistics industry transforms itself on the path towards a carbon-efficient sector. The forecasts made in this chapter are based on the assumption that current trends towards sustainability – as described in the third chapter – continue. This chapter’s seven key developments are probable consequences if those trends continue and if companies, particularly logistics providers, strive to incorporate sustainability into their business models. Furthermore, the chapter draws substantially on some of the expert contributions to this publication and benefits from the assessments made in the *Green Trends Survey*. Here is a brief summary of the key developments:

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*Logistics counts – it is not a commodity.*

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1. Logistics counts – it is not a commodity. Logistics is not only a chief catalyst of global trade and a defining component behind value creation – it is also a business of strategic importance in the move towards a low-carbon economy.
2. Technological change will be achieved through a concerted drive from companies, governments and financial institutions. Given the higher price tag attached to new technologies, mutual support and long-term planning by all key players is essential.
3. Collaboration will increasingly be seen as an enabler to attain sustainability; even erstwhile competitors will cooperate more closely. As carbon emissions reduction becomes a priority for suppliers, business customers and logistics companies, cooperative business models will expand both vertically and horizontally along the supply chain.

4. Business models of logistics companies will change as sustainable innovations open up new opportunities.
5. CO<sub>2</sub> labeling will become standardized. CO<sub>2</sub> labels allow customers to compare green products. Transparency will raise confidence among logistics customers and end consumers when making climate-friendly choices.
6. Carbon emissions will have a price tag. As reducing carbon emissions becomes more important for companies, governments and customers, it will become part of a business' accounting and decision-making process. This will increase the demand for a price to be attached to CO<sub>2</sub> emissions.
7. Carbon pricing will lead to more stringent regulatory measures. Companies will only accept a price tag on carbon emissions if governments ensure a level playing field.

## Epilogue

In an epilogue, Rainer Wend, Head of the Public Policy and Responsibility department at Deutsche Post DHL, outlines how the company is changing its business processes and making its operations and products more sustainable. *GoGreen*, the Group's environmental protection program, has four main focus areas: A carbon accounting and controlling system to manage and measure efficiency improvements, a group-wide binding target to improve CO<sub>2</sub> efficiency by 30 % by 2020, numerous efforts to develop low-carbon technologies and solutions, and initiatives to mobilize Deutsche Post DHL employees worldwide. But Deutsche Post DHL is not only changing its own business practices. With its comprehensive experience, the company is also helping customers to make their business more sustainable. Thereby, Deutsche Post DHL not only facilitates global business, but also influences sustainable business practices.





# 1 On Sustainability

## Why Acting Sustainably Is Rational – Yet Challenges the Human Mind

by Dr. Clemens Beckmann

### A Question of Systemic Risk

A nobleman from the silver mining city of Freiberg in Erzgebirge (Germany) seems to be the first to highlight the necessity of sustainability: Hans Carl von Carlowitz, in his 1713 work, *Sylvicultura Oeconomica*. Traveling around Europe, he saw that the over-exploitation of wood as a resource was an acute problem of his time. Shipbuilding, because it was a time of war, as well as mining, consumed entire forests.

Von Carlowitz's observations appear remarkably progressive, even today: one should not act only in pursuit of profit in the short-term, but, instead, should consider the welfare of society at large. Man can make outsized profits by logging relentlessly, but in doing so, he will cause irreparable damage to nature. Rather, wood should be harvested in a manner that strikes a balance between deforestation and reforestation, so that its exploitation will be "*immerwährend und kontinuierlich*" (ever-lasting and continuous). Thus, von Carlowitz revealed the basic principles of sustainability, 300 years ago.

## **Sustainability in Complex, Risk-Prone Systems**

In today's complex societies, sustainability relates to the actions of individuals or stakeholder groups in dynamic political, social or ecological systems. Such systems are characterized by a large number of influencing factors, which often do not show linear behavior. As a result, there are extreme states in these systems, accompanied by strong system destabilization and high risk. A simple example that demonstrates this phenomenon is road traffic: at a certain traffic density, rather than a proportional slowdown of traffic, the extreme state of congestion and standstill occurs.

Modern society has become keenly aware of systems whose functioning is critical to the survival not only of individuals, but also of entire populations, or even of mankind as a whole. Recent examples in the economic sphere include the global financial crisis and the euro-zone debt crisis, while the Iranian nuclear standoff is an example in the political sphere. One of the topics that has gained tremendous attention in recent years is the threat to the environment posed by global warming, due to man-made emissions of CO<sub>2</sub> and other greenhouse gases.

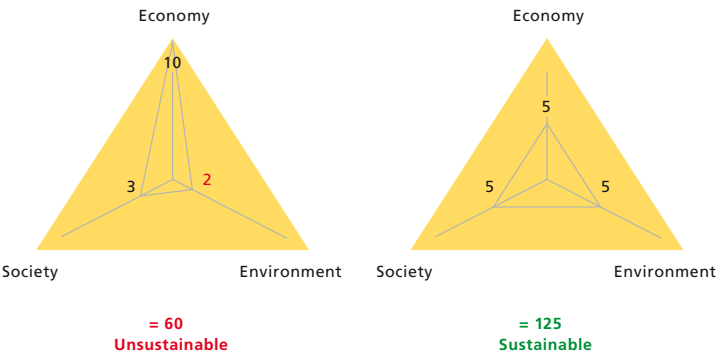
The concept of a sustainability-oriented society is not only characterized by the quest for prosperity, progress and social participation by all, without detrimentally exploiting natural resources. It is also a society that neither creates nor knowingly accepts risks that threaten its existence or that of future generations.

## **Sustainability as a Multiplicative Concept**

There is a profound rationality and humanity behind the concept of sustainability. Take, for instance, actions to benefit the welfare of future generations, or to ensure that the most vulnerable members of society are not excluded. Put in a mathematical way, the very rational, basic concept is: when acting in dynamic systems, all three target dimensions (economy, ecology and society) are worthwhile to pursue, but in a way in which it is not their "sum" that is regarded as optimal, but their "product."

In other words, no single dimension may be optimized to such an extent that one of the other dimensions is negatively affected too much (see figure 01), meaning that certain thresholds need to be fulfilled. And, the impact on these dimensions must be considered in the long-term (spanning generations).

SUSTAINABILITY IS A MULTIPLICATIVE CONCEPT



**Fig.01** A balanced distribution of “15 points” leads to a higher overall result

Most people feel that the concept per se sounds promising and evokes Kantian ethics of doing the right thing, because it’s the right thing to do (“Always act in such a way that you can also will that the maxim of your action should become a universal law.”) From where, then, do the problems of sustainability derive? Why does acting unsustainably so often appear “convenient”?

Motivational, Distributional and Measurement Conflicts Pose Challenges

The **first challenge** is measurability. The three dimensions of sustainable action cannot be measured in the same unit. GDP or income per capita can be used as a measure of the economy, but how can you measure the environmental contribution or societal impact of a certain action? This can often be done qualitatively, but the results are usually a lot more difficult to interpret. Particularly when a region is beginning to industrialize and prosper economically, the ecological and social consequences of high growth may not be evident or cannot be quantified at all.

In addition, the benefit of an action can often be identified much easier than the damage it causes. The ecological damage, for instance of the extinction of a species is very hard to quantify. In this context, the role of the major reinsurers becomes especially interesting. They are increasingly retained in critical situations to determine an economic reference value for ecological risks.

The 2006 “Stern Review on the Economics of Climate Change” attempted to put a figure on the economic cost of climate change. According to this comprehensive assessment, the economic impact of global warming could be at least 5 % of global

GDP per year in a business-as-usual scenario. In the worst case, the damage could even be up to 20 % of global GDP, per year!

A **second challenge** of sustainability – also touched on by von Carlowitz’s example – is the strong dissynchronicity that often fosters unsustainable thinking. Success is typically apparent long before the disadvantages become evident, which sometimes can be more than a generation down the line. Prompt rewarding motivates unsustainable behavior, just like the immediate pleasure of eating sweets often obscures the longer-term risks of cavities and obesity. This problem is the root of a typical unsustainable attitude that can be described metaphorically by the classic expression, “Après moi, le deluge.” (“After me, the deluge.”).

A **third challenge** of sustainability is related to the perception of reality and probability. The positive effect of unsustainable actions is conceived of as reality, meaning a high probability of occurrence, whereas possible significant damage is defined as residual risk, meaning negligibly small probability.

Nuclear power provides an excellent example, where the benefit is cheap energy production with low CO<sub>2</sub> emissions; but there are well-known problems, such as the unresolved issue of final disposal of nuclear waste, or the low but real risk of operational accidents. Chernobyl reveals how events previously considered as “dangerous, but probability almost zero,” like reactor core meltdowns, can become reality. Clearly, risks that are severe enough to harm the whole of mankind should be avoided, however small their probability is.

The **fourth big challenge** in the struggle against unsustainable behavior is the asymmetric distribution of benefit and damage in terms of target audience and size. For instance, a small group of significant stakeholders (typically with privileged positions of power) in a dynamic system may engage in behavior that benefits themselves, while the damage caused by their actions is spread among other, often much bigger, stakeholder groups, and is thus mitigated.

The recent financial crisis provides just such an example, where promising bonuses incentivized people to act unsustainably in the financial sector. The resulting destabilization of the financial system affected almost everybody in the world and the cost of the global financial crisis was borne not by the bankers or the financial sector, but by entire populations.

## Time for Action

In the ecological sphere, the need for action is increasing. Through globalization, previously limited local issues can pose global risks. The pandemics of modern times, such as the bird flu, or the financial crisis, are striking proof of that. The pace of technological innovation, which facilitates globalization, further exacerbates this problem.

In fact, it was the pace of future technological innovations and their impact on global raw material and energy consumption that was grossly underestimated by the Club of Rome in the book, *The Limits to Growth*. Nevertheless, more than 30 million volumes have been sold, raising awareness of the threats that go along with unchecked economic development.



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## Sustainability – Philosophical Considerations

*by Professor Dr. Dres. h. c. Otfried Höffe*

### I.

The term “sustainability” has become a buzzword. That is why a philosopher responds to it first and foremost with skepticism. Nowhere, among the thousands of keywords and references found in multi-volume tomes of philosophy, does the term appear, which is telling. Upon closer consideration, it becomes clear that an important challenge has been laid bare here, a challenge that concerns everything human: from the individual, to the family, the company, the school and university, to the national economy, politics and society at large.

With the concept of sustainability, we are confronting a dual issue just about everywhere: that is, that the corresponding problems can only be solved with perseverance and systemically – as part of a network of challenges and goals that are interlinked into a system; namely, a unity and totality articulated by these elements.

In principle, both aspects are familiar today, but in our everyday reality, they have become alien. This is due to a motley array of factors. Among them, on the one hand, is the pressure to change – partially real, partially only imagined; a business economics mentality that only thinks in terms of quarterly reporting periods, or even shorter timeframes; and, the media democracy, always looking for new headlines and favoring the political fashions of

the day, combined with information technology that makes any news available globally in a fraction of a second. These and other factors favor short-term actions.

On the other hand, contextualized thinking cannot be avoided. This knowledge, however, is integrated reluctantly into actual work due to the division and specialization of labor, with ever more restricted spheres of responsibility, together with the associated tunnel vision and jealousies.

Whether it is the general welfare in politics, company welfare in economics, the welfare of the patient in medicine, or happiness in life for individuals – what matters is that a complex challenge within a complex totality of multiple, interlinked factors is perceived and mastered. To focus on a single or very few aspects and then to maximize these is to succumb to reductionism. Optimization, by contrast, is the preferred methodology. First, you explore which factors matter overall, then consider their totality, carefully assess the relative weight of the individual factors and, finally, strive to overcome the problem in an optimal manner that is not insularly maximal, but holistically ideal.

A number of things are needed for this purpose, especially from leaders in positions of responsibility: in response to increasing specialization, a generalized competency, including openness and flexibility, esprit de finesse and a strong

capacity for good judgment; the readiness to think far-sightedly; and, finally, courage. The reason is that one must forgo the (only putative) safety of maximization, which is easier to obtain. Those who only maximize are not merely narrow-minded in the literal sense, i.e., intellectually limited; they are also intellectually timid. Those individuals who are willing and able to optimize, however, display independence and authority.

This authority reveals itself in various strengths. A philosophy that enumerates these levels of strength and clarifies them with examples becomes an eminently practical and political philosophy. Less independent and authoritative minds consider tomorrow, while those with a greater portion of these traits consider the day after tomorrow, but truly free minds think to the distant future. Once again, this characterization applies to all areas of life. To optimize one's own life means considering not only the next few days and weeks, but also the next few years. To lead your life with independence and authority as a whole means that you must also view it as a whole and orient yourself around a guiding principle – happiness founded on integrity.

In politics, less independent and authoritative minds only look beyond the business of today to the next election. For those with a greater degree of these generous traits, a whole generation counts; whereas,

truly free minds consider the children of their children. Only they are truly enabled to provide justice to future generations – a generational justice.

The spirit of sustainability is already inconsistent with legislators who, through numerous short-term reforms and counter-reforms, rob the relevant spheres of life – be they education and family, school and university, or companies and other organizations – of the solidity and dependability that is necessary for longer-term thinking.

## II.

Whatever is at your disposal, sustainability demands that the object concerned – one's own life, a company, a commonwealth or humanity as a whole – be maintained in such a way that it has future viability. This task is not fundamentally new, and the relevant strategies for mastering the task do not have to be reinvented. What are new are the prevailing conditions under which they can be applied.

I have proposed three strategies for the sphere of politics and these are also suitable for companies and other areas of society: the Genesis strategy, the Noah strategy and the prophetic strategy. The Genesis strategy derives from the divine command in the story of creation to "subdue the earth;" in secular concepts since the early Greeks, one speaks of the endowment of language

and reason. Both challenge humanity to develop future viability, to expand and deepen this ability and to safeguard it in its expanded and deepened form.

This challenge is not, for example, only to be understood technically. It is not enough to develop means for any kind of purpose. It is also not enough to become a little more generous and to serve one's own welfare pragmatically. What is required is the expansion of reason from its individual-pragmatic orientation to one that is socially pragmatic – even moral. In relation to an ever-so contemporary task as climate protection, this takes into consideration the whole of humanity and does not merely include the present, but for the purpose of generational justice, the future as well. In order to achieve a success that is sustainable here, we need an agent that acts globally and a global legal order as a framework.

According to the Genesis strategy, humanity is able to develop growing competencies, i.e., increasing knowledge and capacities. Nevertheless, humanity will never be sufficiently armed against all dangers that threaten it. Take for example, earthquakes, seaquakes and volcanic activity. Even if humanity knows their causes, as well as what areas are at risk, we will never know the exact times, places or intensities of their occurrence. Environmental catastrophes, such as periodic forest fires in the Mediterranean region, or the oil spill in the Gulf of Mexico, offer further examples. However, in these latter cases, insufficient precautions and circum-spection played a role.

For these and other incidents, the Genesis strategy must be expanded and supplemented with the Noah strategy. It is based on insight into the fact that we can protect ourselves to a great degree against

many catastrophes. Catastrophes like conflagrations and epidemics can be largely prevented. And precautions can be taken against others, such as building dikes in flood-threatened areas and keeping rescue boats with provisions in reserve.

Two things are required for the Noah strategy: specialized knowledge on the one hand (of precautions against large-scale fires, floods, or earthquakes, for example); and, on the other, the ability and willingness to use and apply this knowledge in a way that is timely and effective. Institutions are required here that do not retreat from the covetous glance of real estate developers and local politicians. In effect, administrative bodies or other institutions are called for that can bring the right expertise into play and bundle this together in the best fashion. Armed with the relevant authority and necessary attitude, they will also have to force through the requisite expertise against resistance, if necessary. They will have to be resistant to corruption and act courageously. With the help of institutions and individuals of this kind, as well a political culture that shares a sense of responsibility, a large portion of catastrophes can be prevented and those that do occur can be combated more quickly and the damage and harm reduced as a result.

A major catastrophe or true calamity demands even more. It requires its own strategy – the prophetic strategy. What is meant here is not the ability to foretell the future; rather, it is an expectation based on knowledge that we are imperiled by a future that is in high jeopardy, but that can be avoided by fundamentally new ways of behavior and living.

The climate topic offers a good example of the need for the prophetic strategy. It fulfills the most important conditions:



a catastrophe looms on the horizon and it is highly likely that its victims, human beings, are partially responsible for it; and that it can be prevented by a reversal or, at least, substantially diminished.

What is required is a veritable about-face – indeed, nothing less than a cultural change – from an energy-intensive to an energy-saving lifestyle. Considerations here all too often move in circles, from climate to energy, to climate. In reality, however, a square is needed, consisting of the four corners of climate, energy, political dependence/independence, and national economy. An even more appropriate figure would be a hexagon, which includes the points of forests and the world population.

Once again, that special kind of reflection is required, reflection that is simultaneously systemic and optimizing, and that begins

from the larger context. Not least of all, a global legal framework, mentioned above, is needed. Because, without a doubt, the collaboration of different groups and types of groups will be required: this means, in addition to the United States and large regional entities like the European Union, companies that act globally as well as globally active non-governmental agencies.

For these entities to work together, the previous approaches of international cooperation – i.e., an increasingly dense network of international law, several world courts and numerous international governmental organizations – are not sufficient. We need a legal framework that is as stable as it is efficient – a world legal system. Only such a system can take on the additional and, without a doubt, most important task of sustainability: a lasting, worldwide peace.



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## 2 The Logistics Industry's Role in Sustainability – and Vice Versa

*by Katharina Tomoff*

### **The Role of Logistics in the Economy: Creating Opportunities, Fueling Global Prosperity**

In the highly interconnected world in which we live, where the next shopping bargain or international business opportunity may be just a few clicks away, the transport and logistics sector plays an increasingly important role. Logistics and transportation companies not only facilitate the sourcing of raw materials and supplies, they are also crucial when it comes to assembling and warehousing products, and in getting the finished goods to market.

The key role that transportation and logistics plays is as true for a Nepalese charity generating vital funds by exporting traditional handicrafts, as it is for a huge multinational automobile manufacturer with assembly plants and retail dealerships around the world. Logistics connects people and markets through a physical network that is just as important as the virtual network of the internet. It makes the global distribution of the latest “must have” gadget possible within a precise time window, as well as enabling the specialized transport of life-saving vaccines and medicines to field hospitals in remote locations.

Logistics is a key driver of economic growth, wealth creation and jobs. In terms of its direct contribution to the economy, logistics and express services account for around 9 % of global GDP (Logistics Today, 2010). In the European Union alone, the logistics sector generated revenues of € 1 trillion in 2009, or around 10 % of European GDP (Klaus and Kille, 2008/2009). At the same time, the transport and logistics sector creates

growing employment opportunities worldwide. In Germany, for example, around 2.6 million people are employed in the logistics industry (around 7 % of the national workforce).

### **The Environmental Impact of Logistics: Recognizing the Importance of a Sustainable Approach**

Having contributed significantly to economic growth, increased employment and the creation of a global marketplace, the logistics sector must now equally understand its responsibility for the environmental impact of worldwide trade and transport – especially the sector's contribution to climate change. Just as logistics contributes to economic prosperity around the globe, it now needs to help bring about an ecologically sustainable, low-carbon economy.

A business-as-usual scenario is not an option. The economic consequences of climate change, with an estimated cost of around 5 %–20 % of global GDP, have been clearly described by Nicholas Stern (2007), while the social consequences of the imminent flooding of entire island nations needs no elaboration. This climate change scenario does not even include the fact that the production of the key natural resource currently required for most transportation – oil – will decline dramatically.

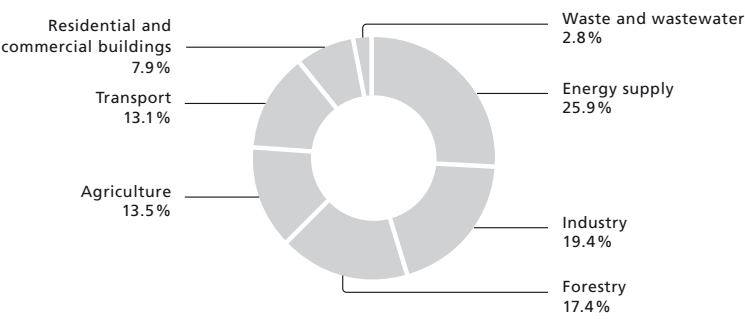
The way forward begins by recognizing that the logistics industry is a major source of CO<sub>2</sub> emissions. According to the IPCC (2007), transport, including freight and personal transport, accounts for 13.1 % of global greenhouse gas (GHG) emissions (see figure 02)<sup>2</sup>. The World Economic Forum (2009) calculates that the logistics industry is responsible for around 2.8m metric tons of GHG emissions per year, which is around 5.5 % of global GHG emissions (see figure 03)<sup>3</sup>.

Road freight accounts for roughly 60 % of total emissions from the logistics and transport sector, with over 1,500 megatons of CO<sub>2</sub>-equivalent emissions. Assessed in emissions per ton kilometer, air freight today is still the most carbon-intensive transportation mode, even if new generation aircraft are expected to burn up to 20 % less fuel (see figure 04). The most carbon-efficient transportation modes of motorized transport are rail and ocean.

<sup>2</sup> Or about 23% of world energy-related GHG emissions as energy production based on fossil fuels accounts for around 57% of total anthropogenic GHG emissions.

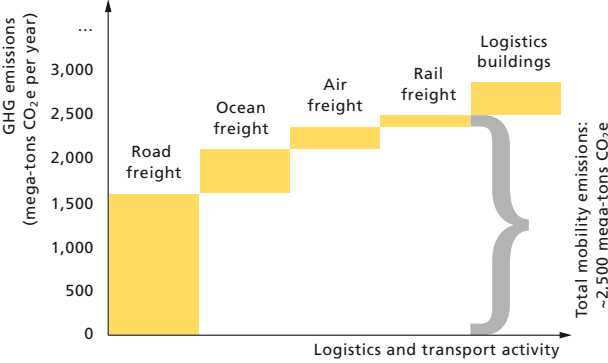
<sup>3</sup> Or about 10 % of world energy-related GHG emissions. McKinnon (2010a) comes to similar figures, estimating that the logistics industry (freight transport including warehousing and goods handling) accounts for roughly 10 % – 11 % of world energy-related CO<sub>2</sub> emissions.

SHARE OF SECTORS IN GHG EMISSIONS



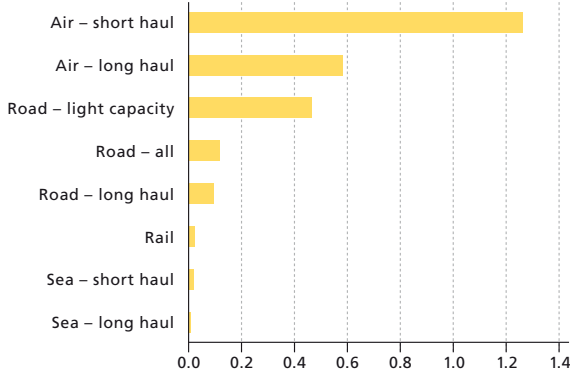
Data refer to total anthropogenic GHG emissions in 2004 in terms of CO<sub>2</sub> eq. (forestry includes deforestation) [Source: IPCC, 2007]

GHG EMISSIONS OF LOGISTICS ACTIVITIES



[Source: WEF, 2009]

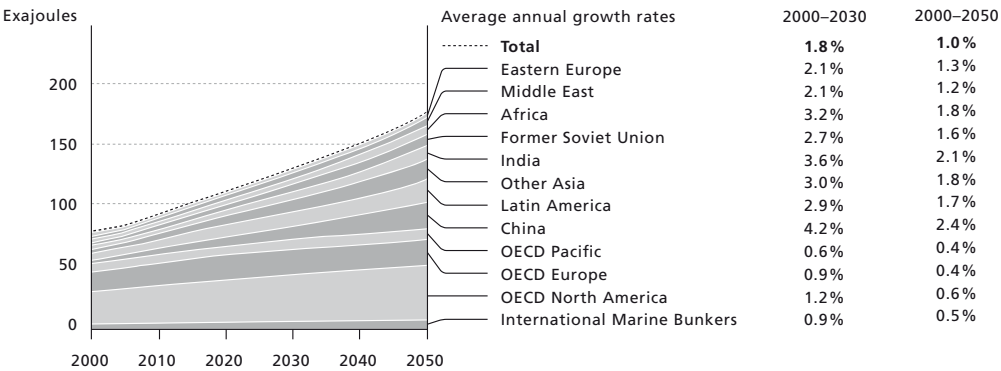
CARBON INTENSITY OF TRANSPORT MODES



Emissions factors in CO<sub>2</sub>e kg/ton-km [Source: WEF, 2009]

Over the past decade, the transport sector’s GHG emissions have increased at a faster rate than any other sector that uses energy. Globalization and economic growth have driven an increased need for logistics – a sector that, up to now, has largely been dependent on fossil fuels. As the logistics industry is expected to continue growing, so will its energy consumption and GHG emissions (see figure 05), unless changes are made.

### TRANSPORT ENERGY BY REGION



**Fig.05** [Source: © WBCSD, 2004]

Although the fuel efficiency of commercial vehicles and aircraft continues to improve, these gains are more than offset by the increase in their number and the total distances they travel. As a result, energy use by the transport sector is forecast to more than double by 2050, compared to 2000. If the transport and logistics industry does not improve its energy efficiency and develop viable alternatives to fossil fuels, it will find itself ever more vulnerable to the uncertainty of oil supplies as well as the increasing price volatility of fossil fuels. Additionally, governments that have aggressive greenhouse gas emissions targets, such as the United Kingdom with its legally binding long-term reduction target of at least 80% by 2050, will increasingly look to the transport and logistics sector to do its part.

### Leading the Way Towards a Low-Carbon Future

While the need for the logistics sector to respond to the challenge of climate change is clear, low-carbon logistics solutions and flexible transport modes are not yet widely available. The option of switching the transport of goods from a more carbon intensive transport mode to rail, for instance, depends on the railway infrastructure being in place. Improving the efficiency of transport modes also presents a challenge. There are only a few market-

ready technologies and solutions today that can meet the specific needs of the transport and logistics sector. This is especially true for air freight and long-distance road transport, where there is currently a lack of alternative technologies and fuels.

Finally, sustainability also seems to be a cultural issue: today, many still see a contradiction between economic growth and environmental protection, rather than realizing how they might go hand-in-hand. Companies or individuals who already act in an environmentally aware or sustainable way are still considered by some to be “tree huggers.” At the same time, although combating climate change has become a key topic of public discourse and media coverage, governments still have a hard time reaching global political agreements on reducing greenhouse gas emissions.

As already demonstrated by many companies and organizations today, sustainability can be a trend-setting business model, opening up new market opportunities and preparing for future scenarios. It can also help to cut costs thanks to the introduction of more efficient processes and reduced inputs of natural resources. Through the *GoGreen* program, Deutsche Post DHL has not only pioneered the growth of more environmentally-friendly products and services in the mail and logistics sector, it is also transforming the way we do business.

No single company can come up with all the answers by itself. That's why it is important that organizations such as the World Business Council for Sustainable Development (WBCSD) or the UN Global Compact bring together companies from all regions and industries committed to doing business in a more sustainable way. In fact, the first indices that rank companies based on sustainability-related criteria, such as the Dow Jones Sustainability Index, are already being used by investors. These indices and rankings not only encourage companies to change their approach to business, but they also provide a level of transparency that was previously missing.

## **New Business Models by 2020?**

There are many trends and developments indicating that, for most companies, long-term success will be strongly linked to more sustainable business concepts. The following are some of the trends and developments that are likely to shape businesses by 2020:

- **Customers** will place sustainability factors higher on their strategic agendas, creating demand for and incentivizing the production of sustainable products and services. One key driver will be the need to measure and reduce their own carbon footprint.
- **Investors** will expect companies to adopt more sustainable business models, such as producing goods and services with fewer natural resources, or by demonstrating how they intend to manage the risk of future environmental and social regulations. Expectations of how a company reports on its sustainability-related performance, as well as the frequency of reporting, will also increase.
- **Employees** will be encouraged to transfer their sustainable behaviors from the home to the workplace. A company's sustainability-related performance will become even more important in recruiting and retaining employees.
- **Political leaders** will support increasingly stricter sustainability legislation (e.g., carbon accounting, biofuels, cross-border/entry regulations that help avoid empty trucks, air traffic control restructuring), and foster alternative technologies (e.g., solar panels, electric vehicles).
- **Industry alliances** will be organized to set standards (e.g., the Clean Cargo Working Group), and promote new ways of thinking (e.g., subcontractor management, and the issue of companies being both customers and subcontractors to each other).

Although some of these elements may sound visionary, the transport and logistics sector has already started to change its course towards a more sustainable approach. The transformation to a greener business is right on our doorstep.



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## 3 Trends Towards a Sustainable Logistics Industry

The logistics industry already started to take sustainability into account some years ago. This shift was further reinforced by additional trends impacting the main stakeholder groups. These include an increasing awareness of environmental issues within society, resulting in greater demand for green, the rising importance of economic drivers of sustainability, as well as growing political action and regulation in this direction.

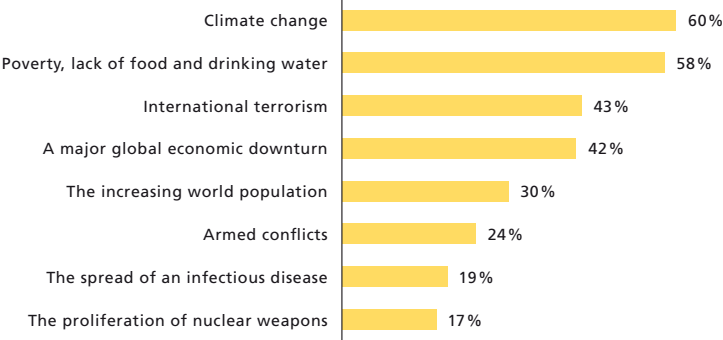
### 3.1 Consumers Are Increasingly Aware of Their Market-Shaping Power

While the so-called LOHAS (Lifestyle Of Health And Sustainability) consumer segment – composed of relatively upscale and well-educated individuals – may remain an elite phenomenon for the time being, there is still no denying that, in just a few decades, environmental awareness has evolved from a minority issue in mature Western societies to a top global consideration for consumers, media and policymakers alike.

In the *Green Trends Survey*, conducted by Deutsche Post DHL (see p. 46/47 for details), respondents identify climate change as one of the most serious problems currently facing the world, along with “poverty, lack of food and drinking water.” In fact, 60 % of all respondents identified climate as being among the

top three serious current world problems, followed by “poverty, lack of food and drinking water” (58 %) – while no more than 24 % of respondents singled out armed conflicts or the proliferation of nuclear weapons.

**RANKING OF THE MOST SERIOUS PROBLEMS**



**Fig.06** Ranking of the most serious problems currently facing the world as a whole, according to the *Green Trends Survey* (N.A. 2%, N = 1,800)

The poll also shows that environmental concern today is shared by people in Europe, Asia and the Americas alike. An astonishing 70 % of respondents from China and India see climate change as occupying a top position among the major world problems (followed by “poverty, lack of food and drinking water,” with 52 %). This reveals that, rather than environmental concern being the “privilege” of mature Western economies, there is a widespread awareness that sustainability is essential for every country, irrespective of its current position on the development path.

Echoing this, educational institutions are recognizing the shared concern about climate change and the need for qualified people to face it. Accordingly, the number of MBA careers that require environmental knowledge is rising: more and more business schools are incorporating green subjects into their curriculum (GradView, 2010).

Behavioral Changes Already Underway – Major Shifts Expected in Years to Come

While a single household has a relatively small environmental impact compared to manufacturing and transportation, millions of households together are major contributors to climate change, air and water pollution, land use and waste generation. At the same time, at least in market-driven economies, consumers have significant strategic power. Their buying preferences determine market opportunities. And, they are increasingly aware of this power.

Today, people around the world are not only concerned about climate change, but are increasingly taking action in favor of more environmentally-friendly behavior. The most common efforts, as revealed by the *Green Trends Survey*, are to separate waste, to reduce consumption of disposable items, to choose an environmentally-friendly mode of transportation, and to reduce use of the car. Figure 07 illustrates that 25 % of respondents answered affirmatively at least five out of the eight proposed actions, and 45 % answered three to five items positively.

GREEN BEHAVIOR

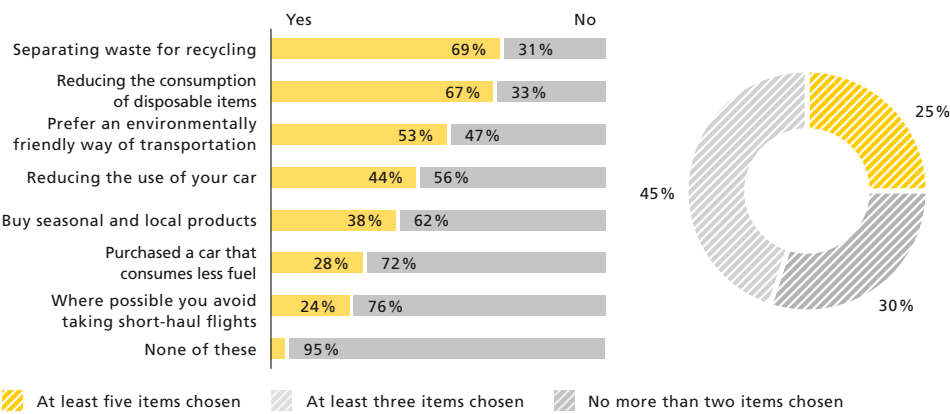


Fig.07 Green behavior (left) and intensity of green behavior (right), according to the *Green Trends Survey*

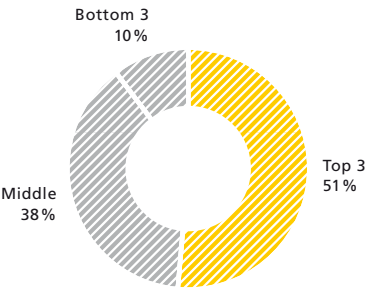
Again, a more detailed look at the results shows that ecological behavior is not just a European topic and that it is not just European survey participants who have responded favorably. While the numbers from the Americas are roughly similar to the European results, respondents from Asian countries reported particularly high rates of ecological behavior. For example, 41% of Asian respondents picked at least five of the items from the above list.

The survey findings confirm that sustainability has become a key buying criterion: half of consumers expressed the view that they would favor a company with green solutions over a cheaper provider in the next ten years.

GREENER OR CHEAPER?

END CONSUMERS

**Within the next ten years ...**  
*... I will favor a company with green transport/shipping solutions over a cheaper provider.*



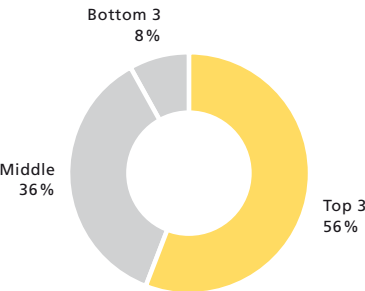
**Fig.08** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

Many of the business customers polled also expected that end consumers would further change their behavior – more than half of them expected the majority of their customers to favor a company that uses green transport/logistics solutions over cheaper solutions, over the coming years.

GREENER OR CHEAPER?

BUSINESS CUSTOMERS

**Within the next ten years ...**  
*... the majority of our customers will favor a company that uses green transport/logistics solutions over cheaper transport/logistics solutions.*



**Fig.09** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

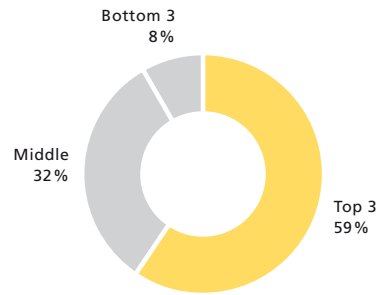
As a consequence, 59 % of business customers estimated that the green transport of their products would be a decisive factor for them in winning customers in future.

However, it is hard for consumers today to discern what is a sound choice from an environmental point of view. While environmentally concerned consumers tend to choose products that have been locally produced in order to avoid transportation

## WINNING CUSTOMERS

## BUSINESS CUSTOMERS

***Within the next ten years ...  
... green transport of our  
products will be a decisive  
factor for our company to  
win customers.***



**Fig. 10** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

emissions, it turns out that the calculus is not that simple: while the distance that food travels to reach the consumer is a significant factor, other variables, such as the transport mode, emissions in the food lifecycle, usage of greenhouses, pesticides and artificial irrigation, also substantially influence the product's carbon footprint. This not only points to the key role logistics processes play in providing lower carbon products, it also underlines the need for clear and transparent information on carbon footprints. Only transparency will empower consumers.

### Demand for Low-Carbon Logistics Solutions on the Rise

Today, more sustainable products are usually more costly. As far as fair-trade products and organic food is concerned, this has not been a barrier to market success. In the UK alone, the retail sales volume of fair-trade products increased from GBP 21.8 million in 1999 to GBP 799 million in 2009.<sup>4</sup> The market for organic food, too, has grown considerably in recent years – by some 70 % from 2006 to 2007 in the Czech Republic, by 24 % in Norway and by 15 % in Germany, in the same time period. The total revenue from organic food in Europe in 2007 was estimated at € 16.2 billion (Padel et al., 2009).

While, admittedly, food is a very high involvement product, will consumers demonstrate the same willingness to spend more for more sustainable offerings for logistics products?

Both research and market data give cause for optimism here, as the level of demand for green logistics offerings is increasing. As previously mentioned, 51 % of end consumers replied that, within the next ten years, they would be willing to favor a company with green transport/shipping solutions over a cheaper

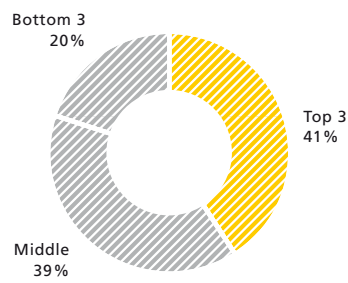
<sup>4</sup> Source: <http://www.fairtrade.org.uk>; fair trade is a trading partnership, which seeks greater equity in international trade and contributes to sustainable development, by offering better trading conditions and securing rights of marginalized producers.

provider. Put differently, a still-encouraging 39 % of respondents from the consumer panel answered that they would choose to pay a premium for sending letters or parcels in a CO<sub>2</sub>-neutral way, over the next ten years.

READY TO PAY MORE

END CONSUMERS

**Within the next ten years ...**  
... I will choose to pay a premium  
for sending my letters or pacels on  
a CO<sub>2</sub> neutral way.



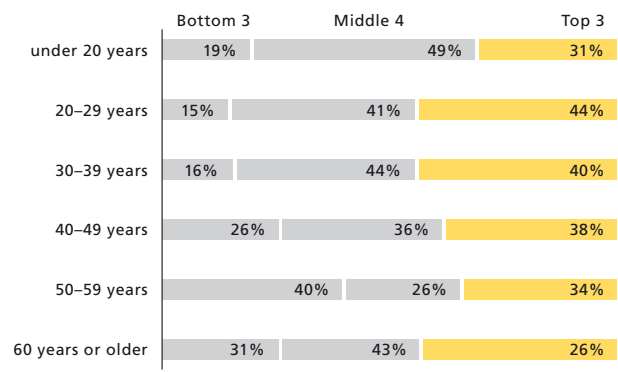
**Fig. 11** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

Younger end consumers, in the age range of 20 to 50, show an especially high degree of willingness to pay more for environmentally-friendly logistics services.

READY TO PAY MORE: AGE SPLIT

END CONSUMERS

**Within the next ten years ...**  
... I will choose to pay a premium  
for sending my letters or pacels on  
a CO<sub>2</sub> neutral way.



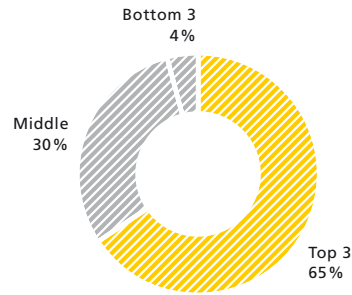
**Fig. 12** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

These consumers are, on average, better educated and have more senior positions of responsibility in organizations.

However, while many respondents seem to be willing to pay a premium for green transport in principle, the majority of end consumers in the *Green Trends Survey* still expect the logistics industry to provide green transportation solutions in future at the same cost as today.

**Within the next ten years ...**

*... I request the logistics industry to provide 'green' transport of products for the same costs as regular transport today.*



**Fig. 13** Level of agreement: Bottom 3 = disagree/totally disagree;  
Top 3 = agree/totally agree

While the survey shows that end consumers increasingly favor sustainable solutions, green transport is already important for more than 60 % of logistics customers. Once again, the importance attributed to sustainable logistics is not just a European phenomenon. Customers in Asia and the Americas consider green transport even more important than European customers (see “take-away” No. 3, p. 46).

## The Changing Role of Logistics for Large Manufacturers – The Case of Unilever

*“A major objective at Unilever is to reduce our carbon footprint in the distribution of our products,” says Chris Broadbent, responsible for logistics development and sustainability within Unilever, one of the world’s biggest manufacturers of consumer products, with worldwide turnover of €39.8 billion in 2009. “We need logistics providers that are not only capable of moving and storing our goods in a service-driven, cost-effective and reliable way, but also with the smallest carbon footprint possible.”*

*The company places top priority on carbon reduction and, here, distribution naturally plays an important role. By 2012, Unilever is on target to reduce distribution-related carbon emissions in Europe by 25 %. Improvements in four areas – optimizing networks, efficient load fill, modal switch and energy-efficient warehouses – have all contributed to this target.*

*For Unilever’s logistics providers, this means that environmental considerations become an integral part of all distribution tenders, and competencies in low carbon logistics and respective innovation capabilities are an important advantage. What is more, Unilever requires all its logistics suppliers to have an effective carbon management program in place. In the UK, for example, Unilever has embedded the Food and Drink Federation’s environmental clause and 10-point checklist for greener food transport within its UK transport contracts. All logistics providers have to comply with this checklist, which includes reporting against targets for CO<sub>2</sub> reduction.*

*“DHL has been very active in transforming its logistics services to make them more environmentally-friendly,” adds Unilever’s Chris Broadbent.*

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## What End Consumers and Business Customers Think About Green Logistics – 12 Key Take-Aways from the Global Green Trends Survey

*In the framework of the present report, the Market Research Service Center (MRSC) of Deutsche Post DHL<sup>5</sup> carried out an online Green Trends Survey in six key global markets: India, China, the U.S., Brazil, the UK, and Germany. All in all, 1,800 business customers and 1,800 end consumers in these countries were asked to give their views on how the logistics industry would develop in terms of sustainability (see pp. 143 for further details on the methodology of the study). Here is an overview of the most striking results:*

- 1. Climate change is the most prominent concern of respondents when asked about the most serious problems facing the world: 60 % of end consumers surveyed think it is one of the most pressing problems, followed by poverty, lack of food and drinking water (58 %) and a major global economic downturn (42 %; multiple answers were possible).*
- 2. Perhaps surprisingly, the sense of urgency regarding climate change is strongest in Asia: Climate change leads the list by far of the most prominent global challenges among respondents in Asia, where 70 % of end consumers surveyed there say it belongs to the most serious problems facing the world, 18 percentage points ahead of poverty, lack of food and drinking water. Climate change ranks on a par with poverty in Europe and slightly behind poverty in the Americas.*
- 3. Similarly, the importance attributed to sustainable logistics is not a “privilege” of “well-off” European residents. What is more, business customers in Asia and the Americas consider green transport solutions to be more important than do European customers: while 73 % of U.S. and Brazilian respondents and 66 % of Chinese and Indian customers say it is important, only 45 % of their European counterparts agree.*
- 4. Sustainability is not a marketing ploy – it has made its way right to the heart of business: Cost savings are just as important of a driver for green transport solutions (8.3 points out of 10) as are intangible reasons, like company reputation (8.3) or corporate responsibility (8.5). In contrast, marketing, or brand perception, is the least important reason (7.9) why business customers think green logistics is vital now or will become so over the coming years.*
- 5. Logistics is increasingly perceived as strategically important for CO<sub>2</sub> abatement: Almost two-thirds, i.e., 63 % of business customers, believe companies will regard transportation as a key lever to reduce their carbon footprint.*

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<sup>5</sup> The MRSC is a global market research institute within the Deutsche Post DHL Group and conducts market research worldwide in cooperation with international and local partner companies in 64 countries.



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6. **Business customers expect the logistics landscape to change:** 63 % reckon they will see more collaborative approaches in the industry and 64 % believe that CO<sub>2</sub> labeling will become standard. Also, 52 % of end consumers say they will pay attention to CO<sub>2</sub> labeling on services and products.
  7. **Business customers are inclined to use green logistics:** While 51% of end consumers express their preference for green transport solutions over cheaper solutions, this compares to 57 % of business customers who say that they will favor a greener provider over a cheaper one, over the coming years.
  8. **Business thus takes a proactive stance:** Not surprisingly, given that a vast majority, i.e., 65 % of the business customers surveyed, expects that the regulatory environment will become much more stringent over the coming years.
  9. **Accordingly, CO<sub>2</sub> reduction is already a topic for more than 50 % of the companies of survey respondents.** In more than two-thirds of those companies, concrete carbon reduction targets or plans are already in place.
  10. **Bigger companies lead the way around the globe:** Company size is key in terms of the importance attributed to greener transportation modes. While green transport is important for 77 % of companies employing more than 500 people globally, only 41% of self-employed business customers feel this way.
  11. **Business customers harbor huge expectations towards government:** 70 % of respondents believe that legislation is needed in order to bring about a substantial shift towards a sustainable logistics industry. End consumers, by contrast, count less on government action: only 53 % of consumers surveyed believe that legislation will effectively become much more stringent – and only half of respondents think that political action will have a significant impact on climate change.
  12. **Consumers expect to be presented with solutions:** Two-thirds of end consumers expect greener logistics services to be available at the same price as conventional transport. It is noteworthy, however, that 56 % of business customers believe consumers would prefer greener over cheaper solutions.

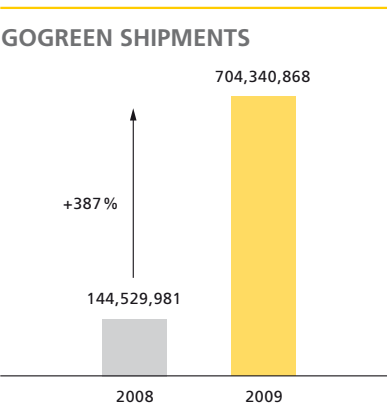
The survey results indicating a growing level of demand for low-carbon logistics services are borne out by the steep rise in demand for the Group’s own pioneering green products. In fact, Deutsche Post DHL was the first logistics company to offer a range of carbon offsetting products to customers.

When *GOGREEN EXPRESS* was launched in January 2007 at the World Economic Forum in Davos, for example, DHL became the first express service provider in the industry to offer carbon neutral shipping options. The phenomenal increase in sales figures achieved within the Group’s *GOGREEN* product range is clear evidence of the growing demand from the consumer and the business side for more sustainable options. Moreover, consumers are also showing increased willingness to pay a premium for these options – as is the case with *GOGREEN* products.

With the *GOGREEN* optional service, all transport-related emissions of carbon dioxide are first calculated and then offset through third party carbon-reduction projects, which are certified and rely on high quality standards.

Most of the increase in volume of shipments using *GOGREEN* comes from business customers that regard it as a key ingredient to their own carbon reduction schemes.

This view is confirmed by *Severin Moser*, CEO *Allianz Versicherungs-AG*: “Deutsche Post’s *GOGREEN* products are a valuable addition to our climate protection program. Our goal is to reduce CO<sub>2</sub> emissions from all Allianz companies by 20 % by 2012.”



**Fig. 14** Increase in *GOGREEN* shipments

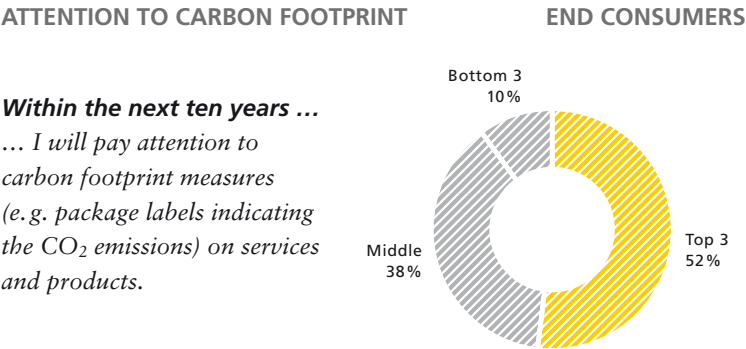
**Consumers Require Transparent Information –  
And Businesses Expect Carbon Labeling to Become Standard**

Do consumers have what they need to make informed decisions? As of today, the answer has to be: only partly. While in some cases information is readily available – for example, the energy consumption of household appliances and cars is prominently advertised – most of the time, information about energy consumption and eco-friendliness of products is not easily accessible.

A number of efforts are being made to introduce labeling of eco-friendly goods. An example is the EU Ecolabel, a voluntary label intended to give consumers information about products that comply with certain environmental criteria. However, a comprehensive and easy to understand carbon labeling scheme is still wanting.

In the absence of a commonly accepted, standardized emissions labeling scheme, some companies have taken their own initiatives. Examples include *Walkers chips*, *innocent smoothies* and *Boots plc shampoo*. However, these piecemeal approaches will not bring the progress needed to fully unleash the demand for low-carbon products and services, which, in turn, will create the full-blown market for low-carbon logistics.

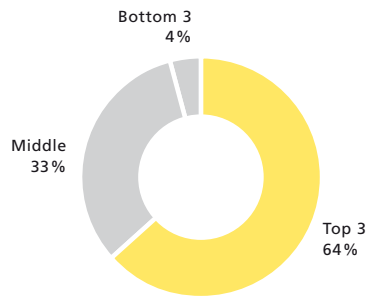
Nevertheless, consumers are ready: in the *Green Trends Survey*, 52 % of respondents indicated they expected carbon footprint labels to become a common guidance in their decision-making within the next decade.



**Fig. 15** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

Interestingly, in the same survey, business customers rated the importance of carbon labeling even higher than end consumers, with 64 % thinking that within the next ten years carbon footprint measures will become the standard.

**Within the next ten years ...**  
*... carbon footprint measures  
will be standard for services  
and products globally.*



**Fig. 16** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

The main challenge with labeling carbon emissions is the significant effort – and therefore cost – involved for companies. In order for products to carry a carbon emissions label, all companies will have to undertake a comprehensive carbon audit of the supply chains, which will require introducing carbon accounting and controlling.

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## **Carbon Accounting, Controlling and Management in the Logistics Industry**

by Michael Lohmeier

Without transparent data on emissions, it will be impossible to effectively reduce CO<sub>2</sub> emissions. This transparency is key from all stakeholders' perspectives:

- End consumers need to see the "carbon footprint" attributable to each product to make their buying decisions
- Companies need to know the CO<sub>2</sub> emissions of products and services they are purchasing from suppliers to be able to calculate and manage their own CO<sub>2</sub> footprint accordingly
- Governments require this data to design and apply appropriate policy measures (e.g. CO<sub>2</sub> taxation)
- The public has an interest in this data as well, in order to assess the environmental impact of a business and to gauge the company's responsible use of natural resources

### **Three Steps to Transparency**

How, then, can comprehensive transparency on CO<sub>2</sub> emissions be achieved? Three steps are needed:

1. Emissions have to be measured (Carbon Accounting)
2. The optimization potential then has to be identified by defining indicators and monitoring (Carbon Controlling)

3. Initiatives for effective carbon emissions reduction must be designed (Carbon Management)

Each successive step is entirely dependent on the previous one. Carbon Controlling, as an intermediate step, translates emission-levels identified in Carbon Accounting into carbon performance indicators revealing the energy efficiency, i.e., the ratio of carbon emissions per performance unit. Thus, the progress that derives from carbon reduction initiatives can be identified without being distorted by changes in productivity. Hence, Carbon Accounting and Controlling establish the decision-making basis for effective Carbon Management, since *you can't manage what you don't measure*.

Due to the lack of international standards, creating transparency is already a major challenge in the first step, Carbon Accounting. Companies need to design their own accounting processes and acquire the know-how to define the level of emissions generated by every single process, including those provided by subcontractors. In order to be able to attribute a carbon value to each process, product and business unit, processes must first be broken down into single activities, and then the CO<sub>2</sub>-emissions level of each vehicle and every site must be analyzed. Emissions deriving from activities that are common to various processes must be broken down and later attributed to each process according to a distribution key.

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## Direct or Indirect?

Companies have developed different approaches to measuring carbon emissions: the direct and the indirect methods.

The **direct method** uses the actual consumption of fuel or electricity purchased by the company and corresponding conversion factors to calculate the related carbon emissions. This method is largely used for emissions that come from own operations where consumption data is available in the finance system. This is convenient, when existing accounting processes monitoring consumption are already registered in financial accounting and, thus, double accounting can be avoided. Through this process, the real carbon efficiency per vehicle could be measured; nevertheless, applying this method is only possible for processes that are controlled by the company. For emissions from outsourced activities, the direct method is largely not applicable, e.g., for subcontracted transportation or external warehousing, due to the fact that subcontractors currently do not report to their clients the amount of fuel or electricity that was consumed for a specific shipment.

This is where the **indirect method** comes into play. The indirect method derives the carbon emissions from activity data, like transport, usually expressed in ton-kilometer, that was carried out by a specific subcontractor. With this method, the fuel consumption is derived from the transport undertaken, the vehicle used (e.g., type of aircraft, van, truck, rail, barge, container vessel, etc.) and the average load factor in combination with so-called emission factors. On one hand, CO<sub>2</sub> emissions calculated on the basis of indirect emission factors do not fully reflect companies' efficiency

increase – factors such as driver behavior or different fuel composition can hardly be considered in emission factors. On the other hand, for the various modes of transport and load factors, so-called emission factors are available that convert the transport handled by a specific vehicle type and load factor into the corresponding CO<sub>2</sub> emissions and thus can deliver a comprehensive picture of the attributable CO<sub>2</sub> emissions to customers.

To summarize the above, one could say that the direct method, while using actual consumption data, produces precise emission figures and enables companies to track their efficiency increase, whereas, the indirect method allows companies to calculate approximate CO<sub>2</sub> figures in absence of actual consumption data. According to the definitions of the World Resource Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), the direct method is applicable to Scope 1 emissions (direct emissions which derive from the processes that occur within the own company) and Scope 2 emissions (emissions caused in the generation of electricity bought from external providers and district heating), as they can be measured by registering bills, kilometers covered, or electricity meters. However, as the CO<sub>2</sub> emissions of subcontracted services (Scope 3 emissions) also have to be incorporated into the corporate CO<sub>2</sub> footprint, the indirect method is currently seen as an internationally practicable and effective way to obtain consistent CO<sub>2</sub> data across all modes and scopes.

## What's in a Unit?

Moreover, measuring is only the first step towards becoming green. Within Carbon Controlling, CO<sub>2</sub>-emissions are translated

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into CO<sub>2</sub> efficiency indicators. Obviously, the emissions of a production site should not be evaluated by the emissions it generates in total, but the emissions it generates per unit produced. As no common output or performance unit can cover, for example the performance of a warehouse (space use) and a delivery department (units delivered) at the same time, for each activity a different performance unit must be defined, in order to guarantee the validity of the CO<sub>2</sub> efficiency indicator.

In conclusion, Carbon Management as well as effective and efficient CO<sub>2</sub> reduction

depend on reliable Carbon Accounting and Controlling, but there are a lot of challenges to be overcome. Without international standards or independent data providers, calculating emissions is especially costly and complex. Therefore, independent institutions are needed in order to create transparency and, thus, allow companies to judge the emissions-level of their subcontracted services (e.g., via programs like *Smartway* in the U.S. Based on these experiences, important industry stakeholders are striving for a similar approach in Europe).



*Michael Lohmeier is Senior Expert in the GoGreen Program of Deutsche Post DHL, with a focus on road transportation, real estate and carbon accounting. Before coming to Deutsche Post DHL in 2005, he worked as Consultant and Senior Manager in a Management Consultancy specializing on the automotive and aerospace sectors.*

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## VOICE OF THE CUSTOMER

### Henkel

*“One of Henkel’s main sustainability objectives is to reduce the carbon dioxide emissions from our worldwide operations and along our entire value chain. We established comprehensive data management systems for the Scope 1 and 2 emissions from our production operations many years ago. In order to achieve across-the-board improvements in our operational carbon footprint, we are also looking closely at the emissions related to the transport and storage of our products. To determine the amount of these Scope 3 emissions more exactly and check the effectiveness of measures undertaken to reduce them, we also turn to our logistics service providers. Especially*

*interesting for Henkel are providers who have a comprehensive carbon accounting system for their operations in place. For us, the greatest value of carbon footprinting lies in obtaining a thorough understanding of our value chains, identifying emission hot spots and further reduction potentials. This helps us to discuss the benefits of new projects with our business partners and to respond to increasing data requests from our industrial and retail customers.”*

*Lars Siebel,  
Head of Global Purchasing Logistics,  
Henkel AG & Co. KGaA*

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# 3.2 The Growing Economic Value of Sustainability

The UN Conference on Climate Change in Copenhagen once again demonstrated the difficulties in achieving an international climate agreement; it also confirmed that government regulation and mandatory environmental performance standards alone will probably not be sufficient to combat climate change. To be successful, it is imperative that the private sector joins in the challenge to reduce CO<sub>2</sub> emissions. And for business to willingly participate, investing in sustainability has to create economic opportunities and be financially viable.

## IDEAL IMPACT OF SUSTAINABILITY ON CASH FLOW

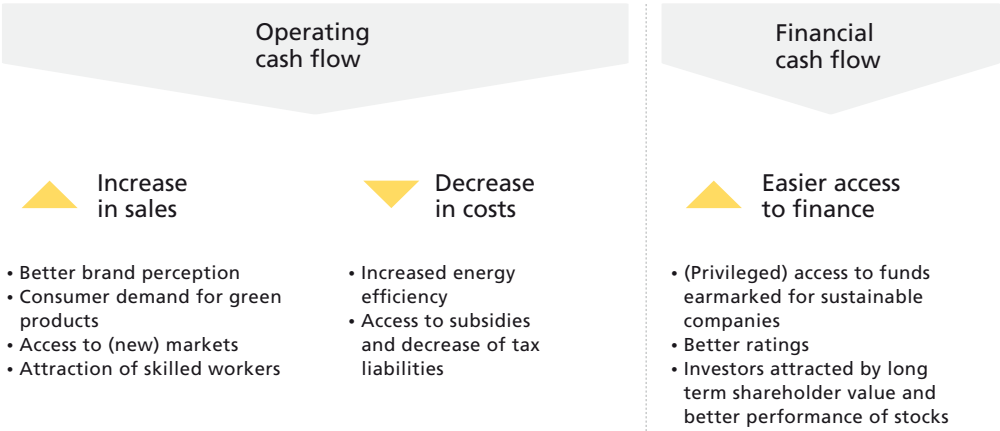


Fig. 17

In fact, according to a study conducted by the consulting firm *Accenture* (2007), 87 % of the CEOs surveyed believe that sustainability is important for profits – either by increasing sales revenues, or by helping to reduce production costs. The *Green Trends Survey* revealed that, for business customers, green logistics is or will become important not only for “intangible” reasons like company reputation (8.3 points out of 10) or corporate responsibility (8.5), but also for economic reasons like cost savings (8.3).

### Growing Customer Demand Translates into More Sales

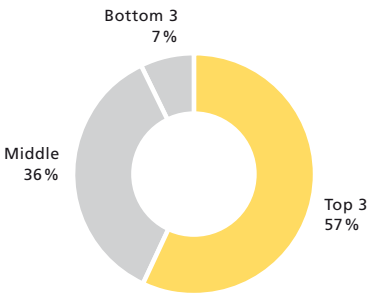
Increasing climate awareness has turned sustainability into a business virtue. In the *Green Trends Survey*, the majority of end consumers have expressed their preference for a green logistics provider over a cheaper one.

With business customers, the evidence is even more telling. While 51 % of end consumers stated they would favor green logistics providers (see above), the majority is even larger among business customers in the industry: 57 % of those surveyed stated that they would favor a greener over a cheaper provider. Here again, it is business that is driving the development towards lower carbon logistics.

#### GREENER OR CHEAPER?

#### BUSINESS CUSTOMERS

**Within the next ten years ...**  
... our company would favor a logistics provider offering green logistics over a cheaper provider.

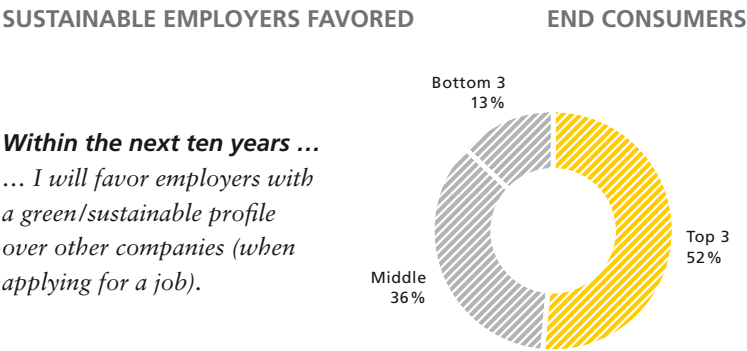


**Fig. 18** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

However, the role of the public sector must not be underestimated in creating the necessary demand to jumpstart low carbon markets. National and local governments are increasingly demonstrating their willingness to tackle climate change by greening public procurement and investing in green products. For example, under the 2009 American Recovery and Reinvestment Act, many tenders opened to private companies were launched to replace existing public goods with energy-efficient alternatives.

But what will further drive the demand for greener products is the very fact that sustainability has become a key success factor in shaping the reputation of a company and its brands. For multinational companies, in particular, it is important to have a consistent approach to sustainability along the whole value chain. NGOs and the public are eager to assess their compliance with stated practices, and, therefore, “green-washing” will be discovered. Due to the high level of media interest and the instant spread of information through online platforms, controversial behavior by companies or subcontractors in some countries or sites can easily affect demand for a firm’s products. For example, 91% of customers would consider changing their purchasing habits in response to learning about a company’s environmentally harmful practices (Accenture, 2007).

On a similar note, being perceived as a sustainable or green business is also important from an employer perspective. Several surveys show that employees have a clear preference for working for sustainable companies. In a survey by the recruiting platform *monster.com*, over 90 % of young professionals stated they would be more inclined to work for a green company. In the *Green Trends Survey*, 52 % of interviewees said that, in the next ten years, they would favor employers with a green/sustainable profile over other companies (see figure 19) – and for middle and upper management respondents, this figure was even higher, at 65 %.



**Fig. 19** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

Thus, the great – and growing – importance attributed to sustainability aspects will further drive companies towards offering low-carbon products and shape their processes accordingly. It will be one important key to being competitive – on the product market, but also in order to attract the most talented employees – a crucial asset in today’s knowledge economy.

## The Price of Carbon Will Change Investment Policies

Implementing environmentally sound practices will also lead to significant cost savings. The initial investment may increase costs at first, but these are often offset by long-term annual savings. Energy efficiency measures, in particular, play a key role with regard to cost savings. Experts estimate that in the U.S., energy costs in different industry sectors could be cut by between 14 % and 22 % by 2020, depending on the sector (National Academy of Sciences et al., 2009).

For the logistics industry, significant cost savings can certainly be made through efficiency measures. In the *Green Trends Survey*, cost savings were the second most important reason to use green transport and logistics services – on the same level of importance as “intangible” reasons like company reputation or corporate responsibility.

In particular, fuel efficiency in transport is vital to reducing costs, given that overall transport (including passenger transport) accounts for 61 % of worldwide oil consumption (IEA & OECD, 2009) and fuel is the major cost driver for logistics services. Such measures will also become increasingly important in the future from a risk management perspective: 38 % of risk managers consider the availability and price of fuel and power as one of the top future risks for companies (Ceres, 2010).

Companies implementing such improvement projects often face big upfront investments. It is particularly difficult for smaller companies to justify energy efficiency measures if they only pay-off in the long term.

However, companies do not always have to bear the whole burden of the underlying investment. Already today, they can make use of some government incentives, such as rebate programs, where part of the investment needed to replace old equipment with energy-efficient alternatives is refunded. In addition, public funds may be used for subsidies, tax liabilities reduced for green companies, or penalties imposed on non-sustainable ones.

Investment conditions will change considerably once there is a real price tag attributed to carbon emissions. Once this is achieved, environmental aspects will be an integral part of investment decisions, as sustainability becomes a key performance indicator of the company: carbon cost will be considered a subtrahend to EBIT (earnings before interest and taxes).

Before such public policies are in place, however, it is largely up to the company itself to transform its investment policies in order to favor the transition towards low-carbon processes internally. Several paths can be considered in this regard:

- Firstly, longer pay-off periods: the level of expected returns can be lowered for capital invested in green projects; e. g., the pay-off period can be longer than for classic investments, or the expected operational profit (EBIT) for those managers investing in sustainability projects is redefined.
- Secondly, extra budgets: green investments can be rewarded financially or extra investment budgets made available for sustainable investments. These extra budgets are very important for R&D projects to develop future technologies and to adapt new technologies for the specific needs of the logistics industry.
- Thirdly, collaborative approaches: R&D is often a long-term task, which sometimes cannot be assessed with classic investment categories. As most of these R&D projects incorporate significant costs and risks, they can be facilitated by collaborative efforts between companies, and further incentivised by governmental support to develop future technologies with significant improvement potential with regard to reducing CO<sub>2</sub> emissions.

It remains clear, though, that as long as carbon pricing is not introduced, much will depend on entrepreneurial leeway with regard to investment decisions. This leeway can be further encouraged if investors also reward sustainability-oriented management with easier access to financial resources.

## The Growing Importance of “Responsible Investments”

The number of funds termed “responsible investments” (RI) is expected to grow rapidly over the next few years. By the end of 2007, RI assets under management (AUM) were estimated at \$5 trillion worldwide – around 7 % of total AUM. By 2015, this share is expected to increase to 15 %–20 % – making RI mainstream instead of a niche market (Robecco & Booz, 2008).

So far, responsible AUMs are mostly institutional mandates generating two-thirds of RI revenues. In particular, organizations dealing with long-term liabilities, such as pension funds, stress their responsible investment approach. The British Universities Superannuation Scheme (USS) and the California State Teachers’ Retirement System (CalSTRS) are two such examples of large pension funds that include environmental, social and governance criteria in their investment decision-making, to emphasize the importance they attach to generational fairness and future-oriented business practices. The Norway Government Fund Systems is based on a different approach, i. e., negative screening<sup>6</sup>, by blacklisting companies not acting in accordance with these criteria (Folketrygdfondet, 2010).

Yet, responsible investments are not only of interest to “mission-driven” institutions. Particularly since the last financial crisis, long-term horizons are experiencing a revival among investors and there is a widespread view that sustainable companies have greater potential to generate long-term shareholder value (WBCSD & UNEP FI, 2010).

Whether a company is “responsible” or not is also a criterion that is increasingly embedded in ratings. Well-established rating agencies have developed sustainability assessment methods for companies and publicize the results. Asset4 (Reuters) and Riskmetrics (MSCI) are examples of specific ratings that, besides financial aspects, consider a variety of social, environmental and governance-related factors. In addition, there are more climate-focused ratings attributing a carbon beta to companies based on factors like carbon footprint, energy efficiency, and technology trajectory (Riskmetrics, 2010).

<sup>6</sup> Negative screening is a responsible investment strategy where companies with controversial business activities are excluded (compared to positive screening, where ESG-conform business practices improve the rating – Kempt & Osthoff, 2007)

Analysis shows that companies with responsible business practices tend to demonstrate good financial performance. They adapt more easily to changing regulations, in some cases even in a proactive way, which makes them better prepared for climate change and the upcoming low-carbon economy. Since the UN Principles for Responsible Investment were set-up to further integrate responsibility as a criterion in investment-decision processes (UN PRI, 2010), more than 800 asset owners, investment managers and service providers have signed on.

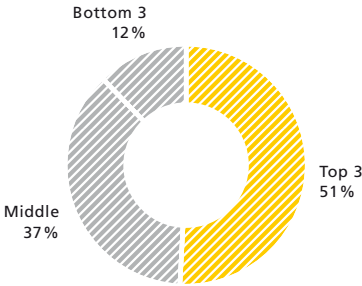
In an analysis by the University of Cologne on the effect of responsible investing on portfolio performance, investments in companies rated best-in-class according to their environmental, social and governance practices, tend to lead to an outperformance of up to 8 % in comparison to companies rated lower on sustainability (Kempf & Osthoff, 2007).

The promising returns of RI have resulted in an increase in private sector demand for opportunities to invest in responsible companies. Hence, a shift in private funds is taking place and business investments are expected to become the main source of responsible investment revenues (Robeco & Booz, 2008). The *Green Trends Survey* clearly shows that the majority of people would tend to invest in companies with a green/sustainable profile (see figure 20).

INVESTING SUSTAINABLY

END CONSUMERS

***Within the next ten years ...***  
*... I will invest mainly in companies with a green/sustainable profile (when making investment decisions).*



**Fig.20** Probability: Bottom 3 = unlikely/very unlikely; Top 3 = likely/very likely

## 3.3 Policy Options Drive the Greening of Logistics

### The Future of Climate Regulation

While the world is still struggling to agree on concerted action and on a comprehensive approach to combat climate change globally (see figure 21), numerous regulatory measures aiming to limit the carbon emissions of transport have been and are being implemented around the world. Regulation has become an important factor and will remain a crucial driver for promoting a greener logistics industry.

This assessment is shared by a majority of end consumers and business customers for logistics services worldwide. In the *Green Trends Survey*, most respondents agreed with the proposition that a substantial shift towards a greener logistics industry needs accompanying political measures, such as green taxes, incentives or other forms of regulation. At the same time, most respondents are also confident that the future regulatory environment will indeed become much more stringent and favor companies offering green products.

Various regulatory measures could contribute to “decarbonizing” transport and logistics in the future. Scrapping legislation that causes inefficiencies within logistics processes – e.g., restrictions that prevent the seamless flow of cross-border transport by road, rail or air – is a much needed first step in the direction of enabling more sustainable transport. Beyond these low-hanging fruits to achieve higher efficiency, traditional regulation can be a lever for adjustment.



More importantly, however, economic incentives deserve special mention. They can become efficient instruments to encourage the necessary changes in the transport/logistics business. This is not only true for financial incentives to foster investment in carbon efficiency or the funding of R&D for low-carbon transport solutions, but it also applies to carbon pricing schemes, since they are essential tools to introduce the effects of carbon emissions into business decision-making.

Carbon measurement standards and the promotion of carbon transparency will certainly be key future areas of activity across industries. The importance of such information instruments is also acknowledged by *Green Trends Survey* respondents. Some of the highest levels of agreement among business customers and end consumers can be found for measures that contribute to carbon transparency.

In addition, an overwhelming majority of transport/logistics customers agree with the proposition that there should be clear standards for the offsetting of transport-related carbon emissions, as well as an evaluation by independent organizations. This certainly is an area where political support could make a difference and contribute to the development of greener transport. On a similar note, a clear majority of end consumers said they would, in future, pay attention to carbon footprint measures such as package labels indicating the CO<sub>2</sub> emissions.

Whatever the merits of the different regulatory approaches, their limited geographical scope will always hamper their effectiveness. Therefore, political solutions with international reach are widely considered to be vital to ensuring a level playing field and prevent “carbon leakage” through the relocation of carbon intensive industries to countries with lax regulation.

However, according to the *Green Trends Survey*, end consumers and business customers alike expect future regulation to take place on a national rather than on an international level, possibly complicating business through a patchwork of different regulations. A majority of consumers nevertheless thinks that political actions will have a significant effect in combating climate change.

## Policy Options for a Greener Logistics Industry

Governments that are committed to actively address climate change use various policy tools to achieve their emissions reduction targets. The following overview will focus in particular on those policy measures that affect the carbon footprint of the transport and logistics industry.

On a very broad level, one can distinguish between three categories: traditional regulatory instruments, market-based economic instruments, and infrastructure instruments.

### POLICY OPTIONS TO REDUCE GHG EMISSIONS IN TRANSPORT

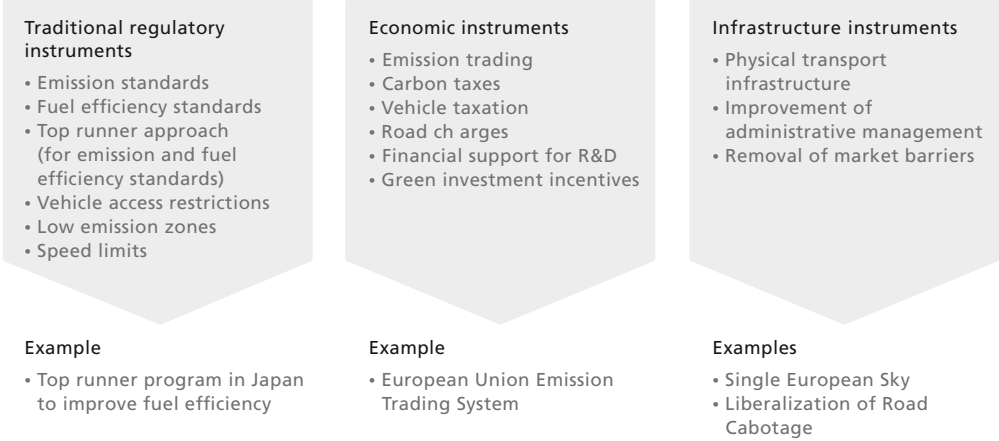


Fig.21

### Traditional Regulatory Instruments

Traditional regulatory instruments encompass all restrictive measures that limit various types of activities or prohibit the production/use of certain products. While some set goals that incentivize innovation, others are prone to limit the freedom of choice of individuals and companies as to how they comply with the targets set. Thus, they can have a far-reaching impact on business and individuals alike.

- **Emissions standards and fuel efficiency standards** are prominent examples of traditional regulatory instruments. While emissions standards set limits to the amount of carbon released, fuel efficiency standards for vehicles require manufacturers to curb the fuel consumption of their vehicle fleet, thereby indirectly reducing the amount of carbon emissions released.

- **The top runner method** focuses on the best-performing models among those available and sets this performance as the future minimum standard. Such regulations can even target particular vehicle components (e.g., the most energy-efficient air conditioners, lights, lubricants or the best-performing tires become the basis for the minimum standard). Japan probably is the country with the most extensive experience with top runner programs across a wide range of products – among them passenger and freight vehicles. Manufacturers face sanctions if they fail to meet those standards. Since the introduction of top runner fuel efficiency legislation in 1998, the average fuel efficiency of passenger cars has increased notably.
- **Vehicle access restrictions** completely shut out certain vehicle categories from some geographical locations, while low-emission zones only specify emissions criteria that have to be met in order to be allowed to enter the zone. Both are local level policies to either avoid emissions in concentrated urban areas, or to encourage the use of low-emission transport options and thereby reduce emissions from road traffic. Similarly, speed limits are being seen more and more as a climate policy instrument, instead of just a policy tool to influence road safety.

## Economic Instruments

Contrary to traditional regulatory instruments, economic or market-based instruments are not prohibitive in nature, but instead aim to set the right incentives. Actors are encouraged to reduce emissions via monetary inducements. They ensure that producers and consumers incorporate the goal of curbing carbon in all their decisions.

- **Emissions trading programs** work by setting an overall emissions limit and, in parallel, issuing a corresponding amount of pollution allowances. Firms can respond by either reducing their own emissions or purchasing surplus allowances from firms that have successfully reduced emissions. While trading mechanisms cannot guarantee a stable price development (complicating governmental and business decisions), this flexible approach ensures that an emissions reduction target can be achieved very efficiently. One of the world's largest emissions trading schemes encompassing many countries and various sectors is the European Union Emissions Trading System (EU ETS). Starting in January 2012, aviation

will be the first transport-related industry to be included in the EU ETS.

- **Carbon taxes** are taxes levied on the burning of fossil fuels. They thereby discourage the use of carbon intensive fuels. In contrast to cap-and-trade schemes, their implementation reduces the volatility of all connected prices, but cannot guarantee a specific amount of carbon reduction. Taxes have the advantage of guaranteeing a stable price, but it is extremely difficult to determine what price is sufficient to change behavior, thereby making it difficult to accurately achieve the emissions reduction target.
- **The promotion of low carbon technologies through financial support** rewards emissions abatement contributions and encourages investment in carbon efficiency. Some governments influence demand by supporting the purchase of hybrid, electric or other low-emission vehicles. The recent U.S. “stimulus bill” included several billion dollars in funds targeted to support energy efficiency activities relevant to the logistics industry, e.g., the development and production of electric vehicles as well as \$800 million in support for the research and development of biofuels and commercial-scale bio-refinery projects.

## Why Market-Based Reductions of Greenhouse Gases?

*by Dr. A. Denny Ellerman*

Market-based approaches for limiting air emissions have become more widely accepted over the past two decades, but their success is far from assured and, increasingly, they are being challenged as the preferred policy. In part, this loss of enthusiasm reflects the recent financial crisis and the distrust of markets that it has engendered. But, there is a more fundamental problem: impatience and the seductive lure of non-market based approaches, namely, conventional, prescriptive, command-and-control regulation.

The common and distinguishing feature of market-based approaches is that a price is placed on emissions. This price can be imposed by either a tax or the market price of allowances created by a cap-and-trade system. Although there are important theoretical and, more importantly, practical differences between these two variants, both impose a cost on emissions and, in so doing, make emissions like other commodities. Using them costs something and the cost is greater or less depending on the quantity used. As is the case with naturally scarce goods, the existence of a price makes users – whether they are producers or consumers – more sparing in their use.

### The Price of Regulation

In contrast, when command-and-control regulations are imposed, there is no evident price. A cost is incurred, usually in

the form of installing pollution reduction equipment or adopting more costly practices, but the incidence is highly varied depending on the circumstances of particular producers. Typically, the regulatory mandate is uniform, but the conditions in which it must be applied are not.

Invariably, the prescribed measure would impose inordinate costs on some producers, perhaps even causing a plant to close. These producers will petition for some type of relief, perhaps a deferral or some more appropriate tailoring of the rule to their particular circumstances, and that request will be granted, as it should be. After all, the objective is to deal with an environmental problem not to place an undue burden on a few producers because of some pre-existing condition originating at a time when there was no restriction or price on emissions.

Two problems are created by the presence of this heterogeneity of cost in complying with a mandate that implicitly assumes that all are alike. The first is the basis for the conventional justification of a market-based approach: it is more efficient, meaning that it will cost less to obtain any given reduction of emissions. The essential condition for least-cost is that the incremental cost of reducing emissions be the same for all producers.

This condition is easy to create with a tax or a cap-and-trade system; they all face the

same price. Certain producers may need to emit more or less according to their circumstances, but the uniform allowance price or tax will ensure that all will minimize their emissions up to the point where further reductions would cost more than the going price. With conventional prescriptive regulation, this equalization of the incremental cost of abatement will never occur absent perfect knowledge by the regulator of the conditions prevailing at every plant.

### Market Efficiencies

Market-based approaches, by contrast, allow producers the flexibility to adjust to the tax or cap in a manner that will be efficient using the plant-specific knowledge that only they possess. Granting them this flexibility, while still requiring that the tax be paid or that allowances be surrendered against emissions, avoids the complicated, costly, and time-consuming process of tailoring the mandate to individual circumstances. The end result of the administrative process may be fairer, but it will never be as efficient as a market-based approach.

The second reason for preferring market-based approaches is that they are more effective in reaching the desired environmental goal. Even with the best of intentions and abilities, the process of providing equitable administrative relief concerns only those who face undue hardship. Consequently, the deviations from the mandate are always one-sided. Those for whom the regulatory mandate imposes little or low costs never step forward to volunteer to do more, and the regulator will never know who they are.

In contrast, market-based approaches set up incentives whereby affected parties will reduce emissions more or less accord-

ing to the costs that they face. Even better, for those facing higher than average costs, purchasing additional allowances or paying more tax is always less costly than the legal expenses involved in seeking administrative relief in any system with effective enforcement. As a result, those whose particular circumstances make emissions reduction especially costly pay the price and get on with production, instead of seeking relief, as they would have to do if the costs they faced were disproportionate or prohibitive. This dynamic adds a second reason for preferring market-based approaches: they are more effective in meeting the environmental goal.

### In All Fairness

What's the problem then? Why would anyone advocate an approach that is less efficient and less effective? The explanation resides in the requirement for equitable treatment that is fundamental in any political system. Achieving equity or fairness can be done up-front or later, but it cannot be avoided. Conventional prescriptive regulation provides up-front a clear and satisfying mandate that seems to deal with the problem while pushing all the nasty problems of implementation off to the later and much less visible regulatory process.

In contrast, when an explicit price is proposed, as in a tax or cap-and-trade system, all of the problems of fairness and equity must be worked out ahead of time in the legislative process. Moreover, achieving some degree of fairness is no prettier when carried out up-front by the legislator than when performed later and less visibly by the hapless regulator. Therein lies the seductive lure of command-and-control regulation. It responds to the urge to be done with it, but the job is left half-done.

As with other circumstances in life, we are better off being patient and resisting temptation. The preferred policy remains market-based. Not only will it be more efficient and more effective, but it will

also reach every corner of economic activity and not just those that the regulator designates, however well-informed and well-intentioned the latter may be.



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## Infrastructure and Market Liberalization Instruments

The efficient maintenance, use and administration of infrastructure has a major impact on the efficiency of transportation.

- **Sufficient investment in the physical transport infrastructure** – roads, rail tracks, ports and airports – is not only an enabling factor for transport, but also a prerequisite to help transport and logistics providers achieve optimum levels of operating efficiency. Capacity constraints and infrastructural bottlenecks lead to traffic jams and wasteful detours causing a lot of unnecessary carbon emissions.
- **Market barriers** prevent transport capacities from being fully utilized in various transport segments. Laws that prevent carriers from operating freely in other countries (cabotage restrictions), lack of liberalization or insufficient enforcement of liberalization efforts and the absence of cross-border inter-operable infrastructure all contribute to the waste of valuable transport resources. For instance, the full removal of road cabotage restrictions in the EU has the potential to notably reduce the number of trucks running empty, while a full liberalization of rail systems and better interconnections of national railway infrastructures would improve not only the national but also the cross-border use of rail freight.
- **The suboptimal management of infrastructure** also prevents some transport modes from unleashing their full potential. In recent decades, for example, fragmented airspace control in Europe caused by national borders has contributed to air traffic congestion and costly delays. The improvements envisioned in the European Union’s “Single European Sky II” package could optimize the organization of European airspace and deliver carbon emissions savings of up to 12 %. Similarly, the United States is implementing an air traffic management system called NextGen (Next Generation Air Transportation System). With the help of satellite technology, it aims to significantly improve the efficiency of U.S. air traffic control, thereby contributing to a notable reduction in carbon emissions.

Thus, investment in infrastructure, the removal of market barriers in the transport sector and better administrative management of infrastructure, not only support the seamless flow of goods, but also improve overall capacity. At the same time, these instruments provide an important boost to the greening of logistics.



## The “Sandwich Solution” to Global Climate Policy

by Detlef Sprinz, Ph. D.

High expectations surrounded the meetings of parties to the UN Framework Convention on Climate Change and its Kyoto Protocol in late 2009 in Copenhagen. Some hoped that a global agreement would be reached for the period starting in the year 2013. Others were more doubtful about what could be expected in a forum of divergent interests. In the end, the result was the non-binding Copenhagen Accord and the world community has still not agreed on credible commitments for managing climate change. This contribution reviews the state of international negotiations on climate change and argues that a combination of top-down and bottom-up approaches – the “sandwich solution” – to managing climate change may be a realistic expectation for the foreseeable future.

### Diplomatic Record

In the wake of a series of scientific and intergovernmental conferences since the mid-1980s, climate change has become a priority issue for an increasing number of governments. After the first report of the Intergovernmental Panel on Climate Change (IPCC), which suggested that there would be an increase of 0.3 °C per decade if emissions continued to increase unabated, the United Nations Framework Convention on Climate Change (UNFCCC) was concluded in 1992 at Rio de Janeiro. Article 2 of the UNFCCC states that the “ultimate objective [...] is to achieve [...]

stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.”

Furthermore, developed countries were called upon to curb their greenhouse gas emissions in the year 2000 to the level of 1990. The UNFCCC entered into force in 1994 and enjoys universal support.

Subsequent negotiations led to the 1997 Kyoto Protocol, which mandates specific emissions ceilings for the greenhouse gas emissions of developed countries during the 2008–2012 period. While the U.S. did not ratify the Kyoto Protocol, it nevertheless entered into force in 2004, after Russia’s ratification, following intensive negotiations. Then, in December 2009, the meeting of parties to the UNFCCC and the Kyoto Protocol in Copenhagen agreed to the Copenhagen Accord, a non-binding agreement.

The Copenhagen Accord stipulates the goal of limiting global mean temperature rises to 2 °C as compared to pre-industrial levels, while leaving specific commitments to countries to decide upon. In addition, a major financial package was included in the Copenhagen Accord, including the goal of mobilizing \$100 billion per year by 2020 to support the climate efforts of developing countries, with exact sources of funding left open.

More importantly, the meetings since Copenhagen show a shift away from industrialized countries as the pivotal actors towards key, assertive developing countries. Developing countries are now the major source of greenhouse gas emissions worldwide, and their new weight is reflected in the importance accorded to the BASIC group (Brazil, South Africa, China, and India). The assent of this group, and especially of China – the largest single emitter of greenhouse gases (GHGs) – is indispensable to any global agreement. China has so far proved reluctant to commit itself to legally binding restrictions on carbon emissions, despite its willingness to substantially reduce its carbon emissions per unit of GDP.

The EU has hitherto tried to lead by good example and by a comparatively ambitious emissions reduction goal of at least –20 % of GHGs by 2020. It was, however, the negotiations between the U.S. and the BASIC group, especially China, which paved the way for the Copenhagen Accord, while simultaneously preventing legally binding commitments from being included. The question of which countries will credibly exert strong leadership in subsequent climate change negotiations remains open.

In the aftermath of the Copenhagen negotiations in December 2009, many developed and developing countries published their future climate commitments. However, studies of these unilateral national commitments suggest that they are inadequate to achieve the 2°C goal. It remains to be seen whether a global agreement can be reached to ensure the 2°C goal becomes a reality. This goal essentially implies the transition to a low-greenhouse gas economy during the present century. How could this be accomplished?

## The “Sandwich Solution”

The fourth Earl of Sandwich was supposedly fond of a sandwich as it allowed him to continue working while eating. By analogy, the upper slice of a sandwich may metaphorically represent the top-down approach of global climate governance, whereas the lower slice of bread represents the bottom-up approach. The UNFCCC and the Kyoto Protocol processes essentially aspire to top-down governance, whereas decentralized local, national, European, industry, or consumer initiatives represent the bottom-up approach.

The former approach is expected to work by global agreement, the latter by way of dynamic social, economic, and technological markets, which diffuse across large parts of the world. Each of these has specific pros and cons, and a combination of both may provide the right mix we can realistically aspire to in the quest to prevent dangerous climate change. In the following, I will briefly discuss the merits of each approach on its own, followed by a perspective on how both approaches could be combined synergistically.

Some top-down regulation appears perfectly desirable. Firstly, agreement on a focal point – like the 2°C goal – is a valuable guidepost to focus minds. Secondly, monitoring, reporting, and verification of emissions and impacts provide a synoptic, transparent overview. And, thirdly, reviews of policies and the analysis of alternative future pathways allow assessments of the accomplishments achieved and the challenges that remain.

The top-down approach in universal membership systems, like the UN, has the charm of being considered legitimate and all-encompassing, yet, too often lacks both efficiency and effectiveness.

After two decades of UN climate negotiations, regrettably little has been accomplished.

By contrast, bottom-up approaches thrive on social, economic and technological innovation, and their diffusion to other entities. Inventions, such as zero-energy houses or zero-emission vehicles, may become successful innovations that create new mass markets. By offering strong incentives to innovate as well as to gain market share, select governments have succeeded in mobilizing the supply of decentralized energy, e.g., photovoltaic or wind power from offshore and on-shore locations. There is also a role for small and large companies in experimenting with lowering their GHG footprints. Pursuing environmental goals innovatively often also improves profitability.

Bottom-up approaches risk not making it to the stage of market diffusion. If governments do not sufficiently tax GHG emissions or provide stringent caps on emissions, zero- or low-carbon products cannot easily compete. Governments often provide R&D subsidies, but are surprisingly disinterested in sharing in the proceeds of successful government R&D projects.

Besides business challenges, such as X-Prizes, the role of private equity and innovative philanthropic foundations is slowly emerging as a catalyst to foster innovation processes. Coordination is needed such that decentralized solutions can be rolled out more broadly. Yet, bottom-up approaches have the advantage of avoiding the delays inherent in universal membership systems, which too often include actors who favor the status quo over desirable change.

How can both approaches be suitably combined?

Firstly, overall goals show the direction and indicate the magnitude of the challenge. Environmental "*Ordnungspolitik*," i.e., frameworks created by institutions, such as nation-states, the EU, or international institutions, allow actors to pursue their self-interests while stabilizing expectations regarding the sincerity of the goals, as the framework cannot be changed frequently without losing credibility with consumers, producers, or voters. For example, the Kyoto Protocol established the widely held expectation that the price of greenhouse gases shall be positive henceforth.

Secondly, monitoring, reporting, and verification provide market transparency and enable the evaluation of progress towards the overall goal.

Thirdly, creating decentralized incentives for experimentation with social, economic, and technological innovations allows us to harness entrepreneurial spirit within the framework of overall objectives. Private equity and innovative foundations could amplify both entrepreneurial spirit as well as provide seed money and incubator support. Besides stabilizing expectations about future policies, governments could employ smart investment strategies. Like in the case of Airbus, governments could opt for project-based co-beneficiary investment positions, rather than offering traditional R&D subsidies. This design would allow state support to become revenue-generating for the taxpayer in case of profitable undertakings, while avoiding burdening business with all the risks.

Finally, employing robust decision-making techniques allows us to explore which key vulnerabilities to manage and how near-term policy choices further the achievement of long-term climate goals.

## Conclusions and Implications

The sandwich solution may help overcome the sluggishness of reaching global agreement on a low-greenhouse gas future. The transport sector is expected to grow in terms of absolute greenhouse gas emissions over the next decades, while some other sectors are already

reducing their carbon footprint. A possible sandwich solution for the transport sector may entail a worldwide sectoral cap combined with company- and industry-level innovation. Deutsche Post DHL is already experimenting with options for low-carbon pathways, and increased ambition may make it a pathfinder for low-impact logistics.



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## 3.4 Conclusion: The Opportunity Is Here – But All Parties Involved Need to Act in Concert

Having examined key stakeholder groups, such as customers, financial markets, and policymakers, an across-the-board recognition emerges of the need for more sustainable ways of doing business.

- Customer demand is growing – and we even see a certain readiness to pay a premium for greener logistics solutions; however, even if consumers recognize more and more that they have strategic power via their buying decisions, it would probably be over-optimistic to assume that consumer behavior alone will trigger a massive shift towards environmentally friendly offerings.
- Consumers need to be enabled to make informed choices. Creating transparency about the carbon footprint of transportation modes and products is key – and it is the responsibility of policymakers and companies alike to jointly agree upon common standards of carbon measurement and accounting.
- As company reputation becomes an ever more important factor for customers when choosing a provider, offering vanguard solutions in terms of sustainability can be a sales-driver in itself, while it also boosts a company's allure for well-educated job candidates. However, this is not enough. Energy efficiency positively impacts the bottom line as well – as long as investments pay off quickly enough.

- To make sure payback times are acceptable from an economic standpoint, both financial markets and policymakers need to create the right framework. This should be all the more feasible as studies show that companies with a sustainability-oriented business policy also deliver more sustainable financial results – i.e., they outperform their peers. At the same time, company culture also needs to accept and support slightly longer pay-off periods for the sake of necessary investments in breakthrough technologies.
- The public policy realm can play a key role in creating the framework needed to encourage business leaders to invest in sustainability. Putting a price on carbon through appropriate cap and trade schemes could be one path to realizing this if an international level playing field can be achieved. Focusing more R&D efforts on typical fleet vehicles operated by logistics companies – thus complementing investments in research targeted at private consumer vehicles – would also help considerably. At the same time, an integrated policy approach at national and global levels is pivotal to remove regulatory hurdles, like road cabotage restrictions, market access limitations, complex customs regulations, etc., in order to improve the utilization of transport capacity.

Creating a decision-making environment favorable to sustainability-oriented solutions will also greatly foster the success of technological game-changers, such as electric vehicles, or even entirely new business models. Some main development paths will be examined on the following pages.

### Sustainable Logistics in Asia

*by Professor Robert de Souza, National University of Singapore,  
Dr. Zhou Rong, Sustainable Supply Chain Centre – Asia Pacific (SSCCAP) and  
Laura Bolton, Sustainability Director DHL Supply Chain*

Four of the ten countries in the world with the highest CO<sub>2</sub> emissions from fossil-fuel use today are located in Asia. China ranks first. India, Japan, and South Korea also rank among the top ten emitters.

In China, even though only 5.5 % of all motor vehicles in the country are being used in the transportation industry, the sector still accounts for over 30 % of China's total petroleum consumption. As China recently committed itself to reducing energy consumption per unit of GDP by 40 %–45 % by 2020, more stringent requirements are set to be imposed on the transport sector to cut energy consumption and reduce greenhouse gas (GHG) emissions. A modernized transportation system and multimodal transport are also being developed as part of the efforts to transform China's logistics industry and to contribute towards achieving the country's goals in cutting GHG emissions.

#### Asia's Role in Global Agreements on Climate Change

The high rates of economic growth in Asia means that Asian nations need to play a leading role in addressing global climate change, and in finding practical solutions for more sustainable development.

Japan has enacted a set of laws covering domestic environmental policy, including climate change, air quality, water, waste and recycling. It was one of the first countries to pass extended producer responsibility laws for collection and disposal of end-of-life products. Japan plans to cut its emissions by 25 %, compared to 1990 levels by 2020.

South Korea instituted a set of environmental laws covering air, water, waste and recycling, including high profile campaigns to eradicate plastic bag use amongst consumers. India has bundled laws into the broader Environmental (Protection) Act, and has also established a goal of 20 %–25 % reduction in carbon intensity by 2020, compared to 2005 levels.

Singapore's key strategy to reduce greenhouse gas emissions is to focus on the potential of energy efficiency. Singapore's Sustainable Development Blueprint sets a target to achieve a 20 % reduction in energy intensity per dollar GDP by 2020 and 35 % by 2030, both from 2005 levels. From 2013, the Singapore Government will be introducing an Energy Conservation Act, mandating energy management requirements for organizations that consume more than 15 GWh per year.

## **Awareness and Demand from Asian Consumers for Green Products and Services**

While Asian governments are increasingly establishing goals to reduce GHG emissions, Asian consumers are also better informed about green purchasing, according to Euromonitor International. Moreover, research by Accenture has shown that Asian consumers are significantly more willing than their Western counterparts to pay a premium for environmentally-friendly products. Some 84 % of consumers in China, India, Malaysia, and Singapore say they would accept a higher price for green products, compared with only 50 % in the U.S., Japan, France, and Germany.

Environmentally-friendly behavior among consumers in 10 out of 17 countries has increased over the past year, according to the National Geographic Society and the international polling firm GlobeScan, in their third annual Greendex survey aimed at measuring and monitoring consumer behavior that impacts the environment. As in 2008, the top-scoring consumers of 2010 who show environmentally-friendly behavior are in the developing economies of India, Brazil, and China, respectively. Consumers in emerging economies continue to round out the top tier of the Greendex ranking.

Landor Associates also conducted a recent brand survey that shows a relatively high concern for green issues among consumers in China. For example, 45 % of consumers surveyed there said they consider it very important whether a company is green when thinking about which brands to purchase. Some Chinese environmentalists and NGOs are even directly appealing to consumers to boycott specific products

and manufacturers. This green consumer behavior in China is partly due to the growing middle class in the country, which is expected to comprise 40 % of China's population by 2020.

## **Financial Incentives and Regulatory Pressures for Green Logistics in Key Asian Countries**

In terms of incentives, in June 2010 China introduced a pilot program to provide subsidies towards the purchase of electric and hybrid cars. It also introduced nationwide subsidies of 3,000 yuan (US\$ 441.3) for cars with 1.6-liter engines or smaller that consume 20 % less fuel than current standards. China has also allocated 350 bn yuan (US\$ 51.5 bn) for clean water and waste management. In addition, China will further raise the control level for vehicle emissions and standardize annual environmental inspections of vehicles. Efforts will be made to improve fuel quality and efficiency in order to develop and employ energy saving vehicles using clean fuel, as well.

Taiwan's Economic Vitalization Package gives subsidies for the purchase of dual-fuel vehicles; the use of liquefied petroleum gas is also subsidized. India launched a green urban transport project in June 2010 to overcome pollution and other hazards of urban transport, including traffic congestion. Under a 2009 stimulus package, Japan is subsidizing the purchase of green consumer products, and providing rebates in the form of "eco-points." Similarly, Singapore has more than 30 funding and incentive schemes related to green buildings and transport, energy efficiency and waste reduction.



## Sustainable Logistics Is Increasingly Valued in Asia

As Asian countries continue to industrialize rapidly, associated carbon emissions will greatly increase. Thus, there is a growing need for climate-friendly solutions in Asia, especially in the area of transport and logistics. While there is still a long way to go in this regard, there are many positive signs in Asia to indicate that environmental responsibility is increasingly accompanying economic development.

Rising awareness of Asian consumers of green purchasing will prompt further sustainable practices by businesses. Asian governments are enacting laws to address environmental concerns and are giving financial incentives to stimulate the search for technologies and solutions. New institutions, such as the Sustainable Supply Chain Center Asia Pacific in Singapore, are examples of the growing focus on sustainability in logistics, which has come to be seen as a key industry in efforts to reduce the carbon intensity of Asian economies.



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## 4 Towards Sustainable Logistics – A Review of Conceptual and Operational Solutions

Until recently, cost and speed were the main criteria by which logistics operations were judged. As seen in the previous chapters, this is already changing. Now, a third dimension is included in the decision-making process: sustainability. But what kinds of solutions are at hand to reduce energy consumption, emissions and waste?

This chapter will introduce two types of solutions: at the conceptual level, holistic optimization solutions – some of them with far-reaching implications for business and society alike – are considered. At the operational level, innovative technologies for various transportation modes and solutions for warehouses are the focus.

### 4.1 Conceptual Solutions

Conceptual solutions – measures like the green design of distribution networks or optimized route management – are important strategies to reduce CO<sub>2</sub> emissions. The following section gives an overview and clusters them along a typical supply chain: sourcing, manufacturing and distribution.

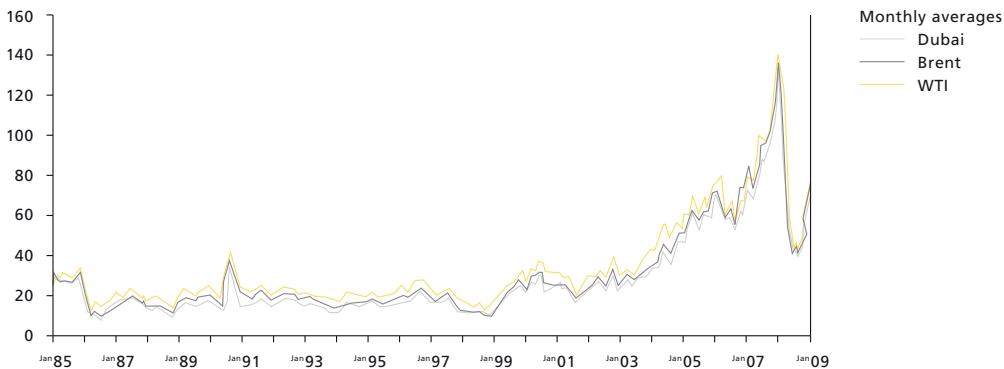
## Sourcing Strategies

Virtually no company is able to produce a product on its own, from start to finish. Every industry does some sort of sourcing. In the past, the main sourcing was for raw materials; today, however, companies source parts and components as well. For example, 75 % of an airplane is sourced, which means more than 6 million pieces have to be transported to the assembly point.

Therefore, sourcing is responsible for a relatively high proportion of carbon emissions, throughout the product lifecycle. And this share has increased with the new “global sourcing” trend. With new technologies making transport cheaper, a relatively constant fuel price in the 1980s and 1990s, and advances in technology enabling companies to manage a global network of business units and subcontractors, offshoring became more and more viable.

The “global” movement of goods reduced the total cost of the product, but it contributed towards an increase in carbon emissions and fuel demand. Experts predict that the critical variables to define future sourcing strategies (labor arbitrage, fuel prices and carbon cost) are evolving in conflicting directions. Although labor arbitrage is expected to continue, increasing demand for potentially scarcer oil leads to rising oil prices, changing the base-line of the original scenario significantly (IEA & OECD, 2009).

### PRICE DEVELOPMENT OF CRUDE OIL



**Fig.22** Prices in U.S. dollars/barrel [Source: © IEA & OECD, 2009; modified]

While the price of crude oil had been relatively stable for decades, it has now more than tripled within five years and this could lead to a shift in paradigm in sourcing strategies. In 2009, there was a fall in the oil price, but the EIA predicts an increase once again to \$95 per barrel by 2015 and \$133/barrel by 2035 (U.S. Energy Information Administration, 2010).

In 2008, Accenture showed the effect the increase in fuel prices has on the landed cost<sup>7</sup> for a casted part produced for an automotive manufacturer. In a two-year time horizon (2006–2008) in which the oil price had doubled, their example clearly shows that, for a Western European automotive company, near-shoring production to Eastern Europe would be more cost-effective than shipping parts from China.

Sourcing regionally not only has an economic impact, but an environmental one, too. Bringing goods that are available locally from the other side of the world, even if economically feasible, exerts a high environmental price. Should a price on carbon-emissions be introduced on a global level, the landed cost structure will change, shifting the balance towards regional sourcing even further.

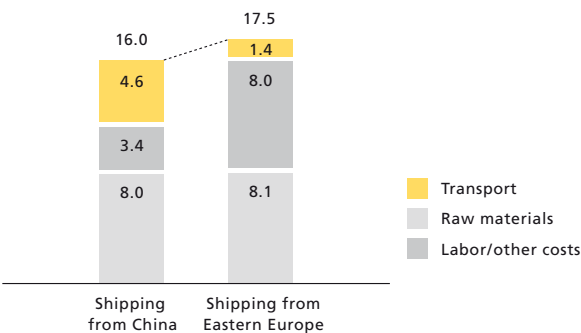
In the example above, for instance, sourcing from Eastern Europe instead of China could reduce the kilometers from 5000 to 700. However, the carbon reduction potential is lower than expected: the main mode of transportation used to bring goods from China is by ocean, whereas in Europe, the infrastructure is such that trucks are the chief mode. Since the carbon efficiency of road transport is much lower than that of ocean shipping, the savings in CO<sub>2</sub> emissions would only be 5 megatons. Nevertheless, for time-sensitive shipments brought from China by air, near-shoring could save 20 megatons of CO<sub>2</sub>.

IMPACT OF HIGHER OIL PRICES ON ECONOMICS OF OFF-SHORING

The effect of a 100% oil price increase between 2006 and 2008 on the total landed cost of a casted part produced for an automotive manufacturer

OIL PRICE OF 2006 (= 100 %)

Landed cost in Western Europe in €



Recommendation: source globally

OIL PRICE OF 2008 (= 200 %)

Landed cost in Western Europe in €



Recommendation: source regionally

Fig.23 [Source of data: Accenture, 2008]

<sup>7</sup> The landed cost is the total cost of purchasing, transporting, warehousing and distributing raw materials, semi-finished and finished goods.

## Manufacturing Strategies

There is also potential for the mass production of consumer goods to become greener. In lifecycle assessments, manufacturing tends to contribute around 25 % of total emissions (World Economic Forum, 2009). With regard to logistics, two aspects are relevant: forward stocking and packaging. There is also a trend for products to become smaller and lighter, which tends to facilitate handling and transportation.

### Forward Stocking

Thanks to the Internet, consumers nowadays can take more informed decisions regarding their purchases. To meet these more exacting demands, companies have to manufacture, transport and stock several variations of the same product. This implies bigger warehousing capabilities or airfreight to meet urgent demand for different product models. In order to cope with this challenge, one solution is to manufacture and transport the basic product and then customize it on demand, near the customer.

Forward stocking is used by some companies to save costs, as it aims to produce customized products at virtually the same level of efficiency as mass production. This solution also saves effort, and reduces stock and ton-kilometers, all of which have an impact on sustainability. A good example of this is the customization of Japanese cars in the port of Bremerhaven, where all customer options are fulfilled locally, such as leather upholstery, radio installation, paint color, sunroof, etc.

### Packaging Design

Most of the goods that we buy today are in some sort of packaging, whether food, electronics, shoes, medicine, etc. A total of 253 mt of packaging is used annually in the global consumer industry, out of which approximately half is paper and half is plastic. The production of this paper requires approximately 7 million trees. Sustainable packaging initiatives thus make a substantial contribution to carbon abatement across the supply chain.

The two main areas in which packaging is used also lead to different optimization potentials. In the distribution part, most packaging is required by regulation: either for safe transportation or labeling requirements. Thus, when looking for potential savings,

the focus should be on the manufacturing part, where significant CO<sub>2</sub> abatement can be achieved by eliminating packaging.

Techniques such as packaging elimination, light-weighting and the selection of alternative materials are already being implemented. By better consolidation in boxes and making packages smaller, less material is used. Furthermore, with smaller packages, increased utilization of loading units can be achieved, thereby reducing transportation and warehousing costs. Experts from the World Economic Forum estimate the potential savings to be up to 125 mt of CO<sub>2</sub> per year.

## **Distribution Strategies**

Since products are usually not produced where they are consumed, a distribution network has to be set up, in order for the goods to reach the final customer. Distribution strategies are mainly concerned with network design, geographical distribution of warehouses and transshipment points, as well as the modal mix – that is, the mode of transportation used to connect the nodes of the network, including warehouses and production sites. Optimization potential and sustainable logistics solutions will be described for both areas.

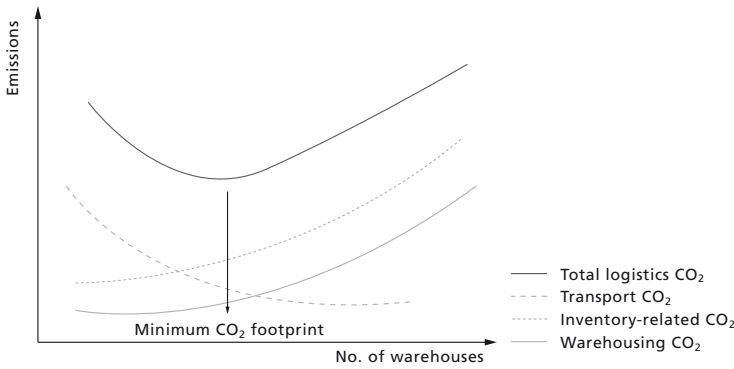
### **Network Design**

Most companies currently design their distribution networks based on cost and speed. However, these processes also have an influence on other factors, including carbon emissions. Optimizing a network design, including the nodes and interrelated transport flows, can reduce both costs and carbon emissions significantly. The problem today is that a lot of networks are inefficient due to change inertia and failure to factor sustainability into their design.

From a sustainability point of view, the design of a network faces two contradicting objectives: on the one hand, to have the lowest inventory and warehousing CO<sub>2</sub> emissions, while, on the other hand, to achieve the lowest transportation CO<sub>2</sub> emissions. This trade-off is illustrated in figure 24.

A common way to improve the sustainability of networks is for companies to come together and create consolidation centers and multi-user warehouses, which can improve the load factor of the transportation, while keeping the warehousing costs

## CO<sub>2</sub> TRADE-OFFS



**Fig. 24** [Source: McKinnon, 2010b]

to a minimum. Additional benefits are increased performance, shorter response time, and carbon emissions reduction.

In an effort to reduce congestion and carbon emissions, Heathrow airport contracted DHL to manage its consolidation center. The facility is based 2 km from the airport, where retailers deliver inbound goods. DHL cross-docks goods, manages a booking system and security screening process and delivers to both landside and airside stores. By consolidating 700 inbound deliveries a week into 300 outbound runs, the center achieves significant environmental and operational benefits. In 2008, a total of 218,000 km were saved through the consolidated deliveries of the DHL fleet, which amounted to 158,000 kg in fewer CO<sub>2</sub> emissions and a significant reduction in congestion.

## Modal Mix Strategy

When comparing between the different modes of transportation currently used, there is a wide spread between their CO<sub>2</sub> emissions per ton-km. As shown in Chapter 2, on average, an airplane emits 1.2 kg CO<sub>2</sub> per ton-km, whereas a ship emits less than 0.02 kg CO<sub>2</sub> per ton-km. This means that the emissions from ocean freight are about 1%–2% of that of an aircraft. Effective modal planning not only leads to a significant reduction in CO<sub>2</sub> emissions, but in other emissions, too, like NO<sub>x</sub>, as well as noise. Therefore, when considering which mode to employ and where, a more holistic view should be taken.



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## How Network Redesign Can Reduce CO<sub>2</sub> Emissions – A Case Study

*A worldwide top-10 pharmaceutical company needed help to optimize its distribution network across Europe. DHL Supply Chain Consulting supported the company in defining their new network strategy and carrying out a network redesign project to better fulfill their strategic requirements for the next 5–10 years.*

*The result of this study was a blueprint of the company's European supply chain, aligning customer service requirements, regulatory requirements, and future demand expectations with the company's production footprint. At the time of the study, this company had about 40 warehouse locations across Europe serving wholesalers (within 48–72 hours), pharmacies and hospitals (within 24 hours). Products were produced in two active ingredients plants and five finished products plants in Europe.*

*From the start, the study's objectives were not just to reduce costs, but also CO<sub>2</sub> emissions. These needed to be achieved without negatively impacting customer service levels. The scope of the study focused on the number and location of warehouses, the areas served by these warehouses, lead times for different customer groups, and mode of transport.*

*As a result of the study, the final blueprint of this pharmaceutical company's supply chain called for 10–15 warehouses, of which some would serve several countries. This number could not be further reduced – either due to country-specific regulations requiring the distribution of pharmaceutical goods from*

*a warehouse within the same country, or because the shipment profile and lead time requirements made a local distribution center indispensable.*

*The blueprint called for closing some warehouses, realigning the areas served by existing warehouses, as well as opening new warehouses at strategic locations to better serve customer requirements from a pan-European perspective. The opening of an additional warehouse in Eastern Europe clearly showed that the focus was not just on reducing warehouses, but also on reducing CO<sub>2</sub>, because this market was previously served from a location in Western Europe – by air, in order to meet service level requirements.*

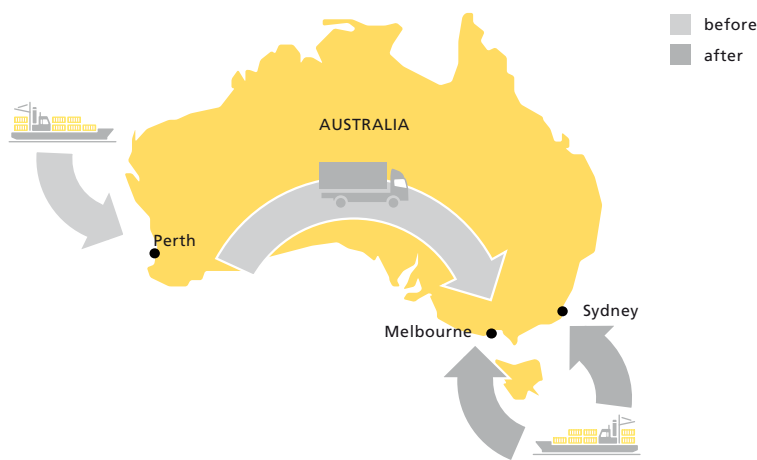
*Simply by shifting from air transport to road transport showed CO<sub>2</sub> reduction opportunities of about 40 %. However, by introducing a warehouse in the region, CO<sub>2</sub> emissions could be further reduced by over 50 %, due to optimized and consolidated replenishment flows and shorter last mile deliveries. Since the CO<sub>2</sub> reduction opportunities in the other areas were lower, the overall CO<sub>2</sub> reduction in Europe is estimated to be around 15 %. Additionally, cost savings of around 20 %–30 % (depending on the region) were also realized.*

*This case study demonstrates how both cost and CO<sub>2</sub> levels can be lowered through network redesign and optimization, including strategically positioning warehouses and inventories in the areas served.*

### Customer Best Practice: HP Australia

*Working with DHL, HP Australia has cut its carbon emissions by 41% (2,600 metric tons of CO<sub>2</sub>) by relocating its switching centers and changing transportation modes. The switching center was moved from Perth to Sydney, removing the need for overland transport. Also, a new switching center in Melbourne was established, which allows for deliveries directly to HP's largest customers*

*on-site instead of offloading everything in Sydney. Richard Bailey, Vice President of HP, South Pacific, underlines that: "The new supply chain model has saved over 2,600 metric tons of CO<sub>2</sub> emitted by HP Australia over the last year, which equates to 21.6 acres of forest preserved from deforestation, or 66,666 trees grown for ten years from seedlings."*



**Fig.25** HP AUSTRALIA REPLACES OVERLAND TRANSPORT BY SHIPPING

Traditionally, two main factors are considered in mode selection: cost and speed. With the increasing awareness of carbon emissions, sustainability is likely to become the third pillar in this decision-making process. This does not mean, however, that the other dimensions will become less important. Consumers will still expect their online orders to arrive in a few days – even if they were purchased in a different country. Similarly, in the fashion industry, because the cycle of fashion products is getting ever-shorter, new products cannot take several weeks in transit on the ocean, since they have to be in the store within days.

FACTORS IN MODE SELECTION

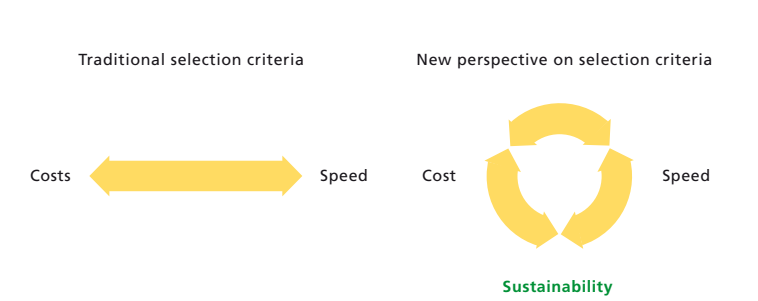


Fig.26

Each mode of transportation has different characteristics, which impact the decision process. For example, air transport is very fast, but expensive and causes comparably high emissions. Sea transport is the most carbon-efficient mode of transportation, as well as the cheapest, but is slower.

CHARACTERISTICS OF TRANSPORTATION MODES








		Cost	Speed	CO <sub>2</sub> Efficiency
	Air	Expensive	Fast	Low
	Road			
	Rail			
	Sea	Cheap	Slow	High

Fig.27

Figure 27 illustrates the characteristics of each mode of transportation, accounting for cost, speed and CO<sub>2</sub> efficiency.

Even on a regional level, a number of possibilities are feasible, such as a shift from air to road or from road to rail, and within cities, tram lines could be used for last mile distribution. However, there are limits, such as less flexibility when moving goods by train.

For intercontinental transport, there is also great potential for carbon emissions reduction through modal switch. Classic options are to change from air to ship or to have a mix of both transportation routes. The rail link, in particular, is often discussed as a revitalized option for certain intercontinental routes and products, as it is faster than a ship, as well as cheaper and more sustainable than air.

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### Customer Best Practice: Bosch Siemens Germany

*As part of its contract with Bosch Siemens Hausgeräte GmbH (BSH) for domestic sea freight logistics, DHL Global Forwarding shifts around 13,000 TEUs (Twenty-Foot Equivalent Unit containers) from road to rail each year, which saves using 120 trucks from the BSH facility to the harbor. The DHL rail service reduces CO<sub>2</sub> emissions by up to 70 % and maintains competitive transport times, without compromising other transport parameters.*

*As Hans-Gerd Bauerfeind, Director of Logistics at Bosch Siemens Hausgeräte, puts it: “We can transport our products in a much more environmentally-friendly way using the rail service rather than truck transport, without increased transit time. We also have more flexibility as a result of the good arrival and departure times, and are able to schedule shipments at even shorter notice. This is an ideal basis for sustained business in the future.”*

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The rail link connecting China and Europe, opened in January 2008, between Beijing and Hamburg, is an important step in this direction. The journey of more than 10,000 km passes through six countries and takes about 15 days, which is half the duration by sea. However attractive this intercontinental rail link is, though, several challenges have to be taken into account: gauge systems, transshipment time, regulation, security and customs. For example, more than ten different gauge dimensions are used around the world.

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## Customer Best Practice: Fujitsu Japan

*“To contribute to the sustainable development of society and to achieve the top-level industry target of reducing transport emissions, we aim to build an advanced green logistics model utilizing our various IT capabilities together with DHL, the leading logistics company,” says Akira Motomiya, President, Corporate Logistics Unit, Fujitsu.*

*DHL Supply Chain Japan implemented a number of supply chain optimization measures for Fujitsu, such as a shift from road to rail*

*transportation, and the practice of 3R (“Reduce, Reuse, Recycle”) for packaging materials. With the joint Green Logistics Partnership Promotion Project, Fujitsu successfully reduced carbon emissions by 20 %, or over 300 tons each year, and aims to reach a 40 % reduction overall in 2010, by carefully controlling the allocation of vehicles throughout the supply chain, from source to delivery. The leadership shown by the partners involved led to a Green Logistics Award by the Japanese Ministry of Economy, Trade and Industry.*

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## Route Management

The vast majority of overland transport is currently done by road. Routing and scheduling all these vehicles is a highly complex process. Optimization of transportation routes not only leads to significant cost savings, but also protects the environment. Logistics companies have developed dynamic vehicle routing software, which, compared to earlier routing systems, considers real-time information and adjusts the routes.

One example is the Smart Truck, which Deutsche Post DHL is currently trialling in Berlin for express parcel deliveries. The main role of this system is to ensure that vehicles do not travel more kilometers than necessary. The system replaces static route planning with dynamic tour planning, which integrates up-to-date traffic data, has SMS notifications for pick-ups and driver positioning.

A dynamic routing planning system calculates the most efficient delivery route, managing traffic jams, detours and instant orders, and enables couriers to meet on their rounds to exchange shipments and speed up delivery. The route can be adjusted according to traffic data and new orders that appear throughout the day. As a result, a higher productivity of tours can be achieved with a significant reduction in kilometers and CO<sub>2</sub> emissions, along with improved service quality, better visibility and proactive intervention. The Smart Truck system is estimated to reduce CO<sub>2</sub> emissions of express deliveries by around 10 % – 15 %.

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## ***Current Challenges in Implementing CO<sub>2</sub> Strategies – A Snapshot from the Front Lines of CO<sub>2</sub> Reduction***

*by Sander van den Berg*

DHL Supply Chain Consulting has been involved in many initiatives regarding CO<sub>2</sub> reduction for customers, internally and externally. The final results of these projects have been mixed. While, in almost all cases, opportunities for CO<sub>2</sub> reduction could be proven, many CO<sub>2</sub> reduction initiatives never saw the light of day, since the hurdles to implement them were perceived as too great. Why? Let me highlight five reasons:

1. Of course, there was the recent economic crisis. This is definitely the No. 1 reason why CO<sub>2</sub> reduction initiatives have lost momentum. While some companies might have used it as a very welcome excuse, many companies were and still are focusing on surviving the economic crisis. They need to keep their head above water so they are focusing purely on cost reductions, instead of looking at CO<sub>2</sub> reductions at the same time. This would add complexity and therefore distract from their focus on “real” cost reductions.
2. Cash is king and therefore there is no focus on investments with longer pay-back periods. Again, due to the economic crisis, many companies ran out of cash or had to be very careful regarding their investment policies. As long as CO<sub>2</sub> reductions do not have an immediate payoff, they will not become part of the short-term investment policy in years of economic distress.
3. When you are fighting for survival you become very internally focused, whereas collaboration would usually be the better strategy. This means collaboration between companies, internally between different business units, and externally with suppliers and customers. Surviving companies mainly look at what is good for them, what they can influence themselves and what lowers their cost base immediately. CO<sub>2</sub> reduction initiatives can deliver the most value when done in collaboration with internal and external supply chain partners, and this is usually perceived as taking too long.
4. In many companies, sustainability is managed within departments and not across departments or even across supply chains. There are hardly any structures in place to accommodate true collaboration between departments and business units of a company, let alone across companies within a supply chain. Corporate Strategy, Communications and Marketing & Sales see the value of being perceived as a “green company” and have accepted targets to increase this, but the departments that need to make it happen are still managed through separate cost and service level Key Performance Indicators (KPIs).  
The result is a lack of internal cooperation, since it does not benefit all parties equally – even though the company as a whole benefits hugely. Also, across companies, suppliers are talking to Procure-

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ment and customers are talking to Sales. These departments hardly have the same objectives, thus blocking true collaboration and failing to realize the true value of the supply chain.

Similarly, logistics service providers are in many cases talking to the wrong departments within the customer company. Procurement's main focus is cost reduction, not collaboration or cutting CO<sub>2</sub> emissions. As long as CO<sub>2</sub> reduction targets are managed separately per department, the only CO<sub>2</sub> reductions delivered are the tip of the iceberg. The real potential stays underwater and out of sight.

5. While there may be a certain social pressure for change, the necessary perceived urgency is lacking. There will be no urgency so long as there is no cost attached to CO<sub>2</sub> emissions (via tax, ETS and/or quotas), unless there is a clear macro-economic policy in place. As long as there is no legislation and no commonly agreed targets or calculation

methods, companies will use this excuse to wait until these are in place.

As long as the internal pressure for cost reductions is greater than the pressure for CO<sub>2</sub> reductions, departments will focus all of their efforts on reducing costs, as resources are not available for doing both. CO<sub>2</sub> reductions will have to be supported from corporate sustainability departments. As these are relatively young departments within all companies, these still need to earn their place within the decision process.

Notwithstanding the above, many cost reduction initiatives bring CO<sub>2</sub> reductions as well. In many cases, these CO<sub>2</sub> reductions were calculated afterwards to demonstrate that the cost savings initiatives were also good for the environment. In this way, however, companies lose even greater opportunities to reduce CO<sub>2</sub>, as studies have shown that much more CO<sub>2</sub> reductions can be achieved without moving too far away from the cost optimum.



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## Capacity Management

One of the problems faced today in the logistics industry is the underutilization of assets, including trucks, trains and containers. Around 25 % of truck kilometers in the EU are running empty (Eurostat, 2007). Empty journeys are not only wasteful economically, but also carry an environmental cost. This means that, out of the 1,620 mt of truck emissions in Europe, 405 mt are in vain (World Economic Forum, 2009).

In 2008, DHL Freight Euronet in Germany concluded that 10 % of all empty kilometers are empty swap bodies. In 2009, DHL launched an initiative to reduce these empty kilometers and the resulting CO<sub>2</sub> emissions. This was done by defining clear responsibilities to increase backloads, training dispatchers to optimize capacity utilization and installing a real-time information tool to monitor vehicle availability. As a result, there were 7,000 fewer empty runs and the CO<sub>2</sub> efficiency improved from 100 to 70 g CO<sub>2</sub> per revenue ton kilometer.

Increasing the load factor of trucks is an attractive way to achieve more sustainability, as it not only improves the carbon footprint, but is also very appealing from an economic perspective. As there is no rule of thumb for the best truck utilization strategy, companies face tradeoffs when minimizing the total logistics cost: longer loading and consolidation time versus higher loads.

Sustainability and the carbon footprint have to be considered in this decision process, thus tipping the balance towards more efficient truck utilization. Other legislative measures, such as vehicle taxation, road usage charges, congestion charges, and carbon taxes, will further push companies to increase their vehicle utilization levels and reduce cost per unit. (Given that congestion is caused primarily by private vehicles, these should also be integrated into road usage charges or congestion pricing schemes in order to reach an overall positive effect.)

The reasons behind empty trucking are diverse: poor coordination of purchasing, sales and logistics, demand fluctuations, unreliable delivery schedules, vehicle size and weight restrictions, incompatibility of vehicles and products, goods-handling requirements, just-in-time deliveries, and regulations (e. g., cabotage restrictions in Europe, which oblige trucks to run empty cross-border after providing services in a neighboring EU member state), among others. While increases in fuel prices are forcing companies to give greater priority to vehicle utilization, there is a limit to how much an



individual company can do to improve its utilization. Collaboration, both between competitors and members of the same supply chain, will lead to mutual benefits.

Higher capacity utilization can also be achieved in the “last mile,” when delivering to homes and commercial premises. Not only are unsuccessful deliveries time-consuming, expensive and inconvenient, they also have a detrimental effect on the environment (Webster, 2007). The solution to this problem is to have an automatic reception box, where the carrier can plan an almost “failure-free” delivery, independent of the customers’ presence. This solution allows for greater control of the schedule and capacities, while reducing time, cost and carbon emissions. This concept is now widely used in countries like the UK, the Netherlands, Japan, and Austria.

A prominent example is the DHL Packstation, which was introduced in Germany in 2002. It allows customers to receive their packages at a secure station, normally located at popular spots, like train stations, which they can access 24/7. In this way, the delivery system does not depend on the availability of the customer and can reduce the kilometers spent trying to deliver to unavailable customers. Currently, there are some 2,500 Packstations in Germany, with 1.5 million users. The savings from such an initiative can be significant: in 2005 alone, the network of 33 Packstations throughout the German city of Cologne helped reduce the total driving distance required to deliver items by over 40,000 km and CO<sub>2</sub> emissions by 11 tons.

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## How Sustainable Logistics Solutions and Technologies Have Helped Walmart Become More Efficient

*Walmart is the world's largest retailer in sales (\$405 billion in revenue in 2010), with more than 2.1 million employees worldwide. Recently, the company was voted No. 1 for Retail and among the top 10 in all industries on both Fast Company magazine's "The World's Most Innovative Companies 2010" and Fortune magazine's "World's Most Admired Companies 2010" lists. This was due to the company's commitment to sustainability, corporate philanthropy and employment opportunity.*

*The importance Walmart attaches to these topics can be seen in the ambitious environmental target the company pursues. As part of its sustainability efforts, the retailer set out three main goals: to be supplied 100 % by renewable energy; to create zero waste; to sell products that sustain people and the environment.*

*To realize these essential targets Walmart defined a variety of initiatives, including sustainable sourcing practices, energy efficiency, renewable energy, waste reduction, and lifecycle management, in different areas of activity. While some of the initiatives are testing which approaches are more effective for the company, others have already proven to be effective and profitable.*

*Given the fact that Walmart operates one of the largest private trucking fleets in the U.S. and the UK, many of the sustainability initia-*

*tives address the efficiency of the fleet and distribution. Back in 2005, the company defined concrete and measurable fleet efficiency goals for the U.S. to be achieved by 2008 (25 % efficiency increase) and 2015 (100%), respectively. To achieve these goals, Walmart focuses on sustainable logistics solutions and innovative technologies.*

### **Sustainable Solutions**

*As to the solutions, some tactical decisions were taken. Routing and load factor were identified as two of the major sustainability improvement levers. By increasing the load per truck, the total number of vehicles needed could be reduced and the number of empty truck miles decreased. From 2008–2009, Walmart decreased its miles per driver by over 7 % while delivering almost 1.5 % more cases. This decrease in miles driven combined with improved truck technologies helped Walmart avoid emitting over 180,000 metric tons of CO<sub>2</sub> emissions in 2009 and save \$170 million.*

*Furthermore, the company's affiliate in the UK, ASDA, made further achievements by increasing the flexibility of the distribution systems, thus saving 8 million trucking miles in 2008. On the one hand, backhauls were increased, so trucks that usually traveled back empty from the store to the distribution*

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center could be used by suppliers for direct deliveries to their distribution centers. On the other hand, more suppliers could make use of fronthauls, by filling their residual capacity with ASDA goods, if they were heading in the same direction.

Moreover, solutions to increase the operational efficiency were added and the existing infrastructure was upgraded. Thus, the distribution centers were provided with retrofitting equipment, such as more efficient light bulbs and Energy Demand Monitoring Systems that turn off lights and equipment when not in use. Similarly, systems adapt cooling to the actual stock of perishable foods and enhance energy efficiency by separating cooled areas by automatic rapid doors. In addition, some distribution centers already run partly on renewable energy. Since 2007, Walmart has opened several high-efficiency stores that use 20%–45% less energy than a typical Supercenter.

### **Continued Efforts**

The technological innovations mainly focused on the actual vehicles circulating between suppliers and distribution centers. Walmart added several new technologies into its fleet to determine their potential to reduce emissions. The company is also testing a number of new technologies to see whether they are viable

for business and provide return on investment. The different measures ranged from installing fuel-saving technologies on trucks, to running routes with aerodynamic trucks, to using vehicles that run on alternative fuel sources, as well as different types of hybrid vehicles. In addition, the initiatives were expanded to the passenger cars the company makes available to its associates.

By the end of 2009, Walmart had managed to increase the efficiency of its U.S. fleet by 60%. Nevertheless, Walmart continues to make further efforts and, thus, has extended its sustainability program to its logistics suppliers. Last year, Walmart announced plans to develop a worldwide sustainable product index. The effort includes supplier assessments, the creation of a lifecycle analysis database and a simple tool to help consumers make more sustainable choices through product labeling.

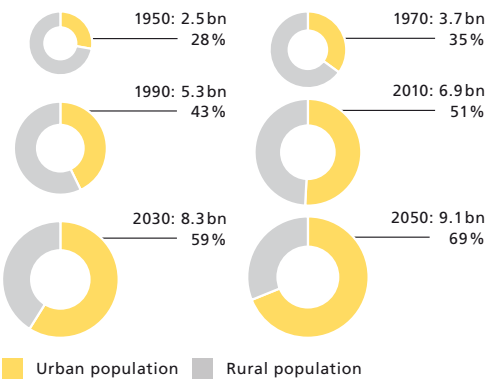
*“The sustainability product index will bring about a more transparent supply chain, drive product innovation and, ultimately, provide consumers with the information they need to assess the sustainability of products. If retailers work together with suppliers and logistics suppliers, we can create a new retail standard for the 21<sup>st</sup> century.”*

Mike Duke, President and Chief Executive Officer, Walmart Stores, Inc.

**City Logistics – Distribution Within Growing Urban Areas**  
by Petra Kiwitt

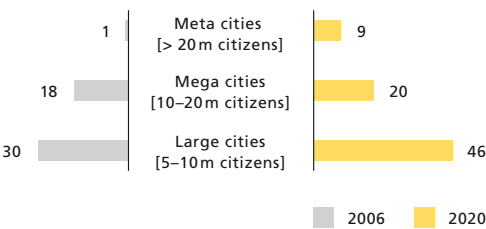
Since the 1950s, urbanization has been increasing rapidly and continues to do so. For the first time ever, in 2007 more people lived in urban areas than in rural regions (see figure 28).

**INCREASING URBANIZATION**



**Fig. 28** [Sources of data: United Nations, 2009; United Nations, 2010]

**DEVELOPMENT OF LARGE CITIES**



**Fig. 29** [Source of data: United Nations, 2010]

The number of cities with more than 5 m citizens is expected to increase from 49 in 2006 to 75 in 2020 – especially in Asia and Africa (see figure 29).

These city conglomerates are faced with severe challenges that are linked to logistics:

- Lack of appropriate transportation infrastructure leading to massive traffic congestion – for example, the average speed in London’s city center before the congestion charge was around 15 km/h – even horse-drawn carriages at the beginning of the 19<sup>th</sup> century were faster
- Shortage of (affordable) space leading to urban sprawl, which means that passenger as well as freight transport has to cover more and more kilometers
- Increase in pollution from various activities, with transport as an important source of emissions

This also leads to major challenges faced by businesses:

- Low service levels and supply chain reliability in central city areas (e.g., low percentage of on-time delivery)
- High on-site storage requirements, resulting in suboptimal utilization of space and significant capital investment
- Higher city complexity and customer demands result in an increase in supply chain and logistics cost
- The growth of e-commerce is also an important factor contributing to challenges for cities, while also offering opportunities, such as reducing congestion

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through less individual shopping by car; however, logistics companies need to manage the resulting volume growth in deliveries

Therefore, there is an urgent need for more sustainable development of cities in order to cope with these challenges and to achieve a better quality of life. This requires a comprehensive concept, which addresses the social, economic and ecological needs of metropolitan areas.

In recent years, several local municipalities introduced measures to reduce and/or improve inner-city transport through restrictions, taxes, incentives or comprehensive planning. Examples include environmental zones with restricted access for high-pollution vehicles in Germany, the congestion charge in London, or the traffic master plans in Dubai.

Logistics providers have a particular responsibility and interest in increasing the efficiency of inner-city transportation, reducing congestion and pollution, and thereby increasing quality of life within cities.

City logistics is the optimization of flows of goods within and into urban conglomerates by leveraging existing public infrastructure. The concept aims to reduce the total economic cost of urban goods movement. The most important city logistics solutions are described below.

### **Using Alternative Infrastructure to Road Transportation**

Alternatives to freight transportation by truck could include using the existing streetcar and subway infrastructure with light rail delivery (see the section on automatic tunnel delivery on page 118, as well). Major barriers include the huge investment costs, especially within existing city structures (even if already existing underground infrastructure is used). However, when these kinds of systems are included from scratch within the development of completely new cities (like in Asia), the required investment is significantly lower. Better management of existing transportation is a much more feasible option, in the end.

### **Urban Consolidation Center**

Urban Consolidation Centers (UCCs) consolidate freight transport of different industries and business owners outside the city center to maximize the utilization of vehicles, thereby reducing the amount of inner-city goods transport. Two different options are possible:

- Several shipments are consolidated into one delivery to a single customer (e.g., a hospital)
- Several shipments are consolidated into one delivery for several customers (e.g., different shops in a shopping street)

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The UCC concept focuses on four key sectors: consumer/retail, hospitals, hotels and the public sector (e.g., airports).

One example of a UCC in action is the Heathrow Consolidation Center in the UK (see p. 86 above). Further examples exist in Stockholm and London, as well as UCCs planned in Dubai, Kuala Lumpur, and Istanbul.

### Service Point 24/7

To a large extent due to the growth of e-commerce in recent years, the demand for parcel delivery has increased significantly and continues to do so. Retail (B2C) e-commerce sales are expected to more than double in India and China between 2006 and 2011; in the same timeframe, these sales are even expected to triple in Europe. One possible solution is pick-up and drop-off points for documents and parcels located at central locations like metro stations and malls. The *DHL Packstation* – see page 95 above – is one example of such a service point that is available 24/7. Currently, the *DHL Packstation* is mainly used in Germany, but there is also a pilot ongoing in Dubai, and other countries are considering this solution, too.

A more futuristic solution to cope with the increase in parcel deliveries is the *Bring Buddy* concept – envisaged by Deutsche Post DHL (see p. 101).

### Night Transportation

Another solution is to shift freight transport to nighttime, when there is less traffic. A major barrier is the fact that stores are closed at night, so there is no one to

receive the delivery. This could be overcome by giving full access to store premises to logistics providers, having specialized delivery points within the stores, or having security personnel receive the deliveries. In China, DHL staff already have access to *Starbucks* stores to deliver supplies directly into the selling floor at night.

A second barrier is the noise due to the traffic, as well as the unloading. These problems could be overcome by using vehicles that are quieter than conventional trucks, such as electric vehicles, for delivery, as well as low noise forklifts to reduce the noise of unloading.

### Technological Improvements to Reduce CO<sub>2</sub> Emissions

In addition to measures to reduce traffic like those described above, emissions and noise can also be reduced within cities by using the most efficient vehicle generation for inner-city transport (see page 107 ff.). In addition, more efficient warehouses can contribute to a reduction in inner-city CO<sub>2</sub> emissions from the logistics sector, as well (see page 122 ff.).

Although some of the measures described above could be implemented by individual customers or logistics providers, the topic of city logistics is a prime example of the need for strong collaboration and upfront dialogue between customers of logistics services, retailers, governmental authorities, local administrations and logistics providers. As the example of UCCs shows, dedicated monopolies could even be the most effective way to reduce freight transport within cities, although this would most probably spark intense debate in many countries.

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## Bring Buddy

*The bring buddy concept is a way to reduce inner-city traffic by combining everyday movement of people with freight transportation. The idea is to have people who are already moving across the city pick-up and deliver parcels on their way. This would make additional delivery vehicles superfluous, reducing congestion and CO<sub>2</sub> emissions in inner-city areas.*

*The concept would be integrated into the international network of logistics service providers. Parcels sent from outside the city would be handed over to bring buddies for transport within the city. Here is how it would work:*

- *The bring buddy looks up online, via their personal profile, which parcels need to be delivered on their way, from nearby Packstations to destinations they will be passing by. The bring buddy decides which ones to take and gets the corresponding retrieval codes on their mobile phone.*
- *The bring buddy picks up the parcel at the indicated Packstation using the code on the phone. Some bring buddies might pick up a parcel at other locations (e.g., a bar, or at somebody's home, etc.), since bring buddies can also take a parcel just part way to its destination, or exchange parcels with another bring buddy en route.*
- *The bring buddy takes the parcel along on their usual way to the office, shopping center, jogging route, etc.*
- *The parcel may be handed over at a designated location to another bring buddy who then takes over the last mile delivery. In order to take over the parcel, a corresponding code is required on their mobile phone.*

*With this procedure, the track and trace system recognizes that the new bring buddy is now in charge of the parcel.*

- *As they pass the parcel's destination, the bring buddy delivers the parcel. The bring buddy can identify the addressee since they have the corresponding code on their mobile phone, thus ensuring that the parcel is delivered to the right person.*

*This concept could only work if urban citizens were willing to participate. To motivate them to do so, they could collect reward points on their online profile and compete with others via rankings of the fastest and most active bring buddies. In this way, social networks would become real networks.*

*The logistics companies would be in charge of organizing the deliveries, monitoring their transport and administering the network of bring buddies. They would have to make sure that bring buddies did not have to face long detours in order to combine their own activities with parcel delivery. Otherwise, the concept's full potential of carbon reduction could not be achieved, because delivery times would be long and no one would be willing to become a bring buddy.*

*Given that the privacy of correspondence must not be violated and correct delivery ensured, logistics service providers would need to supervise the transactions. Supervision and track and trace could be done by using mobile phones as an information and documentation tool. Nevertheless, legal questions of security and liability would still need to be resolved before the concept could be realized.*

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Further challenges include the huge investment costs of some of these proposed solutions, such as new underground transportation systems, while even the creation of UCCs would incur major costs. Because of the variety of stakeholders and the com-

plexity involved in a comprehensive city logistics approach, there would likely be long lead times before any environmental, economic, or societal benefits would be apparent.



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### **How Sustainability Will Foster a More Collaborative Logistics Business** *by Professor Dr.-Ing. Frank Straube and Dr. Stefan Doch*

Environmental sustainability in mobility and logistics is increasingly at the top of political and social agendas. To support uptake of sustainable practices in the economy, governments and NGOs are working on core issues, such as environmental trading schemes and price regulations in transport. This also includes areas such as the standardization of measurement and accounting standards for logistics emissions, as well as standardized labeling and carbon footprint concepts for products.

While some companies are following a passive, wait-and-see sustainability strategy, most companies – especially large multinationals – already have sustainability initiatives in place. In general, there are two approaches taken by these companies to focus and systematize their initiatives – the bottom-line focus and the holistic focus.

#### **The Bottom-Line**

The first approach is to bring the corporate sustainability strategy to the bottom-line of supply chain operations. The steps for this process include:

- Detailed measurement of current emissions levels
- Identification of potential ecological optimization techniques

- Quantification of these techniques through appropriate performance indicators of eco-efficiency
- Definition of objectives and guidelines for logistics planning and supply chain design to realize the potential of these techniques

One barrier to this process is the availability of appropriate measurement concepts supporting a systematic and detailed calculation of the emissions levels from logistics processes. Nevertheless, solutions like the Deutsche Post DHL *GoGreen* emissions calculation – providing customers transparency on emissions from the various transport modes – or Deutsche Bahn's *EcoTransIT* – providing support in modal shift decisions – are good examples of decision support systems for certain logistics configurations.

Similarly, TU Berlin's and ITCL's "Green Logistics Assessment" methodology supports the detailed analysis of the ecological effects of logistics processes in different supply and distribution systems (e.g., Just-in-Sequence, Just-in-Time, Milk-run, direct supply), ordering processes (e.g., delivery frequency and planning accuracy), and supply chain designs (e.g., sourcing strategies and production footprints). Only by developing and applying such process oriented measurement methods will companies be able to identify and implement ecological improvements in their logistics

processes that go beyond obvious improvements, such as modal shift, and eco-efficient vehicle fleets.

The Holistic View

The second approach takes a holistic view of ecological supply chain practices. This approach takes into account various areas of activity, internal and external partners, and the relationships between emissions levels, cost and service quality.

Besides the optimization of the operational processes per se, a major emphasis should be put on the underlying planning and administrative processes. This is because environmental inefficiency is mainly a consequence of inaccurate demand and capacity forecasting, as well as poor planning in the customer order and procurement processes. High-quality planning leads to stable logistics operations, thereby creating greater potential for eco-efficiency measures, such as increasing the load factor and modal shifts.

While many companies are already far along in terms of integrating environmental improvements, collaboration initiatives are only just beginning to evolve. Basically, the idea of collaboration in the area of environmental sustainability follows on from the successful concept of total cost orientation. By allowing a cost disadvantage in one area, major cost savings could be realized in other corporate functions and, thereby, the total costs of the internal and external supply chain can be optimized. In the same way, corporate environmental performance should be viewed from the level of the total emissions of a company's supply chain. For example, a product design change leading to higher production-related emissions could significantly decrease transport-related emissions due to weight savings or value density increases.

The same applies when we include supplier, customer and service provider relations. In order to evaluate and optimize total emissions of supply and distribution networks, a holistic view should be taken that

AREAS AND SUCCESS FACTORS OF COOPERATION

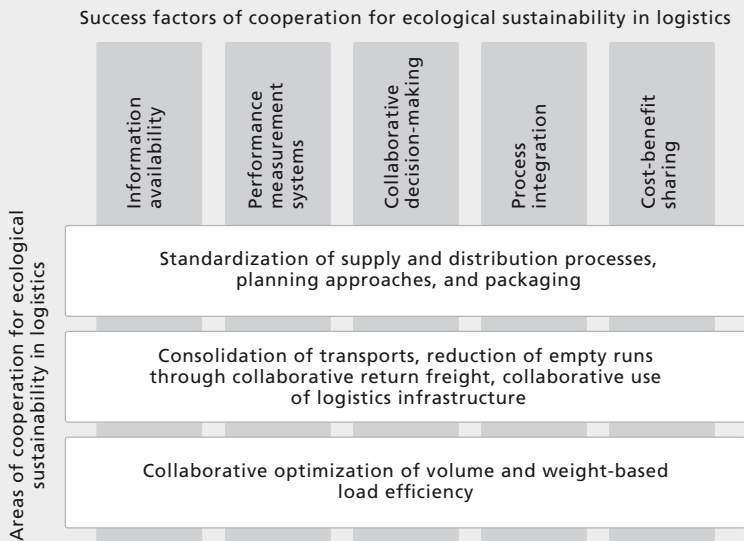


Fig.30 [Source: TU Berlin and International Transfer Center for Logistics]

integrates different configurations of the supply chain networks. For instance, the optimization of an isolated distribution activity of a supplier could lead to a sub-optimal solution regarding potential load factors and distance reduction. A more sustainable solution could be realized if the purchasing company takes a more integrated view, consolidating different supplier flows through the deployment of respective transport concepts. This will depend heavily on the supplier-customer structure in terms of who is delivering the critical volume to the logistics network.

### A New Impetus for Cooperation

The increasing importance of environmental sustainability in logistics will enhance the role of logistics service providers as a transport and network optimization partner within supply and distribution systems. However, a main barrier to fully realizing synergies by using service provider networks that are managed neutrally is the heterogeneity of loading

equipment, delivery frequency, transport concepts, data standards, and so on, as a result of individual customer requirements. From this background, standardization initiatives should be fostered by collaborative approaches between supply chain partners (see figure 30).

In this context, ecological sustainability becomes one of the driving forces for a more cooperative business environment in terms of vertical cooperation between customers, suppliers and service providers, as well as horizontal cooperation between industrial companies. While the cost efficiency potential of horizontal cooperation has been known for a long time, its implementation has not been successful due to communication, mutual trust, and cost-benefit sharing issues. Sustainability can be a new driver to overcome these barriers as a starting point for cooperative initiatives.



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## 4.2 Operational Solutions

While changes such as the redesign of distribution networks, the optimization of transportation modes or the implementation of city logistics concepts can notably improve the CO<sub>2</sub> footprint of logistics, the industry will not become a low carbon sector without operational changes, especially without adopting new, more efficient technologies. Two key focal points for CO<sub>2</sub> reductions in operations are how goods are forwarded and how they are stored – that is, transportation vehicles and warehouses. In addition, employee involvement also plays an important role.

### Road Freight

To be clear right from the start: today, there are no ground-breaking, market-ready technologies that will revolutionize the transport sector by eliminating overall well-to-wheel emissions. Nevertheless, by combining evolutionary technologies already in use or close to market maturity, significant CO<sub>2</sub> reductions can be achieved. By far the biggest chunk of those technologies concern road transport, which is why this section is particularly rich in detail.

## Hybrid Vehicles

Hybrid electric vehicles combine a conventional engine with a high-voltage electric motor supporting the performance of the combustion engine. The energy storage for the electric motor is recharged by the combustion engine. Currently, there are three main mechanisms through which hybrids reduce fuel consumption:

- Firstly, during idle or low output, the internal combustion engine is turned off; the electric motor can then be used as the sole source of propulsion at low speeds, such as in urban areas with stop-and-go traffic
- Secondly, a regenerative braking system recovers the kinetic energy that is usually dissipated as heat when braking; the recaptured energy recharges the energy storage system
- Thirdly, the internal combustion engine is reduced in size and power and can run at the optimal engine operation point due to the additional energy from the electric motor, which decreases inefficiencies from under-utilization

In logistics, hybrid powertrain systems are particularly suitable for smaller trucks (7.5–12 tons) in urban traffic with many stops and low average daily mileage. In this application, the expected energy efficiency gain of 15 %–25 % is much higher compared to a gain of only 2 %–6 % for linehaul traffic or heavy-duty trucks on high daily mileage routes.

Due to the considerable fuel savings and the relatively low capital expenditure, hybrid systems are expected to have a positive financial impact, under the conditions of mass production. Prototypes are available and should reach market maturity during 2010, and their use in logistics is expected to increase for mail and express services by 2014.

In contrast, unlike small trucks, hybrid electric vans are less likely to reach profitability. This is because only limited prototypes are available so far, while the potential for fuel savings is smaller due to the lower total fuel consumption of vans and limited average annual mileage, amounting to less than 12,000 kilometers.

Deutsche Post DHL has been running small truck (7.5–12 tons) pilot programs with Daimler in suburban and rural areas over the last two years already and the company is now considering similar pilot projects in urban areas. Furthermore, DHL and Volvo are partnering in a two-year trial of the world's first 18-ton

hybrid distribution truck. The vehicle, which will initially be operated in and around London, is expected to achieve up to 15 % in fuel savings.

## Electric Vehicles

Electric vehicles will probably have a major impact on the logistics industry. First of all, they will increase the potential for nighttime deliveries within cities, since noise becomes less of an issue. On a more systemic level, this will flatten the infrastructure usage between days (when congestion is a major issue) and nights (when most roads are empty). Additionally, the large fleets of electric vehicles run by logistics companies are strong candidates to become a major part of any future smart grid: the batteries would be charged during periods of low demand (e.g., nighttime) or high supply phases (e.g., strong and steady wind) of electricity. If there were high demand but low supply of energy, the vehicles would serve as a source of energy (as long as they are not running at the same time). Thus, the logistics industry would not only be a supplier of logistics services but also become a part of a country's intelligent energy infrastructure.

Electric powertrains not only have the potential to end the transport sector's dependency on fossil fuels, but they also have the advantage of no local NO<sub>x</sub> or particle emissions. However, the main hurdle to large-scale adoption of electric vehicles for logistics companies is the high initial investment, as ownership costs, as of today, are typically twice as high compared to an equivalent conventional van or truck. Furthermore, the availability of recharging infrastructure is an issue. Charging stations still need to be installed at consolidation centers or warehouses in order to be able to recharge vehicles overnight. Here, again, a collaborative approach by government and business is needed to pave the way for a breakthrough for this solution. Deutsche Post DHL is currently starting to test prototypes of electric vehicles for urban transportation.

An intermediate development is the plug-in hybrid vehicle, which can be charged from the grid and, so long as the electricity storage lasts, there is no need to revert to fuel. Recharging the battery from the grid could reduce fuel consumption by about 50% in comparison to hybrid vehicles (Euroelectric, 2007). As the range of full electric drive depends on battery capacity, the electric engine of the plug-in hybrid vehicle will mainly be used for transport in urban areas with high stop

density. As a positive side effect, this will also reduce the noise level of stop-and-go traffic in inner-cities.

However, even if electric vehicles were to be used on a large scale, their CO<sub>2</sub> reduction potential may still be constrained by the continued reliance on fossil fuels in electricity production. Therefore, the energy mix of the grid-based electricity is critical to the sustainability of electric vehicles. If electric vehicles were supplied with 100% green energy, they would generate no emissions. However, given the current energy mix of grid-based electricity in Germany and the UK, for example, only a 30 % CO<sub>2</sub> reduction is possible at the moment.

## Fuel Cell Vehicles

One of the oldest electric energy conversion technologies – invented back in 1893 – the fuel cell is, nevertheless, seen as a promising powertrain of the future, in which water and heat are the only by-products of electricity production. A shift to fuel cell vehicles could end oil dependency, as hydrogen can be produced from wind and solar energy, allowing 100 % CO<sub>2</sub> reduction at point of use. Even if hydrogen is produced from other primary resources such as natural gas, coal, or biomass, well-to-wheel emissions of fuel cell vehicles is much lower compared to conventional vehicles.

However, due to their high cost and technical uncertainties, the future of fuel cell vehicles remains unclear. While investment per vehicle exceeds the cost of ownership of a conventional vehicle by about six times, the cost savings potential is unknown due to the lack of sound estimates for price and hydrogen consumption. Investment in this technology is hampered by a number of uncertainties and technical restraints, including:

- The limited range of fuel cell vehicles due to the lack of hydrogen infrastructure
- On-board hydrogen storage, which continues to be one of the most technically challenging barriers
- The safety aspect of hydrogen remains an issue, both in production and in storage and handling

Due to the many issues to be resolved and the need for further R&D, fuel cell vehicles for logistics operations will probably not become marketable before 2030.

## Alternative Fuels

There has been a lot of effort to develop alternative fuels, which are widely seen as an important way to reduce both fossil fuel use and emissions. Especially in the segment of large trucks, they are key to realizing climate-friendly transportation. This is because promising new technologies (hybrid and electric vehicle technologies) will be considerably more effective in the smaller vehicle segment than for heavy-duty transportation. At the same time, trucks account for a large share of the logistics sector's carbon emissions. For example, while trucks represent just 20 % of the entire Deutsche Post DHL vehicle fleet, they account for 80 % of the Group's road emissions.

The first real step forward in alternative fuels was made in 1995, when vehicles powered with natural gas were launched. Gasoline engines were converted to run on compressed natural gas (CNG), combining the virtues of the low CO<sub>2</sub> emissions of a diesel with the low particulate NO<sub>x</sub> emissions of a gasoline engine, with reduced operating noise as a bonus.

The limited success of CNG vehicles, however, can be explained, in part, by:

- The high initial investment required for CNG engines (from €4,000–€25,000, depending on vehicle type and size)
- Their limited savings potential due to high fuel consumption and additional maintenance costs
- A loss in payload capacity

While the emissions levels and fuel consumption of a new generation of vehicles are currently being tested, CNG-powered vehicles are not the sought-after breakthrough in fully sustainable transportation, given that they still rely on fossil fuel.

In future, the focus will be on regenerative fuels, instead – that is, fuels based on renewable energy.

## Biofuel

Today, only first-generation biofuels are available, including biodiesel and ethanol, made from oil-producing plants, such as rapeseed, palm, jatropha curcas, soya, corn or other vegetable matter. The first generation-plus of biodiesel will be produced



using a different chemical process called biomass-to-liquid (BTL), which generates lower emissions and could lead to a reduction in CO<sub>2</sub> of 40 %–60 % compared to previous biofuels, depending on the production scenario, but will not reach market maturity before 2015.

Depending on the blend, in some cases, no vehicle conversion is necessary to run on biofuels, which means no initial investment is required. Furthermore, variable costs (i.e., fuel prices) are comparable to those of conventional engines. Some governments have initiated incentive programs and set concrete targets to promote the use of biofuels, but it will take some time to build the infrastructure to make biofuels broadly available on an international level.

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### **At Deutsche Post DHL, the Group's Biofuel Guidelines Contain Severe Sustainability Criteria to Ensure the Usage of Sustainably Produced Fuels:**

- *In order to minimize our impact on the environment, and with fossil fuels being a scarce resource, alternatives to fossil fuels need to be investigated. Deutsche Post DHL supports the use of alternative fuels under the condition that they are produced sustainably.*
- *At this stage, several factors hinder a sustainable production of liquid biofuels. These and the related risks need to be addressed.*
- *The support and usage of biofuels is only realistic, if international regulations are set in place, that ensure transparency throughout the entire production chain including a consistent lifecycle analysis.*
- *Deutsche Post DHL calls for these international regulations and legislation to ensure such a sustainable and transparent production of biofuels. Until these requirements*
- have been met, Deutsche Post DHL will not use liquid biofuels other than in tests for research and development programs that protect the environment and further develop our sustainable logistics services.*
- *Therefore we only conduct pilot projects to test the operational usability of future 1<sup>st</sup> generation plus, 2<sup>nd</sup> and 3<sup>rd</sup> generation liquid biofuels. A prerequisite for supporting pilot projects is full compliance with our strict sustainability criteria.*
- *In particular, Deutsche Post DHL does not support first generation liquid biofuels, as no advances are expected in the future. The additional need for vehicle modification, an increasing number of maintenance needs, and the food versus fuel challenge are the main reasons for not supporting first generation biofuels.*

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Nevertheless, the most critical problems remain: biofuels vs. food security and the impact of biofuels on greenhouse gas emissions considering the lifecycle, land use change (e.g. conversion of forests to farming land), biodiversity and other social impacts.

Currently, scientists are working to devise ways to produce biofuels from cellulosic material, which will herald the second generation of biofuels. The main advantage of using waste (including food waste), non-food cellulosic and lignocellulosic material (e.g., algae) in the BTL chemical process is that they can be grown on non-agricultural land and hence are less competitive with food products.

### *Biogas*

CO<sub>2</sub> emissions could be cut by over 80 % by replacing fossil fuel with biogas. However, access to refueling infrastructure is currently limited, at least partly due to the lack of a regulatory framework for biogas distribution in the natural gas network. Another factor is regional differences, with demand mainly concentrated in Nordic European countries where biogas usage is quite common and biogas reached market maturity in 2008, compared to Central Europe, where it is only expected to be marketable by 2011. There is also a reluctance to procure biogas vehicles due to the high additional investment cost per vehicle (ranging from €4000 for vans up to €25,000 for heavy duty trucks) and significantly higher fuel prices compared to CNG.

Nevertheless, because of its high emissions abatement potential (both global and local), and its decentralized production and availability, it is one of the most promising solutions for logistics companies – especially for urban fleets and trucks used for mail or express deliveries.

### *Hydrogen*

Not only can hydrogen be used to power vehicles through fuel cells; spark-ignition engines can also run on H<sub>2</sub>. Gasoline engines can be retrofitted to run on hydrogen without major modifications. The advantage of this alternative fuel is its high energy content per weight and its high flammability, which can power engines with no CO<sub>2</sub>, particulate or sulphur emissions. This means that, if solar or wind energy, for example, were used to produce the hydrogen, a CO<sub>2</sub> reduction of 100 % is possible.

So far, there are no prototypes for logistics purposes, which means that no serious cost savings estimates or recommendations for deployment areas are possible today. Safe hydrogen storage in mobile applications remains the most critical challenge – and technical feasibility does not mean economic feasibility. Further-

more, a refueling infrastructure must be set up in order to achieve a successful roll-out. Therefore, it will take more than five years to bring hydrogen vehicles to market maturity.

### **Increasing Energy Efficiency of Conventional Combustion Systems**

Although innovative combustion and fuel technologies will be necessary to address climate issues in the long run, many are not marketable at their current stage of development and it will probably take decades until they reach mass-market potential. The low rates of fleet turnover and lack of infrastructure are only some of the reasons for this time lag. Other reasons include, for example, the fact that the current electric grid source mix means that electric vehicles are hardly more GHG-efficient compared to conventional technologies.

In fact, manufacturers' plans in the short run focus mainly on existing engine and powertrain systems. Future projections by MIT, for instance, foresee a gradual increase in energy efficiency for both conventional gasoline and diesel powertrain systems. By 2035, gasoline-powered light trucks are expected to become 37 % more fuel-efficient, while a 50 % improvement is expected for diesel light trucks, at unchanged size and performance levels (Bandivadekar et. al., 2008). Thus, technological improvements of conventional vehicles will remain a key factor.

### **Bodywork Design**

Vehicle weight and size have a significant impact on fuel consumption and greenhouse gas (GHG) emissions. Lighter materials and changes to the bodywork design can bring important benefits. Many vehicle components can be downsized at a relatively low cost. Vehicle weight reduction of anywhere from 20 %–35 % is feasible and could reduce fuel consumption by 12 %–20 % (Bandivadekar et. al., 2008).

While downsizing is one option, optimizing capacity can also be beneficial. Pilot projects in Europe with longer and heavier vehicles are being conducted, in which the idea is to reduce the number of vehicles on the road by combining different existing trailers and semi-trailers, creating a longer and heavier vehicle combination. This will create a higher load capacity by consolidating deliveries in one vehicle. By reducing overall truck traffic, emissions are expected to decrease. Nevertheless, the

dimensions of the truck might not be compatible with current infrastructure (such as roundabouts and bridges). However, on dedicated networks and roads (hinterland connections of ports, hub-to-hub transport) the benefits could be huge, in particular, if cross-border permits were issued.

### Aerodynamics

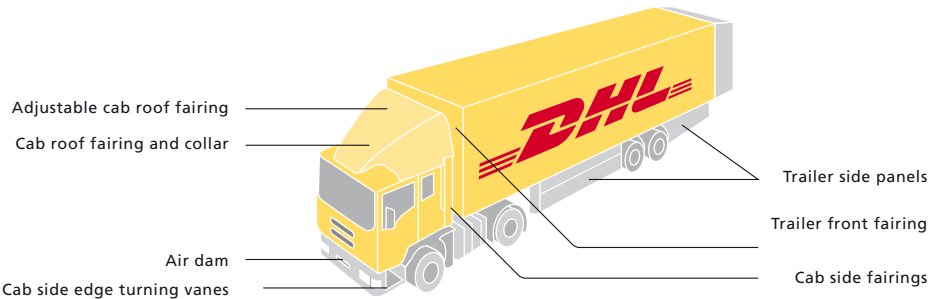
Aerodynamic drag is a major source of a truck’s GHG emissions. For example, it is responsible for about 40 % of a heavy-duty truck’s fuel consumption at motorway speeds (Transport & Environment 2010). Therefore, depending on existing equipment, optimizing the aerodynamic design of a truck can result in an increase in fuel efficiency of 10 %–20 % at medium speeds, and it becomes even more relevant when travelling at higher speeds, such as on motorways (see figure 31 for different options).

New truck designs are being developed to achieve the optimum truck shape in terms of fuel consumption and internal load space, such as the teardrop shape. The teardrop trailer rises higher than standard with its 4 m–4.5 m cab height and reduced rear height. Full side skirts help to minimize aerodynamic drag. Although investment costs exceed conventional trucks by €10,000, the amortization period is only two and a half years due to savings from reduced fuel consumption. The advantages of this striking design include an increase of some 11.3 % in CO<sub>2</sub> efficiency and full compatibility with current supplier networks and fleet vehicles in terms of load.

Even though companies could benefit from increased brand visibility, and promote their green image, the deployment of the

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#### REDUCING AERODYNAMIC DRAG



**Fig. 31**

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teardrop truck is still limited and the existing infrastructure is not suitable in areas such as mainland Europe, where bridges are too low. Further barriers include regulatory standards in some countries with restricted vehicle dimensions, and operational challenges, like high damage risks with forklifts. Nevertheless, Deutsche Post DHL is currently using the teardrop truck in the UK, with positive results.

## Eco-Driving Systems

Whereas most technological innovations address the operational efficiency of the vehicle, some address the operator. Driving style is the single greatest influencing factor on fuel efficiency. Eco-driving is the shorthand for a number of techniques to reduce fuel consumption through influencing driver behavior. For example:

- Displaying fuel consumption or emission levels is sometimes enough to increase the driver's awareness of the effect of his driving behavior
- Start-stop-assistants remind the driver of switching off the engine where appropriate and allow it to start much faster
- Gear-shift indicators suggest the gear that should be selected to maximize fuel efficiency

Eco-driving training can lead to a decrease of up to 20 % in fuel consumption, though, because drivers tend to fall back into their old habits, the significant long-term effect is about 7 % (Kompfner & Reinhardt, 2008).

Therefore, the MAIL division of Deutsche Post DHL uses the “diamond driver,” a small box fitted to the vehicle that gathers information on driving behavior via sensors – for example transverse and longitudinal acceleration. Back at base, the data gathered is transferred to a website and processed. Only the driver can then go online to view or print their report and, in this way, receive feedback on how they can improve driving behavior in the long-term.

## Sea, Air and Rail Freight

Large fleet sizes and close links to the consumer vehicle market drive innovation in road transportation. Slower fleet renewal rhythms, high reliability and reach requirements, multi-million euro investments, as well as operating models based on leasing and chartering, contribute to less visible innovations in ocean shipping, aviation and railroad industries. Given that large chunks of global freight volumes, however, are moved by these transportation means every day, it is nonetheless worthwhile to briefly recapitulate key trends in these areas, as well.

- **Innovations in sea freight**, too, focus on propulsion systems, alternative fuels, and enhanced hydrodynamic design. Most ships run on diesel engines combusting bunker oils, thus they offer high potential to reduce pollution. While hybrid technology is, so far, not feasible for ships, due to insufficient battery technology, fuel cell technologies are a possible solution to the problem of reducing local and regional emissions caused by marine vessels and, in contrast to road transport, are already used commercially today. However, no mass production of maritime fuel cells exists so far and barriers include the increased capital expenditure and short lifetime of fuel cells, and their uncertain reliability in maritime applications.

Wind was the propulsion system of the past and its benefits can once again be harnessed for the future. SkySails provide an economic auxiliary wind propulsion solution for maritime transport. The technology is based on a towing kite in the shape of a paraglide that can be fitted to all common cargo vessels and, depending on the prevailing wind conditions, can cut fuel consumption by approximately 15%. In future, solar ships equipped with an on-board solar energy generator could also become feasible for freight transport. So far, however, this technology has only been used for passenger transport and its capacity, with a maximum of 4–7 km/h from solar energy alone, is not sufficient for freight ships.

Like aerodynamic enhancements for road transport, hydrodynamic designs in maritime transport also offer a wide spectrum of optimization potential and significant gains in energy efficiency. Redesigning the basic structure of the hull in terms of hydrodynamic performance can increase energy efficiency by 15 %–20 %. The most straightforward way to reduce CO<sub>2</sub> emissions, however, is slow steaming, as fuel consumption increases exponentially with speed. Thus, some experts predict regulations to limit speed in ocean transport.

- **The energy efficiency of airplanes** has significantly increased over the past decades thanks to major technological improvements, but these have been more than offset by the overall increase in air travel and air freight. For large providers of comprehensive logistics services like Deutsche Post DHL, air transport is a major source of CO<sub>2</sub> emissions. This is being tackled not only through improved capacity utilization and optimized network structures, but also through the use of more modern aircraft. However, the lifecycle of an aircraft can easily exceed 30 years; in freight it tends to be even longer and, thus, fleet turnover takes place at a very slow pace.

Some see the so-called open rotor technology as a possible solution for upcoming aircraft generations, with a potential decrease in energy intensity of around 25 %–30 %. Nevertheless, open rotors are controversial, given the significant increase in noise. Other challenges include incompatibility with the current aviation infrastructure, longer journey times, lack of certifications and availability, and increased maintenance costs.

- **Skyships** are reported to be witnessing a renaissance every now and then – however, no commercial freight airship prototype has proven to work. The technical feasibility of a skyship with sufficient loading capacity has yet to be demonstrated and their range is still quite limited. Furthermore, the altitude achieved by existing skyships is not sufficient to clear high mountain regions. Therefore, it remains uncertain whether widespread commercial deployment of airships for freight transport is viable. This holds true not only from an economic point of view.

Doubts also remain in terms of their sustainability. On the one hand, skyships cannot achieve the speed of an aircraft and thus, cannot be deployed for the time-critical deliveries aviation is used for. On the other hand, given that the energy intensity of airships is highly dependent on the operating speed, at increased speeds, skyship transport is more polluting than maritime transport.

- While **trains** are one of the least carbon-emitting forms of transportation today, rail freight is a rather slow mode and its noise emissions heavily impact surrounding communities. Frequent stops as well as coupling and decoupling wagons lead to average speeds as low as 6 km/h. Significant improvement potential lies in better leveraging the rail infrastructure and dedicated priority rail freight corridors.

Could the future of cargo transport by rail lie with tube systems? In fact, researchers at the Ruhr University of Bochum have been developing a large format tube system since 1998. The CargoCap is designed to transport goods in capsules on driverless trolleys running on rails through underground tunnels. If tests in an industrial hall prove successful, an 80 km ring tunnel may be built to allow freight to bypass the A40, one of the highest volume highways in Germany. Every two kilometers, railway switches will direct the freight to underground stops beneath shopping malls, industrial parks and logistics parks.

Delays in development and high costs have unsettled investors and the local government, but with increasing concerns over climate change, they might reconsider their attitude. The tubes have a high capital cost but low operating cost. So far, the economic feasibility of tube transportation carrying general merchandise remains untested.

### **Dematerialization and Remote Transmission**

The Internet continues to be a revolutionary technology for many areas of commerce and society. The music industry has had to radically adjust its business model to accommodate demand for digital distribution, and the publishing and news industries are undergoing a similar profound transformation to digital delivery, e.g., Amazon (2010) stated that in the second quarter of 2010 it sold 80 % more Kindle e-books than hard-cover books.

This trend decreases the market for logistics services, as fewer goods need to be moved from one point to another. In this respect, logistics service providers and mail operators are faced with a major challenge as their core market is threatened. At the same time, however, e-commerce is leading to a boom in express delivery, as consumers around the world display an increasing preference to shop online from the comfort of their home or office, and take delivery of their goods at their doorstep.

From a sustainability perspective, this growth of e-commerce, however, is not inherently negative. It usually substitutes the individual purchasing of goods in shops, which often entails significant carbon emissions through the use of cars or other vehicles. By comparison, logistics providers consolidate the goods of what otherwise would have been many individual shopping trips into one or a few deliveries. Therefore, compared to private shopping, the environmental net impact of e-commerce can even be positive.



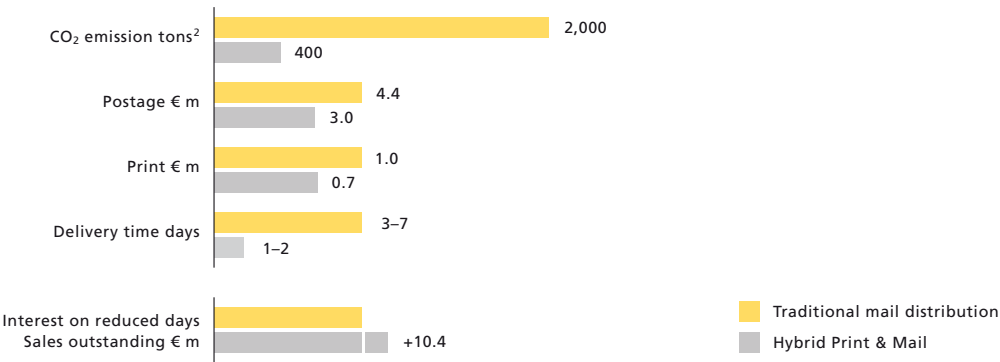
## The Transmission of Written Documents

The ongoing dematerialization trend offers many opportunities to save carbon emissions. Particularly mail order companies or billing companies can significantly reduce their carbon footprint by using dematerialization to shorten the distances their hard-copy products have to be transported. Instead of shipping hard-copies from the sender to an addressee on the other side of the country or world, the data can be transmitted digitally to the destination and printed locally, reducing transport routes and thus emissions considerably.

New services (like Hybrid Print & Mail by Deutsche Post DHL) allow customers to outsource their production and distribution of domestic and international mail, as well as direct marketing. Customers transfer their data (e.g., invoices, bank statements, catalogues or payroll slips) as an electronic file directly to a secure data center or upload them via (S)FTP on an online server. From there, files are sorted and sent to a local production center at the respective destination, where they are printed, labeled and franked. The final delivery is made through the classic postal network.

The service offers significant environmental benefits as it decreases CO<sub>2</sub> emissions compared to conventional mail. Additionally, these services reduce distribution costs as the mail is printed at the destination. Furthermore, the accelerated delivery time for invoices reduces day sales outstanding.

### KEY CUSTOMER BENEFITS ON HYBRID PRINT & MAIL BY DPDHL<sup>1</sup>



<sup>1</sup> Based on a virtual trade lane case with 9.2 million invoices p. a. from US to Europe (75%) and US (25%)

<sup>2</sup> Source: DHL Innovation Center

Remark: The remaining CO<sub>2</sub> can be compensated with emission rights to achieve CO<sub>2</sub>-neutral status for less than € 0.12 per item.

Fig.32

With its most recent innovation, the E-Postbrief, Deutsche Post goes a step further. In order to combine the advantages of the postal world with the digital world, E-Postbrief introduces the company’s core product to the Internet.

KEY FEATURES OF THE E-POSTBRIEF

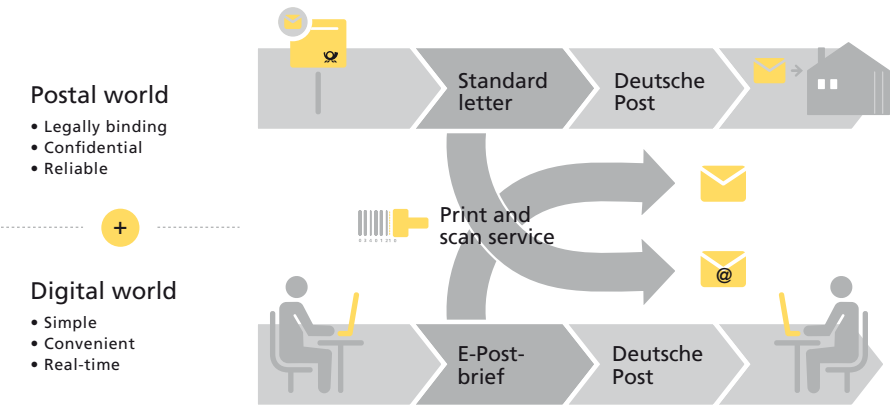


Fig. 33

With digitalization through E-Postbrief, the physical transport of millions of official documents can be completely superseded by using an equally reliable and secure digital method. For postal service providers, such digitalization opens up considerable potential to become more carbon-efficient (although the CO<sub>2</sub> emissions of an e-mail are not zero due to the electricity requirements of the servers and computers).

The Concept of 3D Printing

Also known as “factory on the desk,” 3D printers can produce solid, three-dimensional objects, quickly and conveniently. The 3D printing industry is some 20 years old, with the main application areas being prototyping, engineering, and jewelry creation, as well as dental and medical industries. The 3D printing machine traces its roots back to the first additive manufacturing machines for producing prototypes (stereolithography) and retains most of the earlier concepts.

There are several approaches to how such a printer can work. One concept is to use high-temperature lasers to melt and fuse together powdered ceramics or metal, one layer at a time. Another approach is to squirt, layer-by-layer, a liquid binder in areas where the object is solid, and apply color at the same time. However, one drawback of the technology available today is that it allows only for single-material objects to be produced. Research is being conducted into further developing the capabilities of the printers to produce complex objects or even self-replicate.

The cost of buying and operating 3D printers has decreased significantly in recent years, which can really open the doors for mass manufacturing. While these machines cost as much as laser printers did 20 years ago, with mass manufacturing, it is likely that 3D printing will make its way not only into workshops and factories, but also onto the desks of offices and even homes.

A key consequence of 3D printing is **to reduce the need for transportation**. Once the technology is widely available, CAD (computer-aided design) files can be sent within seconds across borders and printed within hours at the destination. Furthermore, customized items can be produced on a small scale, near the consumer, reducing distribution requirements and, therefore, carbon emissions.

### So, What Does This Mean for the Logistics Industry?

The shift from printed to electronic documentation will significantly decrease volumes in physical transportation. However, the examples of hybrid mail and E-Postbrief show that logistics companies can become the natural catalyst to shape and influence this process.

Even if 3D printers are far from threatening the logistics industry, in the medium-term, they could reduce the amount of freight shipped between continents. Additionally, since experts do not expect 3D printers to become consumer goods in the medium-term, the last-mile service will remain. Therefore, the logistics industry emerges as the natural provider for organizing 3D printing as well: logistics companies can operate local and regional production facilities to ensure the availability of high-end 3D printers, and organize the transport of raw materials and last-mile delivery of final products.

## Warehouse Energy Efficiency

Warehousing – an integral part of any logistics network – comprises a wide range of functions, including storage, picking, packing, cross-docking, consolidation, etc. Overall, it is estimated that buildings make up around 13 % of the freight sector's carbon emissions (World Economic Forum, 2009). For businesses, the efficient and economic use of energy in warehouses will not only help achieve cost savings, but also contribute to a reduction in this carbon footprint. Three main areas of potential savings are analyzed in this chapter: electricity and lighting, heating and cooling systems, and local energy production.

### Electricity and Warehouse Lighting

Up to 80 % of electricity consumption in a logistics facility typically comes from lighting and, therefore, optimization in this area has a significant environmental impact. For example, a single 400 w high-pressure sodium bulb that operates continuously for a year is estimated to produce 1.69 tons of CO<sub>2</sub> equivalents (CO<sub>2</sub>e) (Wyatt, 2007). Multiplying this by the number of bulbs in the warehouse, it quickly becomes evident that the abatement potential is significant.

Achieving progress can be surprisingly simple:

- Regular cleaning of light bulbs can be the first step to improving efficiency, as studies show that the equivalent of two years of accumulated dust can reduce the luminosity by as much as 50 %, thus increasing operating costs by 15 % (Carbon Trust, 2007).
- In addition, using the latest available lighting technologies is an attractive option for warehouse operators, since pay-back times are around three to four years and in many cases can be driven to under two years, depending on electricity pricing and regional equipment and installation costs. In a Deutsche Post DHL pilot project at one of its warehouses in Germany, 40 % savings were achieved by changing the bulbs from T8 to T5, and savings of up to 70 % have been achieved in other cases.
- The efficient utilization of daylight can also make a big difference in terms of energy consumption and this is an aspect that can easily be taken into account during construction of a facility.

- And, lastly, motion detectors and photo sensors can be used to turn lights on and off and dim them automatically, thus reducing waste.

But before electricity consumption can be reduced – and with it operational costs – a key challenge is obtaining information regarding energy consumption. An emerging trend in this regard is the implementation of energy monitoring and carbon footprinting systems. To support metering solutions, a common tool that can be used is the Smart Meter, which not only measures how much electricity is consumed, but also when it was consumed. Other innovative solutions on the market, like digitalSTROM or Kiwigrid are internet-based methods of connecting electrical appliances to allow for communication between them, so that electricity consumption of each appliance becomes visible and controllable. Furthermore, this enables intelligent management of all electrical devices.

## Warehouse Heating and Cooling

Ensuring the required temperature in a warehouse – which can range from  $-10^{\circ}\text{C}$  for frozen meat to  $20^{\circ}\text{C}$  for consumer goods – contributes significantly to the CO<sub>2</sub> footprint of a warehouse. Since most warehouses need heating and cooling systems, a key way to increase the CO<sub>2</sub> efficiency of a warehouse is through a state-of-the-art heating system. Comprehensive insulation is also necessary.

However, in practice, the feasibility of these measures is often rather limited. Not only are the components of heating and cooling systems interlinked: changing the heating system without improving the insulation of a building, for example, has only limited value. But more importantly: most companies only rent warehouses. As investments in better insulation or heating technologies have rather long payback periods, neither the tenant nor the landlord has an incentive to invest in these measures. Thus, external remedies are necessary, first, to change the incentives for the actors involved.

## Local Energy Production

Local production of energy certainly is an interesting option for warehouse operators to consider from a CO<sub>2</sub> reduction viewpoint. Photovoltaic panels and small wind generators are still not cost-efficient, but combined with subsidies and other government

incentives, they can have very short payback periods, depending on the specific circumstances. Large, utility-grade wind systems can achieve operational payback within 8–12 years without government incentives, when favorably located. Combining one of these systems with heat from biomass can also be a viable way to generate low lifecycle emissions at acceptable cost.

Regulation plays an important role here. For example, in the UK, many local authorities require businesses to generate at least 10 % of their energy needs onsite using renewable energy sources. Known as the “Merton Rule,” this policy is estimated to lead to a carbon savings of 350 tons each year for an urban town with a population of 150,000 (Energy Saving Trust, 2007).

Clearly, there are solutions on the market that can help warehouses operate in a more sustainable way. By combining available technologies and solutions in terms of energy savings, heating and cooling systems, and alternative energy sources, a warehouse can be designed that emits 70 % less CO<sub>2</sub> than the typical 15-year old warehouse (Prologis, 2007).

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## The Potential for Energy Reduction in Warehouses – The Case of Dubai

*The Dubai Department of Economic Development (DED) has, together with DHL, led the initiative to develop the first carbon neutral warehouse in the United Arab Emirates (UAE). The project will serve as a template for green warehousing across Dubai. According to the estimates made during the study, it can save 1.9 million tons of carbon dioxide annually by 2020, equivalent to the current annual carbon footprint of some 60,000 UAE residents.*

*Following the highest standards of resource-use efficiency, the upgrade will lead to significant energy savings, with the investment to be paid back in two to four years. Each of the specific energy saving measures proposed for the warehouse was subjected to a standard business case approval process, in order to measure its financial viability in the UAE.*

*The upgrade implementation effort led by DHL Energy Performance & Management has resulted in warehouse electricity savings of between 36 % and 40 %. Upgrading work included installation of state-of-the-art lighting systems, energy monitoring equipment, solar-powered lights and operational training of staff.*

*His Excellency Mr. Sami Al Qamzi, Director General, DED, said: “The carbon reduction project demonstrates that significant improvements in energy usage can be achieved in the logistics sector. In addition to contributing to the environment, this project – if replicated across the logistics sector – can bring about large cost savings, which can eventually be passed on to the supply chain, thus boosting operational efficiency.”*

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## Employee Involvement in the Workplace

Effective change management requires motivated employees and a company that actively involves them in its efforts to become greener. The workplace offers many opportunities to reduce carbon emissions. Lighting, printers and other electronic devices, a reorganization of work routines, tele/videoconferencing, telecommuting or carpooling and driver behavior, are only some of the levers to increase energy efficiency.

To mobilize employees towards this end, information is essential. Employees need to become aware of how their behavior in the workplace impacts the environment and how they can improve their carbon footprint. Moreover, communication has to be two-way: employees often have valuable ideas on how energy consumption can be reduced.

While commitment from the Management Board is important, green workspace projects will only gain a strong foothold if every employee feels individually responsible for their carbon contribution. To this end, motivating and incentivizing employees is an important part of any process that seeks to raise green employee engagement.

At Deutsche Post DHL, the SimplyGreen project was launched in the DHL Innovation Center as a way to reduce carbon emissions through the engagement of employees. Employees are informed about their individual *business footprint* according to business travel, daily commuting distance and mode and energy consumption of their office. Through an online tool, they can give feedback on sustainable actions by which they have reduced their carbon footprint (carpooling, videoconferencing, etc.).

Each action earns a specific number of climate protection points with which employees compete with their colleagues to achieve the highest overall CO<sub>2</sub> reduction, the highest relative improvement or the lowest emissions level. The “game” has generated a lot of interest among employees and is now being expanded across different areas of Deutsche Post DHL. Similarly, the “bike to work” initiative of the health management team, which will now be linked to SimplyGreen, e. g., by providing information on carbon reduction, has proven to be successful with employees all over the group collecting 562,000 “bike-kilometers” in teams or individually in 2009.

## 4.3 Conclusion

Significant carbon reduction results can already be achieved today. This is not only true for sourcing and manufacturing strategies, but even more so for goods distribution. Optimizing the design of a distribution network, using the right modes of transportation and efficiently managing load capacity and routes can all be very effective instruments to cut carbon emissions as well as costs. Furthermore, implementing a comprehensive set of city logistics solutions can also lead to carbon savings while, at the same time, improving the quality of life in cities.

On the operational side, a wide array of optimization levers is available. Possibilities range from increasing the energy efficiency of warehouses, to aerodynamic improvements to existing vehicles, to the use of eco-driving systems. Hybrid vehicles are already in the stage of pilot projects.

Going forward, it will probably be a mix of solutions and technologies already on the market or close to market maturity that will be key in reducing the emissions levels of the transport and logistics sector – be it on the road, in the air or at sea.

Change on a larger scale requires a number of developments to take place and challenges to be overcome:

- The most important challenge is uncertainty. R&D to fund innovations in logistics is expensive and companies often cannot shoulder the high costs on their own. Uncertainty about future prices of alternative and fossil fuels, and a lack of reliable estimates of cost savings are only two reasons why conventional technologies are often preferred over new developments.



- Furthermore, manufacturers tend to focus on developing new solutions, like hybrid vehicles, for the mass consumer market first.
- Subsequently, low production volumes mean that no economies of scale can be realized, which results in a high unit cost for technologies that are yet in their infancy. On a similar note, the roll-out of innovative developments can often only happen after the appropriate infrastructure is in place, such as to enable refueling or energy storage.
- A stronger focus on R&D for logistics is needed to complement private vehicle innovation. Special incentives could accelerate the introduction of new vehicles.
- When it comes to testing new technologies under real life conditions, logistics companies are the natural strategic partners for manufacturers and governments alike given the large fleets of aircraft, ships and trucks they operate.
- Biofuels can help to achieve carbon reduction in the segment of larger trucks and possibly also for aircraft. However, to become a viable alternative, they have to meet strict sustainability criteria.

Change will happen and, while there is no blueprint for “low-carbon logistics” that can be implemented everywhere, regardless of local circumstances, the spectrum of available technologies and solutions is well-known. The same is true for the important stakeholders and other factors influencing the future development of the sector. The next and final chapter will connect both strands in order to outline the changing face of a logistics industry that is becoming more and more sustainable.



## 5 How the Logistics Industry Will Change in the Push Towards Sustainability: Seven Key Developments

While there is no silver bullet that will radically transform logistics into a carbon-free business overnight, a number of important factors will speed the evolution. The *Green Trends Survey* showed a clear desire, especially among business professionals, for sustainability in logistics; while economic necessities, customer demands and regulatory measures will also drive the shift towards sustainability. Among other factors, sustainability in logistics in the coming years will most likely be shaped by seven key developments.

The forecasts made in this chapter are based on the assumption that current trends towards sustainability – as described particularly in the third chapter – continue. This chapter's seven key developments are probable consequences if those trends continue and if companies, particularly logistics providers, strive to incorporate sustainability into their business models. Furthermore, the chapter draws substantially on some of the expert contributions to this publication and benefits from the assessments made in the *Green Trends Survey*.

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## Seven Key Developments Will Shape a Sustainable Logistics Industry:

- |  |   |
|--|---|
| 1. <i>Logistics counts – it is not a commodity</i>   | 4. <i>Business models of logistics companies will change as sustainable innovations open up new opportunities</i> |
| 2. <i>Technological change will be achieved through a concerted drive from companies, governments and financial institutions</i>                 | 5. <i>CO<sub>2</sub> labeling will become standardized</i>  |
| 3. <i>Collaboration will increasingly be seen as an enabler to attain sustainability; even erstwhile competitors will cooperate more closely</i> | 6. <i>Carbon emissions will have a price tag</i>  |
|  | 7. <i>Carbon pricing will lead to more stringent regulatory measures</i>  |
- 

In many cases these developments are interlocked; advances in one area will promote progress in others. At the same time, it is important to stress that change will be gradual at times and not all developments will be felt to the same degree.

### 1. Logistics Counts – It Is Not a Commodity

**Logistics is not only a chief catalyst of global trade and a defining component behind value creation – it is also a business of strategic importance in the move towards a low-carbon economy.**

Today, logistics services are mainly viewed as a commodity where price rules. This will change as customers, policymakers, and companies begin to realize that logistics services and expertise are key to providing sustainable solutions. Within the push and pull of customer demands and regulatory measures on the one side, and innovative improvements on the other, logistics will become an industry where comprehensive expertise and service quality dominate over the simple question of pricing.

As economic and environmental issues become increasingly entwined, this will also shift logistics companies away from being providers of a commodity to becoming competent consulting partners that help “decarbonize” supply chains and distribution processes. The leading logistics companies will be those that possess the unique selling proposition and differentiator of providing these sustainable services; those that compete on the playing field of expertise rather than just offering the cheapest solution.

Efficient supply chains have long been considered key for a company’s *economic* success, but as market and regulatory demand

for greener products rise, efficient, *environmentally-friendly* supply chains will increasingly be sought. Logistics' unique role as a network industry, connecting businesses from all sectors and from all regions, makes it predestined to address the problems of CO<sub>2</sub> emissions all along the supply chain. The full use of the conceptual and operational solutions described in Chapter 4 will play an important role in reducing carbon emissions.

The development towards logistics as a sustainability enhancer will not only come from providers rethinking their offering. Companies will radically adjust their view about their own logistics processes and come to see them as strategic levers that can noticeably influence their market position. This is increasingly the case. Within the *Green Trends Survey*, business customers already anticipate that, in future, logistics processes and actions will be aligned with the goal of reducing carbon emissions.

These improvements in companies' supply chains will not only reduce their carbon footprint; they will, at the same time, help to reduce cost, increase quality and leverage new market opportunities. If companies consider their supply chain a key element of their business strategy, they will also become much more aware of potential improvements – in terms of cost savings, increased reliability, and CO<sub>2</sub> reductions, that greening their supply chain can bring.

## **2. Technological Change Will Be Achieved Through a Concerted Drive from Companies, Governments and Financial Institutions**

Given the higher price tag attached to new technologies, mutual support and long-term planning by key players is essential.

While all actors, both political and commercial, understand that technology can provide important sustainable solutions, financial constraints and longer payback periods still hamper investments. This is true not only for new and innovative technologies, but also existing ones as well. As few companies will be willing to carry these costs alone, business, policymakers and financial institutions will have to work together to promote investments.

This change will be ushered in by rethinking on many levels. Companies need to accept slightly longer payback periods; policymakers need to put incentives like tax breaks and green procurement obligations in place to reward companies who make carbon reduction a priority. And, financial institutions can sup-

port sustainable business practices, too, for instance by developing innovative loans to allow for energy efficiency measures.

Within companies, this will include a change in investment policies. Increasingly, companies will allow for longer pay-off periods for energy-saving measures. Sustainability will become an important factor calculated into any investment decision. Incorporating carbon efficiency targets in the annual assessment of managers is yet another method companies will use to promote sustainability. With incentives and proper funding, research and development in new technologies or solutions will also increase.

Financial institutions will play a twofold role in supporting companies. In particular, innovative funding instruments will be established for large-scale efficiency programs. The sector will also create sustainability assessments and ratings, and design sustainable financial products. Some of this is already happening. “Responsible investment” funds – in many ways the sustainable product of the financial sector – reward companies for their sustainability and are growing in popularity.

Government policy, either by offering low-interest loans or through direct subsidies, will promote the development and use of technologies and concepts until these have reached mass-market stage. An example of this is the support already given to hybrid, electric or other low-emission vehicles in many countries.

These incentives must be managed carefully, though. Otherwise, guaranteed long-term financial support can hinder technological progress and breakthroughs.

### **3. Collaboration Will Increasingly Be Seen as an Enabler to Attain Sustainability; Even Erstwhile Competitors Will Cooperate More Closely**

As carbon emissions reduction becomes a priority for suppliers, business customers and logistics companies, cooperative business models will expand both vertically and horizontally along the supply chain.

The move towards sustainable logistics will bring about an increased level of cooperation among all actors in society, business and government, as they set up standards, agree on price tags and support binding regulations. But business models will change as well, as companies discover that sustainability calls for more collaborative approaches.

Vertical cooperation along the supply chain between customers, suppliers and service providers is already common throughout many sectors, but horizontal cooperation between companies – some of which might even be competitors – also holds great carbon reduction potential. For example, multi-user warehousing and consolidated shipments are ways not only to reduce excess capacity and save money, but they also lower emissions. One precondition to ensure the development of such collaborative approaches is compliance with competition rules in order to ensure legal certainty of those new business models.

At the moment, though, many companies are still cautious about collaborating too closely and are wary of sharing know-how and putting sensitive information at risk. Still, the majority of business customers (63 %) in the *Green Trends Survey* already strongly agree that horizontal collaboration to reduce CO<sub>2</sub> emissions will significantly increase in the next ten years. Cooperation during the standards building phase described below (see No. 5) might form the foundation of trust needed for horizontal collaboration.

#### **4. Business Models of Logistics Companies Will Change as Sustainable Innovations Open Up New Opportunities**

A number of technologies and concepts, currently focused primarily on making logistics more sustainable, will also provide new ways for logistics companies to do business.

Electric vehicles will probably have the largest impact on the logistics industry, with low-noise night deliveries becoming common practice. Vast fleets of these vehicles could also become a part of “smart grids,” with their batteries being charged during periods of low demand (or high supply). Hooked to the grid, their batteries might become a source of energy for others during times of high demand – thus making logistics companies not only consumers, but also managers of energy.

The ongoing dematerialization trend – the digital distribution of documents, books and other media – offers many opportunities to save carbon emissions, as well. While this has initially put logistics providers, especially mail carriers, under pressure, it will also provide for new business opportunities. Hybrid mail services allow what was once delivered as a letter to be sent digitally to distribution centers near points of delivery, where it is printed and delivered to the final destination. Even e-mail is being embraced by postal services, which are now increasingly offering a secure version that is as binding as a letter.

## 5. CO<sub>2</sub> Labeling Will Become Standardized

**CO<sub>2</sub> labels allow customers to compare green products. Transparency will raise confidence among logistics customers and end consumers when making climate-friendly choices.**

Consumers have the power to enforce change through their buying decisions. But they will also demand more transparency, especially when paying a premium for sustainable solutions. Manufacturers will therefore put great effort into establishing comprehensive carbon accounting, controlling and management systems. Logistics companies will use their expertise and knowledge of processes to collect this data, thus supporting efforts to develop standardized CO<sub>2</sub> labeling in a format that is easily understood, transparent and simple to compare.

Currently, this transparency is provided mostly for green products within companies. Deutsche Post DHL, for example, already has a number of consulting services in place to inform customers about the carbon footprint of the services the company offers. But logistics companies will recognize that they have a common interest in working together, along with governments, to develop standards and labels that are accepted by all.

Governments will support this overall development by promoting international standards that provide transparency regarding CO<sub>2</sub> emissions. In some cases, they might set these standards, should industry stakeholders fail to agree among themselves. In the *Green Trends Survey*, 64 % of logistics customers believed CO<sub>2</sub> labeling would become standard.

## 6. Carbon Emissions Will Have a Price Tag

**As reducing carbon emissions becomes more important for companies, governments and customers, it will become part of a business' accounting and decision-making process. This will increase the demand for a price to be attached to CO<sub>2</sub> emissions.**

Transparency provided by labeling and standards is only the first step. An important incentive to make businesses and logistics more sustainable will come with carbon emissions becoming just as much a factor in a company's accounting and decision-making process as costs for procurement or personnel.

To reduce risk and support their planning, companies will demand that costs incurred by carbon emissions be calculable –



thus calling forth the need for emission price tags. In the *Green Trends Survey*, most respondents agreed with the proposition that a substantial shift towards a greener logistics industry needs accompanying political measures such as green taxes, incentives or other forms of regulation. One of the ways governments will facilitate this is by introducing a carbon-pricing framework.

Two instruments appear to be most likely: cap-and-trade or taxes systems. Both have their merits. Cap-and-trade sets a specific reduction target while allowing for some flexibility in how that is reached. For example, in the mid- to long-term, carbon credits could become a tradable currency – like the euro or U.S. dollar.

One of the world's largest emissions trading schemes is already in place: the European Union Emissions Trading System (EU ETS). Starting in January 2012, aviation will be the first transport-related industry to be included in the EU ETS. But cap-and-trade systems will also have a downside. Carbon emissions become a commodity with fluctuating value, thus increasing financial uncertainty.

A second instrument governments will draw on are taxes levied on the burning of fossil fuels to discourage their use, and encourage alternative energy sources. Many countries already use taxes on fossil fuels to support their environmental policies. The challenge for governments will be to set taxes at such a level that they do not hinder growth, but are high enough to change behavior and have a noticeable positive effect on sustainability.

## **7. Carbon Pricing Will Lead to More Stringent Regulatory Measures**

**Companies will only accept a price tag on carbon emissions if governments ensure a level playing field.**

A major challenge for the success of these measures is providing for a level playing field. Common standards and rules that apply to all actors in the business will therefore need to be introduced.

At the start, the industry will see a drive to implement accurate but feasible standards for CO<sub>2</sub> accounting and reporting across the sector. Besides enabling the customer to compare products and services, this will ensure that, when future regulatory measures are passed, companies, logistics providers and governments will still be speaking the same language and using the same sort of data.

Common standards, though important, are but a step in the right direction, however, and will not be enough. Universal rules that cover all actors in one market will also need to be introduced. In fact, the majority (65 %) of professionals surveyed in the *Green Trends Survey* expect that the regulatory environment will become much more stringent over the coming years.

In addition, the more international in scope, the more effective the new regulations will be. Especially when it comes to political measures, like cap-and-trade systems or regulations, a global scope is always preferable for a global industry like logistics; nevertheless, even a regional scope, such as at European level, can sometimes be sufficient. Because of the difficulty of getting a large number of diverse countries and organizations to agree, it is likely that, in the near future, binding regional regulations will be more common than global ones.

A patchwork of policy measures at the national level, however, is not advisable. It could lead to a regulatory race to the bottom and encourage “carbon leakage” – the relocation of carbon intensive industries to countries with lax regulation.

# Epilogue

by Dr. Rainer Wend

## Changing the Business from Within – The Transformation of Business Processes from a Sustainability Perspective

Environmental aspects need to be integrated into the way we do business, instead of just being part of add-on programs. Deutsche Post DHL attaches great importance to making its business practices and services more sustainable. Apart from its intrinsic motivation, the company is also driven by customers who want to “green” their business and, thus, require environmentally sound logistics services in order to do so.

Since the launch of *GoGreen*, the Group’s environmental protection program, the principles of sustainability have had an increasing influence on our daily business. Based on a clearly defined strategy and objectives, *GoGreen* is being gradually integrated into business systems, processes and decisions. Deutsche Post DHL is striving to find the “sweet spot” between environmental and economic considerations in every decision-making process. Furthermore, the company is seeking to help customers make their business more sustainable. The *GoGreen* program has four main focus areas:

Firstly, a comprehensive carbon accounting and controlling system is being set up to manage and measure efficiency improvements. The carbon footprint for each Deutsche Post DHL division is calculated and converted into a division-specific Key Performance Indicator (KPI), which is then consolidated into a Group Carbon Efficiency Index. Despite the challenge it poses, the Group index already includes the so-called Scope 3 CO<sub>2</sub> emissions from subcontracted transportation services, which is crucial given that they account for around 75 % of the Group’s carbon footprint. What is more, direct emissions of

CO<sub>2</sub> (Scopes 1 and 2) have now been integrated into the financial system at Deutsche Post DHL. To further improve transparency, Deutsche Post DHL is asking policymakers to support the development of common, international standards for carbon accounting at the organizational, product and customer levels. The issue of carbon accounting was explored in Chapter 3, “Trends Towards a Sustainable Logistics Industry.”

Secondly, as the world’s leading mail and logistics services group, Deutsche Post DHL has adopted a specific, Group-wide, binding carbon efficiency target. The Group has set itself the target to improve its CO<sub>2</sub> efficiency, including emissions from subcontracted transportation, by 30 % by 2020, compared to the year 2007. Progress is being monitored in business review meetings and discussed in the corporate board. A central *GoGreen* department has responsibility for the program at the corporate level, and works closely with designated representatives at the functional, divisional and regional levels.

Thirdly, Deutsche Post DHL feels a responsibility to drive the development of low carbon technologies and solutions. Optimization activities along different transport modes and the deployment of innovative technologies (e.g., a modernized air fleet and the testing of alternative vehicle technologies for road transport) have already led to a number of successes. Besides reducing CO<sub>2</sub> emissions, these measures have also proven to be cost-effective. Therefore, in addition to vehicles, other potential sources of efficiency are also being implemented in real estate and transport networks, such as energy-efficient lighting and capacity optimization.

As the requirements of the logistics sector differ from those of the broader market (e.g., delivery vehicles tend to travel relatively short distances each day and make frequent stops), new technologies such as electric powertrains or alternative fuels for trucks and vans, and energy-saving building infrastructure, are being tested in pilot projects across the Group. By exchanging experiences gained in these worldwide trials and sharing expert recommendations, resources for pilot projects can be used as efficiently as possible; synergy effects between the divisions and regional branches created; and the most promising and innovative technologies implemented. Chapter 4.2, “Operational Solutions,” contains information on new road technologies.

Additionally, we have put in place an investment policy that requires carbon efficiency to be considered in major investment decisions and allows for longer payback periods for sustainable investments.

Fourthly, given that energy efficiency at the working level is driven by employee behavior (e.g., eco-driving) many different initiatives have been launched that are aimed at mobilizing Deutsche Post DHL employees worldwide, as well as providing tips and guidelines on how to act more sustainably. Employees are expected to include resource efficiency in their business decisions and to adopt sustainable behavior at work. What is more, the staff of Deutsche Post DHL has shown great commitment even beyond the workplace, such as for the annual World Environment Day. The importance of this topic was addressed in section 4.2, under the heading “Employee Involvement in the Workplace.”

With the experience gained by increasing the sustainability of our own business practices, we are helping our customers to introduce low-carbon business models into their businesses. Deutsche Post DHL was the first logistics company to offer carbon-neutral shipping products, and to bundle its innovation activities in order to develop sustainable solutions for the industry, such as providing carbon-neutral shipping options, and modal shifts in just-in-time production processes. In the future, we predict that carbon footprint information will appear on every invoice, allowing business customers to include CO<sub>2</sub> emissions from their contracted logistics services in their carbon footprint calculations.

In conclusion, Deutsche Post DHL is not only a facilitator of global business, but is also an influencer of industry practices. At the same time, the company certainly understands the importance of sustainability to modern consumers, business customers, as well as to society at large. As a leading force in logistics, Deutsche Post DHL is channeling its industry clout along with its green insight to take a leading role in the drive for sustainable logistics, and as a facilitator of sustainable business practices, worldwide. This publication “Towards Sustainable Logistics,” is just one of the ways in which we seek to do this.



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Numerous Deutsche Post DHL departments contributed to this project. *Inhouse Consulting* coordinated the project and elaborated large portions of the content, with support from the MAIL, EXPRESS, GLOBAL FORWARDING, FREIGHT and SUPPLY CHAIN divisions, and valuable advice from their respective sustainability experts.

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Many useful insights were provided by the experts from *DHL Solutions & Innovations* and *DHL Energy Performance & Management*. The *Market Research Service Center* (MRSC) put their great expertise and effort into conducting the *Green Trends Survey* and evaluating the results. The advice and help from various departments within *Corporate Communications* has also been vital.

Furthermore, this publication has greatly benefited from the expertise and perspective of all external and internal experts who generously agreed to participate in this report. Similarly, the experiences of all those customers who allowed us to publish their statements provide invaluable insights into how carbon reduction is becoming more and more widespread among leading businesses.





# Green Trends Survey: Taking a Closer Look

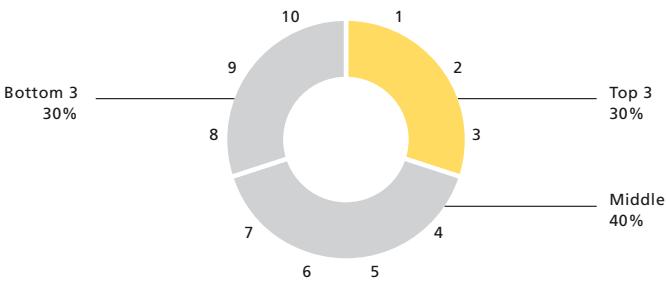
An essential element of a more sustainable logistics industry is the acceptance of green logistics services by business customers (i.e., shipping decision-makers/influencers) as well as by end consumers. To better understand those attitudes, the Market Research Service Center (MRSC) of Deutsche Post DHL conducted a *Green Trends Survey* in June 2010. This survey covered six countries across three continents:

- Americas: U.S., Brazil
- Asia: China, India
- Europe: Germany, UK

To guarantee the empirical relevance of the survey, two large international online databases (panels) were used – the *Business Panel GMI* for shipping decision-makers/influencers and the *Toluna Panel* for end consumers (i.e., the general public). Separate questionnaires for each group allowed for target group-specific questions. The following charts provide details on the respondents' profiles.

For most questions, the respondents were asked to attach a value from an ordinal scale (from 1 to 10) to a specific statement or scenario – indicating their level of agreement or their assessment of probability. The results are accumulated in a pie chart, with a yellow section (Top-3-Box) displaying the share of respondents that, for example, highly agree with the statement and two grey sections. The Bottom-3-Box indicates the share of respondents that, for example, highly disagree with the statement.

RATING OF RESPONDENTS



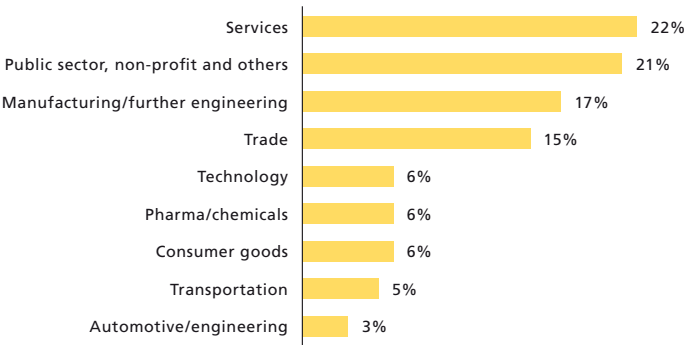
**Fig. 34** The Top-3-Box is the percentage of respondent who rate the top 3 of the scale. The formula to translate scores from a 10-point scale to a 100-point scale is as follows:  $x = (y - 1) \times 100 \div 9$ .

Overall, these survey results show an astonishingly high level of awareness about climate change, as well as a considerable willingness for behavioral change in each of the target groups and across all countries. Several factors should be considered that could have contributed to this high level of awareness:

- **Social desirability:** respondents tend to choose those answers that correspond to social etiquette, even though this choice might not reflect their true attitude. However, if the results were distorted because of social desirability, this would be an indicator that green behavior has become part of social etiquette, which equally reflects an increase in awareness.
- **Time of field work:** the survey was conducted at the height of what is currently seen as one of the most devastating man-made environmental catastrophes – the Deepwater Horizon oil spill in the Gulf of Mexico. This fact might have influenced the respondents, especially in the U.S., and should be kept in mind when considering the results of the study.
- Some of the regional variance could also be explained by culturally-based evaluation differences. In Asia and Latin America, scale values tend to be generally higher in surveys.

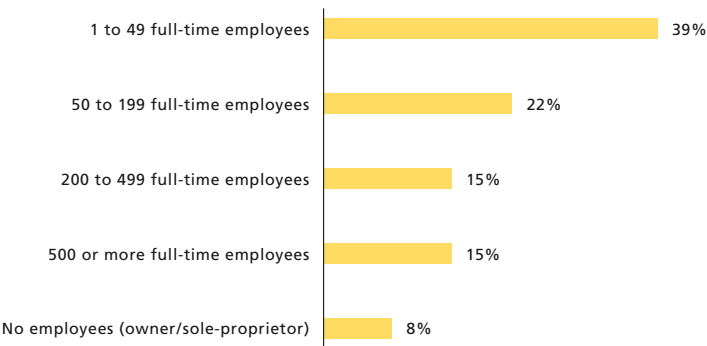
## The Profiles of Participating Business Customers:

### INDUSTRY SECTOR



**Fig.35** N. A. = 0%, N = 1,800

### COMPANY SIZE



**Fig.36** N. A. = 1%, N = 1,800

WORKING AREA

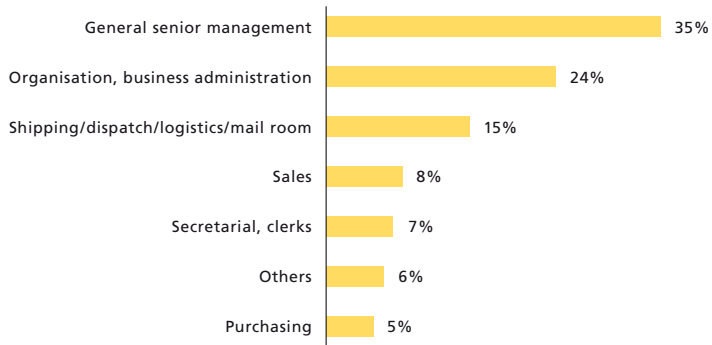


Fig.37 N. A. = 0%, N = 1,800

TRANSPORTATION MODES USED

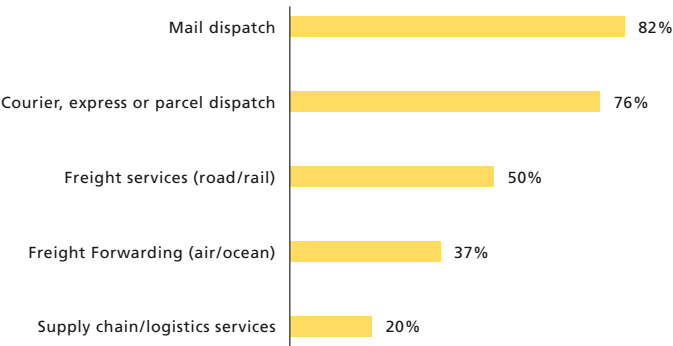


Fig.38 N = 1,800

The Profiles of Participating End Consumers:

LEVEL OF EDUCATION

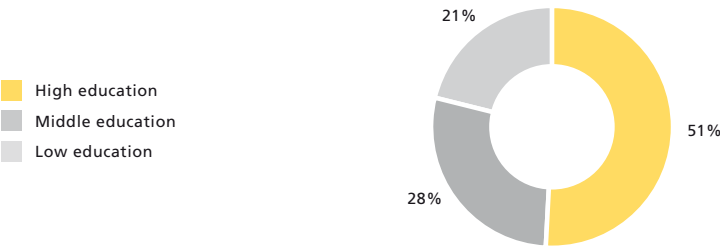


Fig.39 N. A. = 6%, N = 1,800

OCCUPATIONAL GROUP

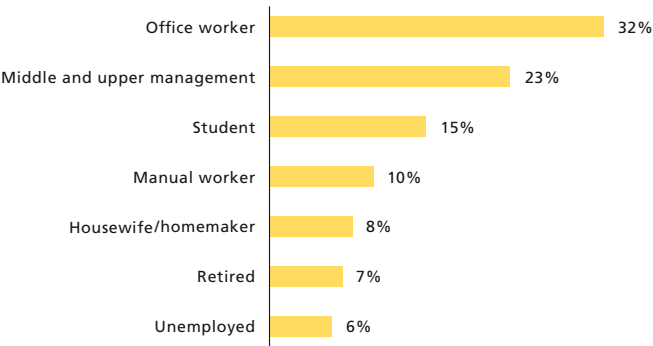


Fig.40 N. A. = 2%, N = 1,800

AGE

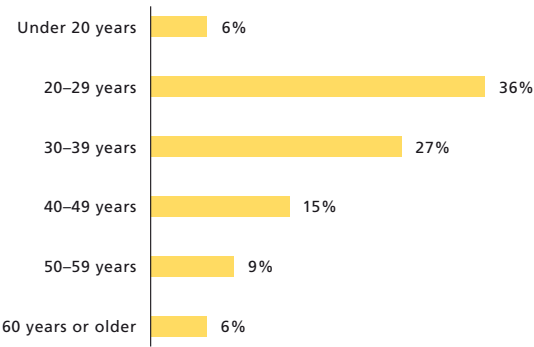


Fig.41 N. A. = 0%, N = 1,800

GENDER

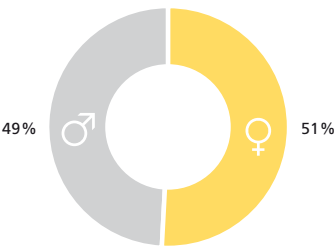


Fig.42 N. A. = 0%, N = 1,800

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