

## Lean and green: creating a network community for sustainable logistics

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### Abstract

Road transport is responsible for about 75% of all volume transported on the continent in Europe, and the emission of CO<sub>2</sub> particles is around 75 gram ton.km. for truck trailers in 2009 and not expected to decrease significantly in the coming years. A new logistics network approach is needed to make road transport more effective and sustainable. The Lean and Green program in the Netherlands was started in 2008, and is a demand-driven public-private network approach in which over 250 companies are participating. The companies commit themselves to saving 20% on CO<sub>2</sub> emissions on logistical activities. The program has been successful, with 91 of the almost 300 so-called 'frontrunners' achieving already 195,000 ton CO<sub>2</sub> emission savings, or about 0.6% savings on all CO<sub>2</sub> emissions of road transport in the Netherlands annually. Because of the community approach, the Lean and Green network is growing continuously. It is a successful platform for private companies and public authorities to work together on one common goal: more sustainable and profitable logistics.

*Keywords:* sustainability, network, logistics, road transport, community

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### Résumé

Le transport routier est responsable d'environ 75% du volume total transporté sur le continent en Europe, et l'émission de particules de CO<sub>2</sub> est d'environ 75 grammes ton.km. pour les remorques de camion en 2009 et ne devrait pas diminuer de façon significative dans les années à venir. Une nouvelle approche de réseau logistique est nécessaire pour rendre le transport routier plus efficace et durable. Le programme Lean and Green aux Pays-Bas a été lancé en 2008, et est une approche de réseau public-privé axé sur la demande dans laquelle plus de 250 entreprises participent. Les entreprises s'engagent à réduire de 20% les émissions de CO<sub>2</sub> sur les activités logistiques. Le programme a été un succès, avec 91 des près de 300 soi-disant « meneurs » atteindre 195.000 tonnes déjà économies d'émissions de CO<sub>2</sub>, soit environ 0,6% d'économies sur l'ensemble des émissions de CO<sub>2</sub> du transport routier aux Pays-Bas par an. En raison de l'approche communautaire, le réseau et vert ne cesse de croître. Il s'agit d'une plate-forme efficace pour les entreprises privées et les pouvoirs publics de travailler ensemble sur un objectif commun : la logistique plus durables et rentables.

*Mots-clés:* développement durable, le réseau, la logistique, le transport routier, la communauté

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## 1. Focus on sustainable road transport in Europe: the challenge

In the current European transport market, the need for effective and sustainable logistics operations is getting more important every year for shippers, logistics service providers and the society as a whole. With the on-going expanse of world trade, the effective use of all transport modes is essential to meet the ever increasing demands of the 500 million customers in the 27 Member States of the European Union, Although the use of rail and inland barge transport is on the rise in some European countries, more than three-quarter of all transport tonne-kilometres (abbreviated: ton. km.) is still handled by road freight transport in the 27 Members States of the EU. Figure 1 shows the development in the modal split for continental transport in Europe, with a market share of 74.8% for road transport in 2001 and 76.4% in 2010.

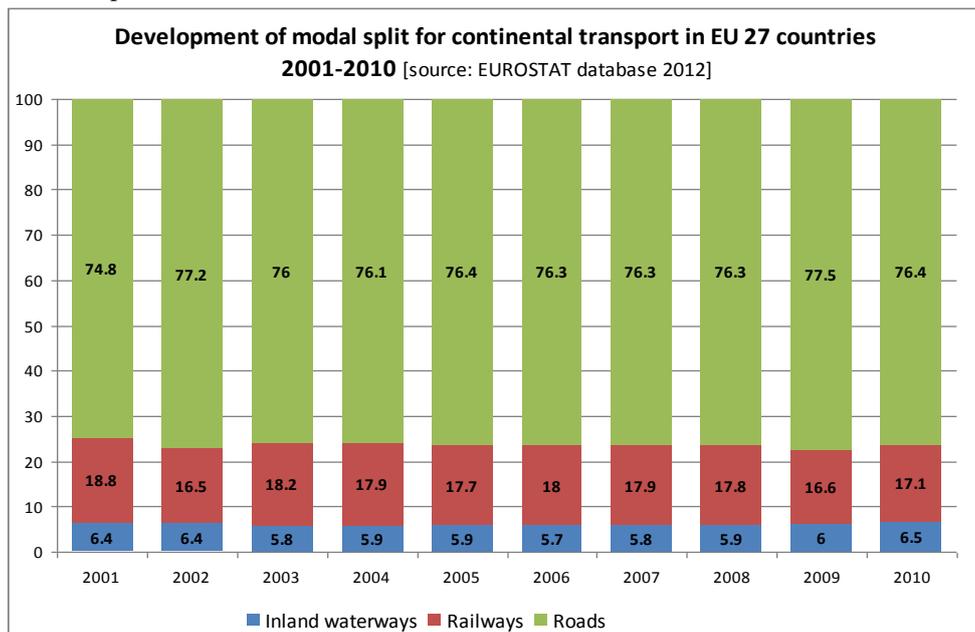


Figure 1 – Modal split between rail, inland barge and road transport for continental transports across Europe 2001-2010 (total % ton.km) (Source: EUROSTAT database 2012)

As can be concluded from figure 1, the market share of road in European continental transport has not come down in the last 10 years. There are many reasons for this, among others that the use of road transport is almost without competition for trips of 50 kilometres or less, or to city centres or other population areas. In practice, road freight transport is flexible, easy sized and easy to use, but also has a number of negative side effects. A major negative effect is the relatively high emission of CO<sub>2</sub> particles per tonne kilometre in comparison with other transport modes. Recent research commissioned by the European Commission (Den Boer, Otten, van Essen, 2011) has shown that the emission of CO<sub>2</sub> particles is around 75 g/ton.km. for truck trailers in 2009 and expected to be a little over 70 g/ton.km. in 2020, if we look from an integral well-to-wheel perspective (adding WTT well-to-tank and TTW tank-to-wheel together). As figure 2 shows, the other continental transport modes rail and inland barge have a lower emission of CO<sub>2</sub> particles per ton.km. in 2009 and 2020 when the trains and ships are running on economically viable loading rates. Especially rail transport results in less CO<sub>2</sub> emission per ton.km., which is under 20 g/ton.km. in 2009 and 2020 for a long diesel freight train and under 10 g/ton.km. for a electric freight train. The main conclusion from figure 2 is that the use of road transport results in more CO<sub>2</sub> emissions per tonkm than other continental transport modes, now and in the future.

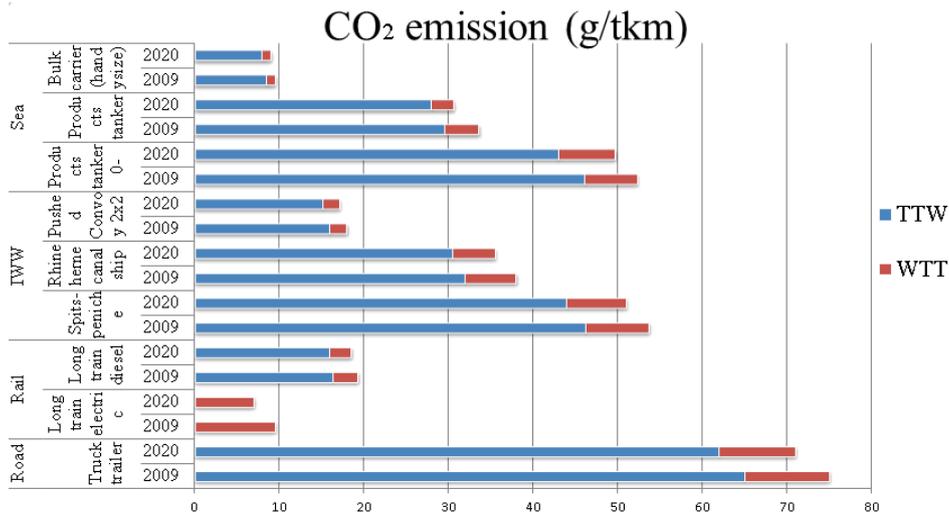


Figure 2 – Comparison of CO<sub>2</sub> emissions 2009 and 2020 for selected vehicle types (Source: CE STREAMS 2011)

## 2. Sustainable road transport in Europe: are proposed policy measures enough?

On a world-wide scale, the European Union has called for a drastic reduction of CO<sub>2</sub> emissions world-wide in the coming 20 to 40 years in order to be able to limit the expected rise of the global climate to 2 degrees maximum. In order to achieve this, the EU itself has stated in the last White Book [European Commission, 2011] that the CO<sub>2</sub> emissions in transport have to decrease with 20% when compared to the 2008 level. This objective can only be achieved with large scale measures, like the proposed shift of 30% of all long-haul transport over 300 kilometres from road to barge and rail transport in 2030. But the question is if in the current economic climate these large scale measures can be introduced successfully. In the past 10 years, we have seen that in road transport across the 27 Members States of the European Union the total amount of CO<sub>2</sub> emissions have not gone down, but increased with 0.7%. This is in stark contrast with the achievements of the European industry as a whole which has managed to decrease the total amount of CO<sub>2</sub> emissions with 8.0% in 2001-2010. The conclusion is that road transport has been lagging in decreasing CO<sub>2</sub> emissions in practice in 2001-2010 compared to other European sectors. The question is whether this trend can be reversed by the proposed policy measures in the White Book of the European Commission. Given the results for 2001-2010, it is easy to have doubts about this.

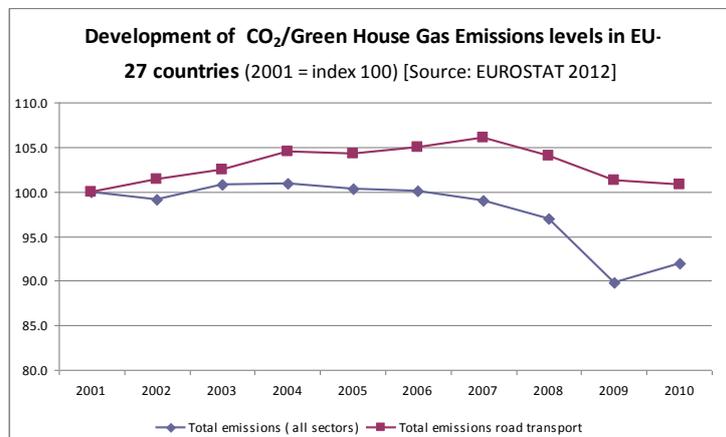


Figure 3 – Development of CO<sub>2</sub>/Green House gas emissions in the European Union for the whole economy and the road transport sector, 2001-2010 (Source: EUROSTAT 2012)



### 3. Sustainable road transport: the Lean and Green approach

In the Netherlands, a new approach called Lean and Green has successfully been set up in the past five years to make road freight transport both more effective and sustainable. This approach is based on creating a vibrant logistics community of shippers, distributors, retailers, road transport companies, other logistics service providers and local and national public authorities, together taking actions to decrease the amount of CO<sub>2</sub> emissions on their supply chains, focusing on road transport. At this moment, 294 organisations are officially participating as a partner in the Lean and Green Community, of which the overwhelming majority are private companies. The organisations that are partner in the Lean and Green program have committed themselves to reduce 20% in CO<sub>2</sub> emissions for a part of their supply chain within 5 years. They are willing to commit themselves to this objective, because decreasing the CO<sub>2</sub> emissions in a part of their supply chain can in practice often be combined with make the logistics effective processes more effective and profitable. The partners are called Frontrunners (Koplopers in Dutch) to shine out as an example for other similar organisations. Although the majority of the 294 current partners are private companies, there are also several municipalities which are a Frontrunner in the Lean and Green program. The Lean and Green Program has been set up in 2007 by the Dutch Ministry for Infrastructure and Mobility, which wanted to give incentives to the Dutch logistics sector to be more sustainable in transport and logistics. They asked Connekt to manage the program. Connekt is an independent private-public partnership, in which private companies and public authorities work together to achieve a more sustainable mobility in the Netherlands for both persons and goods transport. In the Lean and Green Program, the partners can achieve two different levels of CO<sub>2</sub> emission reduction:

1. The Lean and Green Award
2. The Lean and Green Star

Ad 1. *The Lean and Green Award* is given to companies which have set up a Plan of Action to decrease CO<sub>2</sub> emissions in their Supply Chain with 20% in the next five years, while at the same time improving their operational logistics processes. The companies are themselves responsible for writing the Plan of Action, in which the CO<sub>2</sub> emissions in current operation are recorded, and a set of proposed logistics actions are formulated to achieve 20% reduction in CO<sub>2</sub> emissions in the next five years. Also, systematic monitoring activities have to be formulated according to specifications of the Connekt program management. When the Plan of Action is approved by TNO, the largest independent and non-profit research and development organization in the Netherlands, the company is given a Lean and Green Award. This includes the handing over the Lean and Green Award in a public ceremony, and the right to use the Lean and Green logo in daily logistics operations. In this way, the Lean and Green Award serves as an encouragement for companies to start systematically with lowering CO<sub>2</sub> emissions. The first Lean and Green Awards have been awarded in 2008 for the first time to 9 companies, among others Rockwool, CEVA Logistics, Nijhof Wassink, TNT Express and Roberts Europe. At the Award ceremony, selected companies have presented a summary of the operational actions they have taken to decrease CO<sub>2</sub> emissions by 20%. These operational actions included:

- the use of Long and Heavy freight Vehicles (LHVs, also known as Eco Combis). In the Netherlands, the use of longer (up to 25,25 meter) and heavier (up to 60 ton) trucks on specific roads is allowed, and this can result in up to 35% savings on CO<sub>2</sub> emissions per ton.km.;
- the use of alternative fuels for freight vehicles, like CNG/LNG, hybrid or full electric for smaller vans;
- bundling and combining several transport flows in one truck, and thus improving the loading grade;
- avoiding peak distribution hours in city centers, thus avoiding congestion;



- using multimodal transport opportunities, using inland barge or rail transport instead of road transport. In this way, the Lean and Green program is also focused on stimulating a modal shift from road to inland barge or rail transport in order to decrease CO<sub>2</sub> emissions.

After handing over the Lean and Green Award to the first 9 companies in 2008, these Award giving ceremonies have been taking place every few months for between 10 and 70 new partners.

Ad 2. *The Lean and Green Star* is awarded to companies given to companies which have taken a further step in decreasing CO<sub>2</sub> emissions. The Star is awarded to companies who fulfill the following three requirements:

- At least 18 months after being given the Lean and Green Award;
- To have reached a decrease of 20% in CO<sub>2</sub> emissions for at least 12 months;
- To be transparent and open about the results by participating fully in the public monitoring of the Lean and Green Program.

In June 2012, four companies received the first Lean and Green Stars, because they achieved their objective of 20% reduction in CO<sub>2</sub> emissions: SCA Hygiene Products Consumer, Moonen Packaging, Arla Foods en Wim Bosman Group. The four companies together achieved 4,947 ton reduction in CO<sub>2</sub> emissions for at least 12 months. The reductions per Lean and Green Star winner were, Arla Foods (25.3%), Moonen Packaging (53.0%), SCA Hygiene Products (28.8%) and Wim Bosman Group (20.9).

The Lean and Green Star Program gives companies the opportunity to make the next step in sustainable operations. They can sharpen their CO<sub>2</sub> emissions reduction target to a higher level (e.g. 40%), or they can use the Lean and Green objective and use to on other company activities, like leasing or energy management. The basic principle of the Lean and Green program is that companies will continuously challenge themselves to go a step further in sustainable operations, in which the Connekt network is facilitating them. Next to companies, municipalities are also able to become a Lean and Green frontrunner. In 2010, the town of Nijmegen (140,000 inhabitants) was the first municipality to receive the Lean and Green Award, and the objective of Nijmegen is to be climate neutral in 2020, and at the moment there are more than 20 municipalities that have received a Lean and green Award. Municipalities can receive a Lean and Green Award if they stimulate the use of sustainable transport within town boundaries. Examples of actions taken by the municipality of Nijmegen are:

- Stimulating the bundling of transport to and from the city centre and shopping areas by facilitating initiatives like Binnenstadservice (Inner City Service), an organisation which arranges for bundling of transport to 140 small shops in the city
- Stimulate the use of CNG/LNG, hybrid and electric vehicles for inner city distribution by giving specific benefits for these vehicles, e.g. longer delivery time windows and/or use of bus lanes
- Making their own fleet more sustainable by using hybrid and electric vehicles
- Using sustainable transport as a major criterion in procurement of services and tendering public transport for the city (once every 5 years)

#### **4. The results of the Lean and Green approach**

The 294 current Frontrunners in the Lean and Green have mentioned a large variety of company specific CO<sub>2</sub> emission savings activities in their respective Plan of Actions. In the last available database before this paper has been writing, these CO<sub>2</sub> emission savings activities were analyzed for 143 companies. Among these 143 companies, there were 39 shippers and retailers, 94 logistics service providers and 10 others (terminals,



distributors, agents, etc.). In total, 194 different CO<sub>2</sub> emission saving activities are mentioned, of which the top-10 were the following:

1. Monitoring fuel efficiency, including information to drivers
2. Use of LHV (Long and Heavy Vehicle, up to 25.25 meter long and 60 tonnes)
3. More sustainable truck fleet
4. Improvement in truck loading percentage
5. Monitoring/improving driving style of drivers
6. Bundling for transports for different companies
7. Periodic check of tire pressure
8. Use of cleaner fuel sources (bio fuels, hybrid/electric)
9. Coordination of delivery times
10. Use of intermodal transport

The first CO<sub>2</sub> emission saving activity was monitoring fuel efficiency, including information to drivers. This was mentioned by 80 of the 143 reviewed Frontrunners (56%). However, this does not necessarily imply that the other 43% did not monitor fuel efficiency. A part of the remaining companies already had fuel monitoring systems in place, which did not need to be upgraded. The participating companies started their Plan of Action from their individual status in sustainable logistics. The top-15 of mentioned CO<sub>2</sub> emission saving activities is given in Table 1 below.

Table 1 – Top-15 of CO<sub>2</sub> emission saving activities, mentioned by 143 Frontrunners in the Lean and Green program

<b>Top-15 of CO<sub>2</sub> emission saving activity</b>	<b>Number of times mentioned</b>	<b>Average saving</b>
1 Monitoring fuel efficiency, including information to drivers	80	5.3%
2 Use of LHV (Long and Heavy Vehicle, up to 25.25 meter long and 60 tonnes)	49	6.9%
3 More sustainable truck fleet	44	4.4%
4 Improvement in truck loading percentage	32	4.3%
5 Monitoring/improving driving style of drivers	18	7.0%
6 Bundling for transports for different companies	18	3.0%
7 Periodic check of tire pressure	18	6.8%
8 Use of cleaner fuel sources (bio fuels, hybrid/electric)	17	3.7%
9 Coordination of delivery times	17	3.3%
10 Use of intermodal transport	16	7.8%
11 Improving sustainability of the warehouse (e.g. isolation)	16	4.9%
12 Use of advanced software module for optimal transport planning	15	3.5%
13 Reduction of empty vehicle kilometres	13	4.9%
14 Instalment of stop-go fuel saving systems	13	5.5%
15 Use of Green electricity	13	12.0%



The main conclusions that can be drawn from the analysis are the following:

- The top-15 CO<sub>2</sub> emission saving activities are mainly focused on transport (activity 1 to 8, 10, 13 and 14), but also activities concerning planning (activity 9 and 12) and the warehouse (activity 11 and 15) are mentioned.
- The nr. 1 activity clearly stands out on top (56%), while the activities 2, 3 and 4 are also used by 22%-34% of all Frontrunners in this database.
- The average CO<sub>2</sub> emission savings of the top-15 activities is estimated to be between 3% and 8% per company, while the use of green electricity tops out at 12%. This last percentage is caused by a number of Frontrunners which are heavily investing in alternative energy sources on their own ground (e.g. Solar panels and wind turbines). Even when this is not taking into account, it is remarkable that the average CO<sub>2</sub> emission savings to be gained are estimated to be relatively high. This shows that for many companies there are many opportunities to make quick wins in their operational logistics processes to decrease the amount of CO<sub>2</sub> emissions.

Of course, the Plan of Action for CO<sub>2</sub> emission savings in logistics operations is a first step, but the main objective is to achieve these savings in practice. In total 91 frontrunners have reported the results of their CO<sub>2</sub> emission saving activities for 2011, and these results are verified and proofed by the Connekt monitoring system. The result are given in table 1 below, and show that already 43% of all 91 researched Frontrunners have succeeded in achieved a 20% reduction or more in their Supply Chain in 2011. About half of all Frontrunners have reported insufficient CO<sub>2</sub> emission savings between 0 and 20% for a number of reasons, e.g. because the economic downturn made planned investments to be postponed. Finally 8% of all Frontrunners did not achieve a saving in CO<sub>2</sub> emissions in their logistics activities, and need to take action in 2012 to stay a Lean and Green Frontrunner.

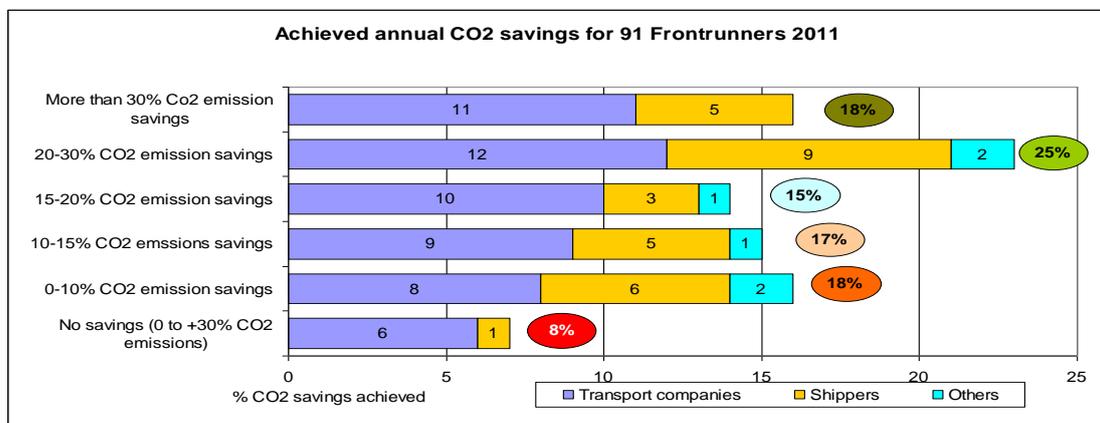


Figure 4 – Achieved CO<sub>2</sub> emission savings by 91 Frontrunners on the Lean and Green Program 2011

The total amount of saved CO<sub>2</sub> emissions in logistics operations by the 91 researched Frontrunners in the Lean and Green Program was 194,388 ton, or 15.1% of savings on average. The largest reported CO<sub>2</sub> emission saving for a single Frontrunner was 25,630 ton (8.3% CO<sub>2</sub> emission savings) in 2011 for a large shipper in the hi-tech sector, followed by a large logistics service provider with 22,780 ton (21.1% CO<sub>2</sub> emission savings). These two Frontrunners also have the largest logistics operations of all 91 companies reviewed.

An overview of all CO<sub>2</sub> emission savings of the 91 Frontrunners is given in table II below. Although the 56 transport companies have made 100,716 ton savings in 2011, the average saving per transport companies was 1,799 tons. This represents on average 16.5% of savings. The 29 shippers have made almost as much savings,



90,531 ton, but the average savings per transport was higher with 3,116 ton. However, because the participating shippers usually have larger logistics operations than transport companies, the average savings was with 14.7% slightly less than for the transport companies. The 6 other logistics companies booked ‘only’ 3,321 tons of savings in CO<sub>2</sub> emissions, and in absolute volume per company (554 ton) and percentage (5.6%) this was well below the result for shippers and transport companies.

Table 2 – Detailed analysis of CO<sub>2</sub> emissions savings in tons in 2011 for 91 Frontrunners in the Lean and Green Program

	CO <sub>2</sub> emission before L&G	CO <sub>2</sub> emission in 2011 with L&G	CO <sub>2</sub> emission savings in 2011	% CO <sub>2</sub> emission saving in 2011	Number of Frontrunners	Average saved ton CO <sub>2</sub> per Frontrunner
Transport companies	609,734	509,018	100,716	16.5%	56	1,799
Shippers	615,058	524,707	90,351	14.7%	29	3,116
Others (terminals, agents, etc.)	59,739	56,418	3,321	5.6%	6	554
<b>Total</b>	<b>1,284,531</b>	<b>1,090,143</b>	<b>194,388</b>	<b>15.1%</b>	<b>91</b>	<b>2,136</b>

In the Netherlands, the annual CO<sub>2</sub> emission of road transport was 34.242 million ton in 2010 (source: EUROSTAT 2012). The savings of the 91 reviewed Frontrunners in the Lean and Green Program amounted to 0.194 million ton in 2011, or about 0.6% of all CO<sub>2</sub> emission of road transport in the Netherlands in 2010. An exact comparison is difficult, because the base years 2010 and 2011 are different, the recorded savings in Lean and Green do not only include road transport operations and the supply chains of the 91 Frontrunners are often international. On the other hand, there are now 3 times as much Frontrunning companies than the 91 reviewed Frontrunners, so it could well be that the total amount of saved CO<sub>2</sub> emissions in logistics operations will be around 500,000 ton in 2012 or even more, and this could amount to 1% of all road transport CO<sub>2</sub> emissions in the Netherlands. This can be viewed as a substantial success for the Lean and Green program, based on the fact that the companies themselves take the lead in sustainable logistics.

## 5. Lean and Green: explanation of success factors

The Lean and Green Program is viewed as a successful program to decrease CO<sub>2</sub> emission of road transport in the Netherlands in the long run. The number of Frontrunners has steadily been growing from the first 9 Frontrunners back in 2008. Every few months, between 10 and 50 new Frontrunners are accepted for the Lean and Green Award, with which they join the Lean and Green network. This network offers many opportunities to discuss the value of different operational CO<sub>2</sub> saving activities with peer companies. Also, a increasing number of Frontrunners work together to think out new ways of CO<sub>2</sub> saving activities. To give a few examples:

- The GREEN ORDER® tool, which can be used to calculate the CO<sub>2</sub> emissions connected to ordering and procurement;
- The Green Tender tool, which was designed by the Frontrunning shippers InterfaceFLOR, Mars Netherlands and H.J. Heinz to incorporate sustainability in transport tendering;



- The GREEN CARE TRANSPORT™ tool, which was designed by Frontrunning shipper SCA Hygiene Netherlands, and can be used by shippers, transport companies and retailers to organize shipments more efficiently and save CO<sub>2</sub> emissions;.
- The annual Speed docking challenge, organized by Mars Netherlands and H.J. Heinz, in which companies from all over the Netherlands compete in bringing back the average docking time of a truck to a minimum;



Figure 5 – Examples of internet tools which are set up by Frontrunners to increase operational CO<sub>2</sub> savings

Another success factor of the Lean and Green program is that a fair share of the managers of Frontrunning companies are willing to commit themselves personally to the goal of lowering the CO<sub>2</sub> emissions in their supply chains. In order to underline this, the Lean and Green program has six Ambassadors, which regularly join discussions and give presentations about the effects the Lean and Green program initiative has for their own sustainable logistics. The Ambassadors take personal responsibility for communicating and underlining the benefits of the Lean and Green program for shippers and transport companies in the Netherlands, and act therefore as role models for potential new entrants.

## 6. Lean and Green: recognition and expansion

In recognition of its success in the past few years, the Lean and Green Program has received the prestigious annual Nederlandse Logistieke Prijs 2012 (Dutch Logistics Awards 2012) in November 2012. This most important annual logistics price in the Netherlands was awarded to Connekt and the Lean and Green Program for the following six reasons:

- Individual possibilities within a network: Lean and Green is innovative, because it creates a network that is free to join for private companies and public authorities, but also monitors and checks the results. The company itself can define the actions to be taken, as long as the result is 20% savings in CO<sub>2</sub> emissions.
- Demand-driven: the program is highly demand-driven, meaning that private companies play a major role in development and implementation of the program. Their needs for making logistics more smart and sustainable are the roots of the program. The companies indicate the innovative fields of interest and ask Connekt/Lean and Green to facilitate the exploration of both these new fields of interest and the new networks involved.
- Without the commitment and involvement of the companies the program would not have been successfully supported and implemented.
- Cost-effective: the program combines the sustainable goal of CO<sub>2</sub> emission savings with the goal of making logistics operational more effective and profitable. This combination makes it especially interesting for new companies to join.
- People make it work: the Lean and Green program focuses on reaching the people who are responsible for logistics operations, and tries to give them valuable information and contact which they can use to reach CO<sub>2</sub> emission savings.
- Continuous development: Frontrunners start with the Lean and Green Award, in which they are recognized in an early stage for the commitment to lower CO<sub>2</sub> emissions. Then, the planned activities



can start, and frontrunners can obtain the Lean and Green Star. A maturity-matrix has been set up to guide Frontrunners through this process, and help them achieve more results over the years.

- Innovative communication: Throughout this paper, examples of the innovative communication campaign that the Lean and Green Program pursues have already been given. The Lean and Green logo is depicted on many trucks that the Frontrunners have on the roads in the Netherlands. Also, the Award ceremony and the Ambassadors show the success of these communication strategy.

There is also growing interest for the set-up, philosophy and results of the Lean and Green program outside the Netherlands. Three major countries where a comparable Lean and Green Program has been launched are Italy , Belgium and Germany while there is also concrete interest from Sweden, England and Poland to launch a Lean and Green program. The fact that many multinational companies are Frontrunner is a major driving force behind the internationalization of Lean and Green.

## **7. Lean and Green: main conclusions**

The main conclusion of the five years running of the Lean and Green program is that the demand-driven public-private network approach of the program has been very effective. Almost 300 frontrunners are achieving 0.5% to 1% savings on all CO<sub>2</sub> emissions of road transport in the Netherlands annually, for the 91 reviewed frontrunners this amounted to 0.2 million ton but in November 2012 there were already 294 frontrunners. The Lean and Green network is growing continuously, and strongly supported by the management of shippers and transport companies. It offers many opportunities for close cooperation between companies, and is instrumental in developing tools for achieving more savings in the future. In short, it is an example of a successful platform for private companies and public authorities to work together on one common goal: more sustainable and profitable logistics with 20% less all CO<sub>2</sub> emissions.

If we look at the results from an European perspective, it seems that still much has to be done. As a sector, road transport has been lagging in decreasing CO<sub>2</sub> emissions in the past 10 years compared to other sectors. Although the results of the Lean and Green program in the Netherlands on first sight seem small compared to the required decrease in CO<sub>2</sub> emissions for road transport in Europe in 2030, we have also seen that the Lean and Green program quickly has gained momentum and is rapidly expanding, both in the Netherlands and beyond. Therefore, this demand-driven Lean and Green program is a potential major factor for successfully achieving a paradigm shift in decreasing CO<sub>2</sub> emissions in this sector across Europe.

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