

Summary:

Strategy for 50 % reduced emissions from distribution of goods in the city of Oslo

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The study suggests that some of the most effective measures to reduce emissions are more coordinated municipal purchasing and consolidation center(s) dedicated for deliveries to specific zones in the city coupled with requirements on use of environmentally friendly goods vehicles. This means that electric vehicles or freight bikes, trucks with Euro VI engine or alternative fuel should be used for last mile distribution. The municipality can contribute to reduced emissions by combining their own purchases and shift to electric or Euro VI vehicles in their own vehicle fleet. Other measures contributing to reduced emissions are zero-emission zones, increased number of filling stations for alternative fuels, increased number of loading- unloading bays and increased use of evening and night deliveries. Collection points for e-commerce deliveries and use of ITS with real-time information on traffic and infrastructure are other solutions that provide significant effects. A Sustainable Urban Logistic Plan (SULP) should be established to ensure that the most cost-effective measures are prioritised.

Objective

Objectives of the study were to summarize the effects and experiences of measures that contribute to reduced greenhouse gas emissions in cities. Important secondary goals were to:

- Outline individual and multiple measures that will contribute to a 50 % reduction in emissions from freight transport in Oslo within 2020
- Assess and quantify effects on emissions from individual and multiple measures.
- Create a basis for prioritising strategies for implementing relevant measures for Oslo

Results from the analysis will also contribute to a Sustainable Urban Logistics Plan (SULP) for Oslo.

Methodology and implementation

A literature study was conducted to gather information about effects of measures for reduced emissions from freight transport and logistics activities in cities. A challenge in the review has been that reported effects of implemented measures are scarce.

The studied measures and tests are carried through in different cities, adapted to local problems and with different degrees of evaluation. Therefore the results can be difficult to compare and in addition contribute to considerable uncertainty.

Municipalities are active in the implementation of measures

The study summarizes measures implemented to increase efficiency in city distribution, improve urban environment and reduce emissions from last mile deliveries in European cities. An observation is that both implementation of measures and the problems they should solve are different from city to city. Effects from the measures are often inadequately documented or are based on simple calculations. We note that in the past few years it has become more common to accomplish small-scale experiments to test the effects of appropriate measures rather than immediately full scale implementation.

Problems to be solved and strategic plans are followed by demonstrations and pilots for restricted areas before full scale implementation and extension to larger areas and/or other industries. With such an approach, negative effects are revealed before up-scaling and implementation of the measure on a permanent basis takes place.

We have noticed that individual measures are rarely implemented, the norm is that several measures are combined to give optimal effect, and to solve several problems simultaneously. We also note that the municipalities or city administration are initiators and active participants in the implementation of measures.

Effects from measures

From the studied measures we summarise effects on emissions in table I. The results are based on findings from evaluations, calculations and measurements. Results, however, have several weaknesses. One weakness is that the evaluation results are stemming from different years. This implies that results from new trials could be based on newer technologies, such as lorries with a new Euro V or Euro VI engine technology compared to what was used in older trials; the new Euro Classes of motors have gradually contributed to cuts in local emissions. Another weakness is that the effect of some of the studied trials are documented in the form of calculations while others are documented with measurements. For some of the experiments, calculations or measurements are stated in absolute terms without information on relative changes. It is then difficult to determine whether the effect of the measure is relatively large or small. Such results are omitted from the table. Despite these shortcomings, we believe that the table provides indications on the measures that may contribute most to emission cuts.

Table I. Measures and effects of measures on emissions, costs and operations.

Element	Measure							
	Co-ordinated deliveries, Oslo municipality	Co-ordinated orders, Oslo municipality	Consolidation centre	Low emission zone	Transfere from EURO V til EURO VI engine	Deliveries on evening and night	Combination of, El cycles og El vans	El.cycles
Environment, health and safety								
CO ₂ , g/km	-(24-38 %)	-(10-20 %)	-(18-90 %)		23 %	-20 %	-54 %	-62 %
NO _x , g/km			-(25-90 %)	-(1-20 %)	-92 %	-40 %		
NO ₂ , g/km				-(1-11 %)	-86 %			
SO ₂ , g/km			-(26-69 %)					
PM _{2,5} , g/km			-59 %					
PM ₁₀ , g/km			-(30-90 %)	-(1-15 %)		-40 %		
PM, g/km				(2-58 %)	-93 %			
Noise, Db			-30 %; '-20 Db/kj.t.			No complains		
Safety						Safer		
Economic and efficiency								
Operating costs, NOK	-(0-9 %)		(-25 - +100 %)			-23 %		
Hours spent			+(5-10 %)			-21 %		
Driven km	-(24-38 %)	-(10-20 %)	-(5-50%)				-20 %	-54 %
Number of goods vehicles	-(28-86 %)		-(20-70%)					

Consolidation centre, coordinated ordering and delivery combined with use of electric vans and electric goods bikes

Use of consolidation centres is a measure that gives a reduction in both local and global emissions. A large number of consolidation centre experiments have been carried out in Europe, with varying success. One problem with use of consolidation centres is the costly additional unloading-/loading activities that have to take place.

To increase the effect of implementing a consolidation centre, this measure may be combined with vehicle restrictions, for example requirements for Euro V or Euro VI engines and even requirements for electric bikes and electric vans in the last mile distribution.

A further possibility for combination of measures is related to the use of late evening and night deliveries.

From the studied experiments the table shows that implementation of a consolidation centre provides significant reductions in emissions of CO₂, NO_x, SO₂, and PM_{2.5}. In addition, reduced noise and distance driven can be achieved.

Co-ordinated deliveries combined with coordinated purchases from Oslo Municipality provide significant reductions in emissions in Oslo. Calculations indicate that achieved emissions cuts from co-ordinated deliveries and co-ordinated purchase, are respectively 24-38 % and 10-20 %. Experiences from established consolidation centres shows that it is often difficult to achieve profitable operations when financial support/subsidies lapses. However, in some cases it seems to exist operational models for consolidation centres facilitating profitable services without financial support, for example the Distripolis concept in Paris.

Low emission zone (s) and the requirements for engine technology.

To reduce local emissions, a low emission zone (defined geographic areas) may be an effective remedy. The plain design is that access to the zone is restricted to vehicles with a particular engine technology such as Euro V or Euro VI engines, electric engines or use of other low-emission fuels. In this setting an increased number of filling stations for alternative fuels is a measure.

Tests suggests that the transition from Euro V to Euro VI engines in trucks contributes to cuts in emissions of NO_x (92 %), NO₂ (86 %) and PM (93 %). It is however uncertainty connected to the level of emissions of nitrous oxide (N₂O) from heavy vehicles with Euro VI engine. In some occasions the emissions is measured to be high.

To achieve the full effect a low emission zone, corresponding access restrictions for private cars should be introduced. The design may have several varieties, but the imposition of a charge on vehicles that do not meet the imposed requirements are common. Control of vehicles running into the zone can be done using ICT.

Evening and night delivery

A measure to reduce emissions and streamline deliveries in cities is permission to deliver goods during late evening and night hours. In tests, this measure seems to contribute to cuts in local emissions of 40 % (NO_x and PM), while CO₂ emissions are reduced by 20 %. In the conducted experiments there have not been complaints about noise, while safety at delivery improves. Both operational costs and time spent for transport are reduced, at the same time traffic during rush-hours is reduced.

Increased number of loading and unloading bays

Especially in peak delivery periods, trucks and vans have problem with access to loading and unloading bays in central Oslo. This means that the freight vehicles are circulating the block/blocks searching for a place to stop.

An increased number of unloading bays may thus contribute to a reduced number of kilometres driven, with associated reductions in emissions. The measure will provide smoother and more efficient operation for transporters and logistic service providers. In addition to increased number of loading- and unloading bays, there should be a stricter enforcement of the access rules to the bays.

Cooperation between actors

In many European cities, including Brussels, Stockholm and London, it has been seen as important to facilitate increased collaboration between actors to promote sustainable goods distribution. The authorities take the initiative and all actors are invited to attend. Forums for discussion may serve as a think tank or partnership forum to discuss problems and "Best Practice" solutions that can be implemented. Other measures are related to development of quality standards ("Freight Operator Recognition Scheme" FORS) ensuring transport buyers sustainable transport services.

Sustainable Urban Logistics Plan (SULP)

To ensure efficient and environmentally friendly goods distribution in Oslo a comprehensive plan for logistics and goods transport should be drawn up. Objectives of the plan should be to provide Oslo with more efficient, safer and greener deliveries. A part of the plan should be dedicated to priority-setting of actions, and quantification of effects from the selected actions. Focus should be on measures that support the strategies determined in advance. Actors involved or affected by distribution of goods should be invited to work with the design of the plan.

Factors for successful implementation of measures

Experience from European cities indicate that successful implementation of measures for reduced freight transport emissions can be facilitated by the following factors:

- It is important that the initiative comes from local actors and is "bottom-up". The measure must have the support of the players before the start
- Private sector must be involved while introducing measures and have support in regulation where necessary
- Measures targeting freight transport in cities must be integrated into overall transport and urban development strategies
- For a successful implementation, it is important that there are significant local transport problems that have to be solved
- If there is a possibility to solve more general logistics problems along with specific measures, it is a factor that increases the possibility of a successful implementation.

It also seems that measures where the municipality enters with either financial support in the initial phase and/or contribute with changes in regulations have the best opportunity to succeed in the long term.

Recommendations

To achieve 50 % reduced emissions from goods distribution in Oslo it is recommended to prioritise the accomplishment of a comprehensive plan for logistics and goods distribution (Bylogistikkplan). To achieve consensus with such a plan all involved actors should be invited to make suggestions for actions. The Bylogistikkplan must be part of a comprehensive mobility plan (Sustainable Urban Mobility Plan - SUMP) for the city.

In parallel with initiating a Bylogistikkplan the municipality may initiate measures in their own organisation that will help to reduce emissions. Such a measure could be to coordinate municipality purchasing. Another measure could be to establish a consolidation centre for deliveries to the municipality. It should also be a requirement that all deliveries to Oslo municipality should be carried out with environmentally friendly vehicles, such as electric vans, trucks or bicycles; trucks with Euro VI engine or other environmental friendly fuels.

Replacement of the municipality's own vehicles from cars with traditional fuels to vehicles with environmentally friendly fuel or Euro VI engine is another measure

that can be implemented by the municipality itself. By introducing these measures the municipality show its willingness to take the lead in reducing the emissions.

An adopted strategy to reach the goal of 50 % reduction of environmental emissions in Oslo will form the basis for the Bylogistikkplan. The plan must include both a prioritization of measures and the expected effects of the measures. Additionally the plan must have determined annual targets for emission cuts, evaluation of effects, need for investment and a schedule for implementation of different measures. Other measures to include in the Bylogistikkplan considered for implementation are:

- Different ways of organising **consolidation centre** servicing: parts of the city (zones), deliveries to specific industries (such as building and construction), specific customers (for example, Oslo municipality, hospitals etc.), specific commodities (packages, e-commerce etc.)
- **Low Emission Zones.** This will be zones where there will only be allowed for goods vehicles with low or no environmental emissions, such as requiring electric motors, Euro VI engines or other engines with low environmental emissions. Low Emission Zones can be combined with the implementation of a consolidation centre. Such zones should, in addition to freight vehicles also include cars.
- **Loading and unloading bays** close to recipients. Such bays will reduce extra driving, double parking, reduce the time spent on deliveries and increase efficiency.
- **Late evening and night delivery.** Increased use of late evening and night deliveries will reduce traffic and queue during rush hours and daytime, and reduce emissions.
- **E-commerce deliveries.** Establish environmentally optimal collection points for e-commerce deliveries.
- **ITS solutions.** ITS solutions with real-time information on traffic and infrastructure to carriers and logistics providers should be implemented. Use of ITS for monitoring loading- and unloading bays.
- **Filling stations for alternative fuels.** When establishing such stations availability will increase. The filling stations can be established through cooperation with e.g. HNO Logistics and Transport and fuel suppliers.