City Logistics with electric vehicles

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1 Introduction

The growing demand for delivery of goods increases the problems of traffic congestion, noise and air pollution and therefore a decreasing living quality in the European (inner) cities. With the growing demand for goods delivery it is a challenge to retain the economic benefits of scale in cities while limiting the deterioration of transport performance (of goods) associated with size and density of cities.

With increasing demands for frequent and just-in-time delivery on one hand and the restrictions of limited spatial infrastructure and environmental demands on the other, future solutions for achieving sustainable urban goods transport should be sought through the consolidation of goods delivery. The purpose of consolidation is to improve the utilization of the transport system to generate economies of scale, thereby reducing vehicle trips, increasing efficiency and decreasing financial and environmental costs of transport.

Due to EU regulations on air quality, but also to maintain quality of life in their cities, local authorities try to regulate and influence the negative effects of growing freight traffic. In many European cities exist regulations for trucks entering the cities. Measures vary from the setting of time windows where trucks are allowed to deliver their goods to strict rules on size and type of engines for lorries. Also tax regulations and environmental zones are implemented to avoid too much freight traffic in city areas. However the measures implemented, freight traffic in cities and its negative effects for the air quality and living conditions of its city residents are still growing.

In this document three different types of electric vehicles are described in relation to different types of goods and volumes. Not all examples might be applicable to every city due to differences in local situation, however implementation of one of the examples might already give an impulse to the process of improving city logistics in your own city.
2 The delivery process: new trends

Freight transport is fundamental for urban life and total freight transport is expected to rise with estimations as 38%\(^2\). One of the causes for this growth is the fast growing internet sales or e-commerce. More and more surveys show that shopping in inner cities is “an emotion” rather than actually purchasing goods. This means that the experience of shopping is getting more and more important. The feel good experience is shifting from a visit to the city centers towards the internet shop. In the first stage of internet shopping books, travels and cd were among the most frequent purchases. The newest trends show that also the supermarket chains are now penetrating the internet with several pilots. For delivery of goods, alliances are formed with delivery companies as DHL and TNT, but also alliances with existing internet shops are created. Another trend in urban freight logistics is the reduction of storage areas of shops in cities. This also requires more frequent deliveries and tailor-made solutions.

The changing market asks for other answers for freight logistics in European cities. Recent survey show that although internet commerce is growing very fast all over Europe, customers keep visiting city centers. The feeling of happiness associated with shopping cannot be found only on the internet is one of the main reasons. Another reason lies in the simple fact that city centers have a much broader function than only shopping with their function as cultural, social, political and spatial space.

Consequences of internet shopping and city freight logistics: the delivery process

The main reasons why urban freight logistics is responsible for about 20% of CO2 emissions in cities is due to the very fragmented operation of the actors involved. Main solutions for improving freight logistics to be found in increasing cooperation of entrepreneurial actors as well as local government actors in order to increase rationality and lower the negative effects of city logistics.

As has been shown in research negative impacts can be expected by only replacing larger trucks by smaller ones. Access restrictions could lead in cost increases and higher traffic and emissions because of lower loading rates.\(^3\)

Therefore consolidation centers created near the city centers might be a feasible option to increase efficiency of city logistics. Most important is that access to the consolidation center is not restricted to few or one entrepreneur so a high loading grade of trucks entering and leaving the city is guaranteed. Also paying attention to increase backload to the distribution centers helps to decrease truck KM in cities.

\(^2\) OECD 2003
\(^3\) Interface transport France 2000
Apart from improving and implementing city consolidation centers innovations in electric delivery vehicles can give an impulse in improving and rationalization of urban freight logistics. In the next chapter some examples will be shown with their respective characteristics.

3 Different kinds of electric vehicles for city logistics

3.1 Electric cargo bikes for last mile logistics.

In many European cities cargo bikes are used at the last part in the chain of delivery of goods to households (BTC) and to business (BTB) as retailers, shops and offices. International and local enterprises are more and more aware of the fact that first and last mile logistics are the most costly in the overall logistic chain. (varies between 18-75% ) Using cargo bikes in the city logistics chain gives logistic entrepreneurs a cost and time effective possibility to deliver light weight goods in cities in the last mile. Also for stand-alone companies the electric cargo bike can be a good alternative for deliveries by truck or van.

**Type of vehicle**

There are different types of electric cargo bikes available on the market. There are two, three and four wheel cargo bikes available with all different characteristics. Main difference is in load capacity and possibilities in locking systems when delivering. Load capacity varies from 80-400 Kg and 0.4-3M³. Locking systems vary from open cargo boxes to padlock and electronic devices which open and lock automatically in order to safe time per delivery stop and protect goods.
Type of cargo
Considering two potential user groups namely stand-alone users and companies working in the chain of freight logistics, different types of cargo can be considered. In the case of stand-alone delivery many sort of goods are transported in nowadays cities: bread, wine, folders and flyers, newspapers among many others. But also many SME’s use the cargo bike to not only transport but also sell their products from the cargo bike like coffee, snacks and ice cream. In the logistics chain and in parcel delivery companies as DHL, TNT, UPS and other companies are using cargo bikes for delivery of parcels to offices, retailers (BtB) and consumers (BtC) for reasons of cost efficiency, branding, and visibility.

Potential use
Cargo bikes can function as stand-alone in small and medium enterprises (SME) or as part of the last mile in the logistic chain. In the later case special conditions are required for the cargo security which has to do with locking systems.
In the case of stand-alone company delivery bikes also special requirements can be needed. When used for food delivery, isolation or cooling systems are required, for delivery of pharmaceuticals also a locking system is needed.

Policy measures
When it comes to policy measures push and pull measures can be considered to promote the use of cargo bicycles and decrease negative effects of motorized delivery.
Push measures like allowing cargo bikes in pedestrian areas and allow parking are simple measures to give a positive impulse to the use of cargo bikes. Another pull measure might be subsidies to obtain bikes or arranging possibilities to try out cargo bikes for a certain period.
Pull measures like delivery restrictions during certain hours and in certain areas can help to successfully implement cargo bikes in business cases.
Introducing cargo bikes in the proper municipal vehicle fleet can also give a positive message apart from the improving function in own municipal logistics.
Brands and characteristics cargo bikes

**G1**

The G1 bicycle is very robust as the manufacturers considered using high quality brakes, spokes and rims. The G1s luggage carrier made of stainless steel is the basis for various transport systems.

**Company:** Gobax
Heerweg 19
72116 Mössingen
Germany
+49 74 73/1 78 56-0
www.gobax-bikes.de

German bicycle manufacturer producing strong two-wheeled bicycles even used for food deliveries.

**Category:** Cargo bike

**Contact:** info@gobax-bikes.de

**Product Website:** http://www.gobax-bikes.de/german-high-tech-engineering/dss-g1/

**Price:** from € 1299

**Capacity:** 180 kg (including the cyclist)

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**iBullitt Professional 8G**

Electric mobility will prevail as a revolution in the urban areas. There is in my view no alternative to the eMobility, here comes driving pleasure and sustainability together in a brilliant way. We want to achieve this through innovative concepts, our electric cargo bike iBullitt this is a fascinating eBike to begin the conquest of the cities with a new mobility.

**Company:** Urban-e
Torgauer Street 12-15, House B
10829 Berlin
Germany
+49 (0) 30 78 89 07 80
www.urban-e.com

**Category:** Cargo bike

**Product Website:** www.urban-e.com/produkte/cargo-ebike/professional8g.html

**Price:** 4490 €

**Capacity:** 150kg
**Vrachtfiets Cargo**

electric cargo bike for parcel delivery

**Company:** Vrachtfiets
Scheepsbouwweg 8 – k8, 3089 JW Rotterdam, Netherlands
+31 (0)6 24726218
vrachtfiets.nl/

Dutch company developing cargo bikes for heavy and voluminous loads for parcel delivery and other uses

**Category:** Cargo bike

**Contact:** onno@vrachtfiets.nl

**Product Website:** http://vrachtfiets.nl/product/cargo/

**Capacity:** 400 kg

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**urban arrow**
cargo bike for smart urban mobility

**Company:** urban arrow
Courbetstraat 15 H5, 1077 ZR Amsterdam, Netherlands
www.urbanarrow.com

The new Dutch bike brand Urban Arrow makes smart urban bikes. Our 1st electric transport bike is designed for families with young kids that want a green, affordable and time saving alternative for their city cars.

**Category:** Cargo bike

**Contact:** www.urbanarrow.com

**Price:** 2700
The Cargo Trike

The Maximus Cargo Trike is capable of doing the job of a small van with the added benefit of being able to negotiate City Centre streets and limited parking. It is easy to ride and operate – a robust, practical vehicle without fuel costs, tax or significant running costs.

Company: CyclesMaximus
UK
0044 (0)1225 319414
www.cyclesmaximus.com

Category: Cargo bike

Contact: stewart.redpath@cyclesmaximus.com

Product Website: www.cyclesmaximus.com

Price: POA

Capacity: 250kg
3.2 Cargo Hopper

The cargo Hopper is not only an electric vehicle for city logistics but part of a complete distribution system. Goods are not directly delivered into the city (center) but are bundled on a location outside (consolidation centre) the city. For this bundling it is of utmost important that logistic entrepreneurs collaborate in delivering to the distribution center. Different from normal city distribution system the cargo is loaded on containers which are brought into the city center with a city trailer to a mini distribution center at the fringe of the city center. From there the Cargo Hopper takes the goods to their end destination. By working with containers no time is lost with loading and unloading of goods.

On the way out of the city the cargo Hopper is loaded with goods from the shops and or with waste products. This is economical feasible for the shopkeepers as they can reduce cost on valuable space in their shops. Also it creates more attractive public space as waste materials do not appear on street.

Type of vehicle

There exist nowadays two types of CargoHopper vehicles. CargoHopper 1 is an electric driven train with multiple wagons. Each wagon can load a volume of about 2,3 M³. CargoHopper 1 is designed for parcel delivery and has no capacity for roll containers or pallets with heavy goods. Cargo Hopper 1 has a max. speed of 20 Km/hour and therefore no driver license is needed. It works from the mini consolidation center near the city center and delivers directly the parcels to shops and other end destinations.

Cargo Hopper 2 is an electric driven truck with a light trailer with solar panels. It has a capacity of 10 Euro pallets or 16 roll containers and can deliver large volumes to shops, restaurants, offices and retailers chains. Because of the different characteristics of CargoHopper 2 more heavy loads can be delivered. The max speed is 50 Km/hour and insurance and driver license BE is needed. CargoHopper 2 can work directly from the distribution center into the city.

Type of cargo

All kind of cargo for retail shops, offices, retail chains, restaurants and other can be delivered. CargoHopper 1 is more designed for parcel delivery to shops in inner cities as the CargoHopper 2 is also able to deliver more quantity and volume goods on pallets or roll containers to city destinations.
Capacity of cargo Hopper 2.0 is 7.5 Tons or 16 roll containers or max 10 euro pallets with hand pallet truck. Action range 75 Km

Potential use
The Cargohopper takes over the job of some 8 trucks and vans in the initial phase. With further fine tuning of logistic measures an even better result can be obtained. The vehicle has zero emissions and has a slight axle pressure. Apart from use in logistic chain the Cargohopper can also be used for removals within the city in weekends and transport of waste products out of the city from the shops they are delivering.

Policy measures
Role of local government in the implementation process of the Cargohopper system lies mainly in facilitation and coordination of the different actors involved in the city logistics. Bringing together different entrepreneurs and convince them with arguments and eventually with measures might be part of the municipal role. Another role might be the facilitation of locations of consolidation centers and regulation of access of the cargo hopper in the city.

Benefits
- Reduction CO2
- Less road maintenance
- Less congestion
- Increase of living and shopping conditions in inner cities
- Time efficiency in delivery

Cargohopper is not only a vehicle but a logistic system. Bundling freight from different transport companies in one distribution center and combine delivery with one vehicle is the essence of Cargohopper. By bundling many trucks and trips in (inner) cities are avoided. The vehicle Cargohopper is the striking electric symbol of this efficient, sustainable city logistics exercise.
3.3 Electric scooter delivery

**Type of vehicle**
Most of the electric scooters available are two wheelers. However some producers offer also three-wheeler variations. Till now they are mostly used for transport of persons and not for freight delivery. Also there is no legal framework for scooter three wheelers thus far on European level. Therefore only two-wheelers are considered in this document.

![Figure 5 Benda Pizza price 2890](image)

![Figure 6 Govecs GO1.2 Price 3597](image)

**Type of cargo/ Use**
Thus far scooters are mainly used for food delivery, mainly pizzas and other food delivery. and also for delivery of pharmaceuticals. Because of limited weight and volume not many other possibilities seem feasible. However examples exist where for examples books are delivered as special services

**Potential use**
Scooter delivery mainly is based on fastness of delivery. Limited range of 60-100 Km might be a limit for daily delivery, but in practice there seem no obstacles for daily fast delivery.

**Policy measures**
A subsidy of € 500 for one year and € 1000 for two years by the municipality of Utrecht has resulted in more than 70 E-scooters with 15 companies involved on the streets in a time period of 6 months. The condition from the municipality existed in replacement of existing two stroke scooters and participating in a lease offer from different participating lease companies who offer different E-scooters. Also companies are now stimulated to offer E scooters for their employees for commuting when traveling more than 3,000 Km per year. The target group for this measure are employees with a travel distance between 10-25 Km from home to work.
Figure 7 Utrecht pizza delivery

Already more than 70 e scooters are delivering food in less than 8 months project period.

### 3.4 Summary

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Cost in €</th>
<th>Type of goods</th>
<th>Use /Volume</th>
<th>Implementation</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cargo bike</td>
<td>1500-8500</td>
<td>Small, medium parcels</td>
<td>Multiple use Independent and in logistics chain. Max: 400Kg, 3M³</td>
<td>Fast and cheap implementation</td>
<td>Low: many practical cases in existence. Upcoming worldwide on company and SME level</td>
</tr>
<tr>
<td>Cargo Hopper</td>
<td>65,000-80,000 depends on model</td>
<td>Light, medium, heavy weight goods</td>
<td>Multiple use for retail in inner cities as part of logistic chain. 7,5 T and 16 roll containers or 10 Euro pallets.</td>
<td>Medium cost investment, immediate results, medium organizational level</td>
<td>Medium: organization strength. Upcoming international phenomenon</td>
</tr>
<tr>
<td>Electric scooter</td>
<td>2,000-4,500</td>
<td>Small light goods</td>
<td>Fast food delivery, max 40 Kg and aprox: 0,08M³</td>
<td>Pizza delivery, pharmaceuticals,</td>
<td>Medium: cost are higher compared to conventional scooters. Range is in 10% of deliveries not sufficient.</td>
</tr>
</tbody>
</table>
4 Electric vehicles for marketing and city branding

As public space is scarce and costly in city centers, advertisers have to be creative to find possibilities for visibility for their shops and products. Maybe the most known is the JC Deceaux advertiser who trades advertisement space in inner cities for financing public bikes like in Paris.

A relatively new phenomena in advertising is the use of bicycles for advertising in public space. It not only is a relative cheap solution for advertising but also the association of cycling and the branding of the shop and its products give a positive image to cycling and shopping.

Experiences from delivery companies in UK and France show that 10-30% of profit can be earned by selling advertisement space on the cargo bikes. But also the cargo hopper or delivery companies with electric scooters can use these option to create more income for their companies. Also it gives municipalities the possibility to increase their own visibility concerning their city logistic programmes.

Different options of branding on vehicles

Conclusion: the low hanging fruit for CO2 reduction on inner city logistics lies with promotion of use of electric cargo bikes and with promotion and implementation of rationalizing of city logistics with freight systems as the Cargohopper. With some subsidies also electric scooters in food delivery are a feasible option to reduce CO2 emissions in cities.
5 links and references

General information on city logistics

- Delivering the Goods, 21st Century challenges to urban goods transport. OECD 2003
- Frevue Towards zero emission deliveries at your doorstep: http://frevue.eu/
- EU implementation project about freight electric vehicles in Urban Europe.
- CityMove, gives insight in latest state of the art technology in freight vehicle design, www.citymoveproject.eu
- CityLog, a joined cooperation project which develops adaptive integrated mission management, vehicle and transport solutions. www.city-log.eu

Cargo bike delivery

- FedEx electric trikes video http://electricbikereport.com/fedex-electric-trike-deliveries-paris/
- Das Lastenfahrrad für städtischen Wirkschaftsverkehr, TU Dortmund, Fakultät Raumplanung, Ernst Rielke. Dortmund 2012

Cargo bikes

Product info base on www.cyclelogistics.eu or Ton Daggers: tdaggers@transportvision.nl

Specific cargo bike producers
- http://vrachtfiets.nl/, Scheepsbouwweg 8, 3089 JW Rotterdam, tel: +316 16529156
- http://www.urbanarrow.com/, Frederikstraat 12-15, 10829 Berlin, tel 49 (0) 35053 312050
- http://cyclesmaximus.com/ email: stewart.redpath@cyclesmaximus.com
- http://www.gobax-bikes.de/ email info@gobaxbikes.nl, or info@gobaxbikes.de

Cargo Hopper

- Roozendaal communicatie, Bert Roozendaal, Maarsen (NL) tel +31 30 8201164 or mobile +31 55720309 or http://www.cargo-hopper.nl/contact/contact-algemeen
- Fifthwheel Europe, Emmeloord NL, producer of Cargo Hopper
  http://www.fifthwheeleurope.eu/news/2013/05/20/11/stadsdistributie_binnenstedelijke_distributie_elektrisch_rijden.html

Scooter delivery

- To “e” or not to “e”: Pizza delivery by means of electric scooters, TNO Nov 2012
- Municipality Rotterdam http://stadsregio.nl/test-elektrisch-rijden
- Videoclip pizza delivery: http://www.youtube.com/watch?v=4NOqNXDYyZc
- Subsidies in Utrecht (NL): http://www.utrecht.nl/smartsite.dws?id=379321