REEL

Regional Electrified Logistics

Case overview report

CONTENTS

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REEL is a national initiative where leading Swedish players have joined forces to accelerate the transition to electrified emission-free regional heavy road transport

Within the REEL initiative, the parties establish, operate and evaluate around 70 different regional logistics flows for various types of transport assignments. REEL gathers transport buyers, freight forwarders and distributors, hauliers, terminal operators, charging point operators, grid network companies as well as suppliers of trucks, charging equipment, energy and management systems. In addition, regions, national authorities and universities participate in the initiative.

REEL receives co-funding from the Strategic Vehicle Research and Innovation program (FFI) through Vinnova, the Swedish Energy Agency and the Swedish Transport Administration.

www.closer.lindholmen.se/reel

2023-12-20

The information in this report is based on an interview study executed with 31 logistic actors during 2022 and 2023.

The interviews have been performed by CLOSER at Lindholmen Science Park in a semi-structured manner covering the following aspects: general organizational info, logistic & operational set-up, hard- and software specifications, policy, business models, working environment, system architecture, and scale-up potential.

The 175 interview questions were designed in collaboration between CLOSER and the academic partners participating in REEL i.e. Chalmers, Linköping University, and Lund University.

Image: Scania, Volvo Trucks

The REEL consortium consists of 45 organizations

The REEL project targets the over-all mission to significantly reduce CO_2, noise, particulate and gaseous emissions through electrification of regional road transport. It is centered upon performing demonstrations of regional electrified logistics systems. By developing and operating these demonstrations, insights are obtained on how different system concepts and architectures perform and need to be dimensioned considering the electric truck performance, requirement on charging, and iteratively need to be revised, to meet the logistics needs in a cost effective and energy efficient way.

Participating actors

ALLTRANSPORT
BOLIDEN
BÖRJE JÖNSSON ÅKERI AB
DAGAB
DANIA CONNECT
Derome
DFDS
DHL
elis
einride
e.on
Eriksons Åkeri Tomtilla
FALKENKLEV LOGISTIK
FLYGFRAKT
FORIA
GLC GÖTEBORGS LASTBILCENTRAL
GTS Gods Transport Service
Höganäs
ICA
JULA LOGISTICS
LBC frakt
martin&servera
M-Lab
NÅ Nordisk Återvinning
postnord
Polfärskt MILJÖSMART SAMDISTRIBUTION
Renova
RAGN-SELLS
SCA
SCANIA
SWEROCK
Söderenergi
UME ASSISTANCE
VATTENFALL
VGT Göteborg AB
VOLVO
WIBAX
Region Halland
REGION SKÅNE
VÄSTRA GÖTALANDSREGIONEN
CHALMERS
LINKÖPINGS UNIVERSITET
LTH LUNDS TEKNISKA HÖGSKOLA
Swedish Electromobility Centre
CLOSER

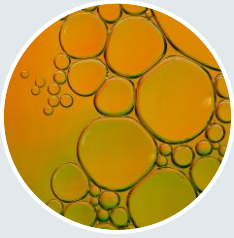
Public co-financing

FFI Fordonsstrategisk Forskning och Innovation
Energimyndigheten
TRAFIKVERKET SWEDISH TRANSPORT ADMINISTRATION
VINNOVA Sweden's Innovation Agency

The logistic solutions in REEL are designed for various types of goods

Ash
see Ragnsells & Foria p. 44

Building materials
see Derome p. 16, LBC Frakt p. 34



Chemicals
see Wibax p. 52

Concrete
see Swerock p. 49

Containers
see Alltransport p. 8, Jula Logistics p. 32, Höganäs & Dania Connect p. 28

Excavated materials
see Boliden p. 9, LBC Frakt p. 34 , M-Lab p. 38, Öhrlunds p. 53

Food
see Börje Jönsson Åkeri p. 11, Dagab p. 14, Erikssons Åkeri i Tomelilla p. 22, GLC p. 26, ICA p. 29, Martin & Servera p. 37, Polfärskt p. 41

Industrial goods
see DFDS p. 18, GLC p. 26

Pallets and parcels
see DHL p. 20, Falkenklev p. 24, Flygfrakt p. 25, GTS p. 27, LB Transport p. 36, Postnord p. 42, VGT i Göteborg p. 50

Textiles and laundry
see ELIS p. 21

Timber
see SCA Skog p. 47

Waste and recyclables
see Nordisk Återvinning p. 40, Renova p. 46

Image: Unsplash

The transport flows in REEL are spread across Sweden

In the REEL project the parties establish, operate and evaluate around 70 different regional logistics flows in various types of transport assignments. The geographical location of these flows are presented in the map.

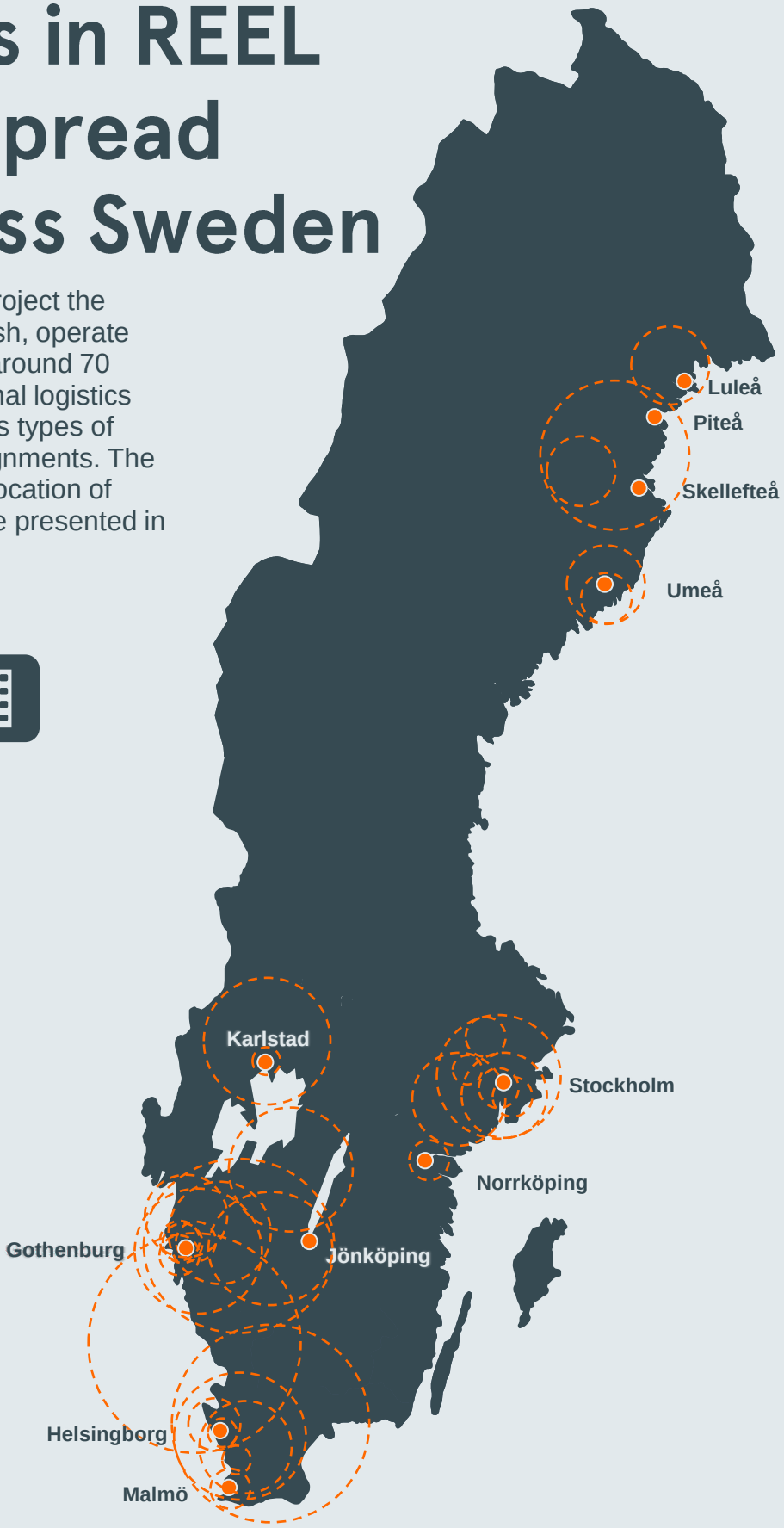


Image: Scania, Volvo Trucks

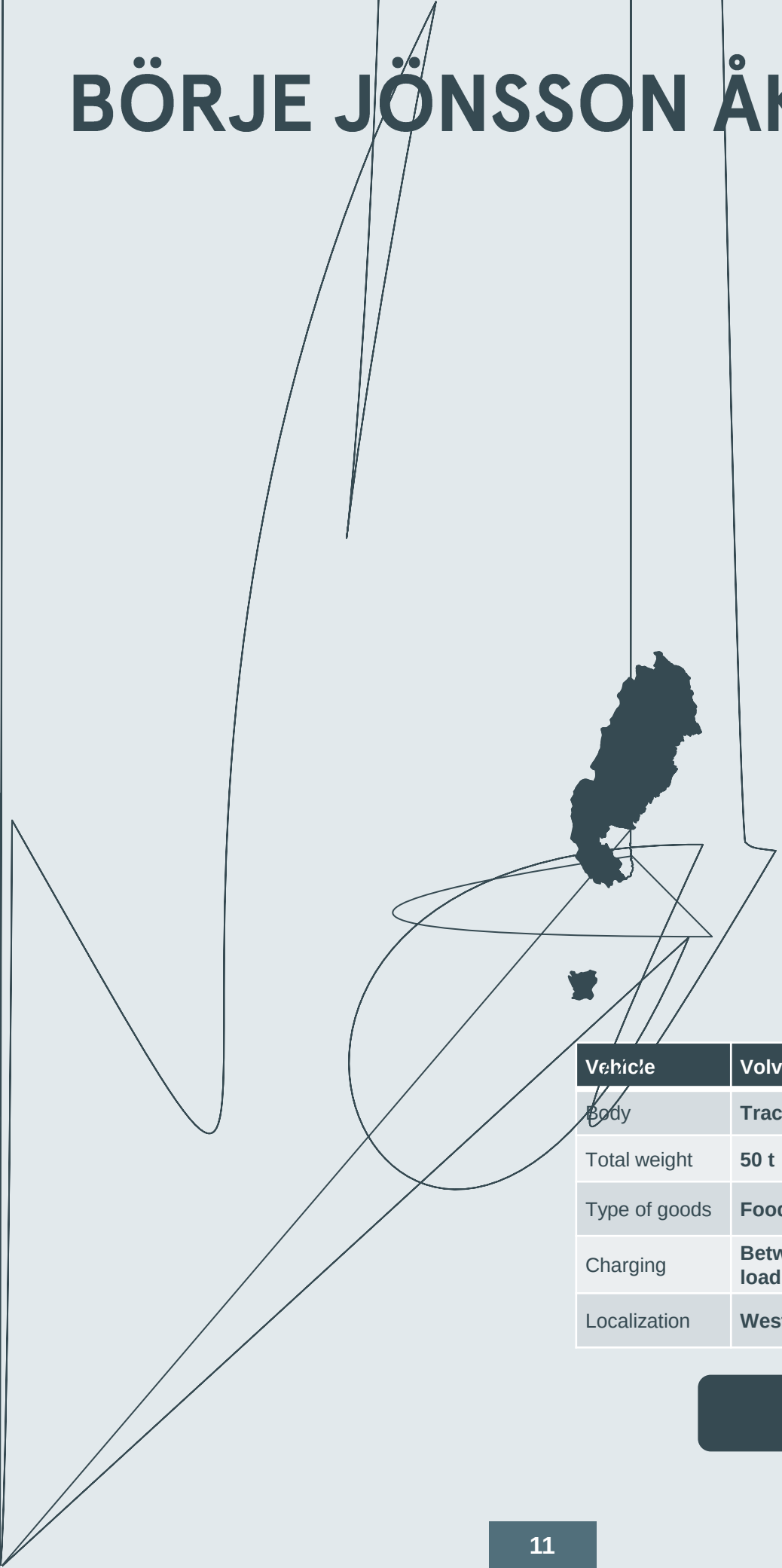
ALLTRANSPORT

Vehicle	SCANIA 25P 4x2, 300 kWh
Body	**Tractor**
Total weight	**29 t**
Type of goods	**Containers**
Charging	**At home depot** (**33 kW**)
Localization	**Norrköping**

BOLIDEN

Image: Scania

BÖRJE JÖNSSON ÅKERI



Vehicle	Volvo FM 4x2
Body	**Tractor**
Total weight	**50 t**
Type of goods	**Food**
Charging	**Between offloading and loading**
Localization	**Western Sweden**

Image: Volvo Trucks

Image: Scania .

DAGAB

DAGAB delivers to Axfood's supermarkets around Sweden. Two demonstrators are set-up in the project: one in Greater Stockholm and one in Västra Götaland County.

Greater Stockholm Demonstration

When designing this demonstration, DAGAB wanted to explore ways to utilize the trucks as much as possible to reduce the cost per km. In order to achieve that, the ability of providing additional charging during unloading and/or reloading was seen as crucial. Two trucks were put into operation, a plug-in hybrid (PHEV) and an all-electric truck (BEV, rigid, 6x2*4, 28 tonnes, 300 kWh). The trucks deliver refrigerated and frozen food. Thus, the total energy demand of the vehicles consists of propulsion of the truck and operation of cooling units.

A 175-kW high-power charger was installed between two loading gates at DAGAB's warehouse in Jordbro, where both trucks return several times a day for reloading. In addition, two night-chargers of 22 kW each were installed at the parking lot at the warehouse premises where the vehicles are parked from around 22:00 to 05:30. By charging during reloading for about 30-45 minutes logistics losses were minimized while total daily mileage was increased. It also enabled two-shift operation with 2-3 rounds per shift, with a total daily mileage of around 350 km per vehicle. The charging station at the loading gates was dimensioned to be able to meet future needs from external hauliers, with electrified transports, serving the DAGAB warehouse. Prior to the installation of the charger, the insurance company of the warehouse facility demanded additional measures with regards to fire safety. The insurance company required some adaptation of the gate to minimize the consequences in the event of a fire while charging the truck. The following adaptions therefore had to be made: fire-resistant surface on the gate and absence of fire-sensitive construction closer than 10 meters from the charger, fire alarm with smoke detectors and sprinkler system in the gates, and emergency exits to prevent drivers being trapped in the gate in case of fire and fire blinds to prevent the fire from spreading.

The specific energy consumption for the BEV is about 1.25 kWh/km and the truck has a range of about 180 km on a single charge. For the PHEV, the combustion engine's fuel consumption was reduced by about 30% by using electric power as a complement to HVO and RME during the urban distribution round in the city and by being able to utilize braking energy to charge the batteries during operation. Apart from plugging in and out the charger the operation has been carried out in the same way as with a conventional vehicle.

Image: Scania


64 ton med
bra mat på väg
DAGAB
DAGAB

DEROME

Vehicles	Volvo FM 6x2*4 450 kWh
Body	**Rigid**
Total weight	**29 t (50 t with trailer)**
Type of goods	**Building material**
Charging	**At home depot** (**150 kW**)
Localization	**Gothenburg area**

The first electric truck with a crane.

Derome is a family-owned company offering a variety of wooden products from boards, planks & panels to finished residential houses. It is based in Derome, in the Halland county and owns several sawmills and fulfilment centers across Sweden. From these fulfilment centers, finished products are being delivered to various construction sites. Derome operates a substantial part of the transports themselves with their own vehicles. Since 2016, the company has made its fleet fossil free by refueling their trucks solely with HVO.

Many of trucks are equipped with a crane to allow for delivering goods to customers construction sites which can often be in residential areas. Since June 2023, Derome operates its first electric truck of this kind around Gothenburg and its outskirts. The truck is being used during one shift, based at the fulfilment center in Mölndal. As the truck is returning to Mölndal several times a day, there are many opportunities to recharge. The company has invested in a 350-kW charger which has been installed at its premises. Quiet deliveries in residential areas in the early morning hours is seen as one of the greatest benefits of electrifying crane trucks.

Image: Volvo Trucks


HIAB
X-HIPRO 232


ELECTRIC
Derome
Derome
Derome

DFDS

The aim of the demonstrator is to study electrified "just in time" transports, between logistics terminals and factories.

In the demonstrator a repetitive "hub to hub" transport is performed between Hisings Backa and Tuve in Gothenburg. The truck runs 4 to 6 laps per day and the total daily mileage sums up to 180-250 km. As a next step, a second shift in the evening with more varied and longer flows will be added.

Between shifts, DFDS plans to charge the vehicle with DC at high power. Based on available battery capacity, the energy consumption for two shifts, downtime, etc., a charging concept was designed consisting of a 350 kW charger at DFDS´s terminal in Arendal. The high charging power was chosen to be able to quickly charge several future vehicles in sequence between shifts to get a high degree of utilization of the vehicles.

A located at a suitable distance from buildings to minimize the risk of possible collisions etc., while being able to charge two vehicles simultaneously. The vehicle combination consists of a two-axle Volvo FM tractor and a standard 3-axle semi-trailer. Nominal battery capacity is 540 kWh and maximum charging power is 250 kW DC. The service weight of the vehicle is slightly heavier than that of the corresponding diesel truck. However, the higher total weight is not a constraint for this particular transport assignment.

Image: Volvo Trucks

Image: Volvo Trucks

DHL

The goal of DHL's demonstration is to study heavier transports over slightly longer distances between logistics terminals in different regions, so called line-haul.

In Sweden, this type of driving is most often performed with a flatbed truck and trailer. The line-haul route in this demonstration between Gothenburg-Jönköping is just over 150 km one-way and is challenging with regards to topography. The route is mainly on motorway, and since it is a truck with a trailer, 80 km/h applies. The return journey from Jönköping begins with a continuous climb of about 130 meters, which makes it possible to test the vehicle's propulsion under high load on the driveline.

A normal day starts with the truck departing from Gothenburg at approximately 19:30 and arriving in Jönköping at 22:00. After that, the vehicle is charged and loaded, departing from Jönköping around midnight and ending the shift in Gothenburg shortly after 03:00, when charging is initiated. To increase the utilization of the truck, it also runs a second shift during the day with bulk goods for DHL Express. On this route the truck is used without a trailer starting just after 06:00 when the truck is driven up to Landvetter for loading. Unloading of the goods is done in the Gothenburg region at various customers. The mileage varies but is normally just over 100 km. This shift ends at 15:00.

The two shifts result in a daily driving distance of over 400 km. Based on available battery capacity, the energy need for the two shifts, downtime etc., a charging concept was designed consisting of a 175-kW charger at Volvo Truck Center in Bäckebol C in Gothenburg) and a 350-kW charger at DHL's terminal in Jönköping. The available time for charging between the two shifts is slightly longer than in the middle of the night shift, hence the different power levels for the chargers. The high charging power in Jönköping was chosen to minimize downtime.

The charging stations are designed to be spacious enough to charge the vehicle with a trailer and at a suitable distance from buildings to minimize the risk of potential accidents. The vehicle combination consists of a three-axle Volvo FH straight loader and a standard 4-axle trailer. The truck is equipped with a swap body, i.e. the cabinet can easily be mounted on and off the flatbed. This is used during loading and charging, the cabinet is loaded at the terminal gate at the same time as the vehicle is parked at the charger.

Nominal battery capacity is 510 kWh and maximum charging power is 350 kW. The service weight of the vehicle is slightly heavier than that of a corresponding diesel truck. As this logistics flow is limited by volume and not weight, the increased service weight has not affected the capacity to transport goods.

Image: Volvo Trucks

ELIS

ELIS transports textiles and laundry in roll-cages to healthcare providers, hotels, and restaurants.

@ D
textiles to businesses such as healthcare units, hotels, and restaurants. About four years ago, they chose to insource most of their transports to enable a better customer experience by having their own drivers meeting the customers. The shift also provided greater opportunities to choose vehicle type. This gives ELIS a better ability to reach its goal of having climate neutral transports by 2030, with the transition to an electric vehicle fleet as an important factor.

ELIS has a fleet of approx. 225 trucks where the majority are vans (LDVs). In REEL they operate three HDVs from their sites in Helsingborg, Huddinge, and Stockholm. The goods are transported in roll cages where each truck can carry 36 cages. All trucks operate in one shift on
time. The total daily mileage for each electric truck adds up to 150-200 km with an average energy consumption varying between 1.1-1.4 kWh/km, depending on the route, vehicle body, and time of the year.

The trucks are charged during evenings and
@ D)
with 22 kW, and this is sufficient to reach a full battery before the shift starts in the morning.

The truck in Stockholm operates for the City of Stockholm in an assignment where emission free transport was required when transports of laundry to healthcare units were tendered in a public procurement.

Vehicles	3 Volvo FL 4x2 265 kWh
Body	**Rigid**
Total weight	**16 t**
Type of goods	**Textiles and laundry**
Charging	**At home depot** (**22 kW**)
Localization	**Helsingborg, Huddinge and Stockholm**

Image: Elis, Volvo Trucks

ERIKSSONS ÅKERI I TOMELILLA

One of the largest electrified fleets.

Erikssons Åkeri i Tomelilla (EÅ) has been operating electric tractors since October 2020, making them one of the most experienced companies in the country regarding electric trucks. EÅ has previously established several electrified logistics flows together with the oat-based dairy company, Oatly by using four EMOSS trucks, provided by Einride.

The company was also the one that received the first series-produced Volvo FH Electric in the fall of 2022. Currently, nine Volvo electric tractors are operated by EÅ on various flows in the southern part of the country. The vehicles are used in various logistics flows between productions sites for food products (often temperature controlled) and retailers. EÅ has tested cross-border operations with electric trucks to Denmark.

The charging takes place at public and semi-public charging stations in proximity of the on- and offloading facilities. For instance, EÅ uses the Rifil charging station (see p. 24), daily for some of its flows. The REEL project has also enabled cooperation between EÅ and other project partners in terms of finding joint electrified logistics flows since the companies share similar ambitions in terms of reducing their environmental impact.

Vehicles	9 Volvo FH 4x2, 6x2*2 540 kWh
Body	**Tractor**
Total weight	**44 t**
Type of goods	**Food**
Charging	**Helsingborg (250 kW)** **Malmö (250 kW)** **Tomelilla (250 kW)**
Localization	**Skåne, Halland and Småland regions**

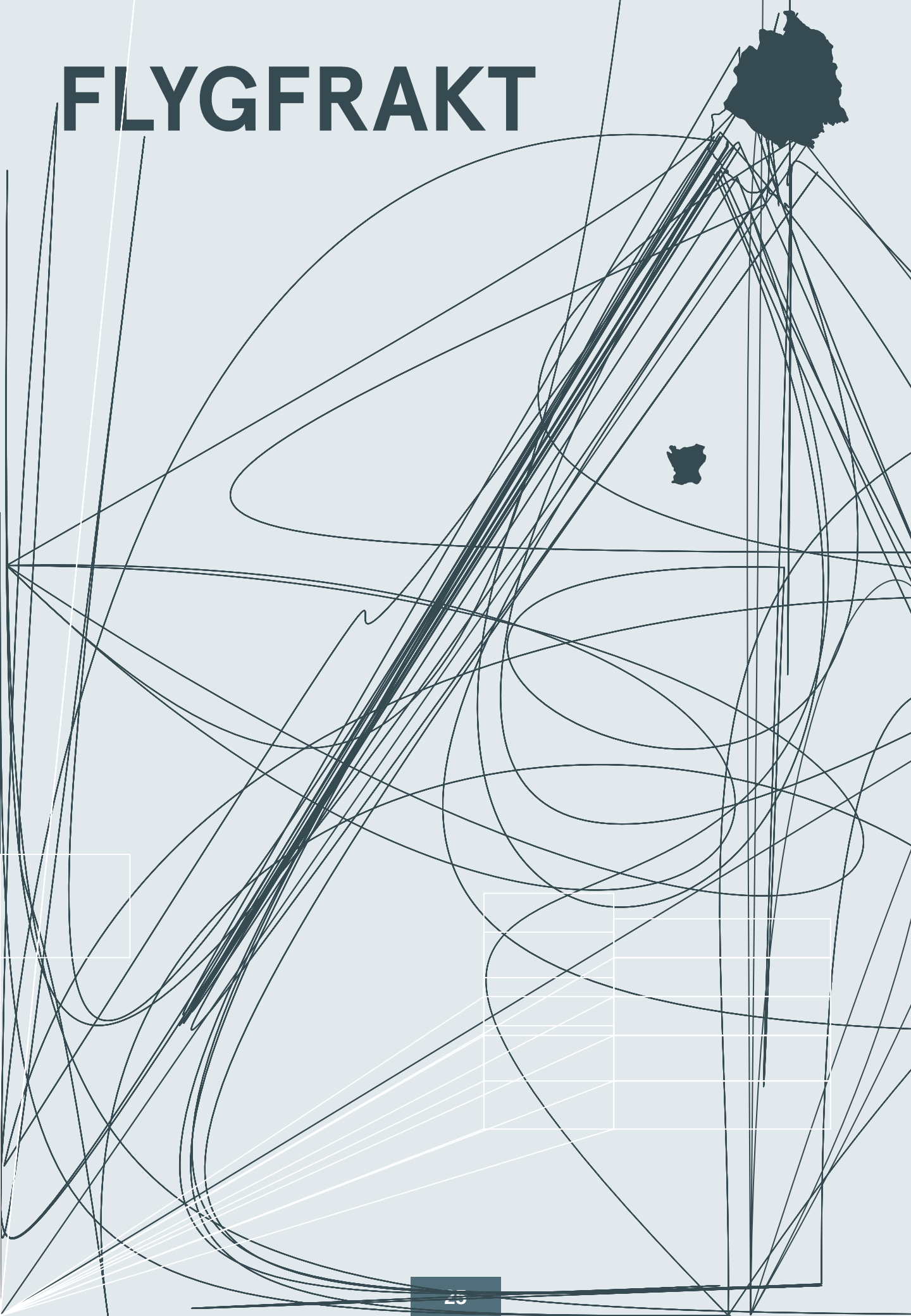
Image: CLOSER

Image: Erikssons Åkeri i Tomelilla, CLOSER

FALKENKLEV LOGISTIK

Vehicles	5 Scania 25P 4x2 165 kWh
Body	**Rigid**
Total weight	**20.5 t**
Type of goods	**Pallets and parcels**
Charging	**Malmö (max 150 kW)**
Localization	**Malmö and suburbs**

FLYGFRAKT



GÖTEBORGS LASTBILSCENTRAL

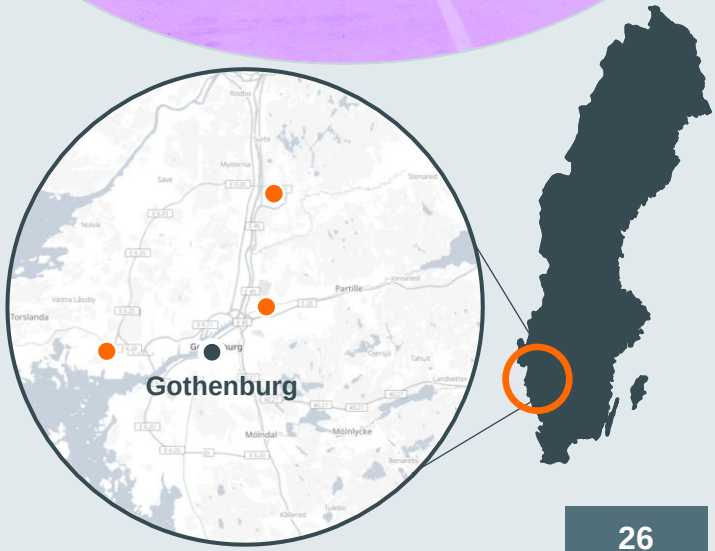
Four electric distribution vehicles from two manufacturers.

Göteborgs Lastbilscentral (GLC) is a major carrier based in Gothenburg consisting of various smaller transport companies. All of them are co-owners of GLC, i.e. a haulier network organization. As a part ' B introduced several alternative fuels. In the REEL project GLC is currently operating vehicles from Volvo and Scania.

Two Volvo FL rigid trucks are operated for ICA, one of the largest grocery retailers in Sweden. The D - commerce warehouse to a dozen ICA stores for its self-pickup service. The trucks are equipped with cooling units. They are operated 6 days a week B shifts.

In addition, GLC operates two Scania rigid trucks for their long-term customer SKF. The vehicles are driven mostly within SKF factory area, distributing material between the various warehouses and assembly lines. One of the vehicles makes an additional round trip to Alingsås. The trucks are operating during weekdays and are parked on A)

Several other electric vehicles have been put into operation during the last year. GLC has also installed a charging hub at their premises where 14 vehicles can charge simultaneously with a total power of 1 MW.



Vehicles	2 Volvo FL 300 kWh 2 Scania 25P 165/300 kWh
Body	**Rigid refrigerated / Rigid**
Total weight	**18 t / 26 t**
Type of goods	**Food/ Industrial components**
Charging	**At home depot** **At customer**
Localization	**Gothenburg**

Image: Göteborgs Lastbilscentral

GODSTRANSPORTSERVICE I UMEÅ (GTS)

The first local distribution truck in northern Sweden.

GTS is a local logistics company based in the city of Umeå. The company is a transportation supplier for DB Schenker.

The vehicle is operating on weekdays on 8-hour shifts. One of the transport assignments is distributing building materials for renovation and extension of the University Hospital of Umeå. Most of the material bound for the site is consolidated onto this electric truck, reducing the number of vehicles distributing to the site significantly. The consolidation has been set up through a project between GTS and Region Västerbotten, the public authority responsible for healthcare. The other assignments is distribution of parcels and pallets in Umeå and its surrounding areas within the DB Schenker transport network.

tough winters, which northern Sweden is known for, will provide valuable insights for the REEL project.

Vehicle	SCANIA 25P 4x2 300 kWh
Body	**Rigid**
Total weight	**18 t**
Type of goods	**Pallets and parcels**
Charging	**At home depot (76 kW)**
Localization	**Umeå**

HÖGANÄS AB & DANIA CONNECT

Electrifying High-Capacity Transport.

Höganäs AB is a company specializing in metal and iron powder solutions, located in a town sharing the same name. In partnership with transport company Dania (Dania Connect), a shuttle container flow is operated between Höganäs and the port of Helsingborg to enable distribution of metal powder products around the world. By introducing HCT road combinations of up to 74 tonnes and double containers, the number of trucks in this flow has been reduced.

A year ago, Höganäs AB and Dania have jointly introduced an electric Scania tractor in this shuttle flow. The electric truck, like the other ones in this flow, is being driven on a fixed route between Höganäs and Helsingborg, a one-way trip of 35 km. As the electric vehicle completes four loops each day, the total daily distance of 280 km is coached, five days per week. Metal powder is transported in containers to the port of Helsinborg while empty containers are returned from the port to Höganäs. Charging takes place in Höganäs between loops, during lunch and nighttime.

Vehicle	SCANIA 25P 6x2*2 300 kWh
Body	Tractor
Total weight	74 t
Type of goods	Containers
Charging	At Höganäs AB (150 kW)
Localization	Region Skåne

Image: Helsingborgs Hamn

ICA

Electrified distribution from two different warehouses.

ICA is one of the largest grocery retailers in Sweden, with approximately 1300 stores around the country. Currently, the company operates three electric trucks, manufactured by Volvo, for distribution of temperature-controlled groceries from the warehouses in Kungälv (outside Gothenburg) and Årsta (Stockholm) to D
areas.

The vehicles have been designed for frozen goods although they are delivering only refrigerated goods. Therefore, the vehicles have thicker walls than an ordinary distribution vehicle to minimize energy consumption as the cooling unit is powered by the vehicle battery and impacts the range.

The distribution is performed during daytime. Trucks are utilized 6 to 7 days each week covering up to 250 km daily. As the vehicles are parked at a terminal during nighttime, slow charging is sufficient for most of the energy used. One of the vehicles receives additional charging at public charging locations in Gothenburg when required.

ICA pursues a strategy of using the electric trucks as much as possible, partly to exploit the low noise advantages of the trucks but also to improve the business case for the vehicles.

Vehicles	3 Volvo FE 6x2*4 265 kWh
Body	**Rigid refrigerated**
Total weight	**27 t**
Type of goods	**Food**
Charging	**At home depot (22 kW)** **Public charging (150 kW)**
Localization	**Gothenburg, Stockholm**

Image: Volvo Trucks

Image: Johan Lilja

Since the winter of 2023, an additional vehicle is being operated by ICA in Region Skåne. A rigid truck pre-series prototype with a cooling unit has been delivered by Volvo. Out of all transports generated by ICA, a substantial part of regional and long-haul flows is performed by rigid truck and trailer combinations. This vehicle is based at ICAs regional distribution warehouse in Helsingborg and delivers to various ICA stores across the region on a weekly schedule, covering up to 350 km every day. Most of the deliveries are done with the truck and trailer combination, with a total length of 25.25 meters, making the test of these deliveries important due to strong presence of this vehicle configuration in the logistics network of ICA and Swedish road transport in general.

Most of the charging occurs at Volvo Truck Centre Helsingborg where the first public truck charging in Sweden was opened in the spring of 2022 in collaboration with the local grid company Öresundskraft. The site is located a short drive from ICAs warehouse and is equipped with fast chargers and slow chargers located in a secure parking area on the premises of Volvo Truck Centre. In addition, some of the charging is occasionally done at Rifil station in Malmö (see p. 24).

Vehicles	Volvo FH 6x2 540 kWh
Body	**Rigid**
Total weight	**28 t (50 t with trailer)**
Type of goods	**Food**
Charging	**At Volvo Truck Centre Helsingborg and Rifil Malmö (up to 230 kW)**
Localization	**Helsingborg**

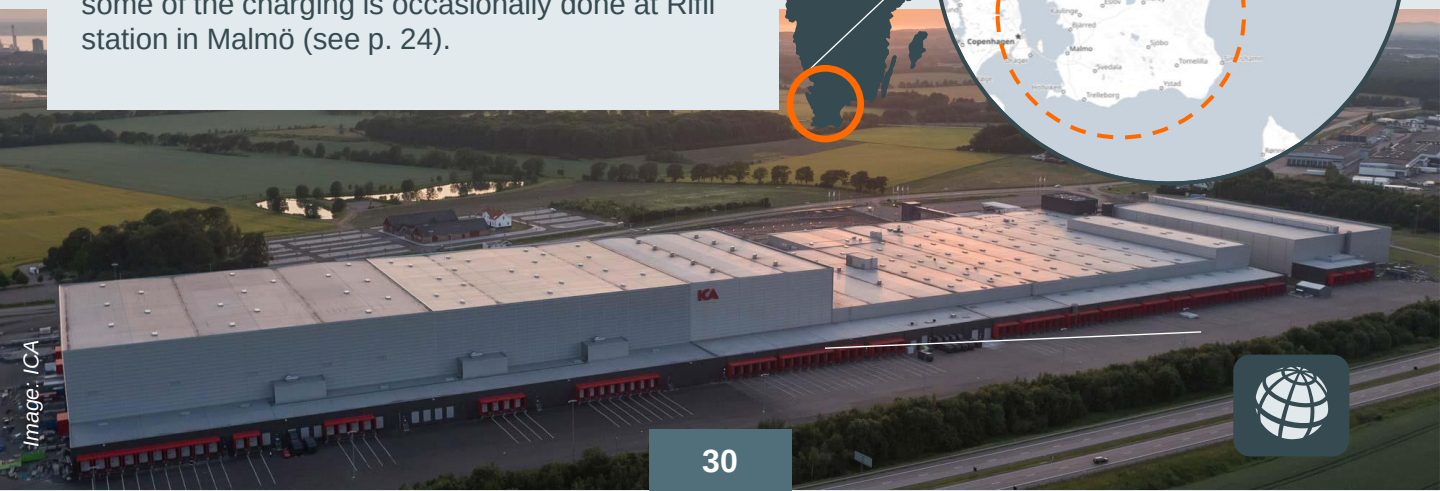


Image: ICA

Image: Volvo Trucks

JULA LOGISTICS

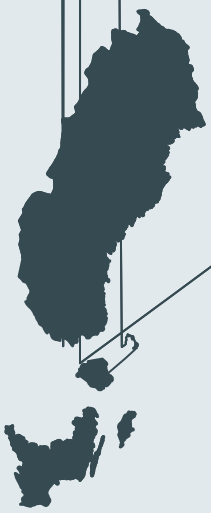
Since 2013 Jula Logistics operates an intermodal terminal in Falköping connected to Port of Gothenburg by railway.

Jula Logistics is a part of Jula'
it yourself (DIY) retailers. The main warehouse of Jula, which is also the largest logistics warehouse in Sweden, is located in Skara. Each day, containers are transported between the railway terminal in Falköping and E main warehouse in Skara, a distance of 30 km, as well as to and from other customers within a radius of up to 200 km from the railway terminal. The transports are performed by a carrier working in a close relationship with Jula Logistics.

The parties have decided to deploy electric heavy-duty vehicles for these transports to make the total transport chain even more sustainable. The first electric tractor was put into operation in June 2022. The vehicle is permitted to haul a trailer combination consisting of two 40 ft containers with a total length of 33 meters. An additional electric tractor has been put in operation in early 2023.

Currently, up to 35 trucks belonging to the carrier are serving the intermodal terminal. The transport assignments are geographically limited to the region with several reoccurring customers. The two most reoccurring nodes are controlled by Jula Logistics which ensures 24/7 access to the facilities for on- and off-loading and the charging infrastructure. There are around 20-25 locations with similar logistics setup around Sweden. If the outcome is successful, Jula Logistics and the carrier are planning to replace the current fleet of 35 diesel tractors.

LBC FRAKT



Vehicles	2 x Scania 25P 4x2/6x2 Scania 40P 6x2 300 kWh
Body	**Rigid**
Total weight	**19, 29 and 55 t**
Type of goods	**Building materials, refuse, excavated material**
Charging	**At home depot, customer's site and at quarry**
Localization	**Värmland County**

Image: LBC Frakt

LB TRANSPORT

City distribution in the city of Borås.

LB Transport is transport company based in Borås with most of its operations in Region Västra Götaland. Through collaboration with Volvo Group, the company has acquired an electric rigid prototype truck equipped with a superstructure and cooling unit designed for transporting refrigerated and frozen food products. The truck is not transporting refrigerated nor frozen products in the current assignment. However, the cooling equipment is set to 4 C° to simulate the truck performance with the cooling unit on.

The field test truck is used during one shift each day. Every morning food products are loaded at a terminal which are then distributed around Borås. The average speed is rather low, and many stops are being made which is typical for urban distribution. Returning cargo such as pallets, packing material is being picked up during the stops. The average goods weight is rather low thus the volume is the limiting factor. The truck is fully charged every morning and additional charging is not required during the shift.

Vehicles	Volvo FM 4x2 360 kWh
Body	**Rigid**
Total weight	**18 t**
Type of goods	**Food**
Charging	**Depot charging, 22 kW AC**
Localization	**Borås**

Image: Volvo Lastvagnar

MARTIN & SERVERA

Martin & Servera delivers food to both privately owned and public restaurants and cafeterias around Sweden.

Martin & Servera (M&S) has 22 cross-dock hubs and four main warehouses in Sweden. For the transports, the company has an internal fleet of approximately 100 trucks, and an additional external fleet of 300-400 trucks. In general, the trucks operate 200 km daily in one-) !
replace two diesel trucks with one electric truck while also adding a night shift. The company has managed to do this with several private and public customers and has also been provided permits to deliver during night in the cities of Malmö, Stockholm and Västerås. This implies that M&S in the long run can improve the inventory turnover rate, reschedule warehouse personnel from night to daytime and achieve a more efficient distribution in the cities during night by avoiding peak traffic.

D !)
continuously growing when old diesel trucks are replaced at the end of their lifetime either to new electric or biogas powered vehicles. Each electric vehicle)
between 08:00-15:00, and the nightshift between 01:00-08:00. Each shift consists of 2-3 rounds and 10-12 stops per round. When the trucks return to the terminal for reloading, they are also charged for about 45 minutes. Chargers with a capacity of 44 kW are installed at the terminal gates. During the longer breaks, they utilize a wall-box charger of 22 kW placed in the parking area.

Vehicles	5 Volvo FE 6x2 265 kWh 1 Scania 25P 6x2 165 kWh
Body	**Rigid refrigerated**
Total weight	**27 t**
Type of goods	**Food**
Charging	**At terminal gates (44 kW)** **At terminal parking (22 kW)**
Localization	**Enköping, Malmö, Stockholm, Norrköping, Halmstad**

Image: Martin & Servera

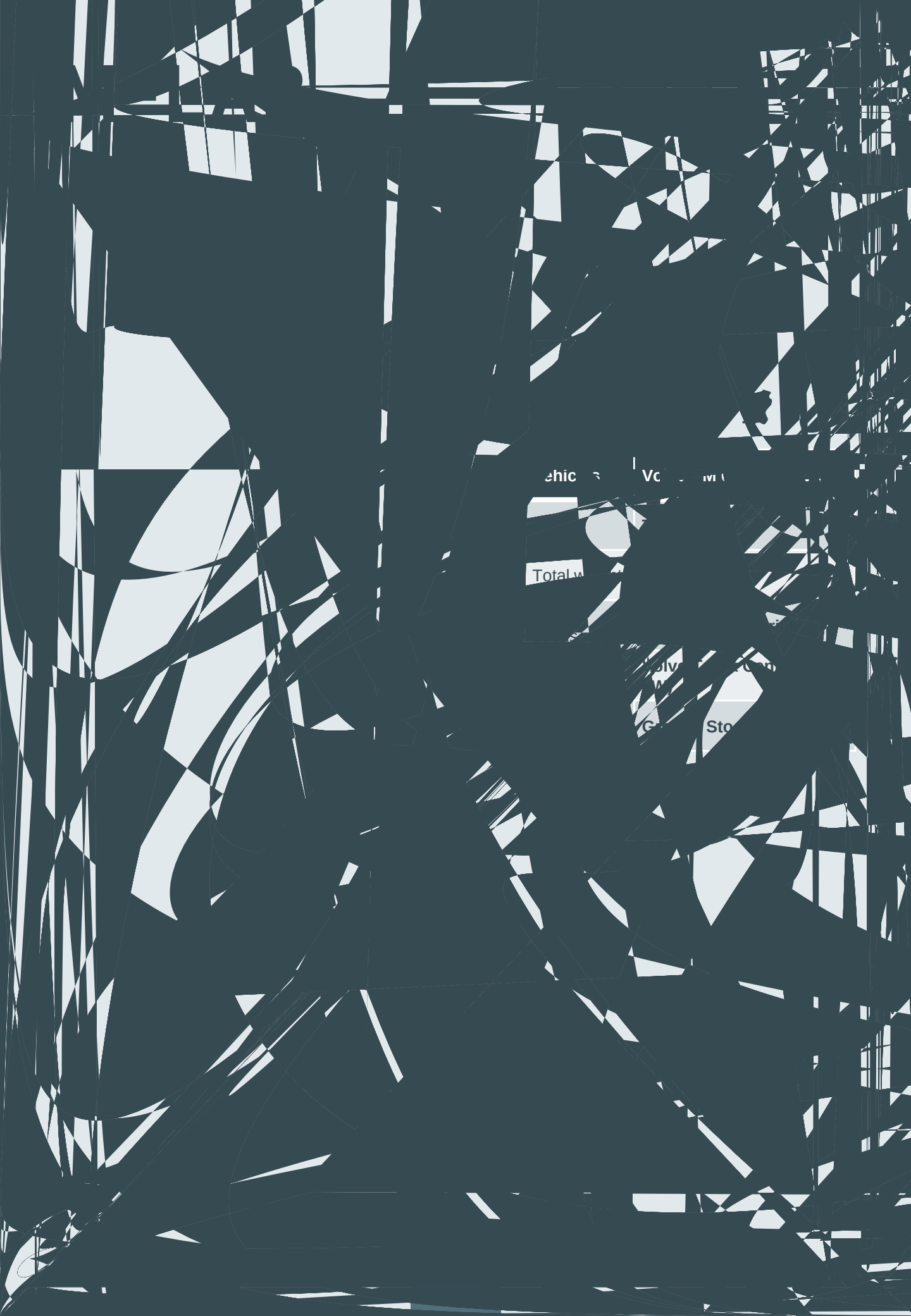

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Image: M-Lab

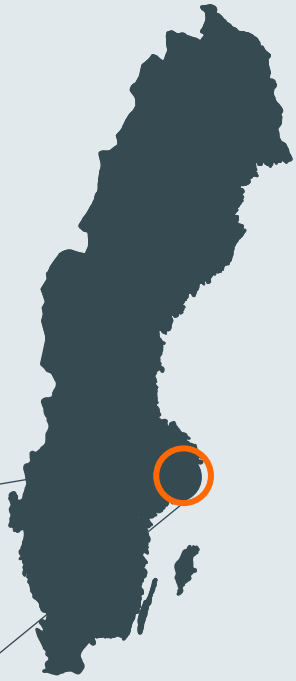
NORDISK ÅTERVINNING

POSTNORD

One of the largest logistics companies in Sweden is testing two types of vehicles for two different applications in the Stockholm area.

One of the cases is based at terminal in Årsta in southern Stockholm. The transport assignment is carried out for Apotek Hjärtat, a pharmacy retailer in Sweden. The vehicle distributes pharmaceuticals around Stockholm and Södertälje during two daytime shifts. A third shift, which is conducted during night, is based on distribution of parcels to various parcel collection points around Stockholm.

Since the vehicle is on the road for most of the day, there is very little time for charging. The vehicle is charged between the shifts at the terminal in order to avoid logistics losses. The vehicle is being operated by haulier Tempcon, a large group consisting of various transport companies specialized in temperature-controlled goods.



Vehicle	Scania P230 6x2 300 kWh
Body	**Rigid refrigerated**
Total weight	**28 t**
Type of goods	**Pharmaceuticals, pallets and parcels**
Charging	**At terminal (150 kW)**
Localization	**Stockholm**

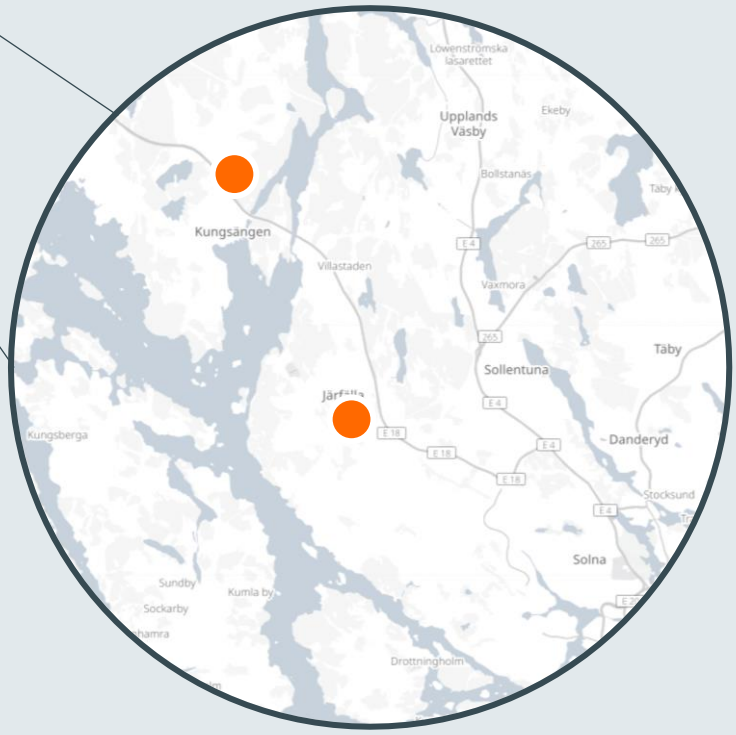
Image: Scania

A lot of regional and long-haul traffic performed in the PostNord network are based on static routes.

Static routes is one of the main motivations for testing an electric truck and trailer within the network. The second flow of PostNord included in REEL is based on shuttle traffic between a warehouse operated by Zalando, a large clothing retailer, and a PostNord terminal in Veddesta. The truck is driven between these two sites up to 5 times a day. The distance between the logistics nodes is 17 km. Total covered distance during the day is around 140 km. Currently, the truck is operated during the day

)

are plans for adding a second shift for the vehicle.



Vehicle	Scania 25P 4x2 300 kWh
Body	**Tractor**
Total weight	**19 t**
Type of goods	**Pallets and parcels**
Charging	**At terminal (150 kW)**
Localization	**Stockholm**

Image: Postnord

R[illegible]-SELLS & FOR[illegible]

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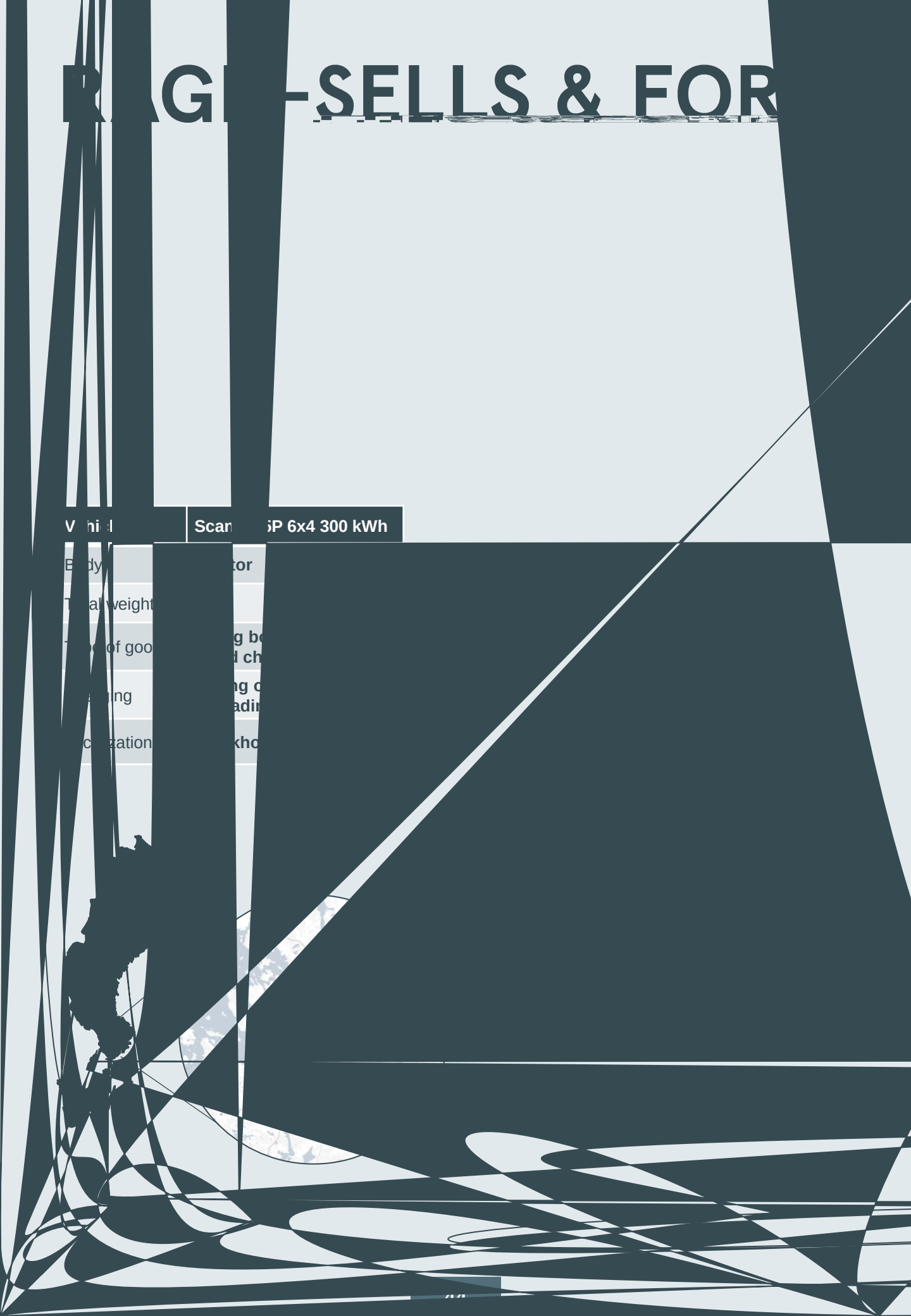



FORIA

RENOVA

An electrified hook-lift truck transporting waste and recyclables in the Gothenburg area.

Renova is a waste management company owned by 10 municipalities in western Sweden. They collect and transport waste and recycling materials from private and public customers for further processing at different facilities such as Sävenäs waste-to-energy plant, treatment facilities, transshipment stations, landfills and recycling centers. About 1.3 million tonnes of waste and materials are handled on a yearly basis.

In total, Renova has a fleet of about 325 vehicles of which approx. 250 are heavy duty vehicles. The company has a goal to electrify 30 percent of its fleet by 2026, and the ambition that the entire fleet will be either electrified, or using other alternative technologies, within the next 10-15 years. Therefore, Renova has actively participated in projects aiming to test and demonstrate electrified transports, such as the use of a fully electric refuse truck in 2018 and the launch of a hydrogen-fueled refuse truck in 2021.

Since January 2022 Renova operates a fully electric hook-lift truck carrying open containers with about 10-11t of recyclables, mainly between Gullbergsvass and Alelyckan. The vehicle is used five days a week, in day-shift, with a daily driving distance of maximum 80 km. Charging, using a 22-kW charger, is done at the depot after the working day. No additional charging during the day is done.

Vehicle	Scania 25P 6x2 300 kWh
Body	**Tractor with hook-lift**
Total weight	**30 t**
Type of goods	**Refuse**
Charging	**At depot (22 kW)**
Localization	**Gothenburg area**

Image: Renova

SCA SKOG

World's first battery electric logging truck operating in the challenging climate of the northern Sweden.

Since June 2022, a Scania rigid truck and trailer combination has been hauling round wood between the rail cargo terminal in Umeå and a paper mill in Obbola. The wood is being transported from the forests across northern hinterland on rail to Umeå. As the paper mill does not have rail access, the last stretch of the route is conducted on road, a round trip of 30 km. The trip is repeated up to 6 times every weekday depending on the volumes arriving to the terminal. Charging takes place in Obbola)

Another research project is being conducted in parallel with the REEL project in which SCA Skog, Scania and Skogforsk use the REEL vehicle to evaluate the feasibility of electric logging trucks by measuring various parameters. This flow requires lifting equipment at the terminal and the paper mill as the prototype truck is not equipped with a lift.

As for many logistics and transport actors in REEL, the truck provides an opportunity to gain insights within electromobility and test the new technology together with the long-term business partners and suppliers. Although SCA does not usually own trucks themselves, the project makes way for learning together with one of the many transport companies operating for SCA to be prepared for the upcoming transition.

Vehicle	Scania 25P 6x2 300 kWh (Prototype)
Body	**Rigid**
Total weight	**70 t**
Type of goods	**Round wood**
Charging	**During driver breaks (150 kW)**
Localization	**North-East Sweden**

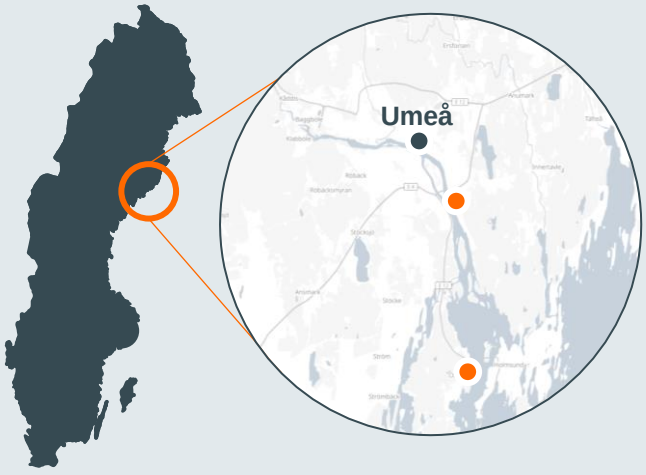


Image: Scania

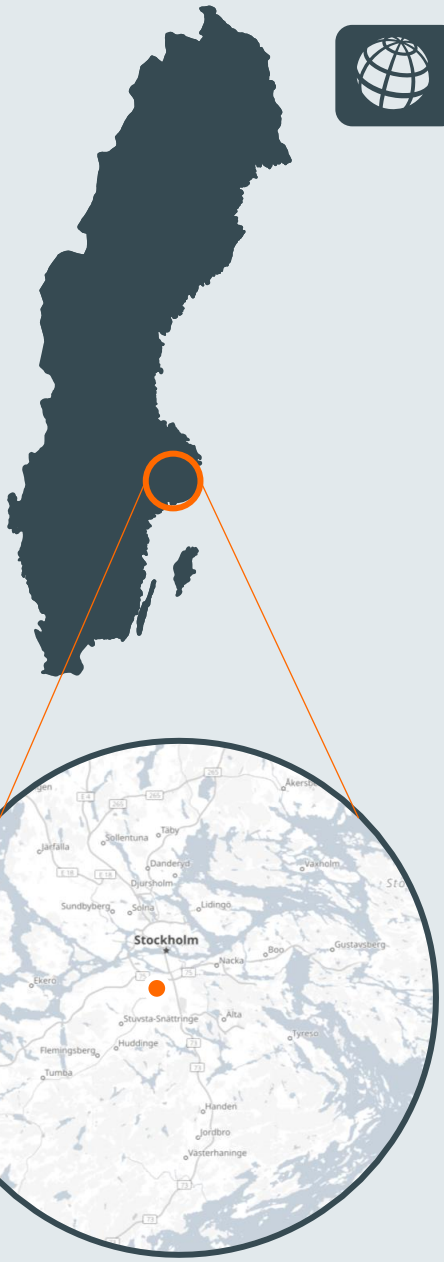
Image: Scania

SWEROCK

The electric truck enables 80 tonnes CO_2 reduction per year and truck compared to a diesel-powered truck.

The four electric trucks with concrete mixers are based at concrete factory in Västberga south of Stockholm City. The trucks deliver concrete to construction sites in and around the Stockholm area. In connection to the concrete factory, a charging hub with four chargers has been installed where the trucks are charged during night and if needed during the day.

Swerock highlights that the electric trucks are very well suited to use in projects where the customers have high ambitions with regards to both reduction of emissions and improved working environment. Another benefit is that they can also be used in the city center of Stockholm when zero emission zones will be introduced 2025.



Vehicle	4 x Volvo FE 6x2
Body	**Rigid with concrete mixer**
Total weight	**27 t**
Type of goods	**Concrete**
Charging	**During night and breaks**
Localization	**Stockholm area**

Image: Volvo

VGT I GÖTEBORG

Electric prototype on a shuttle route in the Gothenburg area.

The transport company VGT i Göteborg is a subcontractor to DHL Freight, performing pick-ups and distribution. VGT serves local areas north of Gothenburg.

In this particular flow linked to the REEL project, tires are transported from a warehouse in the city of Kungälv just outside Gothenburg to a DHL terminal in Gothenburg. The length of a round trip is around 40 km.

The vehicle is utilized during one shift between 9:00 and 18:00. Each shift, six round trips are performed, three before lunch break and three after.

The charging is done mainly during night, at low power (22 kW). Additional fast

break at 150-175 kW. All of the charging is being done at a public location in proximity to the premises of VGT. As the company has limited space on its premises and since the space is rented, investing in and installing own charging infrastructure on the premises is a challenge.

The drivers speak for the improvement of working environment, especially around the vehicle. As this particular case utilizes trailers, coupling and decoupling of the trailer is performed several times a day. This implies working close to the tailpipe which of course is absent in the electric Volvo. Electric trucks are seen as advantageous when recruiting new drivers in the future.

Vehicle	Volvo FM 4x2 540 kWh
Body	**Tractor**
Total weight	**44 t**
Type of goods	**Tires**
Charging	**During night (22 kW) and lunch (175 kW)**
Localization	**Gothenburg area**

Image: CLOSER

Image: Scania

WIBAX

ÖHRLUNDS

An electric light weight tipper in northern Sweden.

Öhrlunds Industritransporter is a local carrier specializing in transportation of steel and iron products. The company is a part of BDX, a major provider of transport and logistics services in northern Sweden consisting of former haulier network organizations and local transport companies. Recently, Öhrlunds has received an electric truck prototype from Volvo which has been deployed in the city of Luleå, making it the most northern logistics case in the REEL project.

The truck is being used in a confined area, a steel production site of SSAB. It is used in a short repetitive flow within the production facility, rarely exceeding speeds over 40 km/h. The vehicle is being used during a day-shift and is charged with a 160 kW DC-charger during lunch and prior to the shift start in the morning. The production facility offers a dry and dusty environment for field testing.

Vehicle	Volvo FMX 8x4R 360 kWh
Body	**Rigid tipper**
Total weight	**32 t**
Type of goods	**Fractions for steel production**
Charging	**Lunch and night-time (160 kW)**
Localization	**Luleå**

Image: Volvo Lastvagnar

Case summary (1/6)

	All-transport	Boliden	Börje Jönsson Åkeri	DAGAB Stockholm	DAGAB Gothenburg	Derome
Truck	Scania 25P 4x2	Scania 25P 6x2*4	Volvo FM 4x2	Scania 25P 6x2	Scania 25P 6x2	Volvo FM 6x2*4
Body	Tractor	Tractor	Tractor	Rigid refrigerated	Rigid refrigerated	Rigid
Battery size	300 kWh	300 kWh	N/A	300 kWh	300 kWh	450 kWh
Gross weight	29 t	74 t	50 t	28 t	64 t	29 t (50 t)
Type of goods	Containers	Ore	❄ Food	❄ Food	❄ Food	Building material
Logistic flow	Port-to-Hub	Shuttle flow	Hub and spoke	Urban & Suburban Distribution	Regional Distribution	Urban & Suburban Distribution
Daily milage	200 km	400 km	1000 km	350 km	300 km	300 km
Shifts per day	1	2	2	2	3	1
Charging up to 49 kW	100%	0%	0%	40%	0%	0%
Charging between 49–149 kW	0%	100%	0%	60%	100%	10%
Charging from 150 kW	0%	0%	100%	0%	0%	90%
Public charging	0%	0%	100%	0%	0%	10%
Charging at customer	0%	0%	0%	0%	0%	0%
Charging at own premises	100%	100%	0%	100%	100%	90%

❄ *Refrigerated goods*

Image: Volvo Trucks

Case summary (2/6)

	DFDS	DHL	ELIS	EÅ	Falkenklev	Flygfrakt
Truck	Volvo FH 4x2	Volvo FH 6x2	3 Volvo FL 4x2	9 Volvo FH 4x2/6x2	5 Scania 25P 4x2	Volvo FH 4x2
Body	Tractor	Rigid swap-body and trailer	Rigid	Tractor	Rigid	Tractor
Battery size	540 kWh	510 kWh	265 kWh	540 kWh	165 kWh	N/A
Gross weight	44 t	64 t	16 t	44 t	20.5 t	44 t
Type of goods	Industrial	Pallets and parcels	Textiles and laundry	❄ Food	Pallets and parcels	Pallets and parcels
Logistic flow	Hub-to-Hub	Line-haul & Suburban Distribution	Urban & Suburban Distribution	Hub-to-Hub	Urban Distribution	Regional Distribution
Daily milage	250 km	450 km	150 - 200 km	300 km	120 km	300 km
Shifts per day	1	2	1	2	1	1
Charging up to 49 kW	N/A	0%	100%	5%	100%	95%
Charging between 49–149 kW	N/A	0%	0%	0%	0%	0%
Charging from 150 kW	N/A	100%	0%	95%	0%	5%
Public charging	0%	65%	0%	15%	0%	0%
Charging at customer	0%	0%	0%	75%	0%	5%
Charging at own premises	100%	35%	100%	10%	100%	95%

❄ *Refrigerated goods*

Image: Volvo Trucks

Case summary (3/6)

	GLC	GLC	GTS	Höganäs/Dania Connect	ICA	ICA
Truck	2 Volvo FL 4x2	2 Scania 25P 4x2	Scania 25P 4x2	Scania 25P 6x2	3 Volvo FE 6x2	Volvo FH 6x2
Body	Rigid refrigerated	Rigid	Rigid	Tractor	Rigid refrigerated	Rigid refrigerated
Battery size	300 kWh	165 kWh & 300 kWh	300 kWh	300 kWh	265 kWh	540 kWh
Gross weight	18 t	26 t	18 t	74 t	27 t	28 t (50 t)
Type of goods	❄ Food	Industrial comp.	Pallets and parcels	Containers	❄ Food	❄ Food
Logistic flow	Urban & Suburban Distribution	Local & Regional Distribution	Urban & Suburban Distribution	Hub to Hub	Urban & Suburban Distribution	Regional Distribution
Daily milage	200 km	120 km	110 km	280 km	150 km	350 km
Shifts per day	1	1	1	1	1	1
Charging up to 49 kW	80%	100%	100%	0%	95%	10%
Charging between 49– 149 kW	0%	0%	0%	0%	0%	0%
Charging from 150 kW	20%	0%	0%	100%	5%	90%
Public charging	20%	0%	0%	0%	5%	100%
Charging at customer	0%	100%	0%	0%	0%	0%
Charging at own premises	80%	0%	100%	100%	95%	0%

❄ *Refrigerated goods*

Image: Erikssons Åkeri

Case summary (4/6)

	Jula Logistics	LBC Frakt	LBC Frakt	LBC Frakt	LB Transport	Martin & Servera
Truck	2 Scania 25P 6x4	Scania 25P 4x2	Scania 25P 6x2	Scania 40P 6x2	Volvo FM 4x2	3 Volvo FE 6x2
Body	Tractor	Rigid	Rigid	Rigid	Rigid	Rigid refrigerated
Battery size	300 kWh	300 kWh	300 kWh	300 kWh	360 kWh	265 kWh
Gross weight	64 t	19 t	29 t	55 t	18 t	27 t
Type of goods	Containers	Building material	Refuse	Excavated material	Food	❄ Food
Logistic flow	Dry port-to-Hub	Regional Distribution	Confined area	Con-struction	Urban Distribution	Urban & Suburban Distribution
Daily milage	300-400 km	200-300 km	150-200 km	N/A	N/A	200 km
Shifts per day	2	1	1.5	1	1	2
Charging up to 49 kW	50%	70%	70%	50%	100%	100%
Charging between 49–149 kW	0%	0%	10%	0%	0%	0%
Charging from 150 kW	50%	30%	20%	50%	0%	0%
Public charging	0%	0%	0%	0%	0%	0%
Charging at customer	0%	0%	0%	0%	0%	0%
Charging at own premises	100%	100%	100%	100%	100%	100%

❄ *Refrigerated goods*

Image: CLOSER

Case summary (5/6)

	M-lab	Nordisk Återvinning	Polfärskt	Postnord	Postnord	Ragn-Sells / Foria
Truck	Volvo FM 6x2	Volvo 4 FE 6x2 1 FL 4x2	Volvo FL 4x2	Scania P230 6X2	Scania 25P 4x2	Scania 25P 6x4
Body	Tractor	Split body rear loader for waste / Rigid	Rigid	Rigid refrigerated	Tractor	Tractor
Battery size	600 kWh	260 kWh / 200 kWh	200 kWh	300 kWh	300 kWh	300 kWh
Gross weight	50 t	27 t / 17 t	16 t	28 t	19 t	75 t
Type of goods	Excavated material	Refuse	❄ Food	Pharma. / Pallets and parcel	Pallets and parcels	Fly and bottom ash, wood chips
Logistic flow	Con-struction	Urban & Suburban Waste collection	Urban & Suburban Distribution	Urban & Suburban Distribution	Hub-to-Hub	Hub-to-Hub
Daily milage	250-300 km	100 km	100 km	200 km	140 km	400-600 km
Shifts per day	2	1	1	3	1	2
Charging up to 49 kW	10%	90%	100%	0%	0%	0%
Charging between 49–149 kW	0%	0%	0%	0%	0%	0%
Charging from 150 kW	90%	10%	0%	100%	100%	100%
Public charging	100%	10%	0%	0%	0%	0%
Charging at customer	0%	0%	0%	0%	0%	0%
Charging at own premises	0%	90%	100%	100%	100%	100%

❄ *Refrigerated goods*

Image: CLOSER

Case summary (6/6)

	Renova	SCA Skog	Swerock	VGT	Wibax	Öhrlunds
Truck	Scania 25P 6x2	Scania 25P 6x2	4 Volvo FE 6x2	Volvo FM 4x2	Scania 25P 6xX	Volvo FMX 8x4
Body	Tractor (with hook-lift)	Rigid	Rigid with concrete mixer	Tractor	Tractor	Rigid tipper
Battery size	300 kWh	300 kWh	N/A	540 kWh	300 kWh	360 kWh
Gross weight	30 t	70 t	27 t	44 t	64 t	32 t
Type of goods	Refuse	Round wood	Concrete	Tires	Chemicals	Fractions for steel production
Logistic flow	Hub-to-Hub	Shuttle flow	Urban and Suburban distribution	Shuttle flow	Urban & Regional Distribution	Confined area
Daily milage	80 km	150 200 km	N/A	250 km	300 km	N/A
Shifts per day	1	1	N/A	1	2	1
Charging up to 49 kW	100%	0%	N/A	90%	0%	0%
Charging between 49–149 kW	0%	100%	N/A	0%	0%	0%
Charging from 150 kW	0%	0%	N/A	10%	100%	100%
Public charging	0%	0%	0%	100%	0%	0%
Charging at customer	0%	0%	0%	0%	0%	100%
Charging at own premises	100%	100%	100%	0%	100%	0%

Image: Volvo Trucks

Contact & info

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