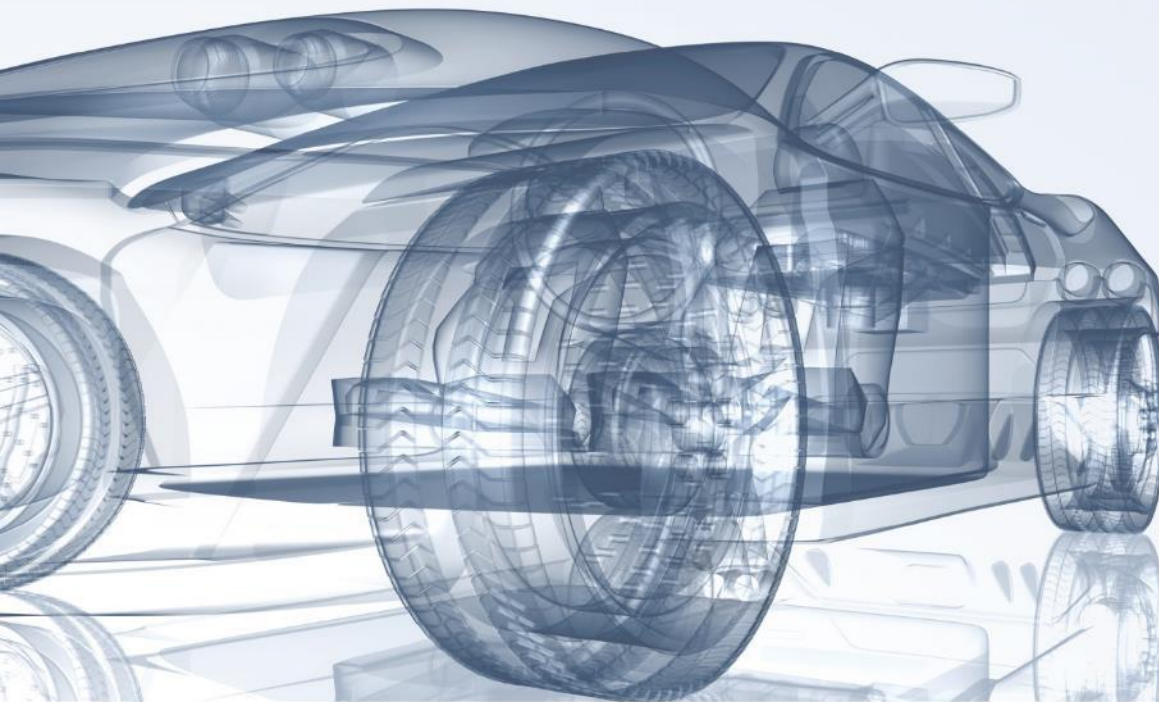


evs 30



The 30th International
Electric Vehicle
Symposium & Exhibition

October 9–11, 2017
Messe Stuttgart, Germany

www.evs30.org

Sponsored by

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swarco



e-Mobility tour Gothenburg Sweden

Per Österström

Head of
Transportation & Automotive Industry
Business Region Göteborg



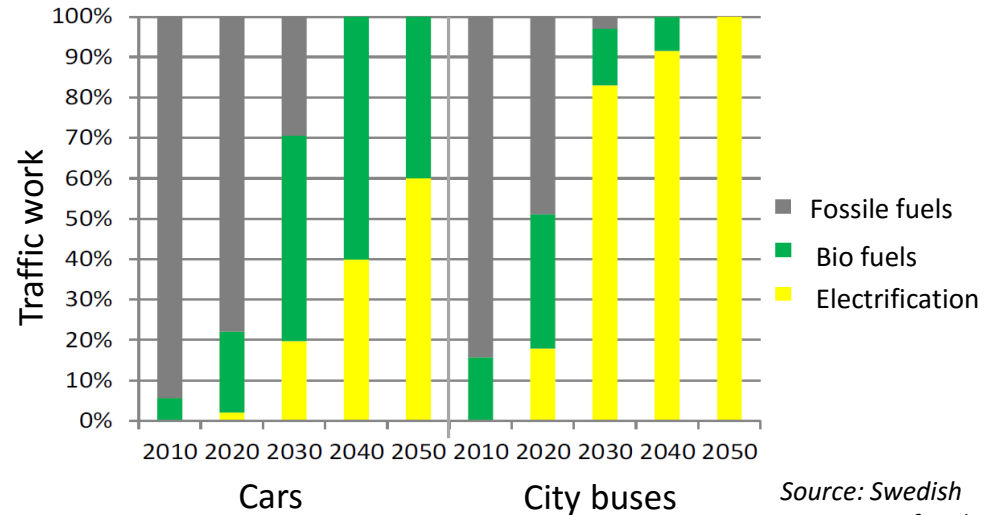
Agenda

- EV development in Sweden
- E-Mobility initiatives in the City of Gothenburg
- The private public partnership project Electricity

Sweden figures



- 4,8 million passenger cars in traffic
- 18 years life time
- 14 000 buses



Source: Swedish government fossil free fuel investigation

EV figures



- **38 000 electrical cars** (44 000 prognosis – 2017), whereof 31% full electric
- **62% growth** (12 month rolling)
- Charge points/vehicle: **0,10**

70% CO₂ emission reduction til 2030

Predicted to:

- 95 CO₂/km (2021)
- 70g CO₂/km (2025)
- 50g CO₂/km (2030)

Sweden climate framework



- **New climate regulation** (Jan 2018)
- **New climate objectives**
- **Climate council**

Worlds most ambitious reduction obligation:

- ~50% of petrol and diesel fuel volumes sold on the Swedish market has to be renewable by 2030.



New bonus malus system (from July 2018)

- Increased vehicle tax the first three years, adjusted to CO₂ emission levels.
- Bonus for lower emission vehicles
- Max 60 000 SEK - zero emission vehicles.
- From 2020 tax will be based on WLTP
- Existing vehicle fleet not affected.

Electric bicycle and scooter premium

Government is allocating SEK 350 million per year in 2018–2020 to an electric vehicle premium for the purchase of electric bicycles or electric scooters.



Environmental zones (proposal considered for 2020)



Environmental Zone class 2 (cars, vans and light buses)

- Diesel Vehicles - Euro 6
- Petrol, ethanol or gas vehicles - Euro 5

Environmental zone class 3 (cars, motor bikes, mopeds class 1, light and heavy trucks, buses)

- Light vehicles - electricity or hydrogen
- Heavy vehicles on electricity, hydrogen or is of the type of electrical hybrids that fulfil Euro 6 requirements.

“This is the forecourt to hell”

Birgitta Dahl, Minister of the Environment 1987



Green Gothenburg 2017

...District Heating, Worlds 1st Green Bonds initiative,
Sustainable Mobility Solutions...

CO₂ (Carbon dioxide) -50%

NO_x (Mono-nitrogen oxide) -90%

SO₂ (Sulphur dioxide) -100%



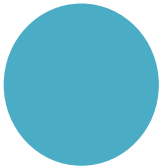
Photo: Pål-Nils Nilsson, Riksentikvarnsmuseet

Great development plans towards 2035



+105 000

APARTMENTS



+240 000

INHABITANTS



+110 000

JOBS



100 BILLION

INVESTMENTS



5 MILLION
5 M²

TO BE BUILT IN CITY CENTER.

RIVERCITY – NORTHERN EUROPE’S TARGETS URBAN DEVELOPMENT PROGRAM

CO₂

Energy use per km

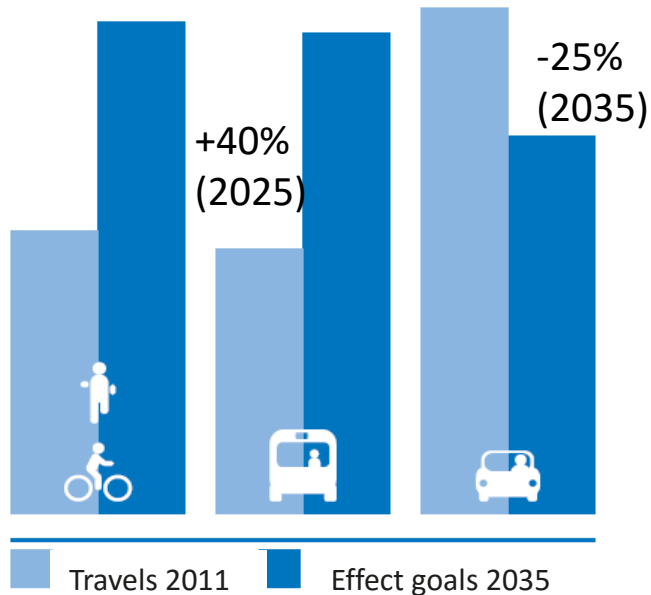
- More energy efficient vehicles
- Change into more energy efficient transport modes (bikes and public transport)

Total km driven

- Increase number of passengers and goods per vehicle
- City planning for reduced transport demands

CO₂ emissions per energy unit

- Introduce fuels with lower CO₂ emissions than current fuels



55% of the journeys to be public transport 2035 (37% (2015))

Transport strategy

Is building a more livable, sustainable and dense city.

With more use of and new ways of using public transport solutions.

We want to:

- Reach new user groups for public transport
- Make it available in environments before impossible because of noise, emissions and other traffic.

Gothenburg societal cost of noise exposure

- **€100 million/year** in societal cost
- **1200 disability adjusted life years/year**
- **100 000 residents** are exposed to traffic noise above national guidelines.
- **30%** affected once a week

Health problems: ↑

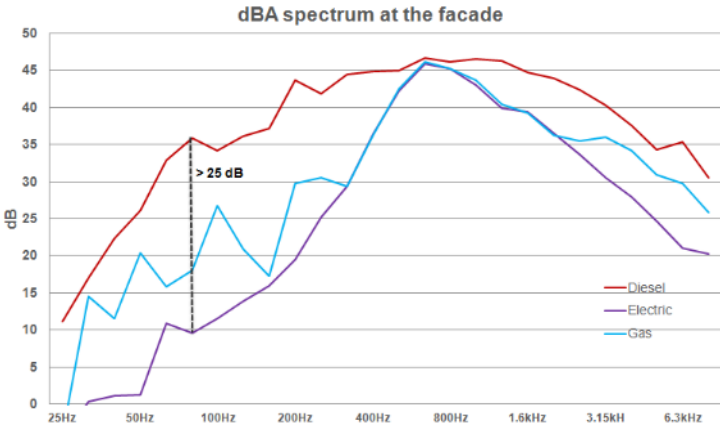
- Sleeping disability
- Stress
- Increased risk of stroke and heart diseases

Real Estate values ↓

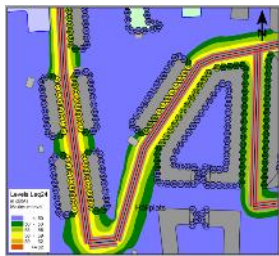
Cost for noise prevention ↑



Socio economical value with different vehicle types



- ELECTRIC, GAS, DIESEL BUSES
- Low frequency noise, difficult to isolate and more dominant indoors
- Low frequency noise needs 100 - 150 m noise distance to be reduced – a big problem for dense cities



Diesel

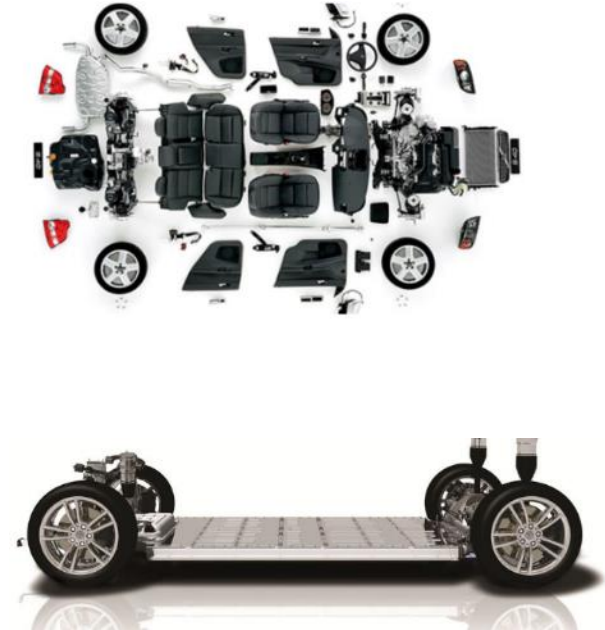
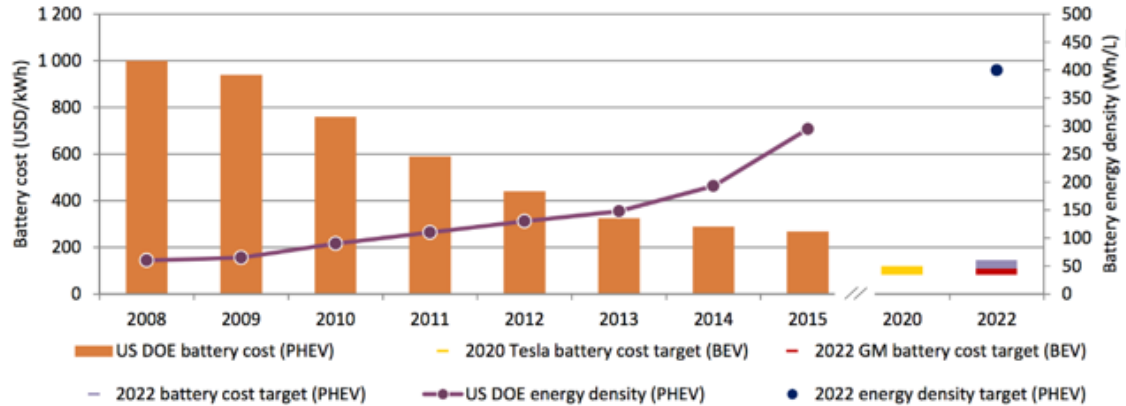


Electric

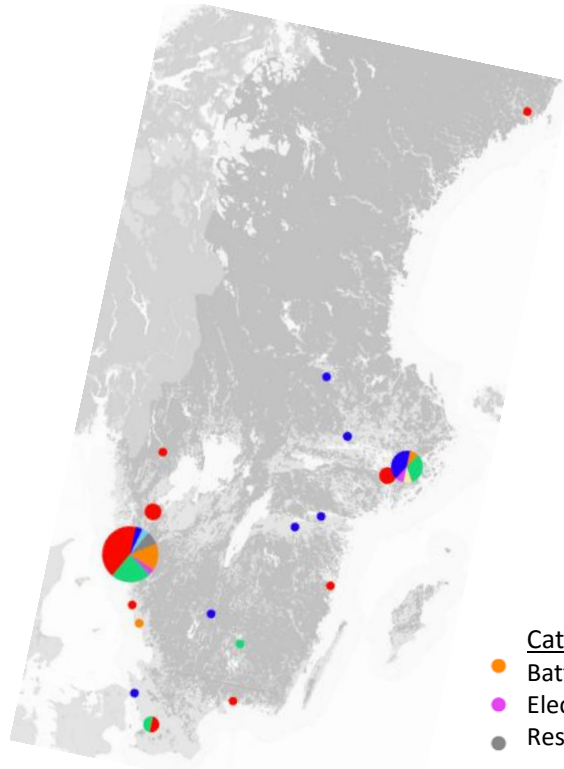
With noise data we can plan city development and traffic

Changing business landscape

Prices versus energy density



Strong e-mobility clusters in Sweden



| | | | |
|------------------------------|-----------------------------------|----------------------------------|------------------------|
| CARVIA | Small working vehicles | Hybricon | Buses |
| CEVT A Sweda Auto Company | Passenger cars | National Electric Vehicle Sweden | Passenger cars |
| CLEAN MOTION | Small passenger cars | NIMBELL | Small working vehicles |
| Coman | Small buses | Scania | Buses & trucks |
| CYCLEURPORE | Bicycles | Uniti | Passenger cars |
| car | Passenger small distribution cars | VOLVO Buses GLOBAL | Buses |
| ELLWEE | Quads | VOLVO | Passenger cars |
| Ecoride | Bicycles | Velove | Cargo bikes |

Categories

- Batteries, fuel cells and energy storage
- Electricity production technology
- Charging infrastructure
- Research institutes

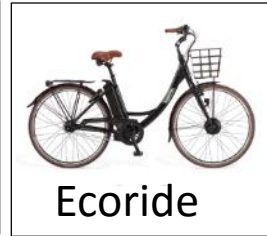
- Organizations within electro mobility
- Consultant companies
- Charging infrastructure
- Electrical vehicles manufacturers (small)
- Electrical vehicles manufacturers (big)



2021



Walleräng



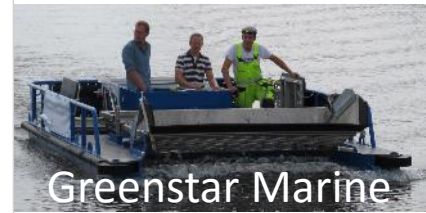
Ecoride



Velove



Clean motion



Greenstar Marine



POLESTAR



Volvo Cars



Lync&Co



NEVS



VOLVO

New Electromobility Lab to be build in Gothenburg

- 100 million Euro investment
- Open testbed for business and research collaboration



CHALMERS



Focus on

- Electrified gearboxes and drivetrain
- Components, systems and complete hybrid and electrified vehicles.
- Charging systems
- Cloud connected control

ELECTRICITY

Route 55 is a result of the ElectriCity cooperation



- Quiet and emission-free electric buses that contribute to a more pleasant urban environment
- Includes innovative bus stop solutions, among them an indoor bus stop, ITS solutions, safety concepts, new depot and energy solutions, cloud infrastructure and data mining
- An arena for testing new products and services in public transport
- ElectriCity runs 2015–2021



Route 55 in traffic since June 2015



- Connects the two campuses of Chalmers Johanneberg and Chalmers Lindholmen
- 8 km (5 miles) long (25 minutes), runs through the city centre
- Charging takes place at the end stations
- Fast charging in 3-6 minutes, 300 kW
- In traffic 6 am – 7 pm weekdays
- Approximately 100,000 passengers per month

Terminal



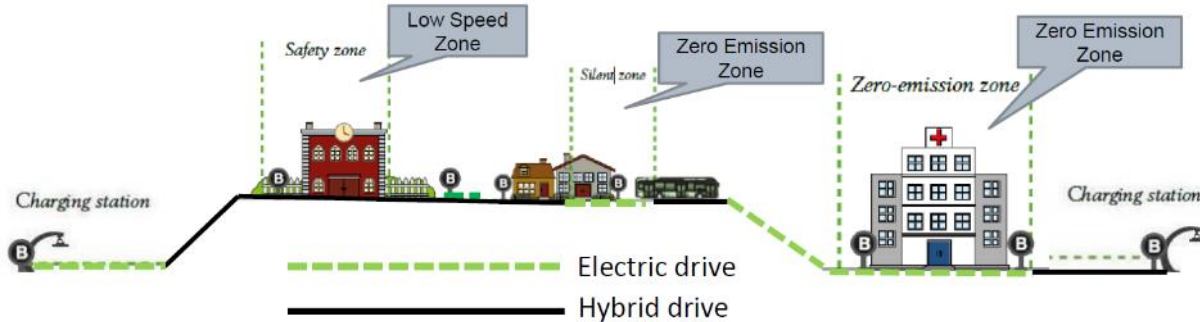
School



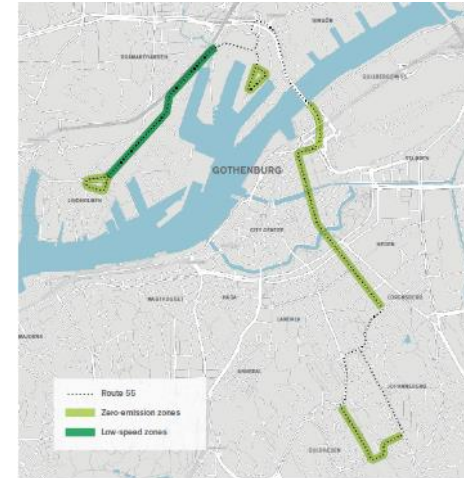
Residential Area



City Centre



Applies geozone technology



HYBRID BUSES



- 30-40% Fuel reduction
- Silent take-off
- 40% lower on road emissions

ELECTRIC HYBRID BUSES



- 75% fuel & 60% energy reduction
- Electrical drive 70% of route
- Silent
- 75% CO₂ reduction*
- Charging 3-6 min at end stations

7 electric hybrids

FULL ELECTRIC BUSES



- 80% energy reduction
- Electrical drive 100% of route
- Silent
- Minimum local emissions
- 100% CO₂ reduction*
- Charging 3-6 min at end stations

3 fully electric buses



Indoor bus stop with cafeteria, Gothenburg



Old batteries used as storage media for sun energy, generated from sun panels at Riksbyggen company new house buildings



Bus stop in real library during Volvo Ocean Race



"Goods on demand" package delivery

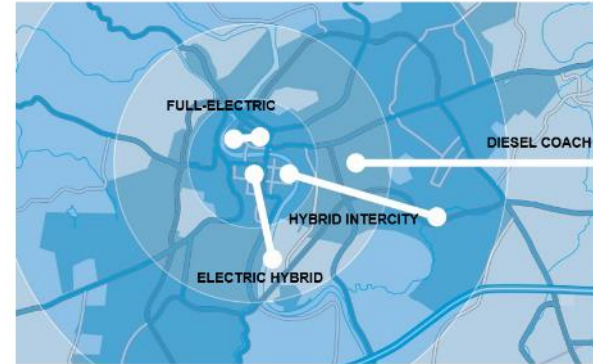
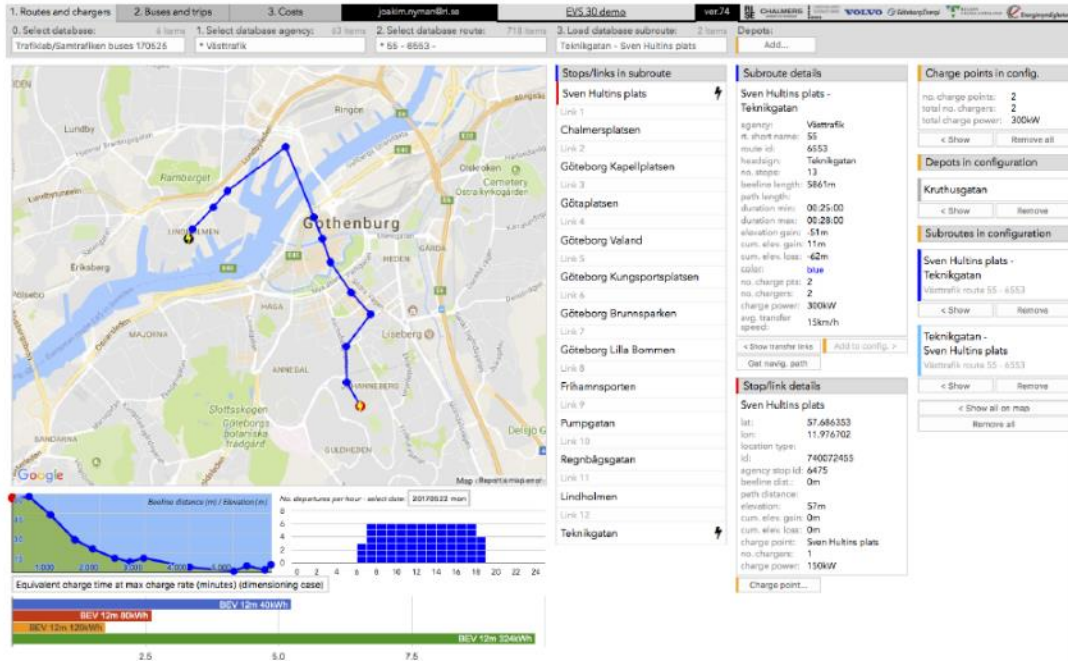


Bus stop with sound-deadening technology

Creating new opportunities for urban planning

- Bringing buses closer to passengers. Opening up possibilities for bus routes in new areas
- Silent mode of public transport improving quality of life and increasing real estate values.
- Enabling indoor bus stops, improving passenger and driver comfort and safety.

Deployment requires system analysis

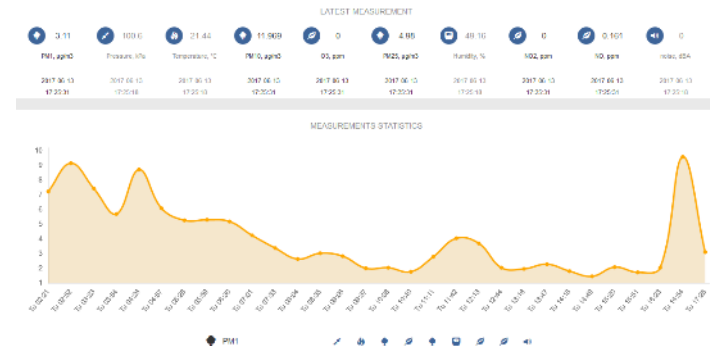


Quantify trade-offs regarding:

- Battery size
- Charging strategies
- Charging infrastructure
- Vehicle fleet
- Operational cost

Environment measurements

- Sensors for air quality and noise mounted on the buses and at bus stops



Awarded project



- **UITP Awards 2017** – first price in category "operational and technical excellence".
- **Euro-China Green & Smart City Award, CINEV 2016**
- **CIVITAS Awards 2016** – second place category "Transformation"
- **European Solar Prize 2015** – best examples of sustainable public transport using sustainable energy resources

High international interest



- More than **7 000 delegation visitors** since launch of ElectriCity line 55 (june 2015)
- Air quality, noise reduction, energy efficiency and sustainability questions high on cities agendas



A collaboration between industry, public sector and academy
















Based on common vision, objectives and will to create a sustainable future

Coming 2018

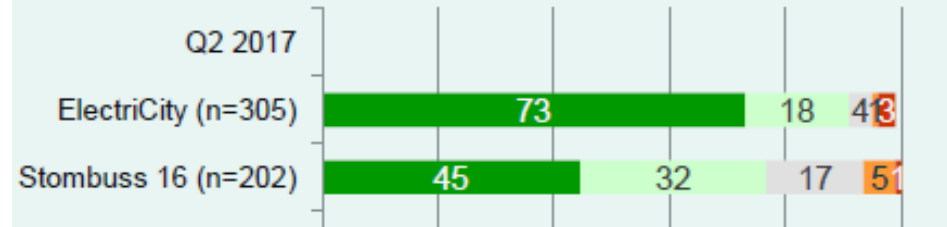
- Electrified bus rapid transit testing
- New bus stops with Bus Rapid Transit-functions
- New charging infrastructure





Citizen response

Attitude towards noise level on-board (%)
Base: All



■ Completely agree ■ Partially agree
■ Neutral ■ Partially disagree
■ Completely disagree

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Presenter: