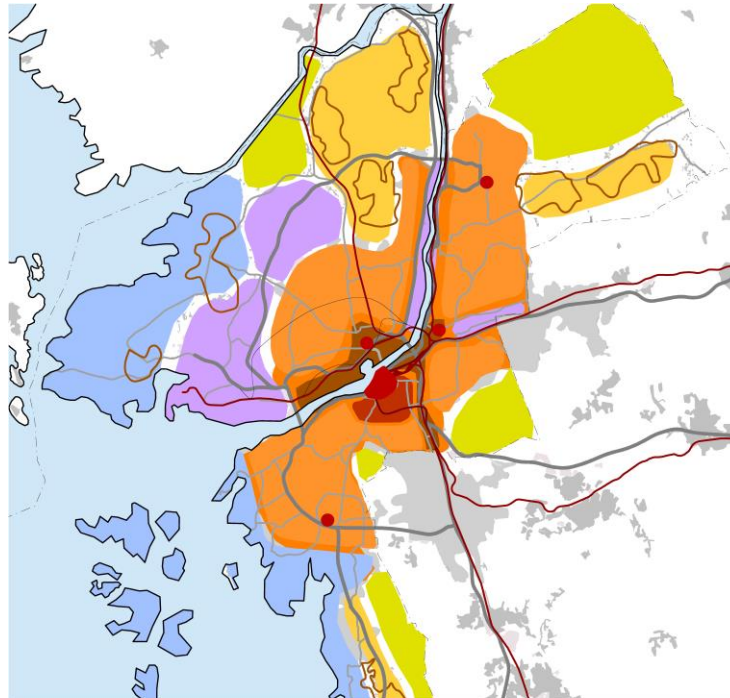


# **ElectriCity Gothenburg: Building the smart city through electric buses**

**Dublin May 2019**

Peter Lindgren

# Gothenburg 2035



- Centrala Göteborg - Innerstaden
- Centrala Göteborg - Förnyelseområden
- Mellanstaden
- Ytterstaden - Framtida utvecklingsområden
- Kustnära områden och skärgården
- Storindustri, hamn och logistik
- Naturområden
- Utredningsområde för framtida bebyggelseområden

**Appx 700,000**  
residents of Gothenburg in 2035

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**70–80,000**  
new homes, including 50,000  
in the existing city, of which  
25,000 in Älvstaden (River city)

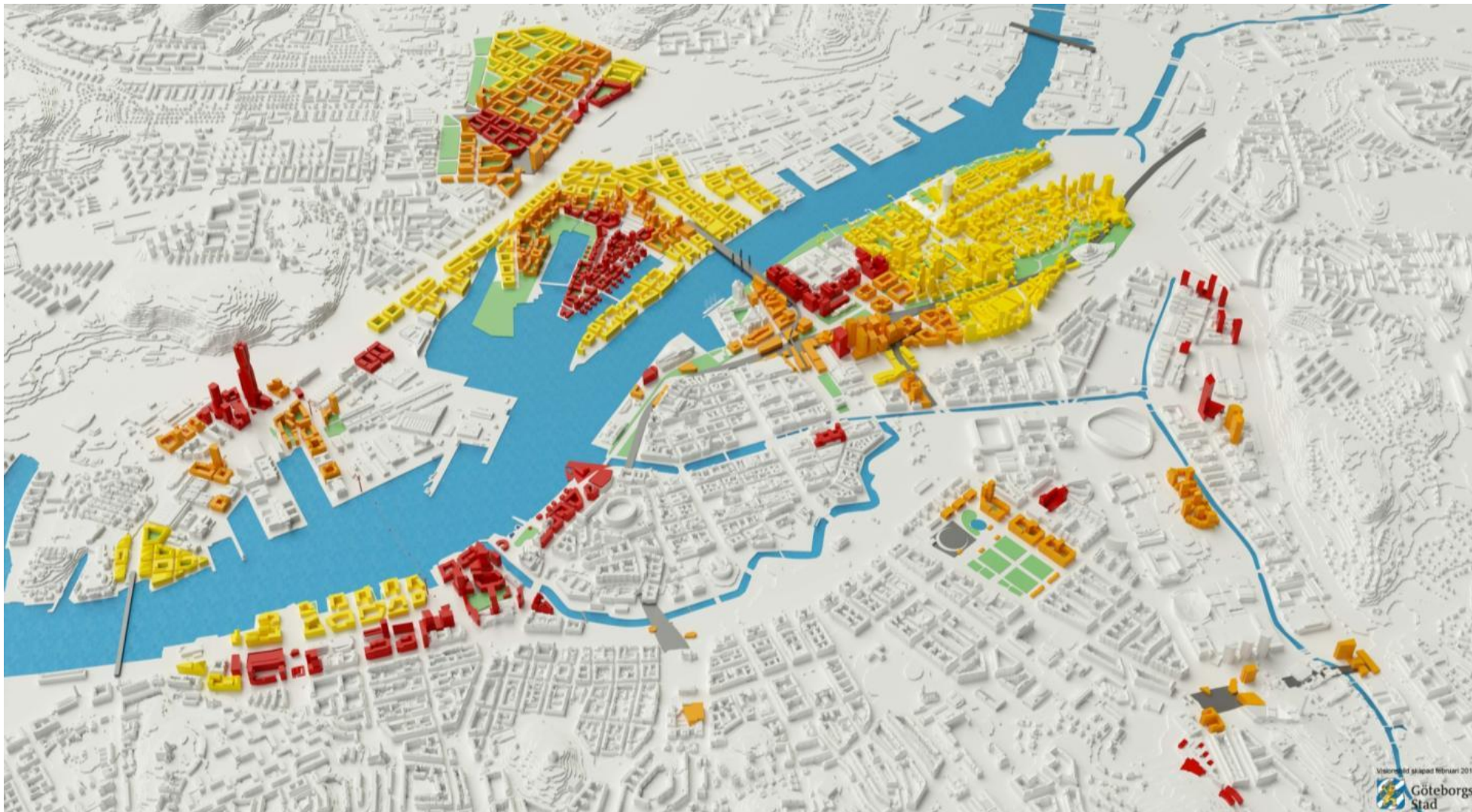
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**80,000**  
more jobs of which 50,000 in Älvstaden

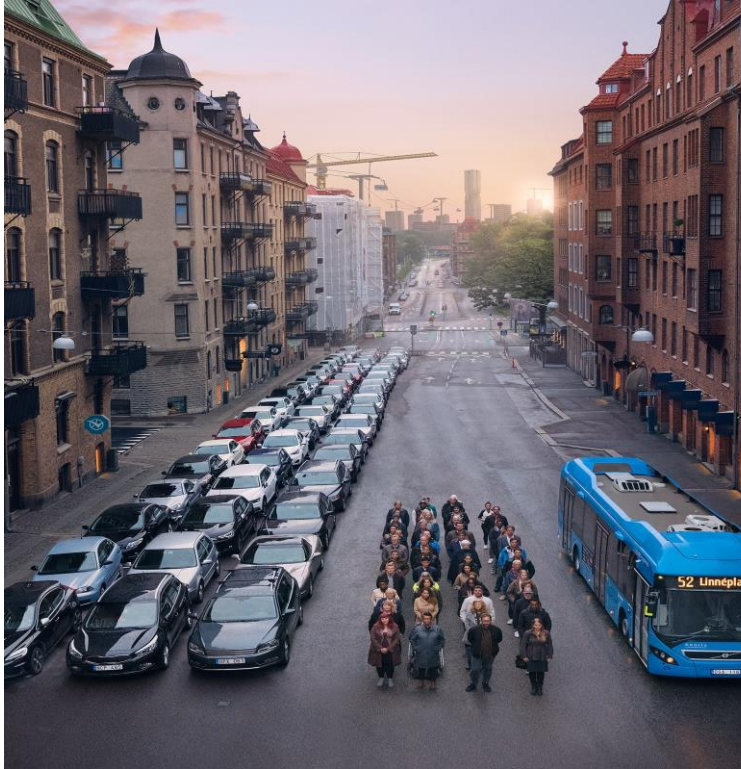
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Source: Expansion planning 2013

# Vision for 2035 and beyond



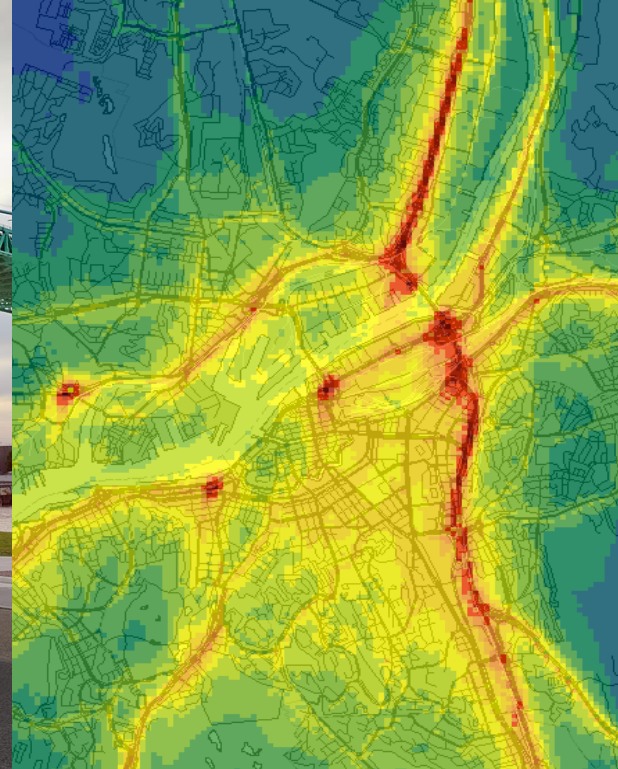
# Our challenges



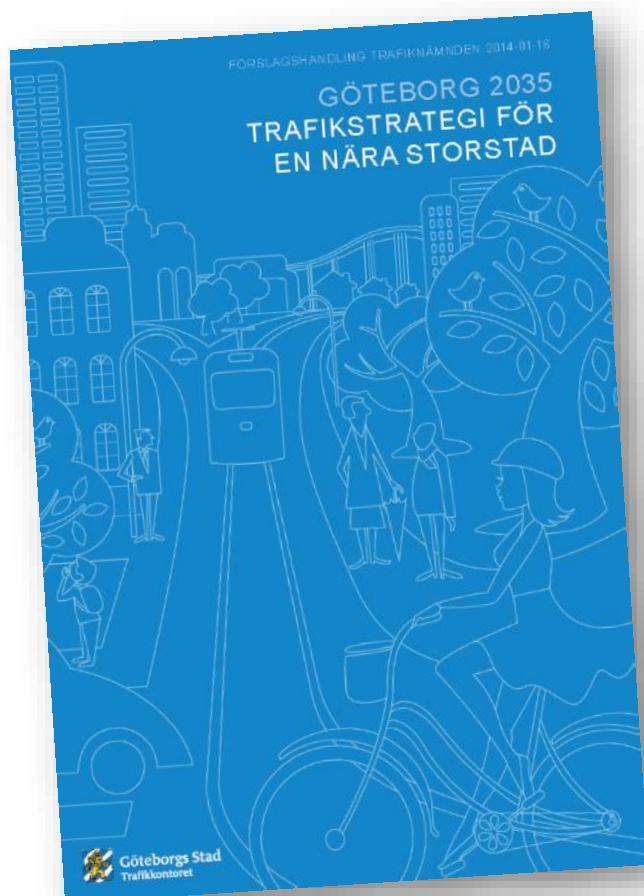
**Urban space**



**Energy use**



**External effects**



**Accessible**



**Liveable**



**Logistic centre  
of Scandinavia**



# Investments in infrastructure

SVERIGEFÖRHANDLINGEN

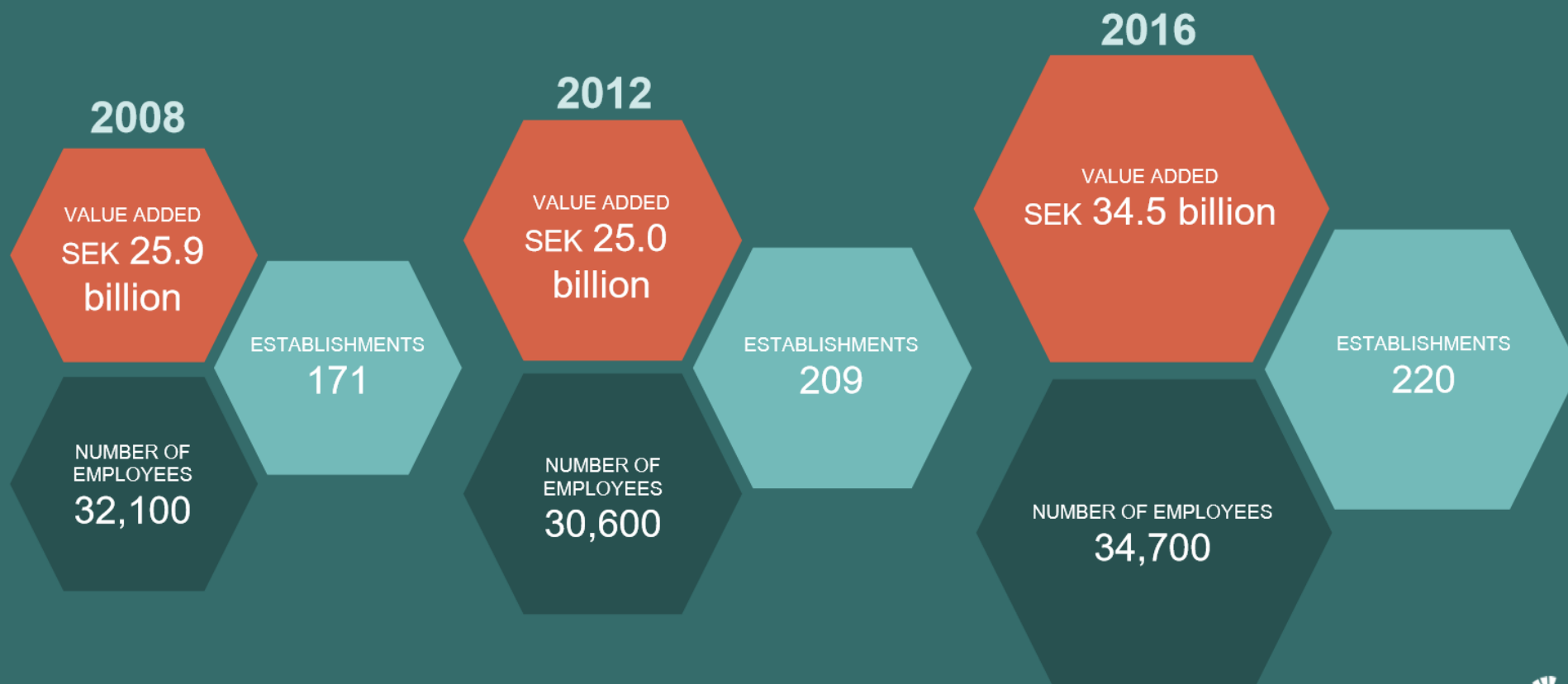
NEXT  
STOP  
2035



*The "Swedish negotiation" is a multi billion investment in public transport, cycle tracks and new housing in Gothenburg.*

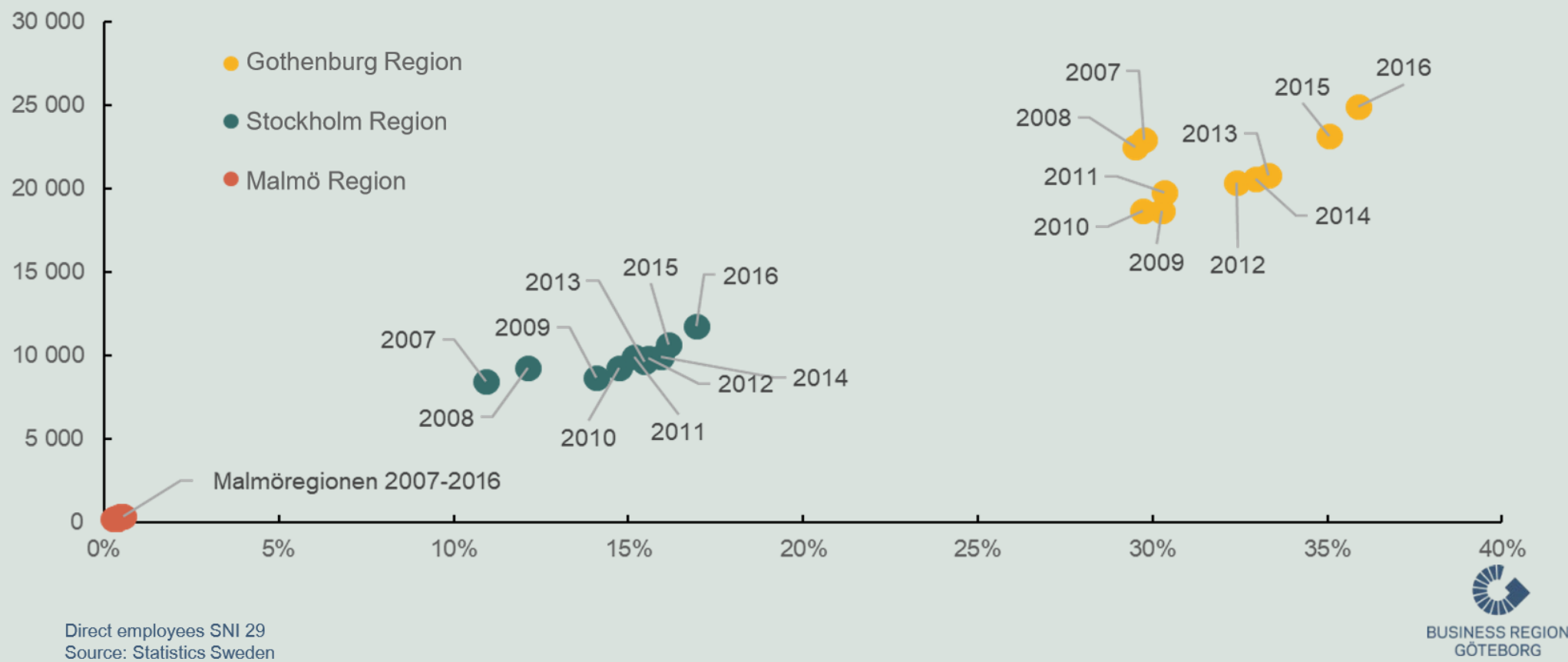
*"Next Stop 2035" is a proposal on how to develop the City's future public transport.*

# AUTOMOTIVE CLUSTER DEVELOPMENT



Value added adjusted for inflation

## NUMBER OF EMPLOYED PERSONS IN THE AUTOMOTIVE INDUSTRY AND THEIR PROPORTION OF SWEDEN'S TOTAL 2007-2016





# A smart, innovative city – with world-class, cutting-edge expertise

- Collaboration between the business sector, academia and the local community is channeled through three large science parks: Sahlgrenska, Johanneberg and Lindholmen.
- Lindholmen Science Park is the largest. Located in the most expansive, knowledge-intensive area of Gothenburg.
- Over 23,000 people currently work, study, research or live in Lindholmen, this figure will increase to 30,000 by 2020.



# The city as an innovation and test arena



# The ElectriCity cooperation in Gothenburg

- ElectriCity was formed in 2013
- A partnership between industry, the public sector and academia
- Started with the electrification of city bus line 55
- Now the scope has broadened: sustainable electrified urban travel and transport that can be scaled up outside the demo arena



## Joined by a common vision

- An **innovative and forward-thinking partnership** between city, region, private sector and academia for **sustainable and electrified travel and transport**
- A **region at the forefront of sustainable solutions** and mobility, attracting expertise, investments and enterprise
- An **arena for testing new products and services** in the fields of travel and transport
- A **source of inspiration** and motivation for **future urban development**
- A **world-class automotive and ICT industry**



# History of ElectriCity line 55

- Connects two campuses: Chalmers Johanneberg and Lindholmen
- A 7,6 km route passing through central Gothenburg
- Charging at the end of the route with overhead 300 kW fast chargers (OppCharge) for 3-6 minutes
- Geofenced for speed and driveline (for the hybrids)
- Indoor bus stop at Lindholmen
- Four new innovative bus stops along the route
- New depot and facilities for aftermarket and service
- More than 100,000 passengers per month
- Continued operation until Dec 2020
- First presented at Volvo Ocean Race 2015, with the entrance as an indoor bus stop and library



# Followed up by line EL16

EL16 is two electric articulated buses on a heavy bus line

- Bus stops have new design and screens for faster passenger flows
- Overhead charging at the end stops, 450 kW OppCharge
- The buses can operate without charging during peak traffic (2-3 hours)
- First presented at Volvo Ocean Race 2018, as the “silent and green city”



# ElectriCity visits and prizes



- A unique arena that attracts global interest
  - More than 10,000 visitors to ElectriCity and route 55
  - Air quality, noise pollution, energy efficiency and environmental issues are high on the agendas of many cities

- ElectriCity also won prizes
  - **POLIS network:** reward the Traffic authority with the prize Thinking Cities Award, 2018 for their work with digital zones
  - **UITP Awards 2017** – first prize in the Operational and Technical Excellence category. UITP is an international non-profit organisation focused on public transport
  - **Euro-China Green & Smart City Award, CINEV 2016**
  - **CIVITAS Awards 2016** – second place in the Transformation category
  - **European Solar Prize in 2015** – awarded for “Exemplary supply of public transport with renewable energy”



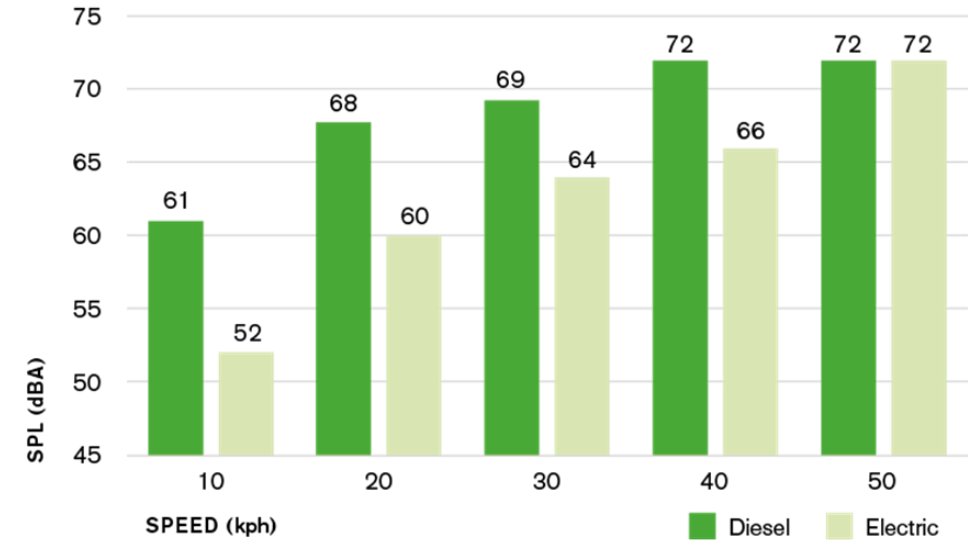
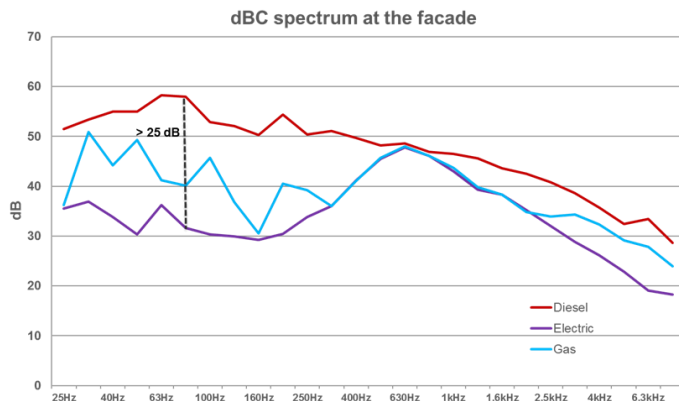
# Lessons learned

- Satisfied passengers
  - Free Wi-Fi and USB charging stations are appreciated
- Drivers are very positive
- Electric buses generate considerably less noise
- No local emissions of NOx and HC
  - No problem to drive indoors
- The indoor bus stop works perfectly
- The charging infrastructure must be planned carefully, together with other types of vehicles



# Noise

- Measurements show a significant difference at lower speeds between electric buses and diesel buses
- This applies to both the noise level and the frequency
- When pulling away the difference is 7 dBm, which sounds half as loud
- No noise when idling
- The difference disappears around 40-50 km/h

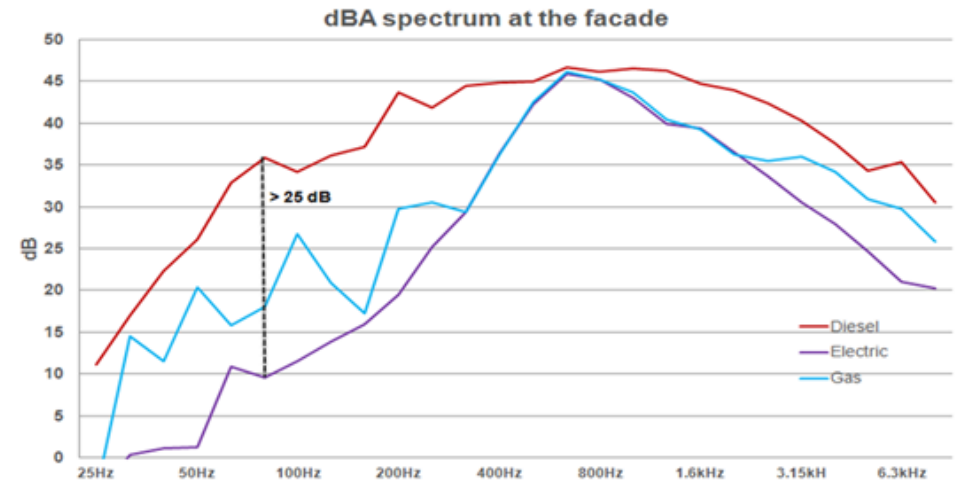


- The difference are noticeable especially at the low frequency range
  - These frequency's are very difficult to shield from
  - Long distances from the noise source is in the planning process



# Noise

- When adding the electric busses to the city noise maps, there is no gain visible
  - The noise calculations are based on dBA (high and low frequencies are dampened)
  - The figures are weighted average (many cars outweigh fewer buses)
- This is an area of research for the ElectriCity project



“It is estimated that traffic noise costs the city of Gothenburg over 100 million Euros each year. Most of these costs are linked to lower house prices, but also include the cost of poor health such as loss of work capacity and health service costs.”

# Research projects within ElectriCity

- Research from a user's perspective, part of the European Bus System of the Future 2
- Connecting charging stations to the electricity grid
- Second-life batteries
- Testing of pedestrian and cyclist detection systems to improve the safety of vulnerable road users



# What about the city

When we have electric buses in the city,  
what can we do them?

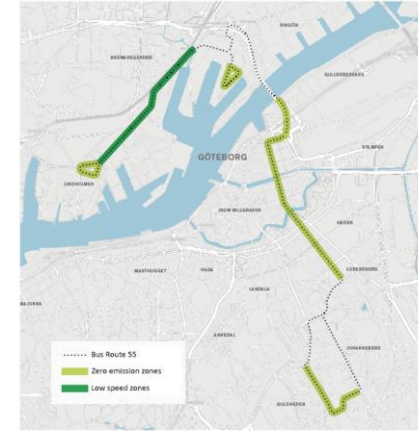
- The bus can come to the passengers  
instead of passengers going to the buses!



- Indoor bus stops
- Drive in shared spaces
- Roofed/indoor public transport hubs
- Indoor depots with “green” operation
- Bus depots integrated in buildings

# The future of ElectriCity

- The partners signed the Electricity 2 agreement last summer
- Commitment from July 2018 to December 2021
  - The focus is now on electrified urban transports, including ferry's
  - More focus on city development
  - How will the electric grid cope with the transformation
  - How to accelerate the transformation
  - More research
    - Noise
    - Air quality
    - Safety and security systems
    - Geofencing
    - Automation functionality
    - ITS



Map of Bus Route 55 showing in which areas the zone management system is set to electric drive and where max speed is limited. Dark green shows low speed zones. Light green shows zero emission zones.



# Heavy trucks, construction machines and ferries



## New test arenas of ElectriCity

- Electric marine arena
- Heavy trucks arena
- Electric worksite arena



# Welcome to celebrate with us!





**Thank you for listening**

**Peter Lindgren**

**City of Gothenburg**

**Urban Transport Administration**

**Development and International Affairs**

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