# KTH Geoinformatics research based startup Gordian: Spatial Decision Support Systems for Transport Electrification

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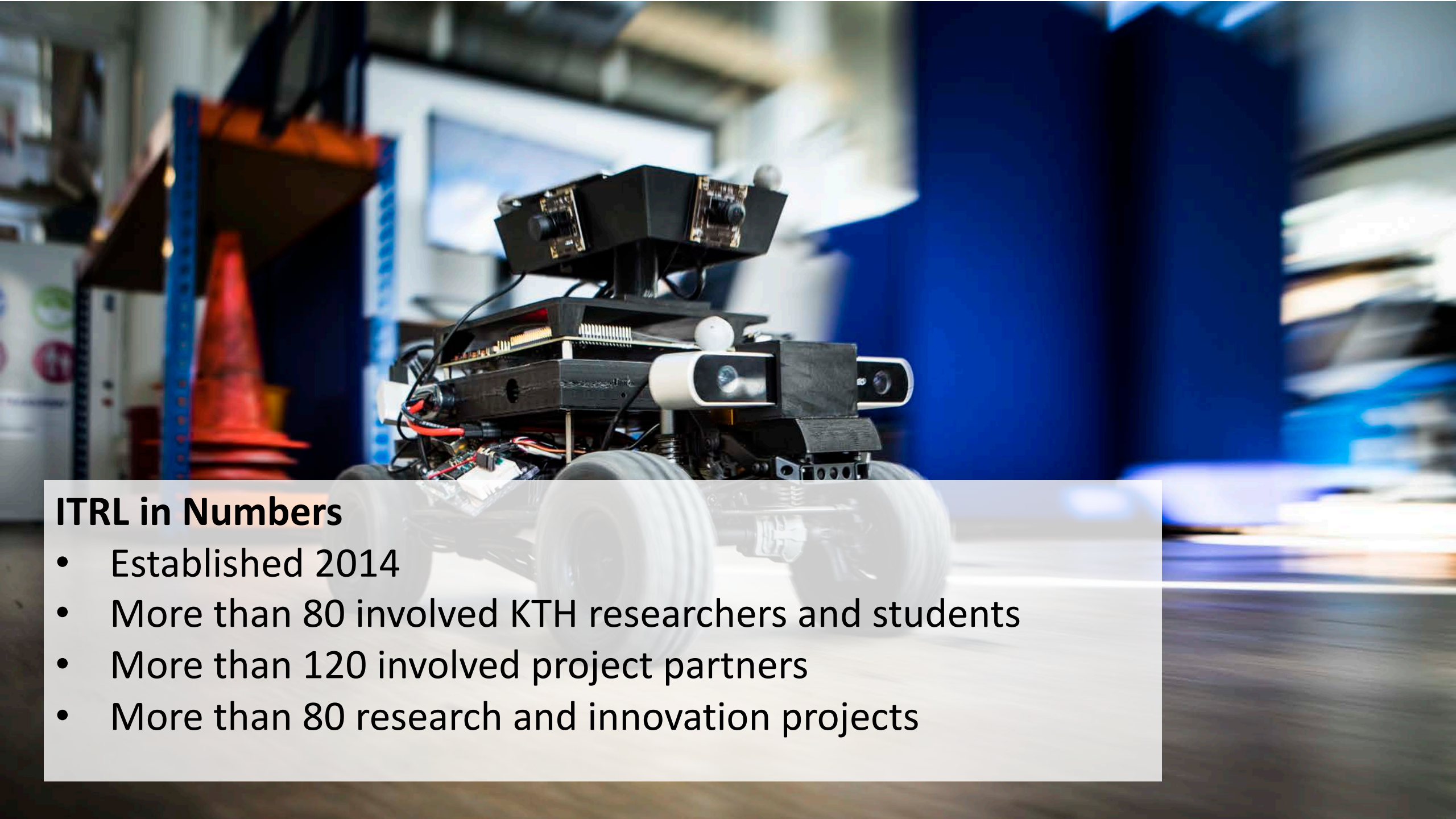
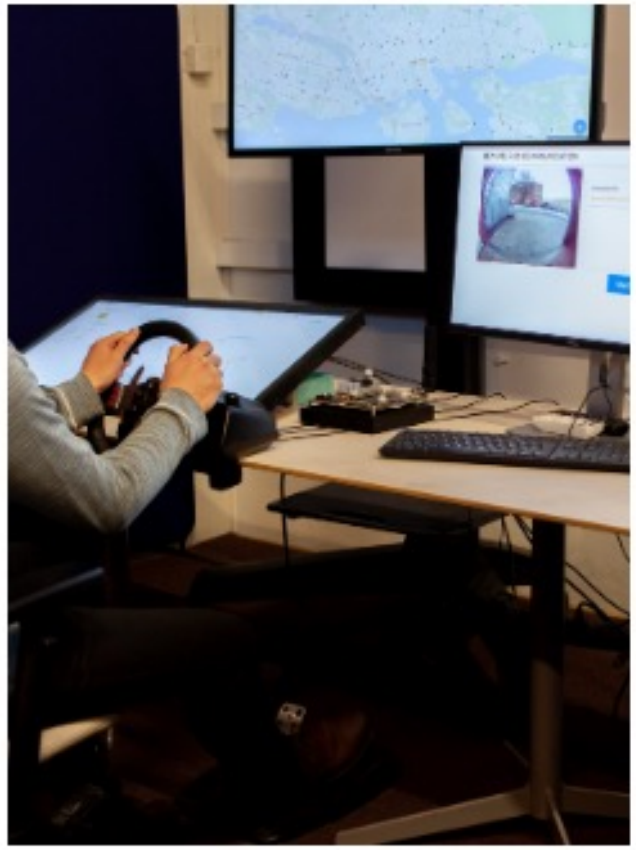


**ITRL in Numbers**

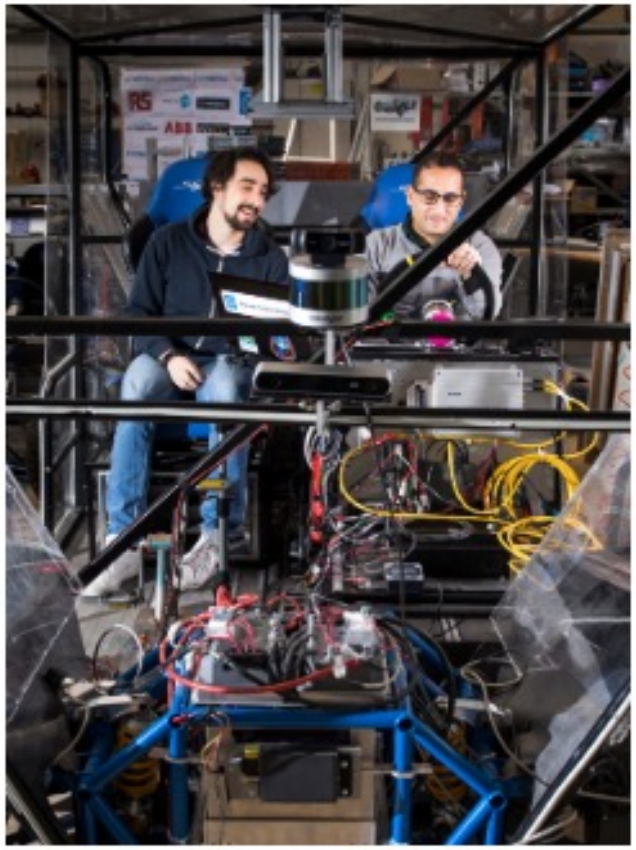
- Established 2014
- More than 80 involved KTH researchers and students
- More than 120 involved project partners
- More than 80 research and innovation projects

# Research Programs

# Labs



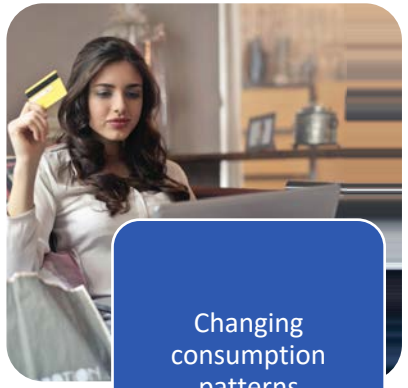
Automated Vehicle Control Tower (AVTCT)



Research Concept Vehicles

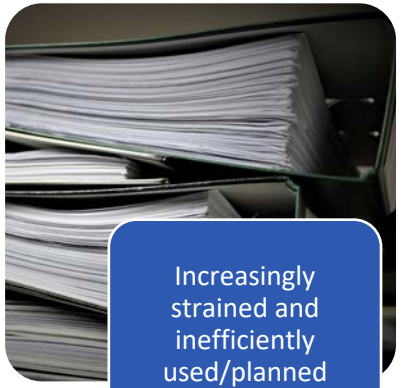

Smart Mobility Lab

# Challenge-Driven: Urban Goods Distribution



Changing consumption patterns

Unsustainable distribution patterns

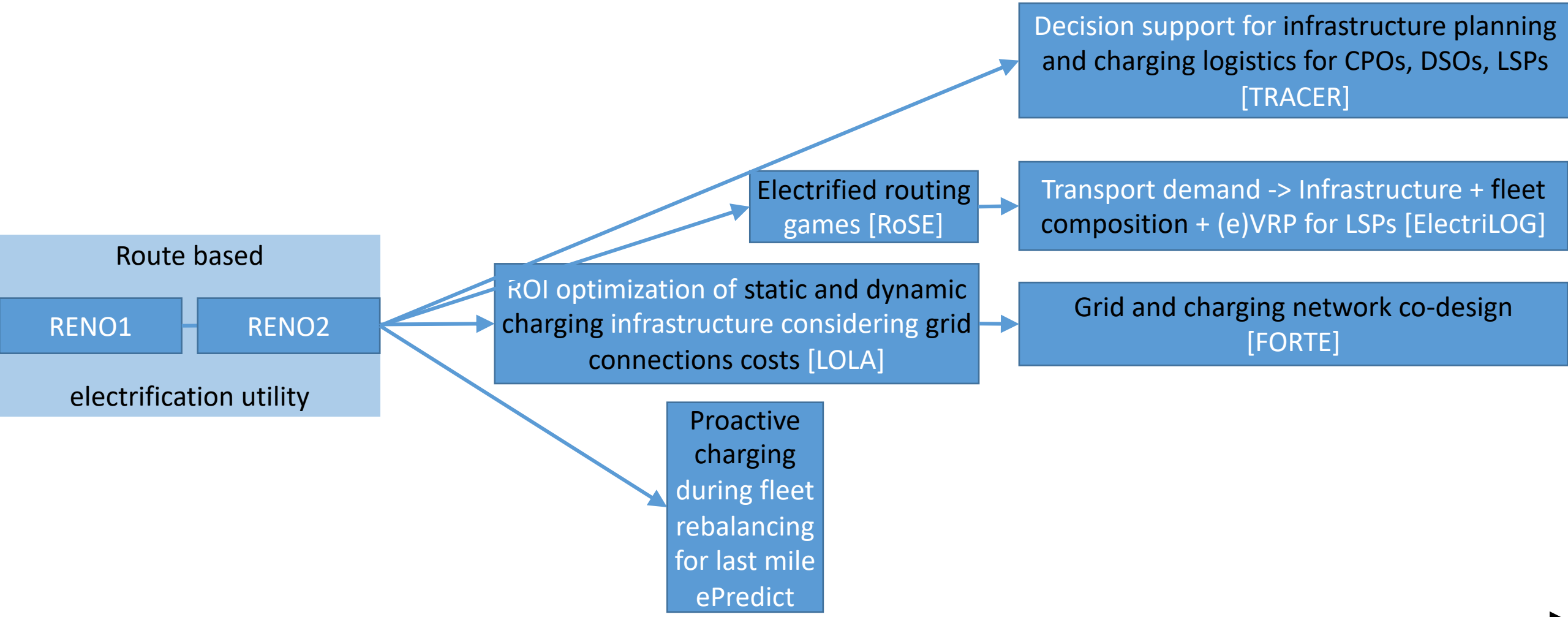


Increasingly strained and inefficiently used/planned delivery environment

Energy supply of urban goods distribution

Lack of comprehensive knowledge about deliveries, goods and material flows, and related travels

# Electrification Project Road Map

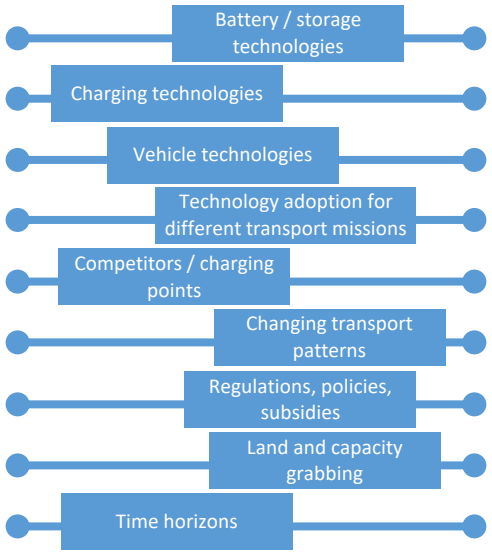


# TRACER: TRansport DemAnd Centric Decision Support for Electric ChaRging Infrastructure Planning and Operations

ITRL – INTEGRATED TRANSPORT RESEARCH LAB
KTH ROYAL INSTITUTE OF TECHNOLOGY

- **Transport electrification problem: Fear of sunk assets and Misconceptions (M)**

Many moving parts and uncertainties




M1: There is one static masterplan

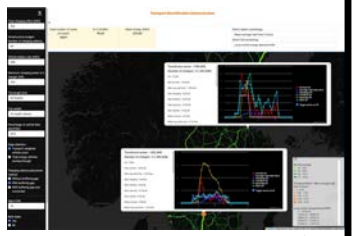

M2: "Lunch top-up charging" is feasible and cost-effective


Calculating a "lunch charging" range extension is possible, but no one will build enough infrastructure to cater for the "lunch charging" demand. The management and optimization of EV routing of a collection of large fleets including their interactions at charging stations is not solved.

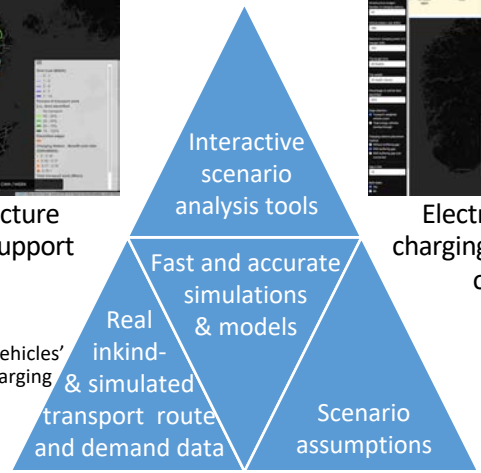
- **Aim**: To provide comprehensive data-driven decision support for charging infrastructure developments / investments and operations of- and on them.
- **Research questions / needs:**
  1. **CPO, LSP, Trafikverket: At what pace, where, how many, and what type of charging infrastructure** solutions (charging stations and/or electric roads) should be developed?
  2. **CPO:** How can charging be managed and optimized to **maximize charger utilization** and **even out demand peaks** and enable large-scale commercial transports? How effective and feasible are dynamic- or service-differentiated pricing, predictive day-ahead routing and charge slot booking / bidding, etc.?
     **LSP**: How **robust** is the charging infrastructure from a logistics point of view? How should (real-time or day-ahead) **charging logistics** be **managed** and **optimized** so that the **transport costs** (including wait and charging times) are **minimized**, and the chargers are best utilized?
- **Previous research: RENO, LOLA, RoSE**

## Innovation Framework: Design Thinking

Charging infrastructure planning decision support



Electrified transport / charging management and optimization




**Principle:**
Transport routes define the vehicles' energy use, battery levels, charging demand, past and future charging opportunities and interactions at stations

**Scope:**
Heavy, long-haul Sweden and EU

## Rolls & contribution from project partners Ellevio (CPO / CPaaS) and PostNord (LSP), and Trafikverket

- **Provide CPO, LSP, & transport agency domain knowledge**:
  - Validate / refine the needs
  - Provide requirements for solutions
  - Validate and shape assumptions and solutions
- **Resources** during 2023-2026:
  - **In-kind data**:
    - CPO: anonymized charging data (capacity, energy prices, usage, waiting times)
    - LSP: anonymized heavy, long-haul transport route / demand data
  - **In-kind time**: 100 person-hours per partner for DT-workshops + reference group and result meetings

# ITRL a Breeding Ground for Startups

Gordian Logistics Optimization Systems

- “Making transport planning easy and effective by untangling millions of movement traces”
- 2020 IVA 100 List (Infrastructure): https://www.iva.se/projekt/research2business/

ABConnect

- “Networking solutions for next-generation swarm intelligence”
- 2022 IVA List (Infrastructure): https://www.iva.se/projekt/research2business/ivas-100-lista-2022/trafiktorn-for-uppkopplade-sjalvkorande-fordon/

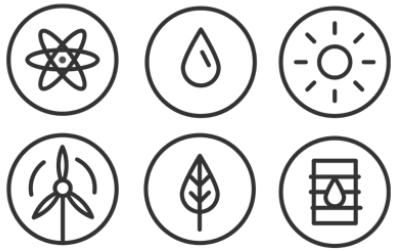
# Need for Transport Planning

**Drivers**

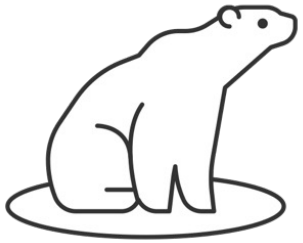
Population growth

Urbanization

Energy security

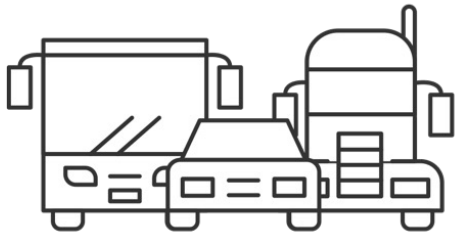


Climate change

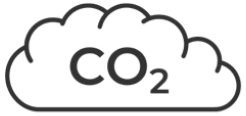


**Challenges**

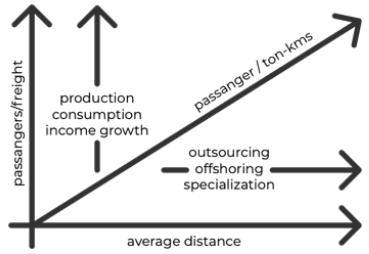
Congestion



Pollution



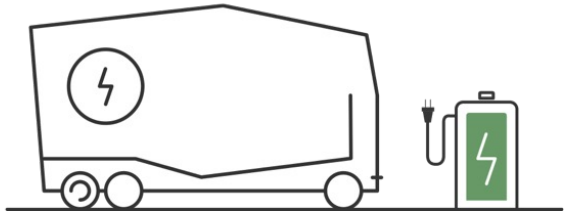

Transport demand



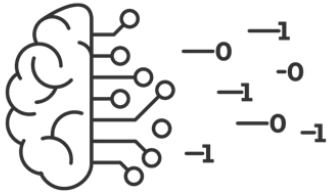

**Technology trends and opportunities**

Automation

Electrification



Digitalization / Big Data / AI




# GORDIAN

Intelligence for cost-effective and future-proof commercial transport electrification

# Intelligence for Electromobility

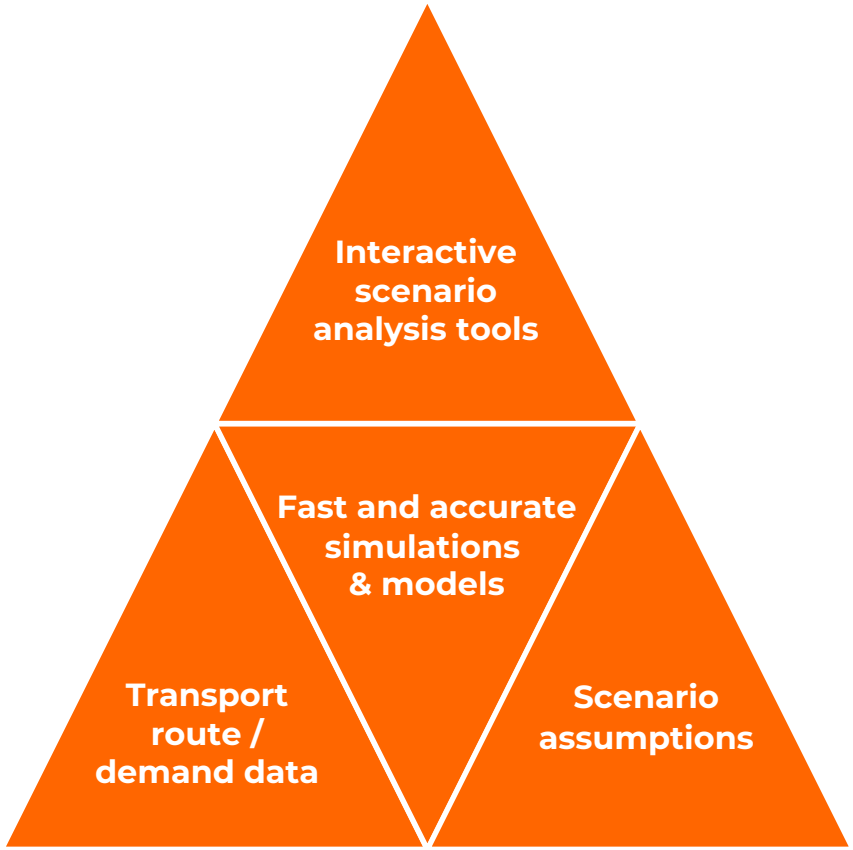
We deliver **advice and superior SaaS products** to **help accelerate transport electrification** by **reducing** the **costs** and **risks** in transport electrification **investments** and **operations**.

# Customer reality

## Customer uncertainties

- Battery technologies
- Charging technologies
- Vehicle technologies
- Vehicle adoption
- Competitors / charging points
- Changing transport patterns
- Regulations, policies, subsidies
- Land grabbing
- CAPEX
- DSO Capacity

## The Gordian solution



# Our competitive advantage

## TRANSPORT ROUTES AND CHARGING INFRA AFFECTS


## MANAGE COMPLEX DATA AND COMPUTATIONS

Planning and operations of transport electrification can be described with a **logical route-based network model**, but the optimization of the plans and operations are computationally complex and intractable using best practices.

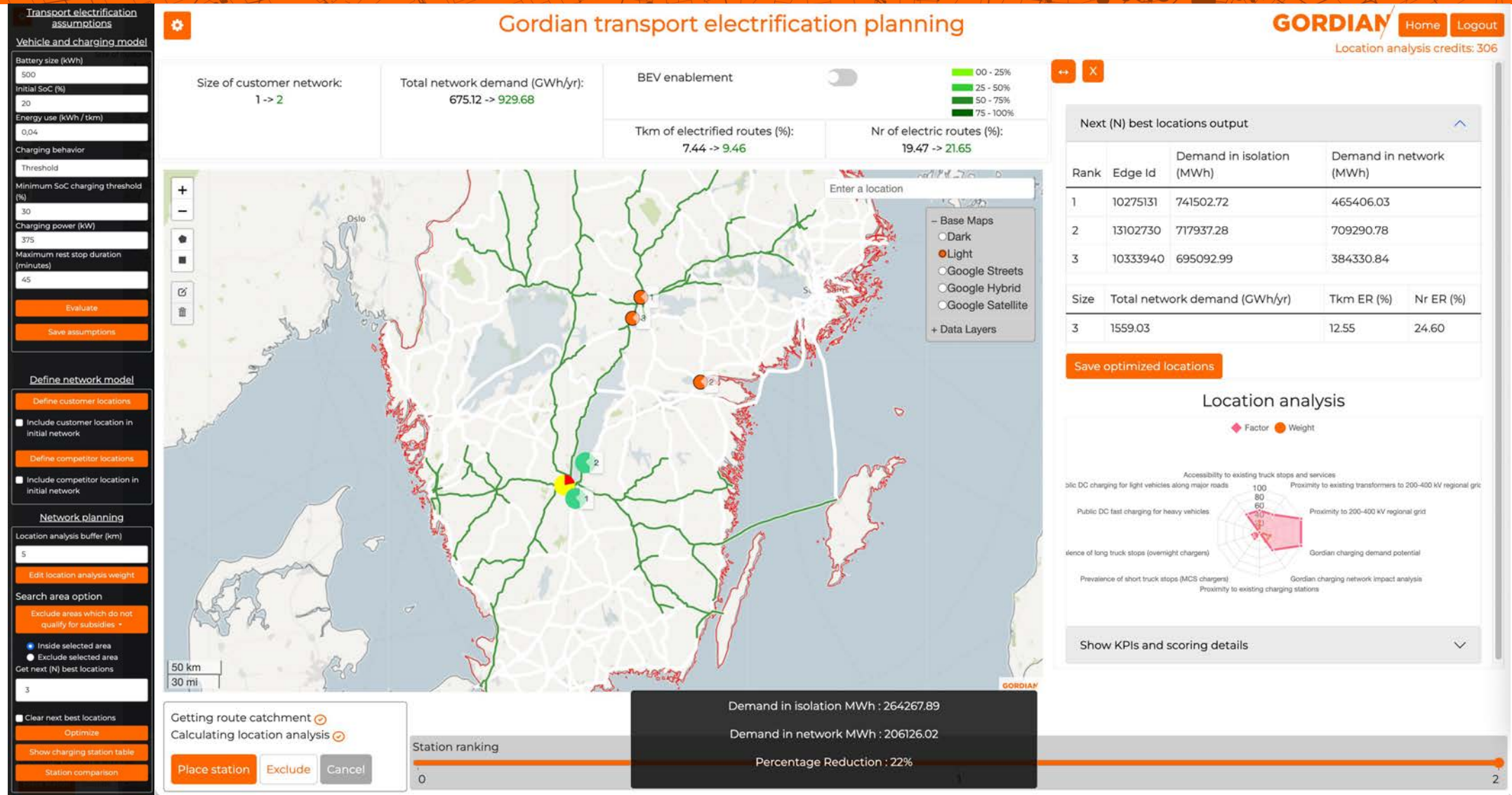
## INCREASE ANALYTIC SPEED

Proprietary technology (**50x lossless compression of indexed route data and analytics**) speeds up the calculation by a factor of 5000.

## IMPROVE CUSTOMER PERFORMANCE

Gordian makes accurate optimization possible, which yields up to **140% increase in charging network performance** (ROI, adoption rates, customer journey etc.) of the plans and operation.

# The Gordian Charging Infrastructure Planning Platform

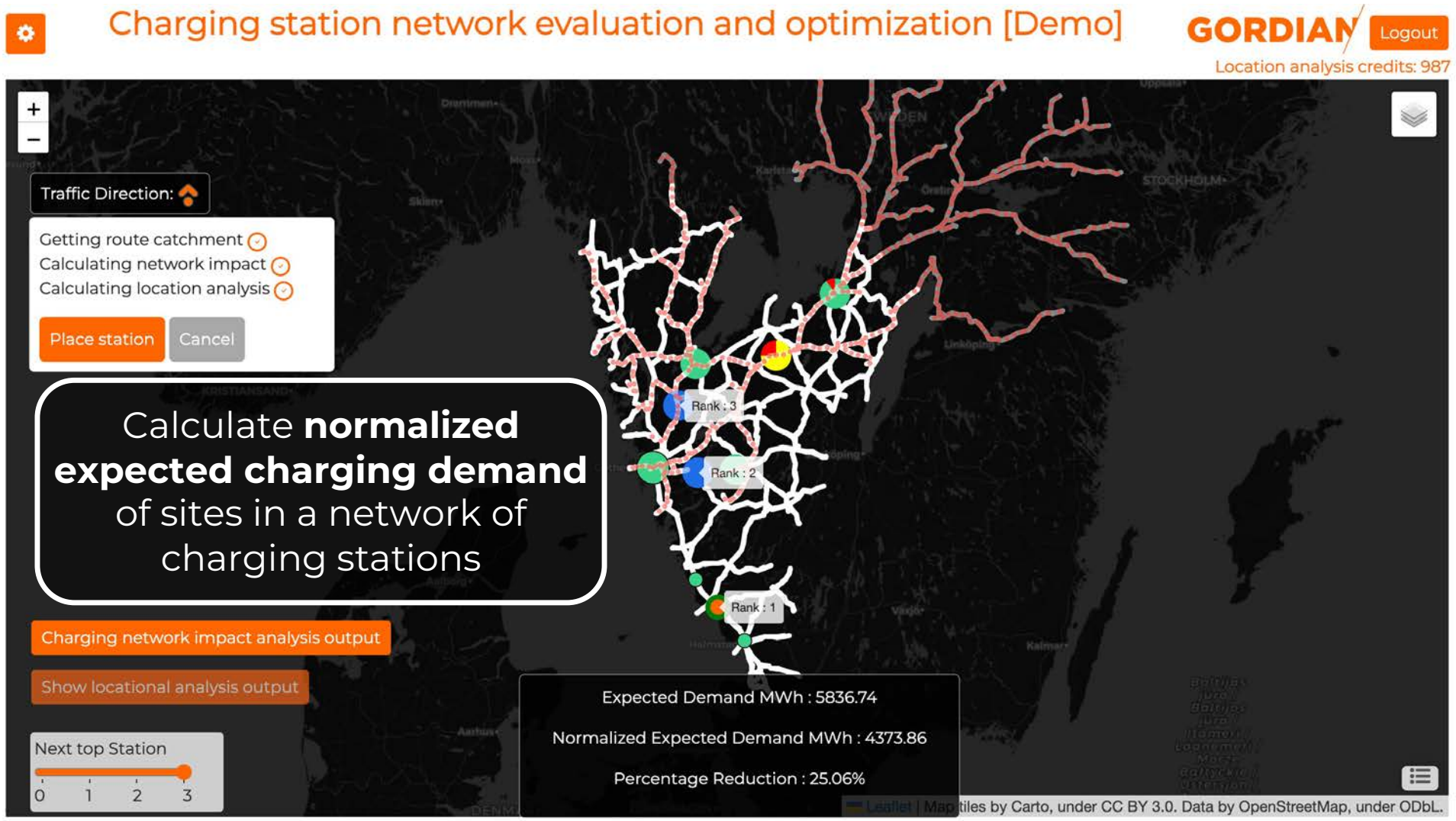


# Harmonized, up-to-date datasets and site and network KPIs across Europe

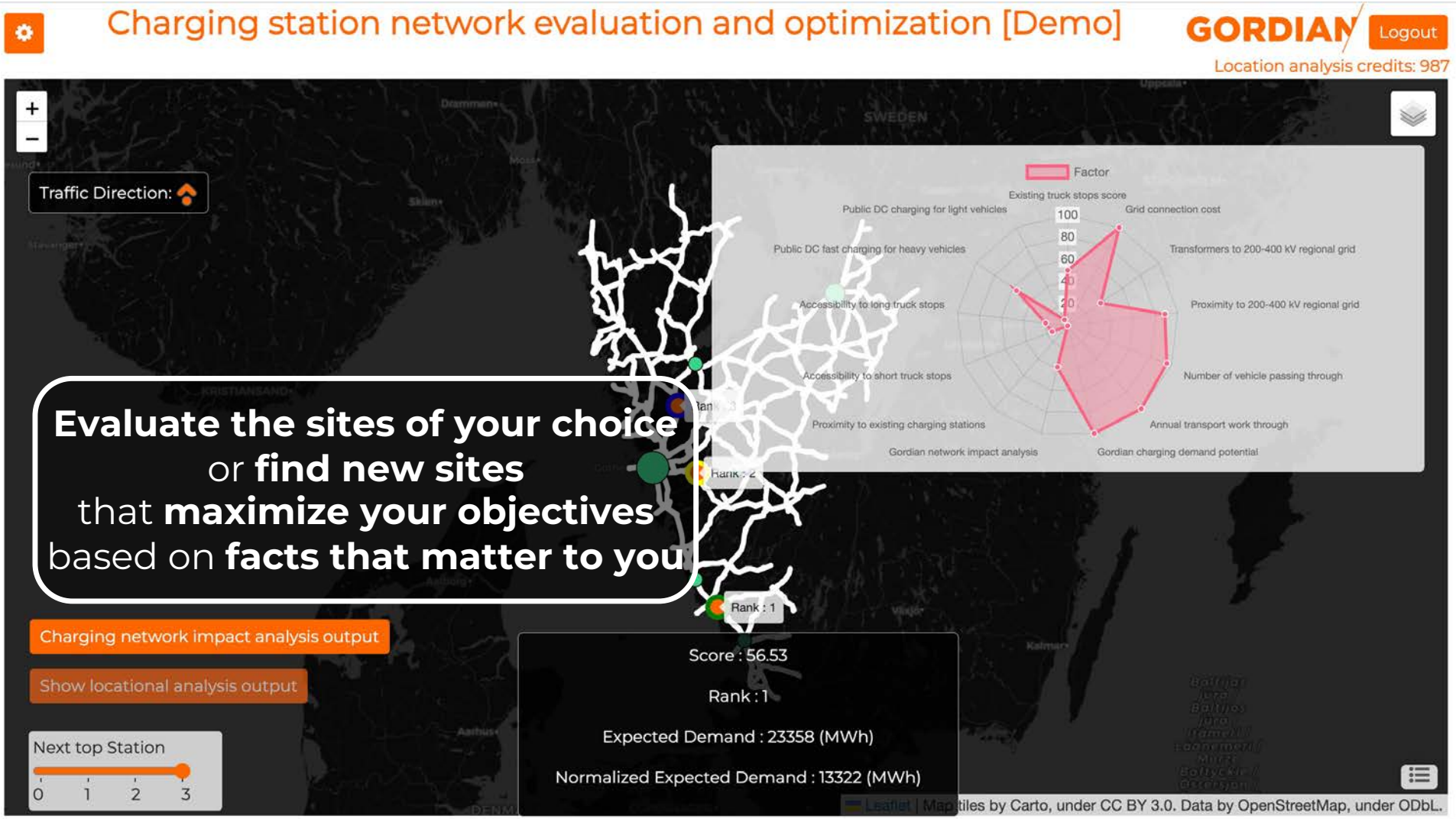
| Data | Sweden sources | Europe |
|---|---|---|
| Existing charging stations | Charge Finder | Charge Finder |
| Truck stops with services | TransPark | TransPark |
| Transport work | Trafikverket | Synthetic European Freight Flows and Routes based on ETIS Plus |
| Transport routes | Trafikverket - Swedish National Freight Model SAMGODS | Synthetic European Freight Flows and Routes based on ETIS Plus |
| Road network | Trafikverket | ETIS Plus / OSM |
| ACEA: Long Truck Stoppings | ACEA | ACEA |
| ACEA: Short Truck Stoppings | ACEA | ACEA |
| Country boundaries | OSM | OSM |
| Grid connection cost | Swedish Land Survey (Lantmateriet) | In progress |
| Transformers | Swedish Land Survey (Lantmateriet) | In progress |
| Grid 200 - 400 V | Swedish Land Survey (Lantmateriet) | In progress |
| Grid 25 - 200 V | Swedish Land Survey (Lantmateriet) | In progress |
| CC1: Priority road network for heavy transport | KlimatKlivet incentive | In progress |
| CC1: Public DC fast charging stations for heavy vehicles | KlimatKlivet incentive | In progress |
| CC1: Non searchable areas due to existing public DC fast charging stations for heavy vehicles | KlimatKlivet incentive | In progress |
| CC2: Priority road network for long-distance passenger journeys | KlimatKlivet incentive | In progress |
| CC2: Public DC charging stations for light vehicle | KlimatKlivet incentive | In progress |
| CC2: Non searchable areas due to existing public DC charging stations for light vehicle service areas | KlimatKlivet incentive | In progress |
| CC3: Urban areas - searchable areas for public DC charging for light vehicles within urban areas | KlimatKlivet incentive | In progress |
| CC3: Non searchable areas for public DC charging for light vehicles within urban areas | KlimatKlivet incentive | In progress |
| CC4: Non searchable areas for public AC charging for light vehicles within urban areas | KlimatKlivet incentive | In progress |
| CC4: Searchable areas for public AC charging for light vehicles within urban areas | KlimatKlivet incentive | In progress |

| Name | Type | Unit / Values |
|---|---|---|
| Proximity to existing truck stops and services | Criterion | N/A |
| Number of truck stops | Factor/KPI | # |
| Services available at the truck stops | Factor/KPI | # of distinct |
| Proximity to energy supply | Criterion | N/A |
| Grid connection cost | Factor/KPI | MSEK (-) |
| Number of transformers | Factor/KPI | # |
| Distance to closest transformer | Factor/KPI | km (-) |
| Distance to 200-400 kV regional grid line | Factor/KPI | km (-) |
| Proximity to charging demand | Criterion | N/A |
| Number of vehicles passing through this point in each weight class (10t, 20t, 30t, 40t) | Factor/KPI | #, #, #, # |
| Annual transport work through | Factor/KPI | tkm |
| Annual transport work through | Factor/KPI | vkm |
| Gordian annual charging demand potential | Subcriterion | N/A |
| Expected charging demand | Factor/KPI | MWh |
| Normalized expected charging demand | Factor/KPI | MWh |
| Gordian network impacts on charging demands | Subcriterion | N/A |
| Losses due to competition | Factor/KPI | MWh (-) |
| Losses due to cannibalization | Factor/KPI | MWh (-) |
| Losses inflicted on competition | Factor/KPI | MWh |
| Losses inflicted via cannibalization | Factor/KPI | MWh (-) |
| Proximity to existing charging stations | Criterion | N/A |
| Distance to closest charging station | Factor/KPI | km |
| Number of existing charging stations | Factor/KPI | # (-) |
| Proximity to existing truck stoppings | Criterion | N/A |
| Proximity to short truck stoppings (MCS chargers) | Subcriterion | N/A |
| Number of top 1% stoppings ≤1 km from TEN-T network && ≤50% of stops are shorter than 1h | Factor/KPI | # |
| Number of top 1% stoppings >1 km from TEN-T network && ≤50% of stops are shorter than 1h | Factor/KPI | # |
| Number of top 1% stoppings ≤1 km from TEN-T network && >50% of stops are shorter than 1h | Factor/KPI | # |
| Number of top 1% stoppings >1 km from TEN-T network && >50% of stops are shorter than 1h | Factor/KPI | # |
| Numbers for top 2-5% stoppings | Factor/KPI | #, #, #, # |
| Numbers for top 6-10% stoppings | Factor/KPI | #, #, #, # |
| Numbers for top 11-50% stoppings | Factor/KPI | #, #, #, # |
| Numbers for bottom 50% stoppings | Factor/KPI | #, #, #, # |
| Proximity to long truck stoppings (overnight chargers) | Subcriterion | N/A |
| Number of top 1% stoppings ≤1 km from TEN-T network && ≤50% of stops are at least 8h long | Factor/KPI | # |
| Number of top 1% stoppings >1 km from TEN-T network && ≤50% of stops are at least 8h long | Factor/KPI | # |
| Number of top 1% stoppings ≤1 km from TEN-T network && >50% of stops are at least 8h long | Factor/KPI | # |
| Number of top 1% stoppings >1 km from TEN-T network && >50% of stops are at least 8h long | Factor/KPI | # |
| Numbers for top 2-5% stoppings | Factor/KPI | #, #, #, # |
| Numbers for top 6-10% stoppings | Factor/KPI | #, #, #, # |
| Numbers for top 11-50% stoppings | Factor/KPI | #, #, #, # |
| Numbers for bottom 50% stoppings | Factor/KPI | #, #, #, # |
| Likelihood for subsidies | Criterion | N/A |
| Likelihood for subsidies from KlimatKlivet for charging category 1 – Public DC fast charging for heavy trucks | Subcriterion | N/A |
| Distance to priority road network for heavy transports | Factor/KPI | km (-) |
| Distance to closest public DC fast charging stations for heavy vehicles | Factor/KPI | km |
| Likelihood for subsidies from KlimatKlivet for charging category 2 – Public DC charging for light vehicles along major roads | Subcriterion | N/A |
| Distance to priority road network for long-distance passenger / light vehicle journeys | Factor/KPI | km (-) |
| Distance to closest public DC charging stations for light vehicle | Factor/KPI | km |

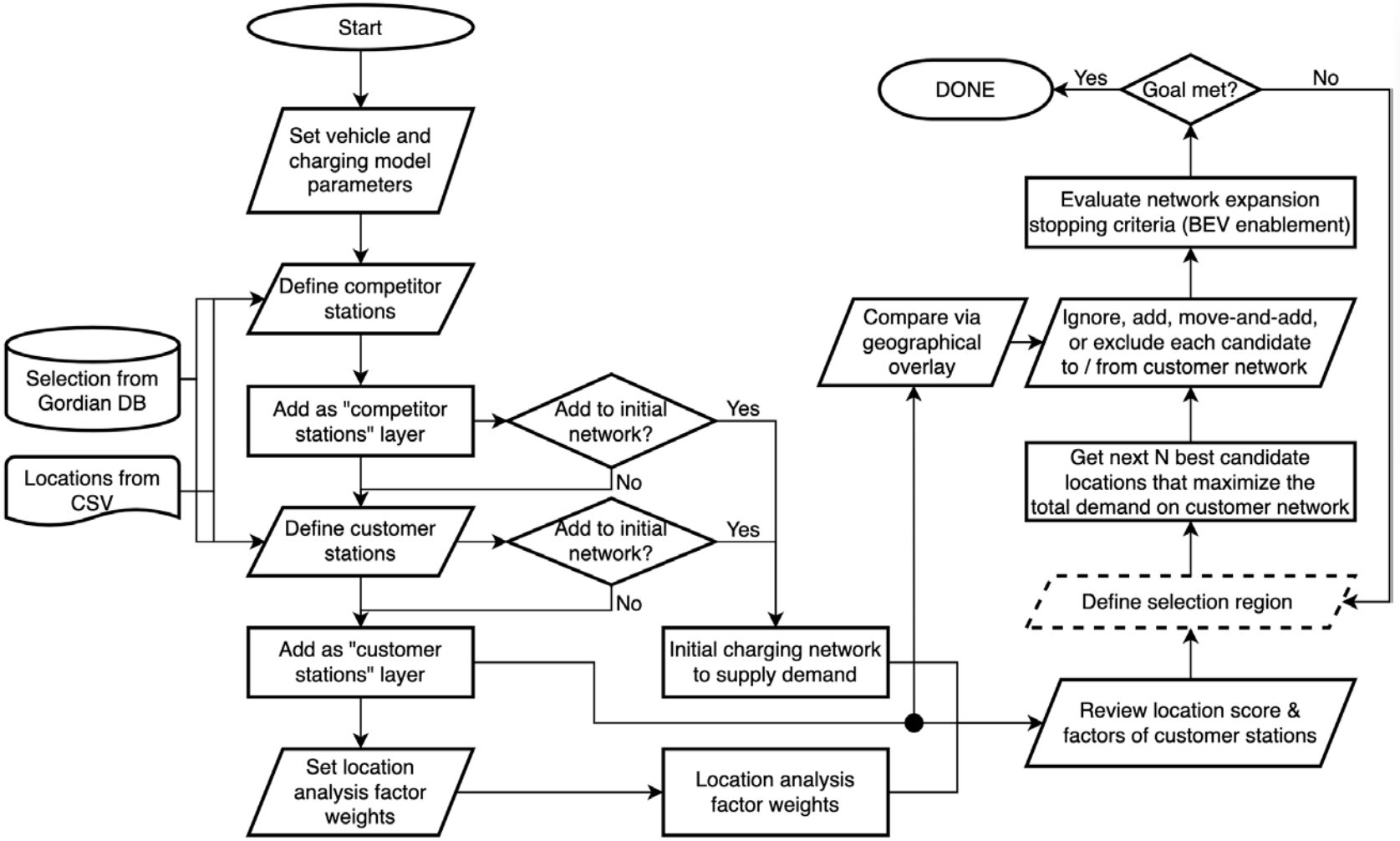
# Charging network impact analysis



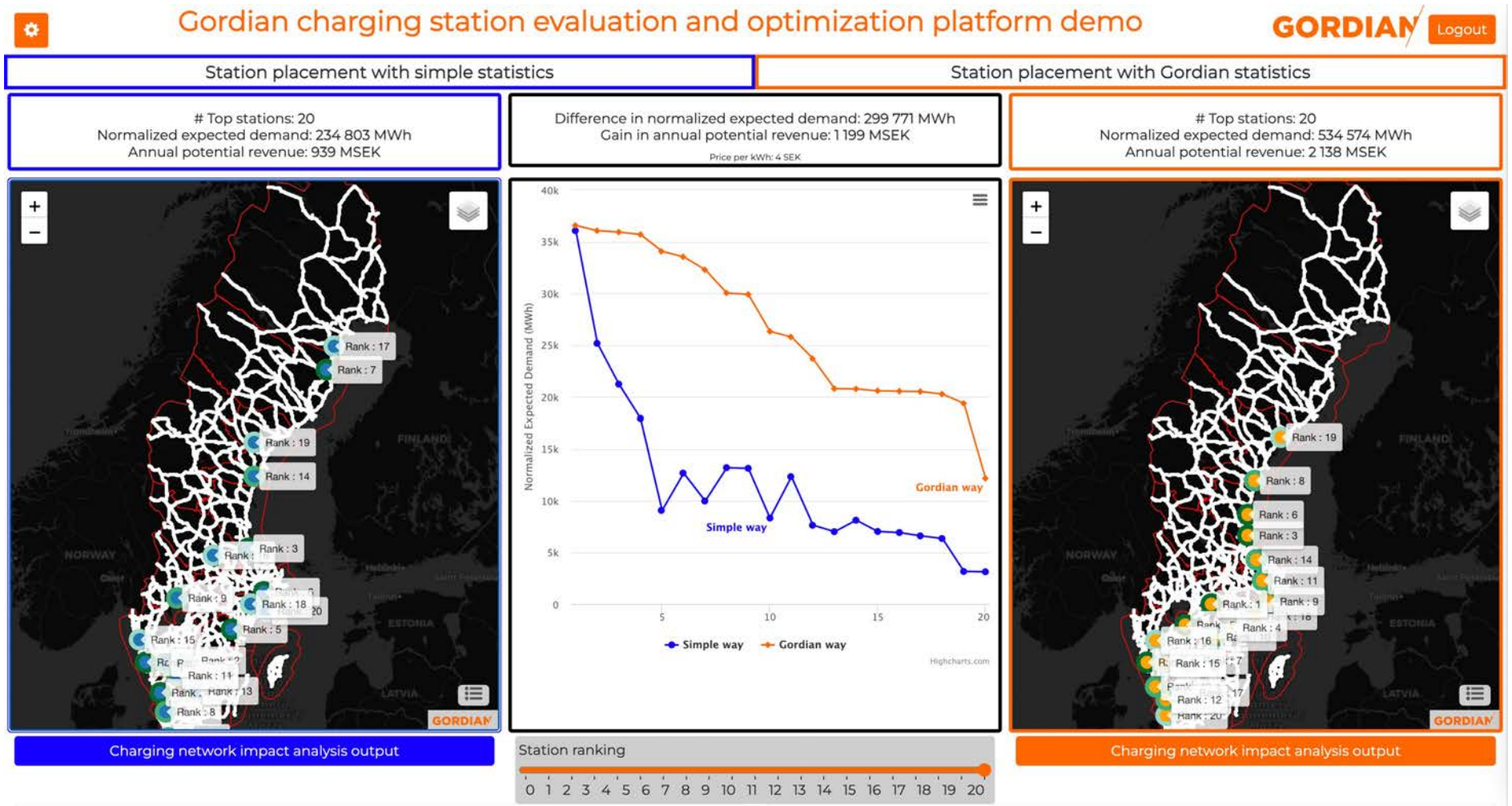
# Multi-criteria site evaluation and optimization



# Simple interactive planning process for multiple scenario analysis types




# The Gordian value proposition




| Country | Gtkm | Relative market size |
|---|---|---|
| Germany | 780 | 7,2 |
| France | 505 | 4,6 |
| Italy | 411 | 3,8 |
| Poland | 350 | 3,2 |
| United Kingdom | 274 | 2,5 |
| Spain | 231 | 2,1 |
| Sweden | 109 | Baseline |
| Belgium | 104 | 1 |
| Netherlands | 94 | 0,9 |
| Austria | 90 | 0,8 |
| Czech Republic | 81 | 0,7 |
| Switzerland | 54 | 0,5 |
| Denmark | 46 | 0,4 |
| Russian Federation | 43 | 0,4 |
| Hungary | 42 | 0,4 |
| Slovakia | 35 | 0,3 |
| Romania | 26 | 0,2 |
| Greece | 26 | 0,2 |
| Portugal | 24 | 0,2 |
| Finland | 22 | 0,2 |
| Croatia | 19 | 0,2 |
| Norway | 15 | 0,1 |

## VALUE SCALING TO A LARGE CPO

Est. **€13bn ARR* potential revenue gain** by selecting, dimensioning, and sequencing the rollout of 1700 sites across Europe.

* Assumes: Full transport electrification scenario, 300 kWh batteries, €2m average revenue gain per location in Sweden, gains on and deployments of locations in other countries is proportional to the relative market size.

# Packaging, pricing, business model & initial traction

| |   Existing Location Analysis |   Potential Partner Analysis |   White Spot Analysis |   |
|---|---|---|---|---|
| **Standard analysis (< 20 sites)** | 4k€ | 4k€ | 8k€ | **30k€ custom analysis consultancy**<br>12k€ **Recharge** project<br>**Onboarding SaaS conversion**<br>**10-30k€/m SaaS platform access with support**<br>90k€ 6month pilot with **Milence** in final negotiations<br>**5 SQLs** |
| **Additional sites** | + 100€ / site | + 100€ / site | + 200€ / site | |
| **Added interactive map** | + 3k€ | + 3k€ | + 3k€ | |

# Product roadmap: needs & activities

## TODAY: CHARGING INFRASTRUCTURE PLANNING

## TOMORROW




**Scenario analysis reports**
For predetermined input data and assumptions.

**Scenario analysis reports + interactive map**
Allow exploration of results in geographical context for a deeper understanding.

**Customized Decision Support System (SaaS)**
Customized setup of data & assumptions in the interactive tool enables iterative and advanced decision making.

**Electrification Transition Planning for Fleet Operators**

**Electrified Closed Loop Transport Operations Planning & Real-Time Control** (e.g., line-haul, mining, agriculture, forestry, construction, terminals)

**Demand Driven Dynamic Pricing**

**Multi-Actor Transport Charging Exchange + Grid-CPO-E-Fleet Services**

| | | | | |
|---|---|---|---|---|
| **Need** | 300k€ & network | 300k€ & network | 400k€ & network | 100k€ & network |
| **Activity** | Product evolution & scaling marketing & sales to EU | Product adaptation & business dev. | Product & business dev. | Business dev. |

# Market potential

## HIGH STAKES:

Global fast-charging infrastructure investments:

NEXT 5 YEARS

HEAVY TRANSPORT: €28bn

NEXT 20 YEARS

CAR & HEAVY TRANSPORT: €450bn

## SAAS MARKETS BY 2030:

€9.2bn management decision software
€7bn energy-fleet mgmt. software
€24.7bn logistic software

## JOB TO BE DONE IN EU

- 15-50K CHARING STATIONS WITH 500K CHARGERS
- 500 000 LONG TRUCK TRIPS/DAY
- 10 MILLION LONG CAR TRIPS/DAY

## CUSTOMERS IN EU

- 50 CNO:S*
  200 CPO:S
- FLEET OPERATORS
  LARGE: 550
  SMALL 100K
- 500 DSO:S

*CNO = LARGE CHARGING NETWORK OPERATORS

# Team

**Győző Gidofalvi**
Co-founder
CEO

**Mattias Tingvall**
Senior Advisor
Working Chairman of Board

**Ehsan Saqib**
Co-founder
Head of SaaS Solutions

**We live and breathe mobility analytics,**
**AI and optimization!**

# Achievements and journey so far

Top 5
of Batch #2
eit Urban Mobility
Accelerator
Pitch Awards

DEEP TECH
hello tomorrow
PIONEERS

Sting

RENO
ITRL – INTEGRATED TRANSPORT RESEARCH LAB
KTH ROYAL INSTITUTE OF TECHNOLOGY
Predict

TRUSTED AI START UP

2021/21 COHORT
OXFORD – AI STREAM
CREATIVE DESTRUCTION LAB
BUILD SOMETHING MASSIVE

KTH INNOVATION
It all starts here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