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Analysis of the market potential of electric road system in the Netherlands

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Setting the scene

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- Strengthened EU plans for New trucks
  - 2030: - 45% CO_2 compared to2019
  - 2035: - 65% CO_2 compared to 2019
  - 2040: - 90% CO_2 compared to 2019
- For the Netherlands, this means
  - 16.000 to 24.000 e-trucks

EU Eyes 90% CO2 Cut By 2040 For Trucks

By Julianne Geiger - Feb 14, 2023, 12:30 PM CST

The European Commission proposed tighter CO2 rules for heavy-duty vehicles on Tuesday, mandating that all new trucks reduce emissions by 90% by 2040 and all new city buses emit zero emissions starting in just 7 years, by 2030, according to a statement from the European Commission.

Current status

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Trucks in 2022					
Total	Diesel	Petrol	LPG	CNG	Electric
60812	59443	734	267	168	200
100%	97,7%	1,2%	0,3%	0,3%	0,3%

Tractor for semi-trailer2022					
Total	Diesel	Petrol	LPG	CNG	Electric
81508	81157	28	128	159	36
100%	99,6%	0,03%	0,16%	0,20%	0,04%

Long-distance transport

- Half of transport kilometres in the EU are journeys longer than 300 km
- Truck with range of 400-500 km, battery of 550-750 kWh required.
  - Battery weight more than 2.5 ton
  - 100 kW for overnight charging(5-7 h)
  - 1 MW for fast charging (30-45 min)
- Related barriers: range, TCO, and payload

Electric Road System (e-Roads)

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ERS in practice

- A few test tracks from Siemens
  - USA: 1 miles near the ports of Los Angeles and Long Beach
  - GER: 5 km near Frankfurt

The A5 motorway segment in Hessen is one of three tests with catenary lines being conducted in Germany.

ERS in theorie

- "Analyse kosteneffectiviteit ERS voor Nederland" (van Ommeren et al., 2022)
  - High investment costs (€ 7.8 billion for a "comprehensive" network in the Netherlands)
  - Positive TCO for logistics service provider compared to BET (especially with a larger range)
  - Not calculation for small ERS
- Rekenregels
  1. At least 70% of day-distance via ERS
  2. Origin/destination max 30 km from ERS
  3. Sufficiently fixed driving pattern
  4. Minimum daily distance (90, 120, 150, 180 km)

Research question

- What is the effect of different ERS network configurations on the market potential of the ERS infrastructure?

Research method

- Different design methods (density vs. corridor) and network sizes (200 vs. 400 km)
- Market or no market?

Factor	Low	Middle	High
1. Distance to ERS network	30 km	90 km	150 km
2. Percentage over ERS network	70%	60%	50%
3. Willingness to make a detour	1,3	1,4	1,5

Data: traffic intensity

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The first 200 km

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Expansion to 400 km

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Data: origin-destination flows

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- BasGoed Database
- Map divided in Zones
- Trips between zones per year for heavy transport

Trip estimations

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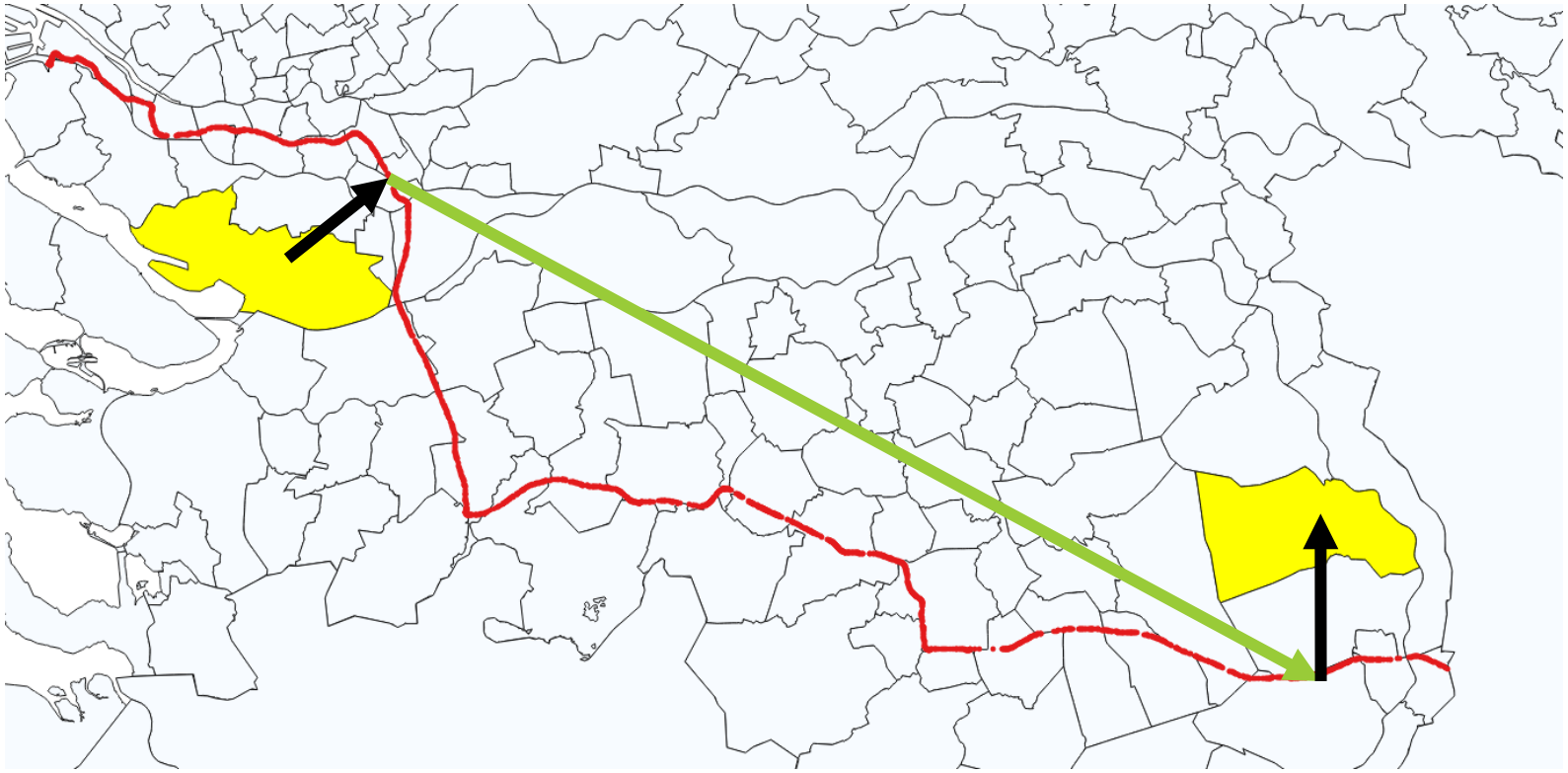
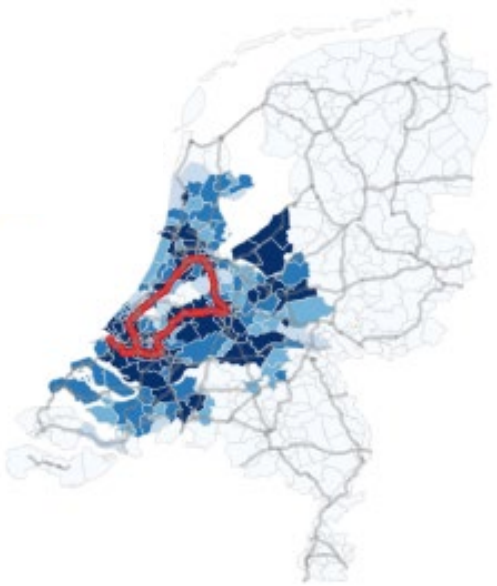
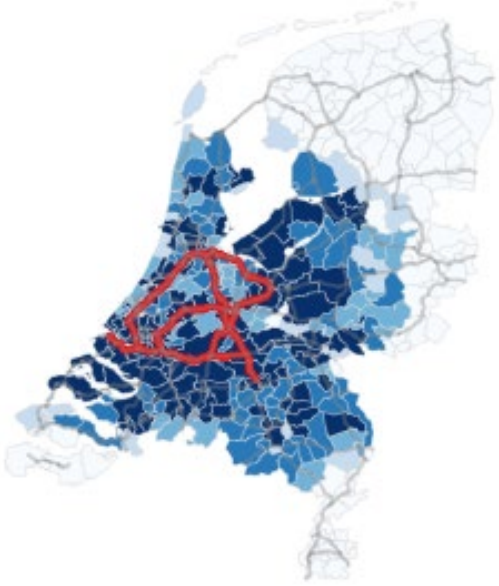
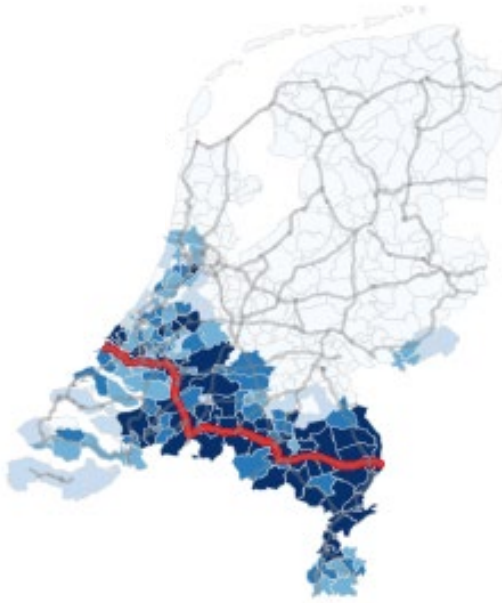
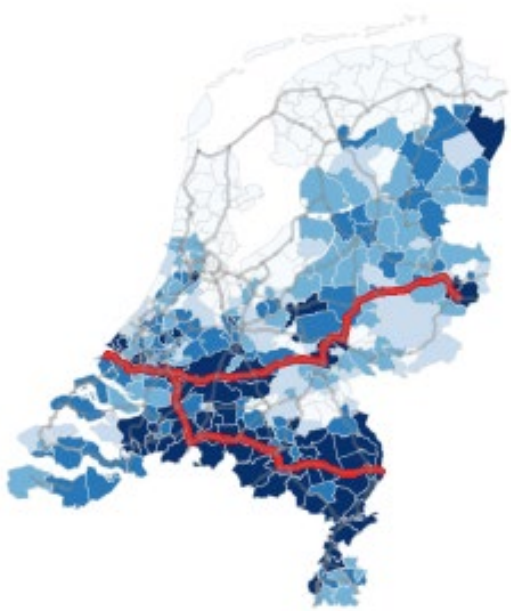


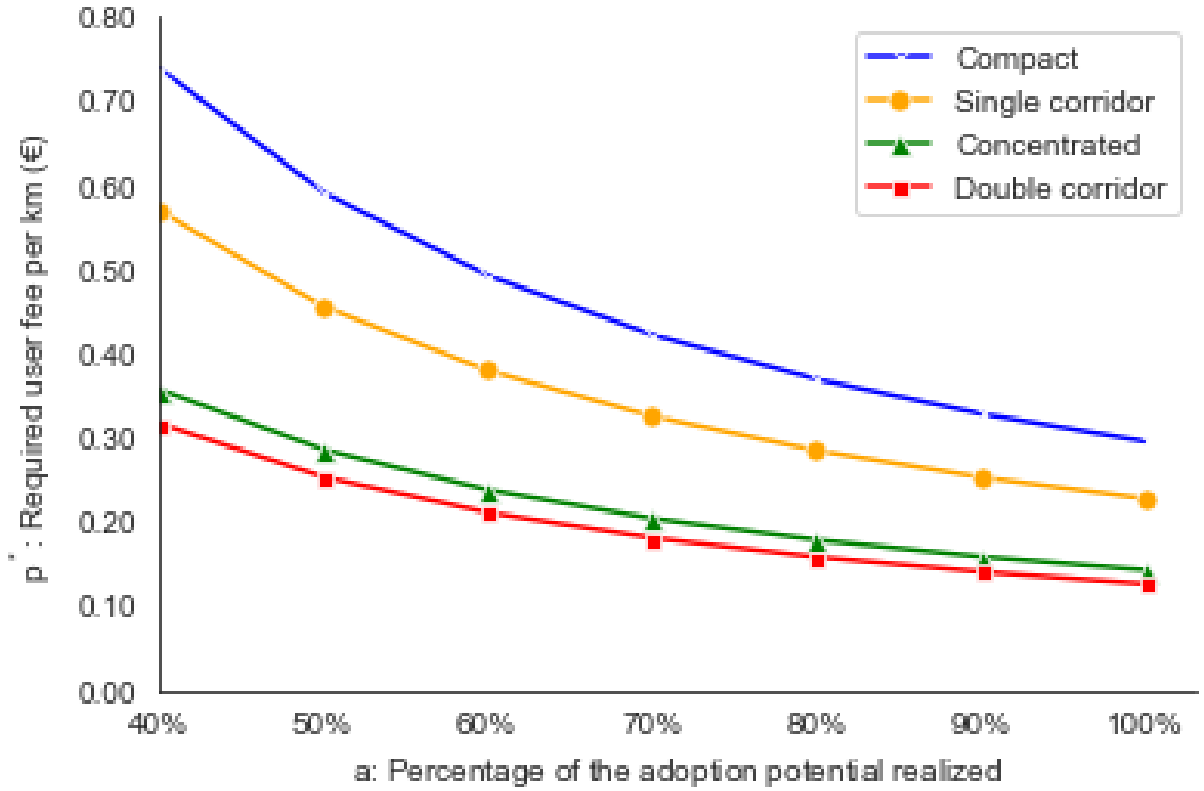
Results

- A density-oriented design attracts a relatively high number of rides.

	Compact	Concentrated	Single corridor	Double corridor
				
Km in network	164.1 Mkm	431.5 Mkm	212.9 Mkm	486.7 Mkm
Market potential	3.23%	6.81%	2.13%	4.29%
Avg Km network	41.8 km/trip	52.2 km/trip	82.4 km/trip	93.4 km/trip

Financial implications

- Input values
  - CAPEX M€3,1 perkm
  - OPEX 2% of CAPEX per year
  - 35 years lifespan
  - Interest of 4%
- Insights
  - Compact network most expensive
  - Corridor philosophy -> lower fee
  - € 0.25 -> 50% adoption needed



Battery support

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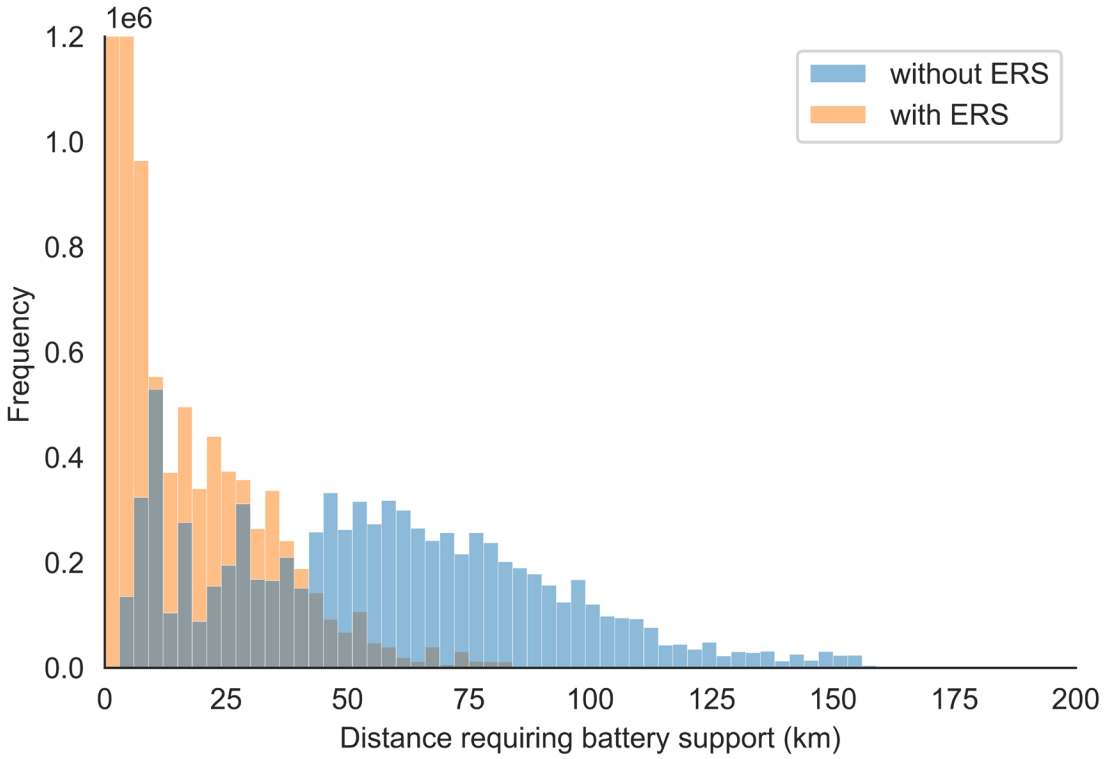
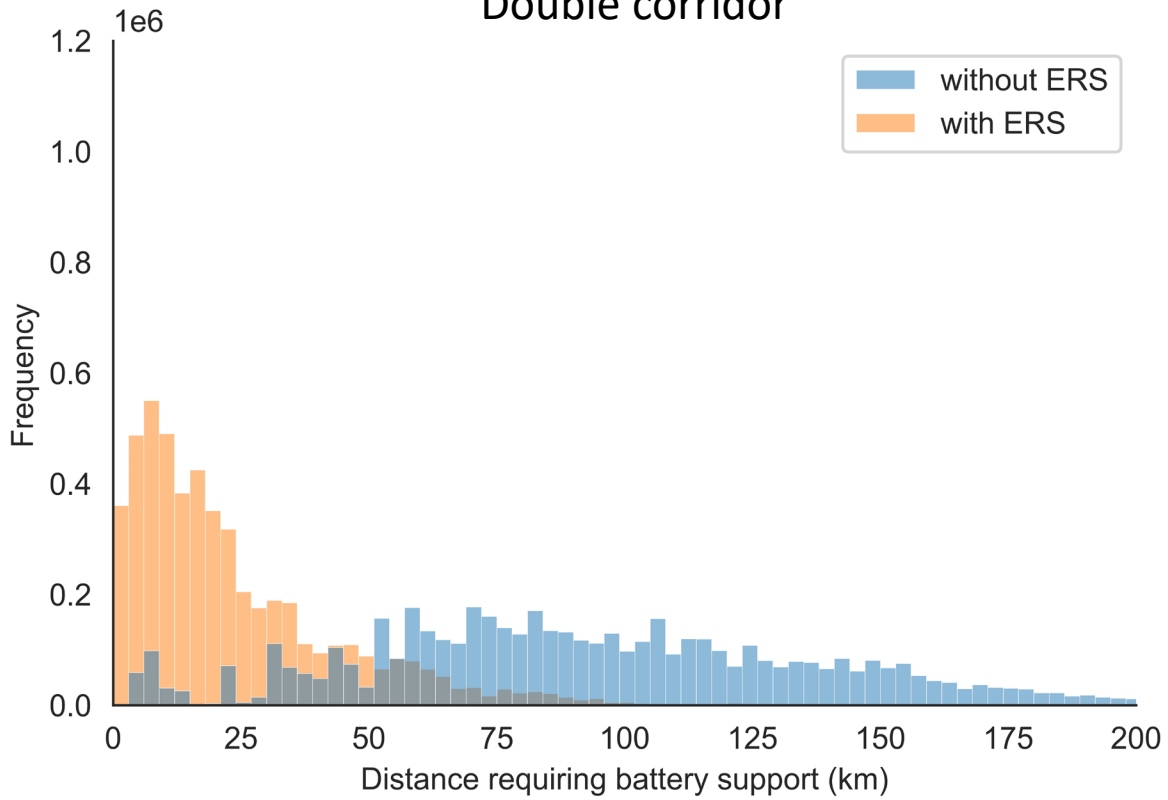
Concentrated



Double corridor



Reduction on energy consumption on batteries:

658 GWh

732 GWh

Conclusions

- If ERS network is established, it will probably be expanded over time.
  - We looked at 200 and 400 km and a design focused on density and corridor.
  - The sooner a big market, the better.

- ERS network does not have to be comprehensive in order to tap into large market potential; But in order to reduce user costs, high adoption is needed
  - Corridor approach attracts more kilometres driven than dense networks
  - Dense philosophy attracts more (shorter) trips over the network