STORM

Smart freight TranspOrt and logistics research Methodologies

Public Megawatt Charging for Long-Haul Trucks in Europe

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006700.

Enabling the Transition: Assessing Charging Infrastructure Requirements for Battery Electric Long-Haul Trucks in Support of a Transport Efficient City

- Charger locations
- Charger point type and number
- Energy requirement

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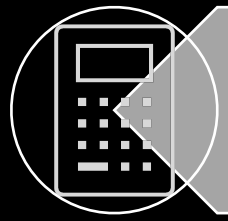
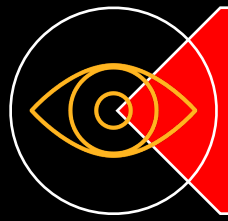


How many stations do we need?



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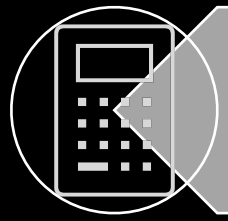

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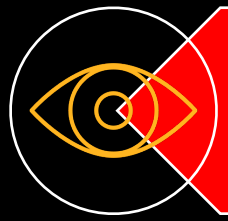

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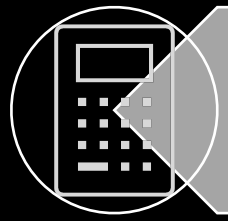

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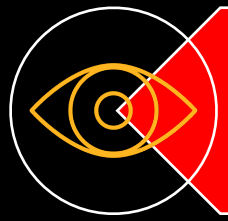

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based on profitability

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PASSENGER VEHICLES CHARGING/REFUELING

CNGV

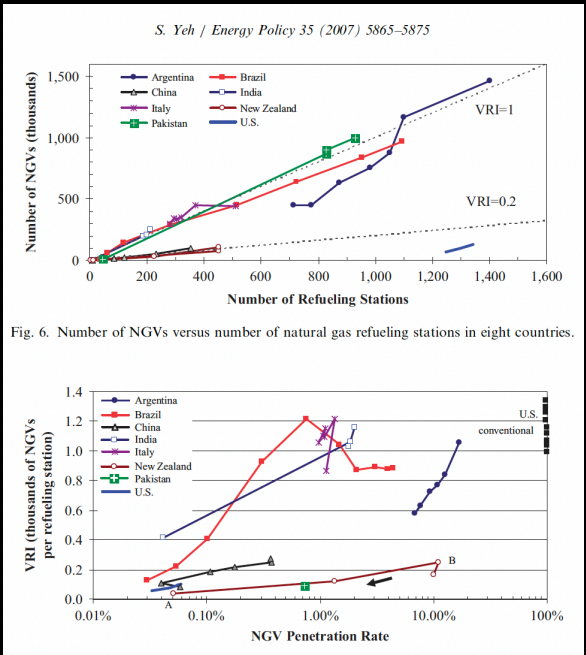

Fig. 6. Number of NGVs versus number of natural gas refueling stations in eight countries.

1000:1

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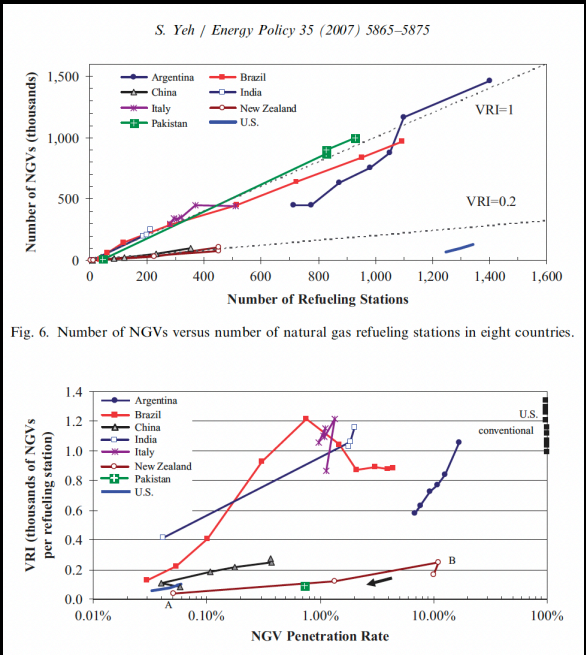

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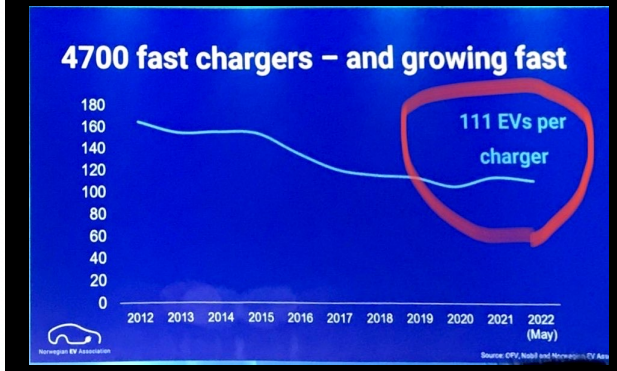

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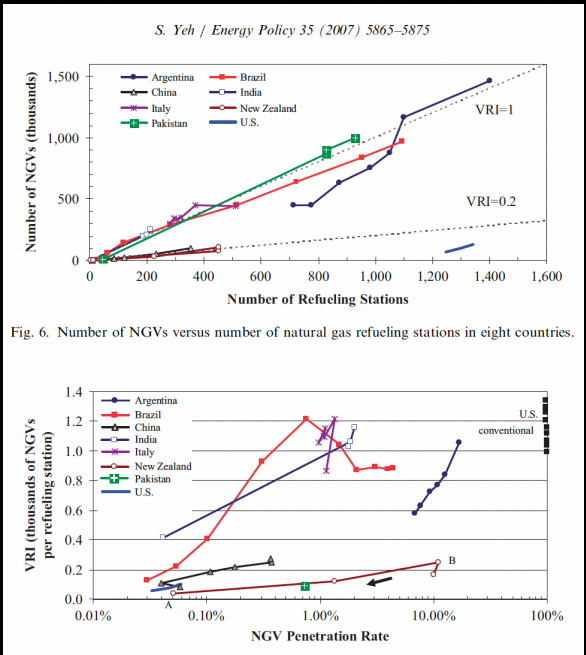

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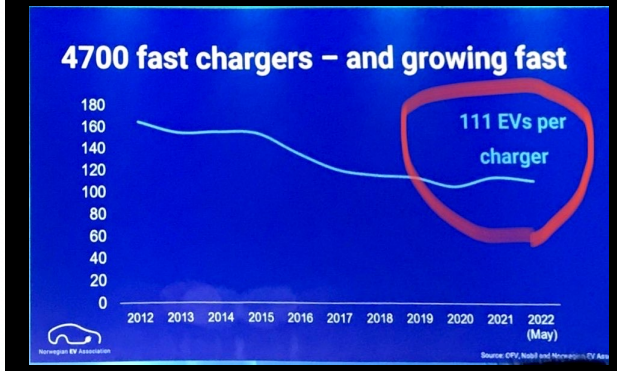

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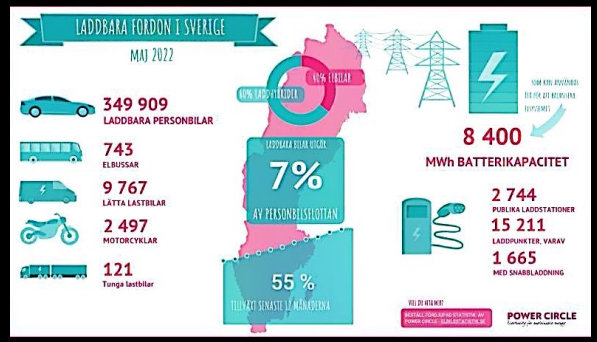

128 cars per public charging station

23 cars per charge point

210 cars per fast charger

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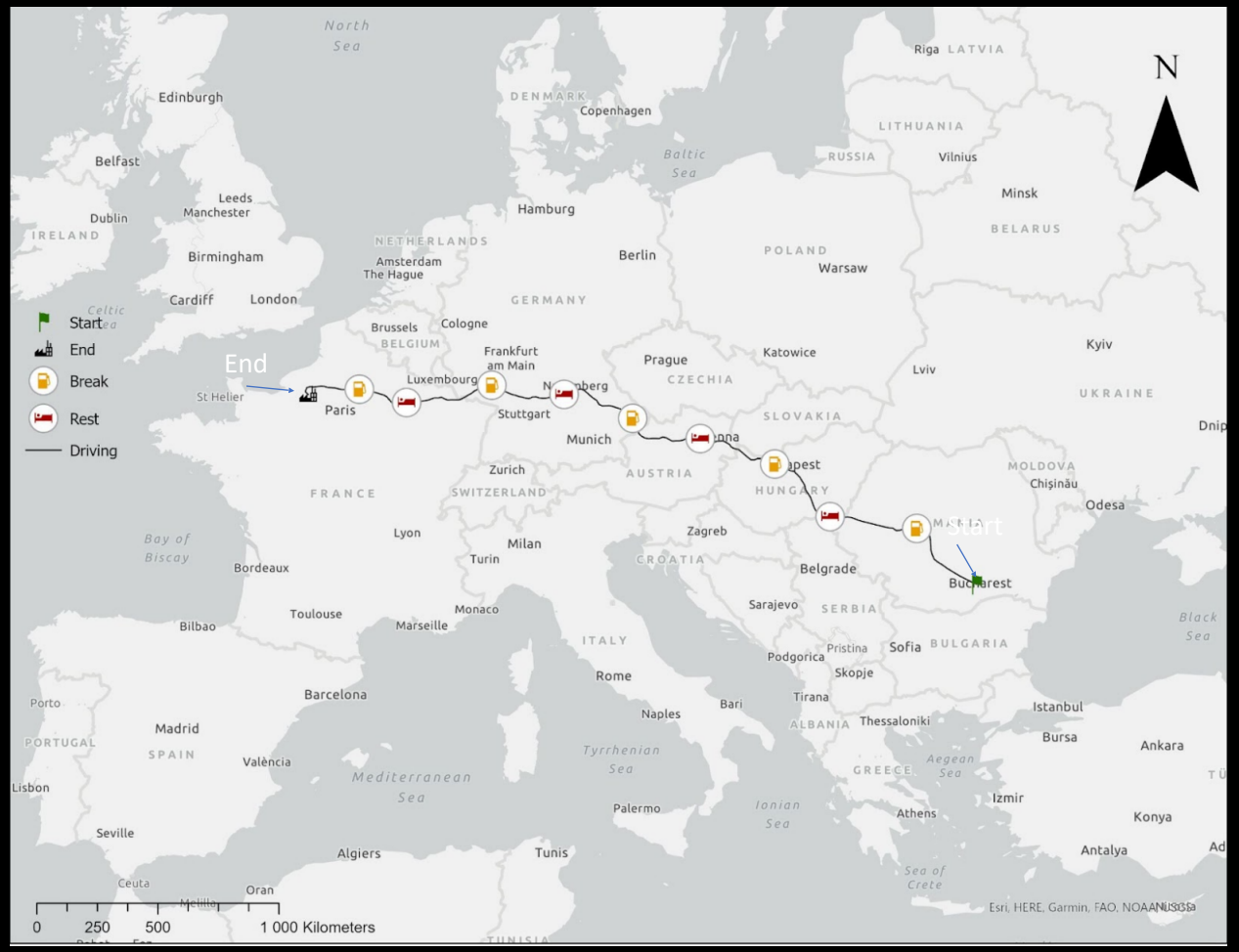
A sample for a trip chain for a long-haul truck



A route sample with one driver.

A sample for a trip chain for a long-haul truck

96% of all journeys.

1 driver	Driving	4.5 (h)
	Break	45 (m)
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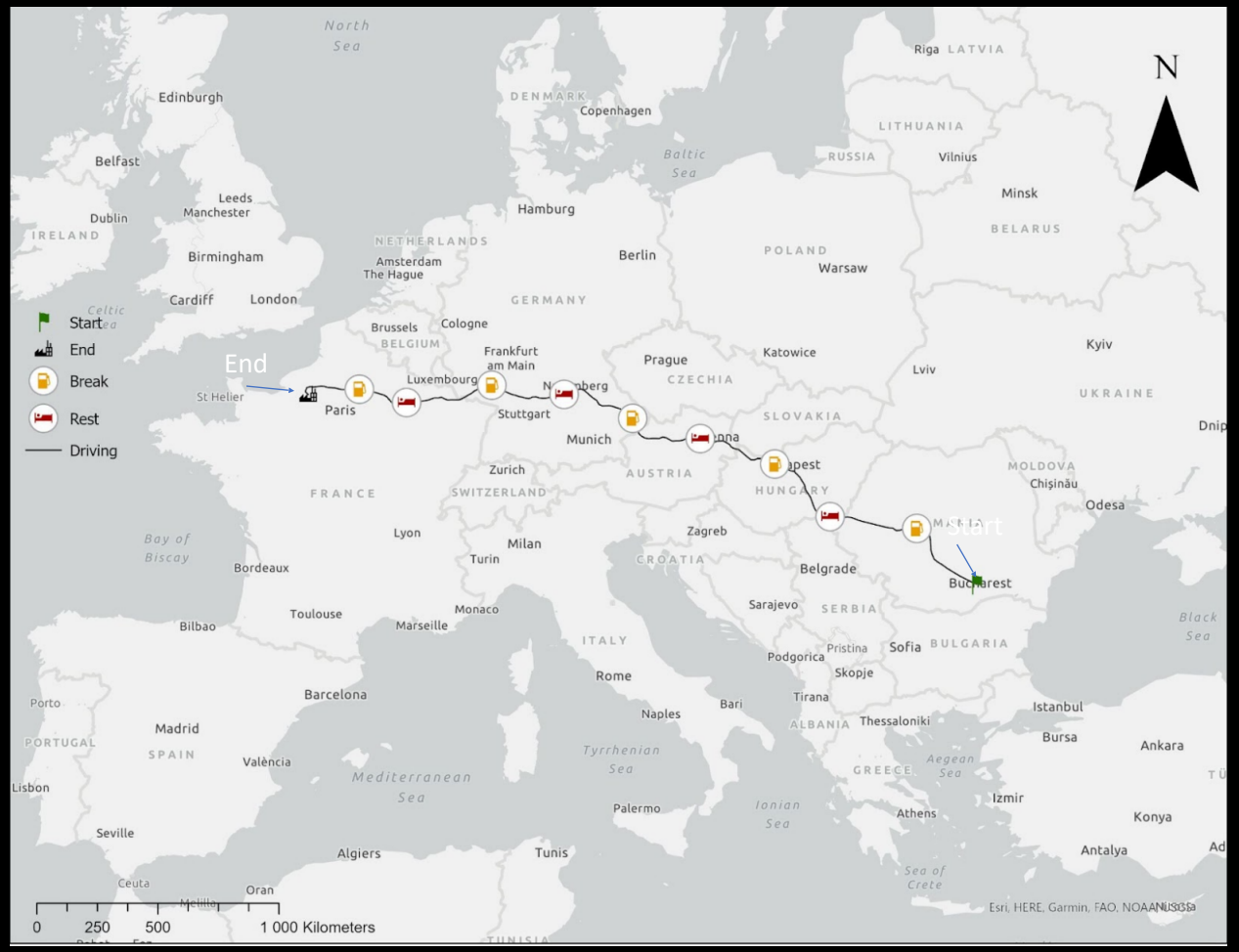
	Daily rest period	9 (h)



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	Driving (driver #2)	4.5 (h)
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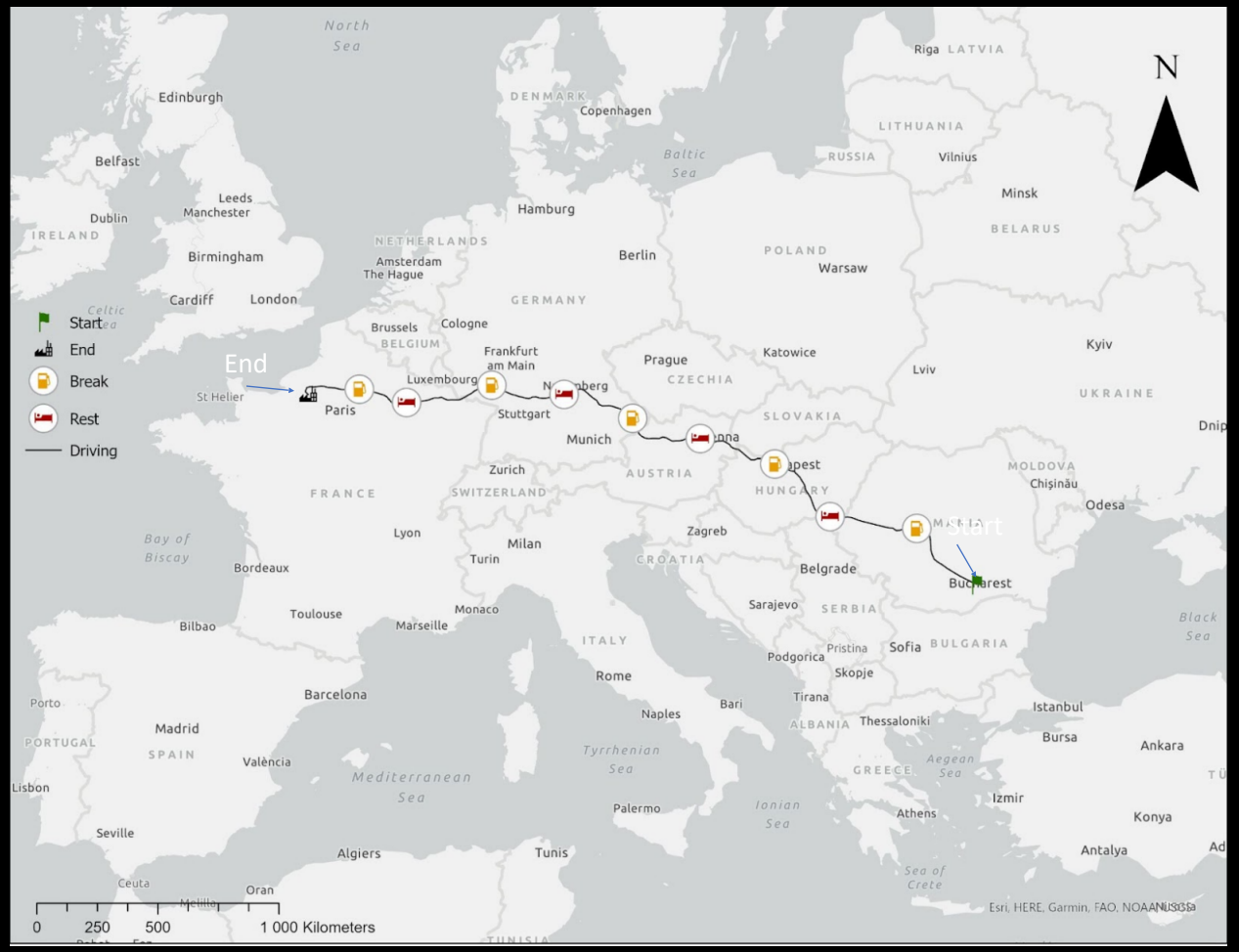
	Driving (driver #2)	4.5 (h)
	Daily rest period for both drivers	9 (h)



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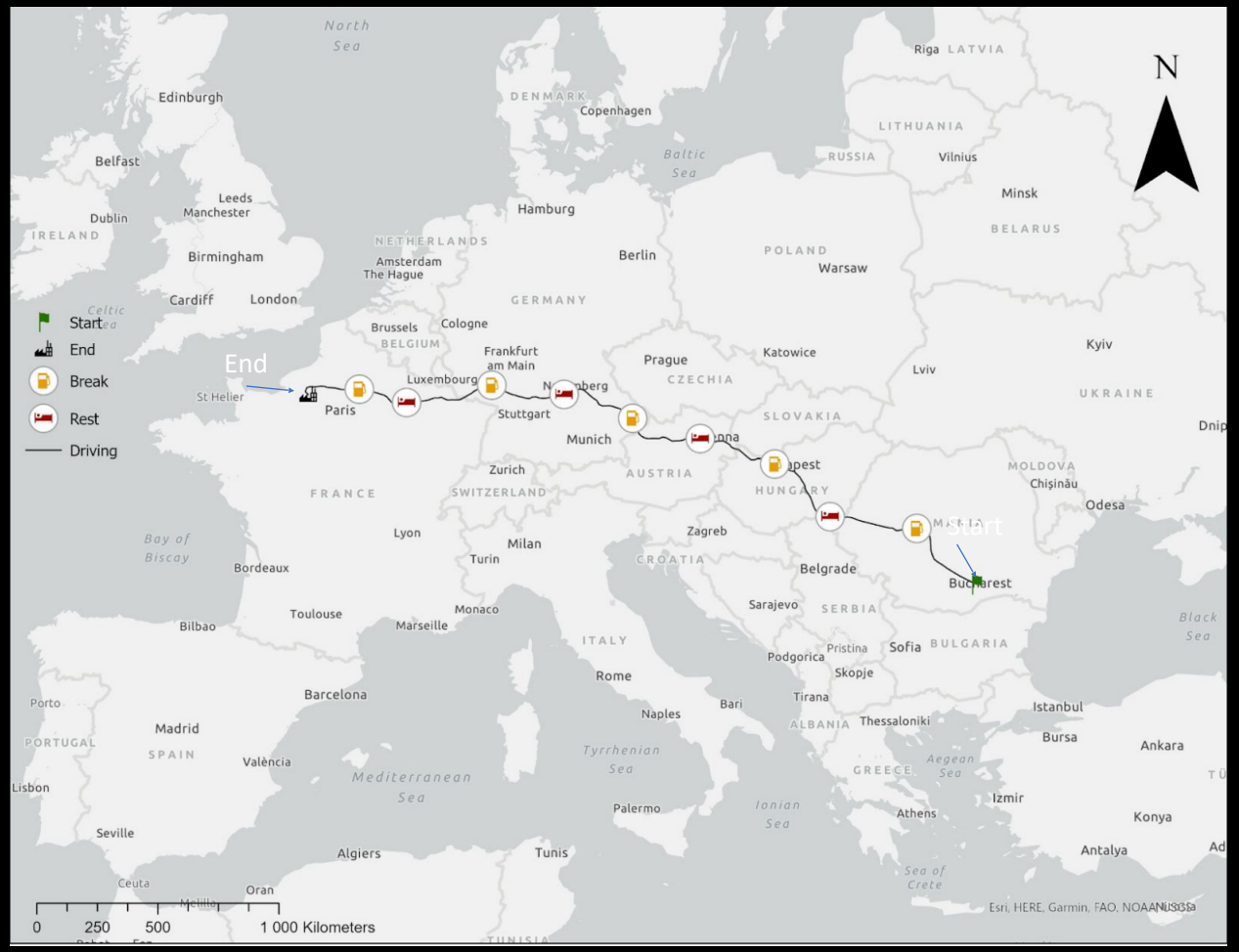

A route sample with one driver.

CCS: 50-100 kW, overnight charger

MCS: 0.7-1.2 MW, fast charger

STORM

The travel time and distance between pairs of OD differ and may be very long

Statistics summarizing the tours (trip chain) and trips between stops for BETs onl

Level	Variables	Mean	Percentile	
			50%	99%
Trip	Distance between stops (km)	350	343	435
	Required energy between stops (kWh)	556	549	750

The travel time and distance between pairs of OD differ and may be very long

- The average tours travel time and distance are 30 hours and 1450 km, respectively.
- 70% of the stops are break stops.

Statistics summarizing the tours (trip chain) and trips between stops for BETs onl

Level	Variables	Mean	Percentile	
			50%	99%
Trip	Distance between stops (km)	350	343	435
	Required energy between stops (kWh)	556	549	750
Tour (trip chain)	Total travel time (hour)	30	27	106
	Total travel distance (km)	1450	1230	5130

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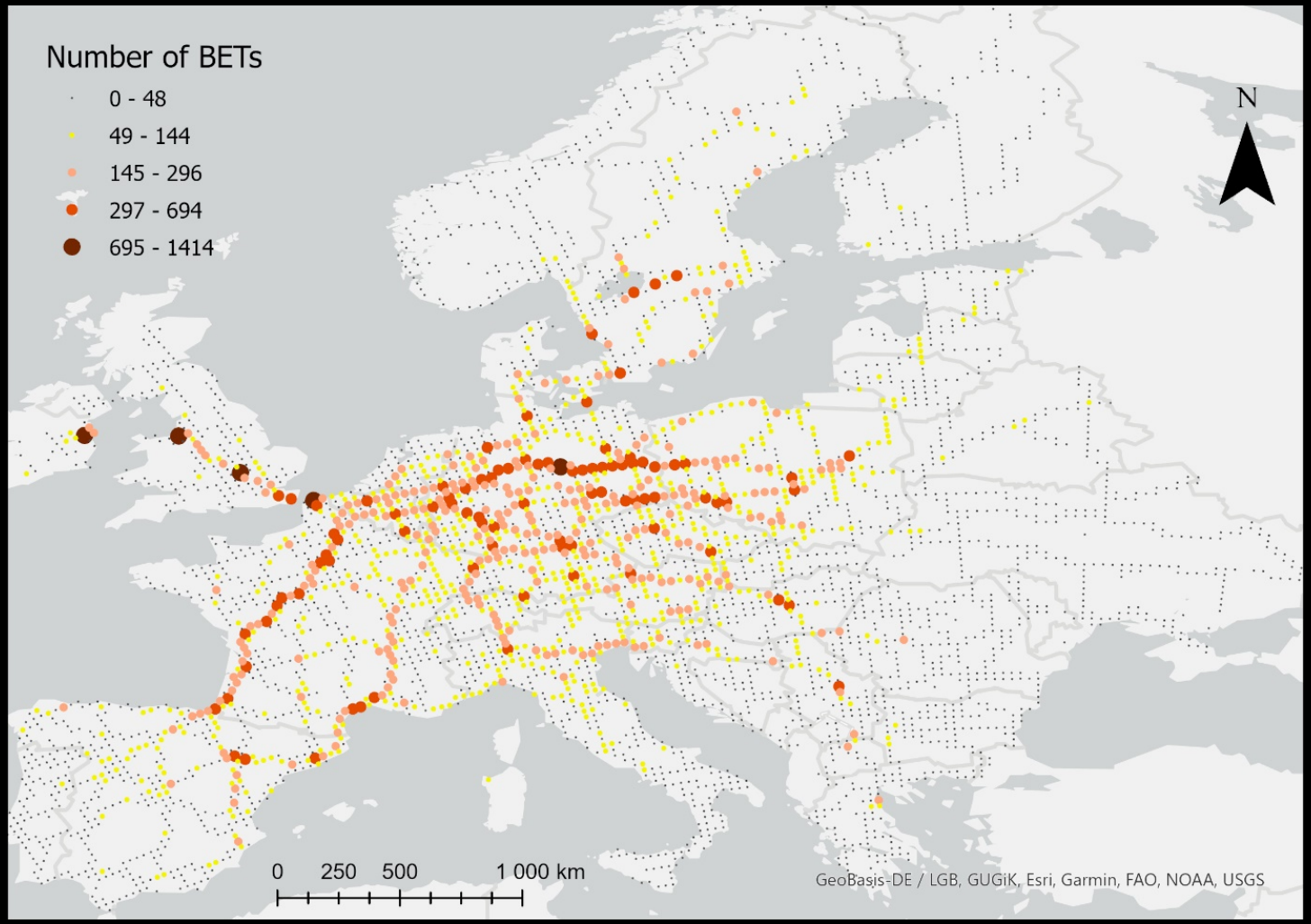
CHARGING STATION DISTRIBUTION

45% of all stations are in 5 countries (i.e., France, Germany, Spain, Italy, and Sweden).



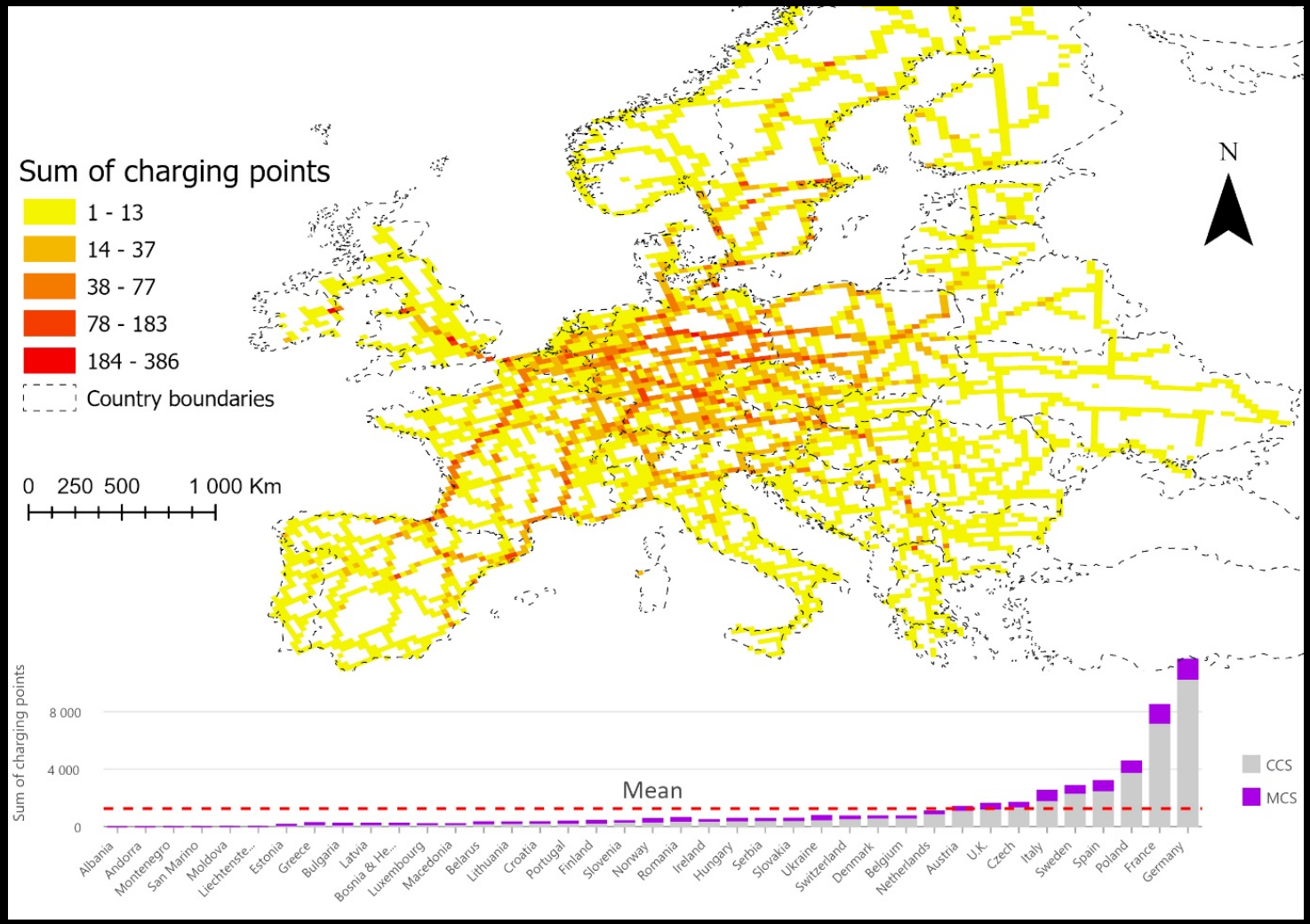
The number of daily LBETs utilizing suggested charging stations. Points are centered in the middle of 25x25 km2 polygons suggesting charging stations.

CHARGING AREAS DISTRIBUTION

15% BETs requires 40,000 CCS and 9,000 MCS charging points.

The average CCS to MCS charging points ratio is 4.5/1.

On average, the charging area serves 47 parked BETs daily.



Total number of CCS and MCS chargers by charging area and country in Europe, for 15% of BET share.

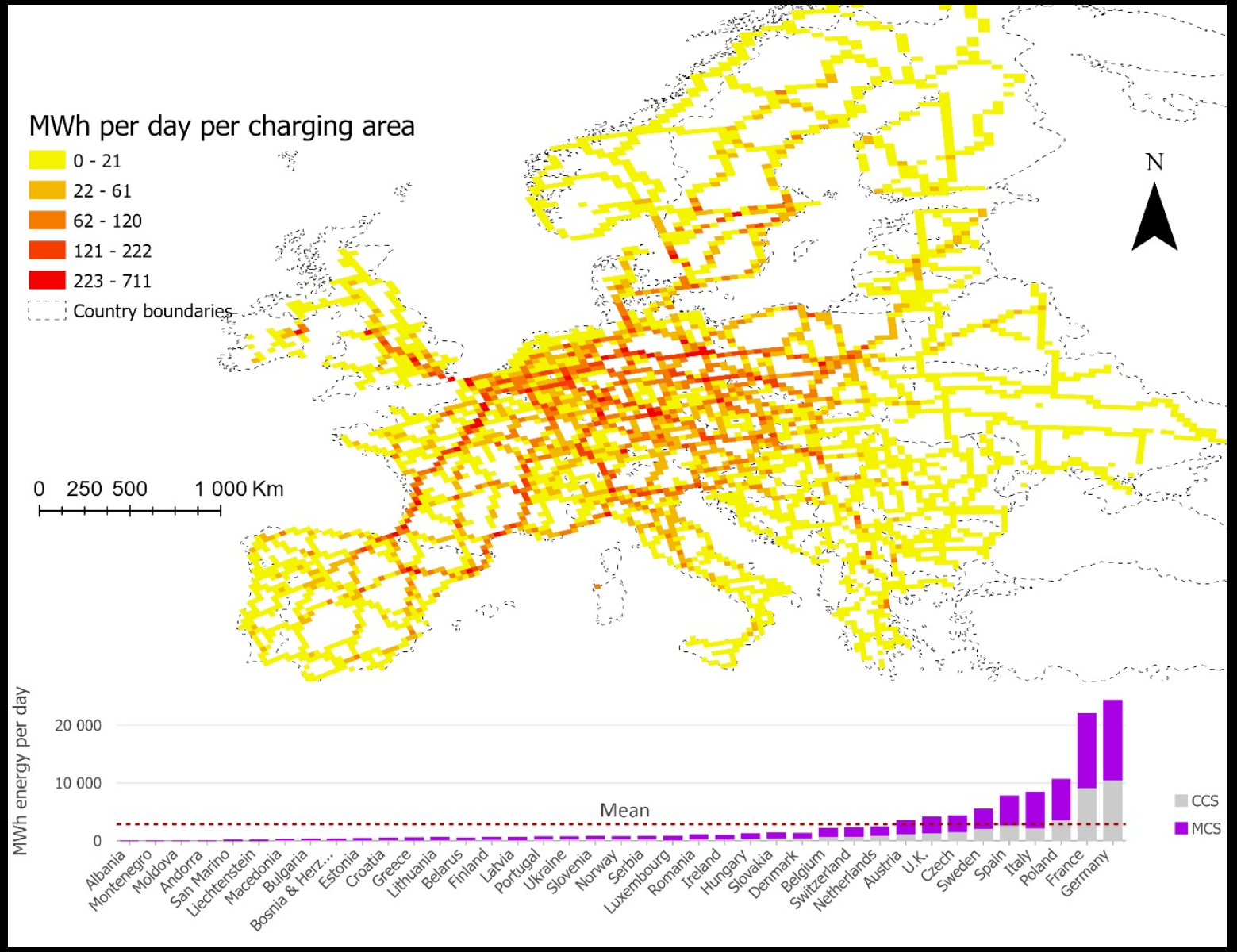
Energy requirement

The required energy to charge 15% BETs could reach up to 110 GWh per day.

100% of BET share requires about 540 GWh daily.

On average, a charging area (25x25m2) requires 24 MWh daily.

62% energy requirements are from MCS chargers. This sums up to 68 GWh/day, representing 8% of the BETs total parking time.



Daily energy requirement for each charging area and country (MWh per day) from both CCS and MCS charging.

Conclusions

- 40,000 CCS and 9,000 MCS chargers are required for 15% BET penetration.
- An average of 8 CCS and 2 MCS chargers per changing areas (25x25 km^2)
- Each charging area serves an average of 2 and 11 BETs daily.