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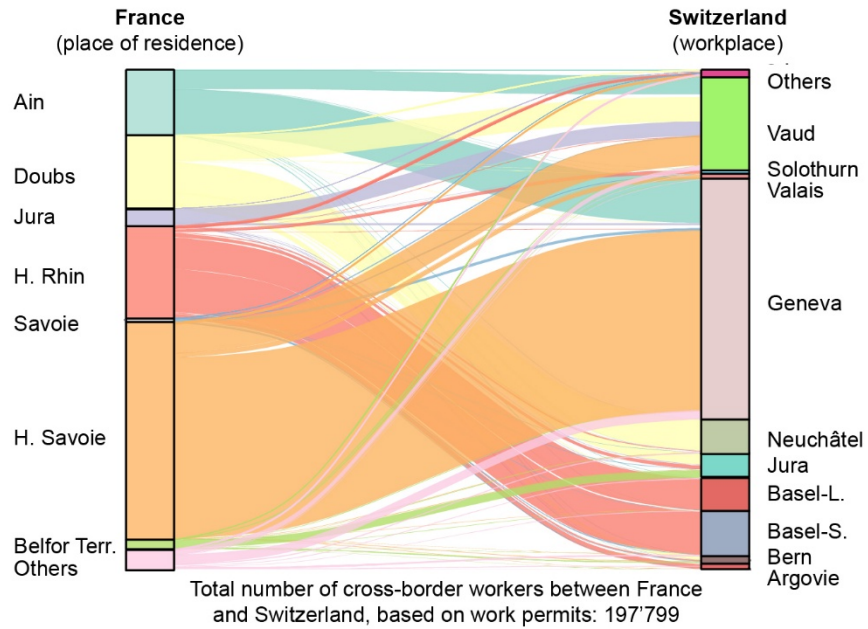
Supplementary Note 1 - Electricity price sensitivity

In 2020, during the COVID-19 pandemic, when electricity prices were approximately 35% lower than in 2018, a substantially higher discharge potential was observed in Switzerland (+32% in the fully flexible scenario and +5% in the work discharge scenario). In contrast, in 2023, when the energy crisis induced a high market volatility and electricity prices were roughly twice as high as in 2018, the discharge potential increased by 8% in the fully flexible scenario but decreased by 14% in the work discharge scenario (see Supplementary Table 1).

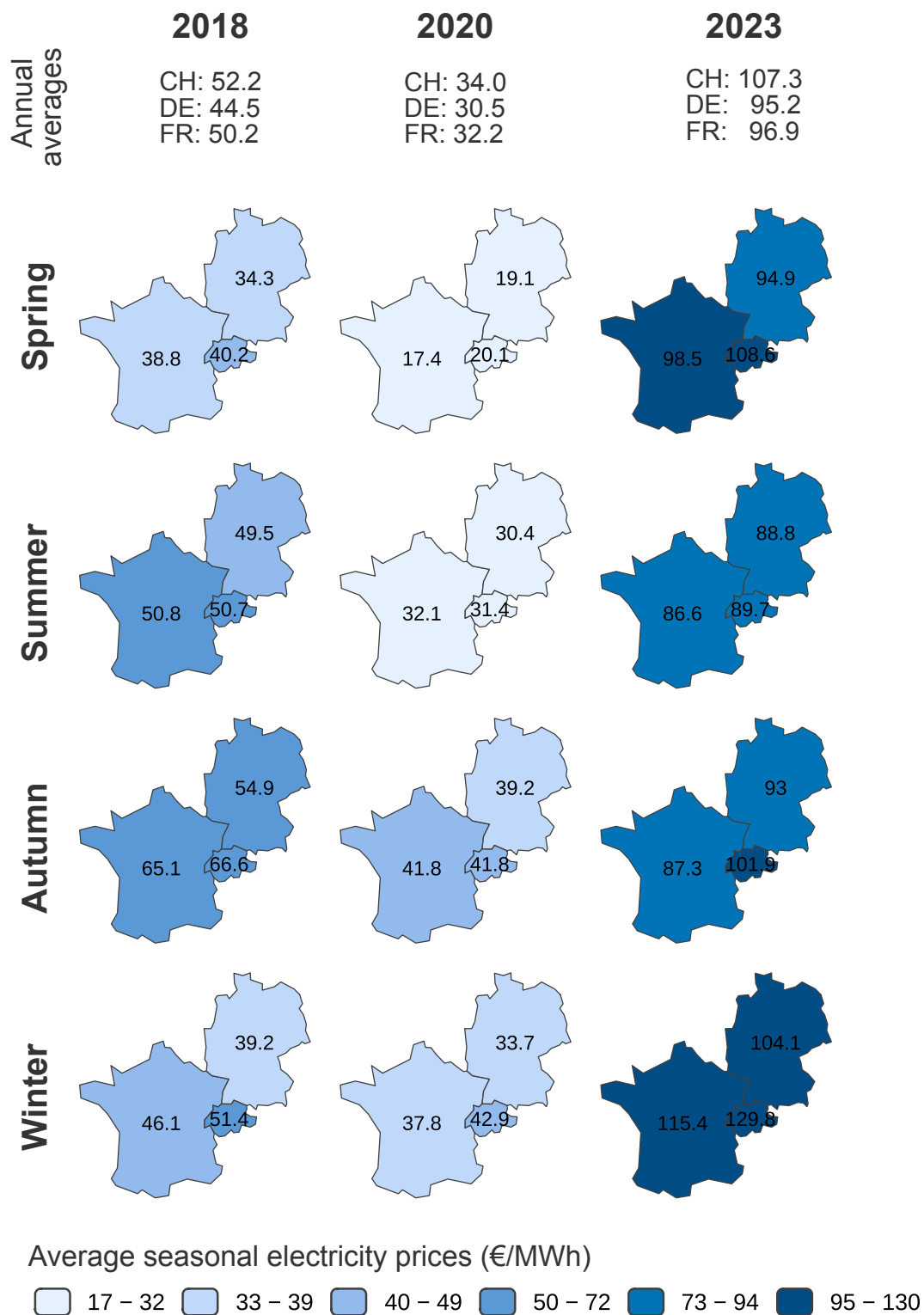
Supplementary Table 1 | Full data of Figure 2. Values are provided in TWh per year.

		Discharge		Charge	
		Switzerland	France	Switzerland	France
fully flexible scenario	2018	0.588	0.988	0.364	1.633
	2020	0.774	1.097	0.707	1.654
	2023	0.637	1.339	1.063	1.431
	mean	0.666	1.141	0.711	1.573
work discharge scenario	2018	0.915	0.000	0.000	1.591
	2020	0.957	0.000	0.000	1.641
	2023	0.788	0.000	0.000	1.432
	mean	0.887	0.000	0.000	1.555

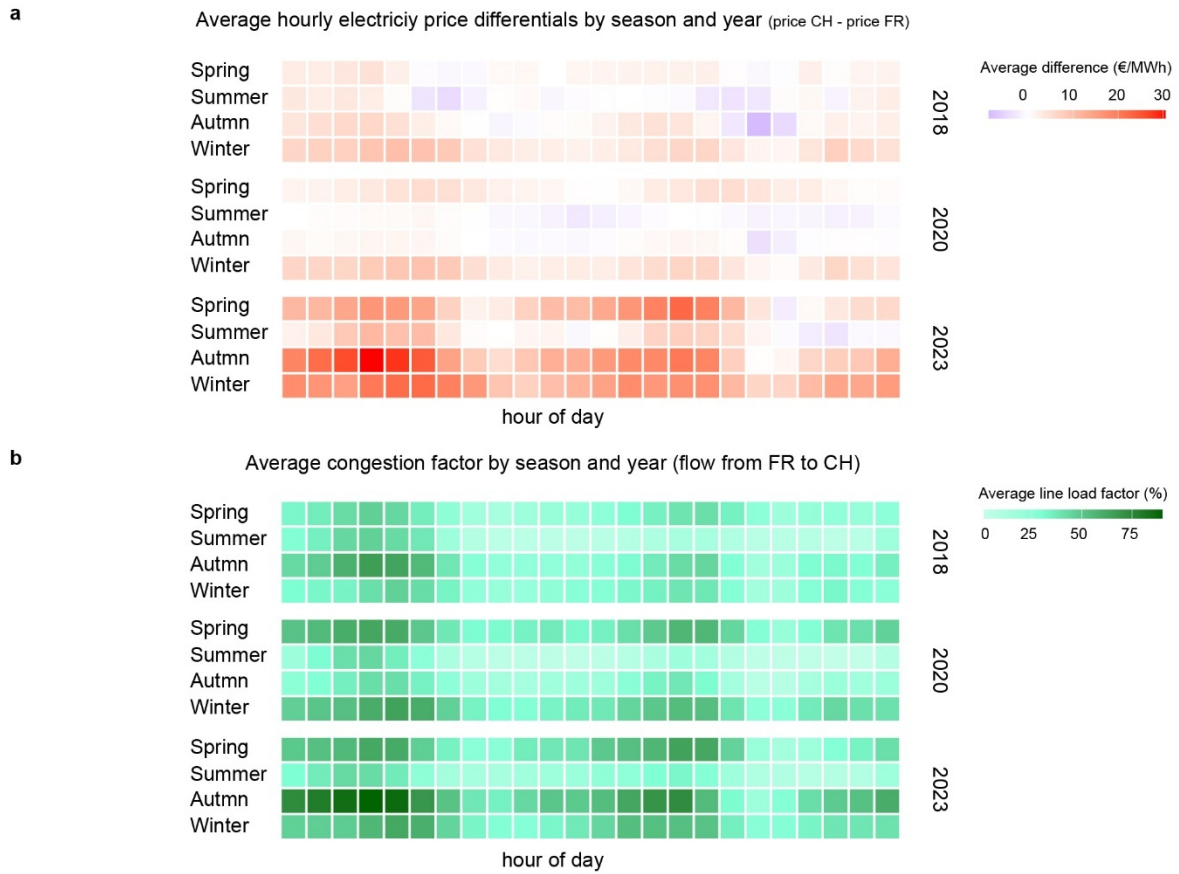
Supplementary Figures



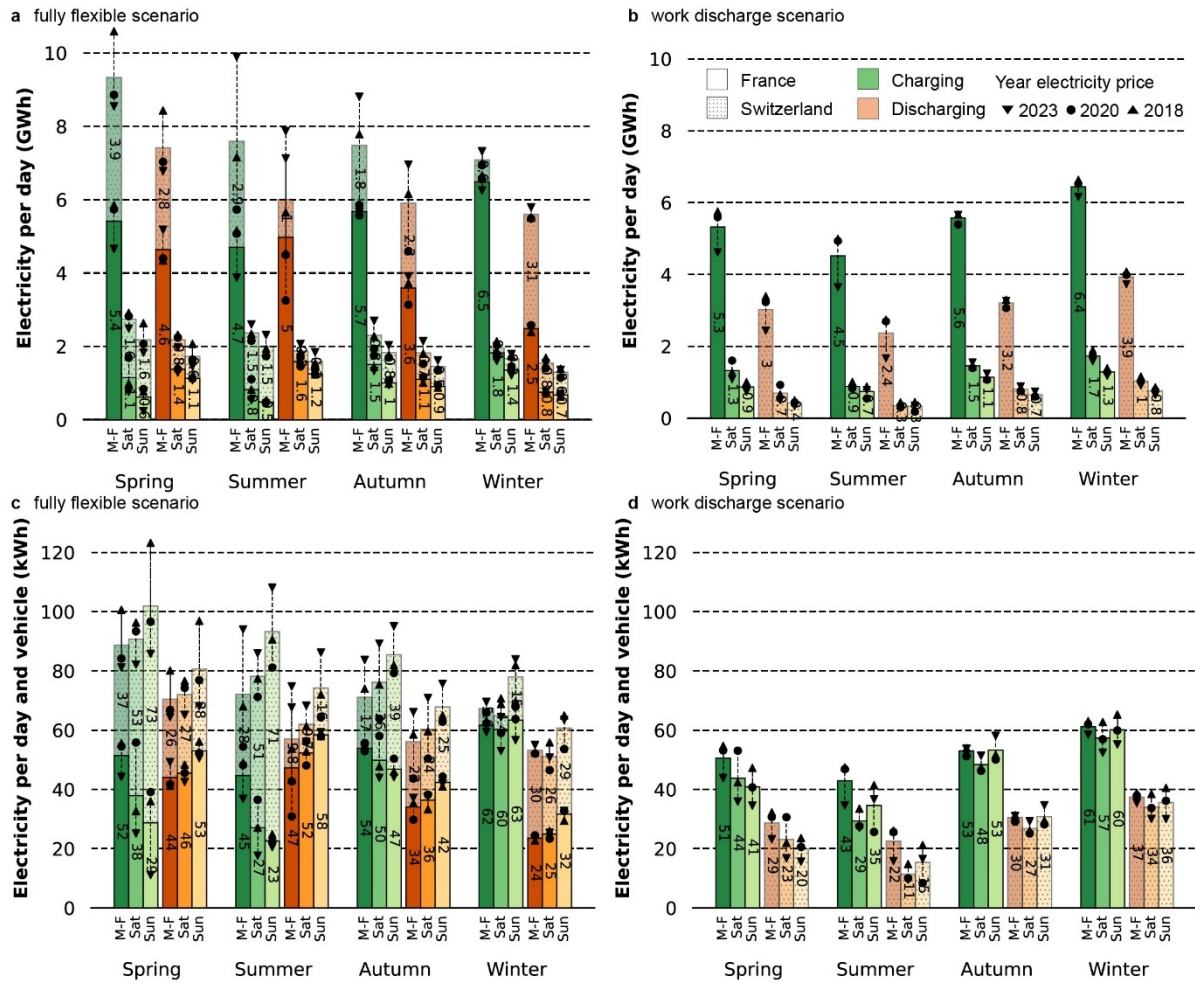
Supplementary Fig. 1 | Cross-border worker flow between France and Switzerland. The Sankey diagram visualises the number of cross-border workers between the place of residence in France (Départements) and workplace in Switzerland (Cantons), highlighting the main commuting corridors between the two countries.



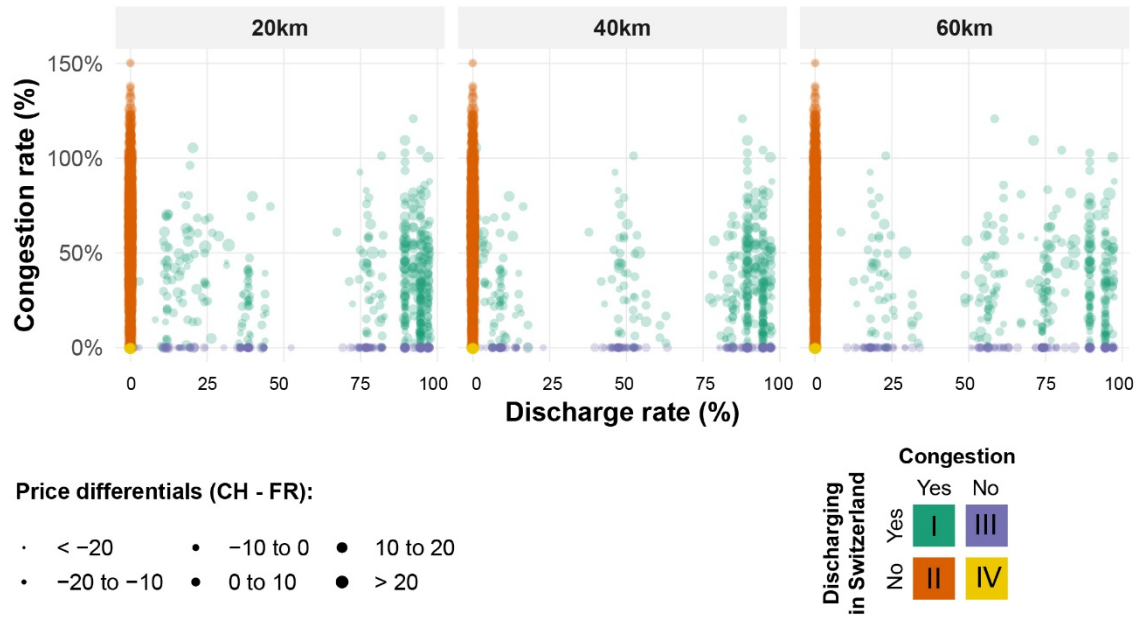
Supplementary Fig. 2 | Annual and seasonal electricity prices for France, Switzerland and Germany. Average seasonal electricity prices for Switzerland (CH), Germany (DE) and France (FR) for the years 2018, 2020 and 2023, according to data obtained from EPEX SPOT²⁵.



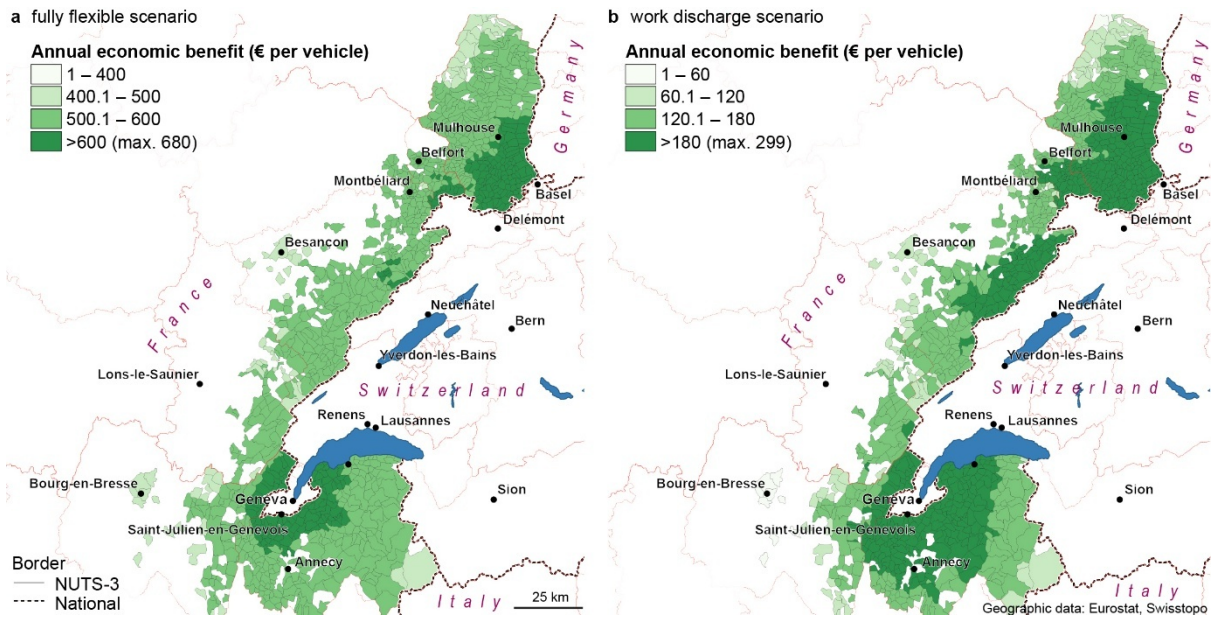
Supplementary Fig. 3 | Electricity price differences and congestion for the simulation years 2018, 2020 and 2023. Comparison of differences in average seasonal electricity prices between Switzerland and France for three years (a) and the congestion factor (line load factor) of electricity flows between France and Switzerland (b).



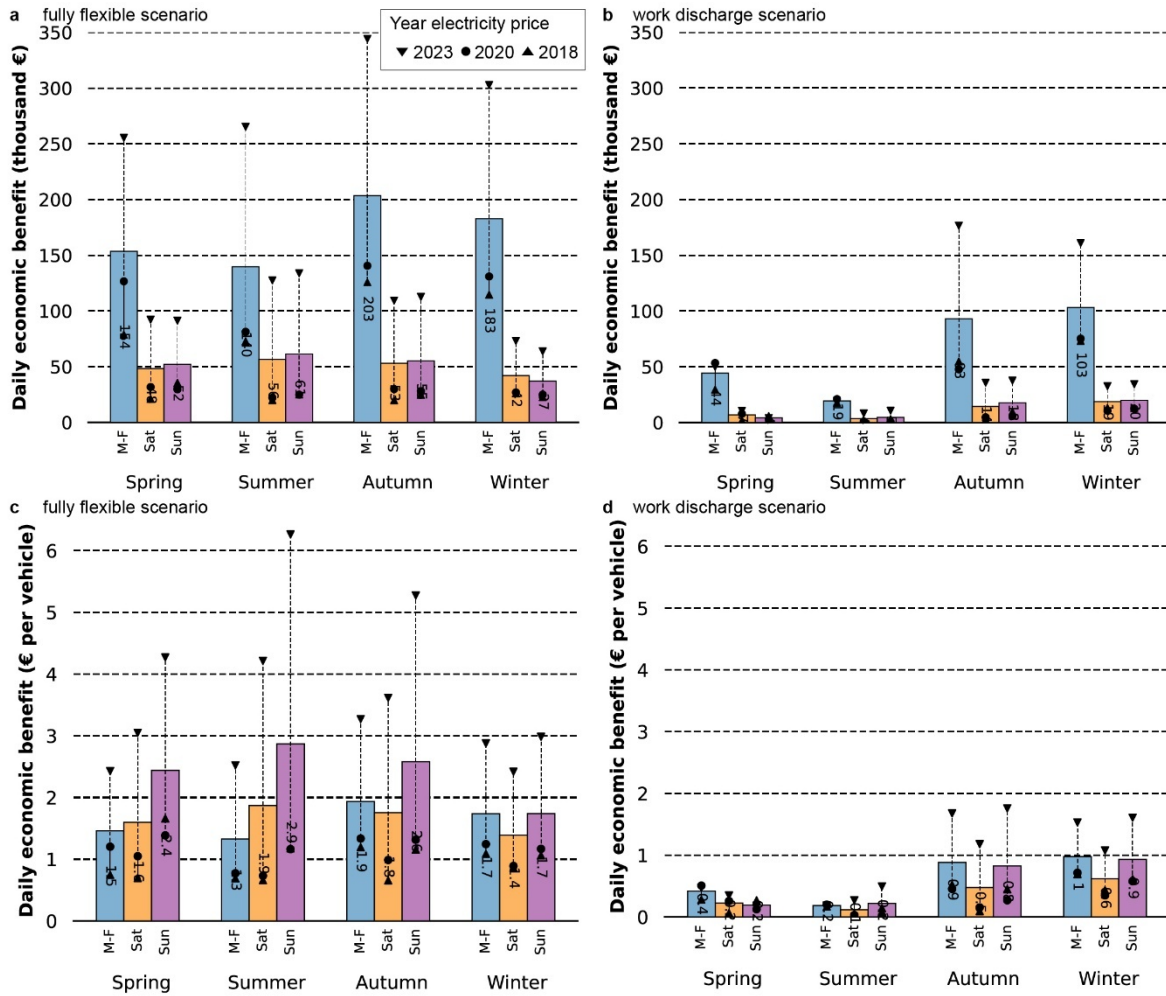
Supplementary Fig. 4 | a–d Simulation results of charging and discharging capacity per day type. The daily values are aggregated for all vehicles per season and day type for the fully flexible scenario (a) and the work discharge scenario. Normalised results assume the same vehicle flow per day type and are shown for the fully flexible scenario (c) and the work discharge scenario (d). The bar charts show average results over the three years.



Supplementary Fig. 5 | Hourly discharge and congestion rate, classified into four situations (cf. Figure 4 in the main document).



Supplementary Fig. 6 | Normalised net economic benefit (Euro per vehicle and year) per French community. Economic benefits per vehicle decrease with increasing distance to the workplace. The plotted values show average values of the three simulation years (2018, 2020, 2023). Please note: the choropleth colouring data range differs between a and b.



Supplementary Fig. 7 | a–d Total and normalised daily net economic benefits per season and day type. Aggregated economic benefits of all cross-border vehicles are aggregated per day type for the fully flexible scenario (a) and the work discharge scenario (b). Normalised economic benefits per vehicle are shown for the fully flexible (c) and work discharge scenario (d). Bar charts show average results for the three years.