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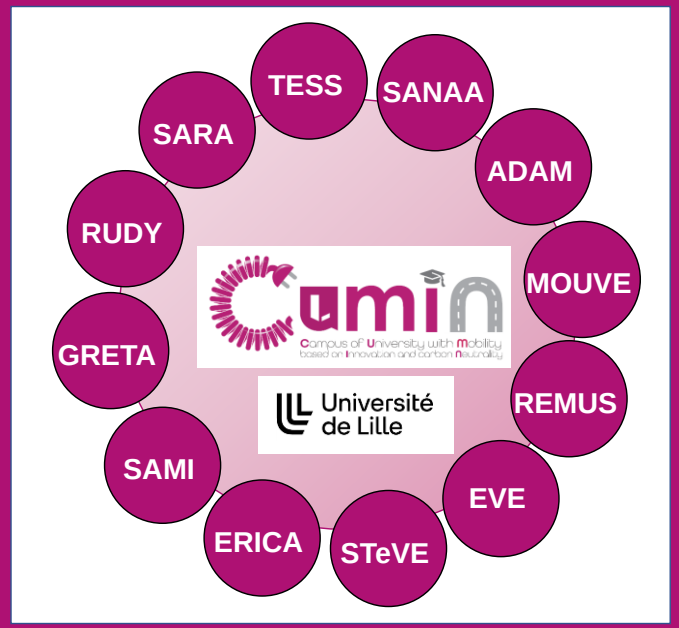

CUMIN - REMUS

Study of a catenary-less regional train

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Master 2 VIE

Université de Lille

Introduction

- In France, 50 % of the railways are not electrified
- The trains that runs on these railways are powered by Diesel

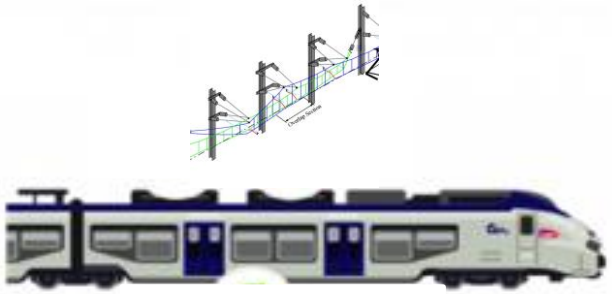
Need to reduce the pollution and GHG

REMUS :
Regeneration of Energy of the Subway for a Sustainable University

Study - What have we done?

- Model of the train traction system
- Model of different energy sources (Diesel, Battery, Catenary)
- Comparison of the different sources according to various criteria

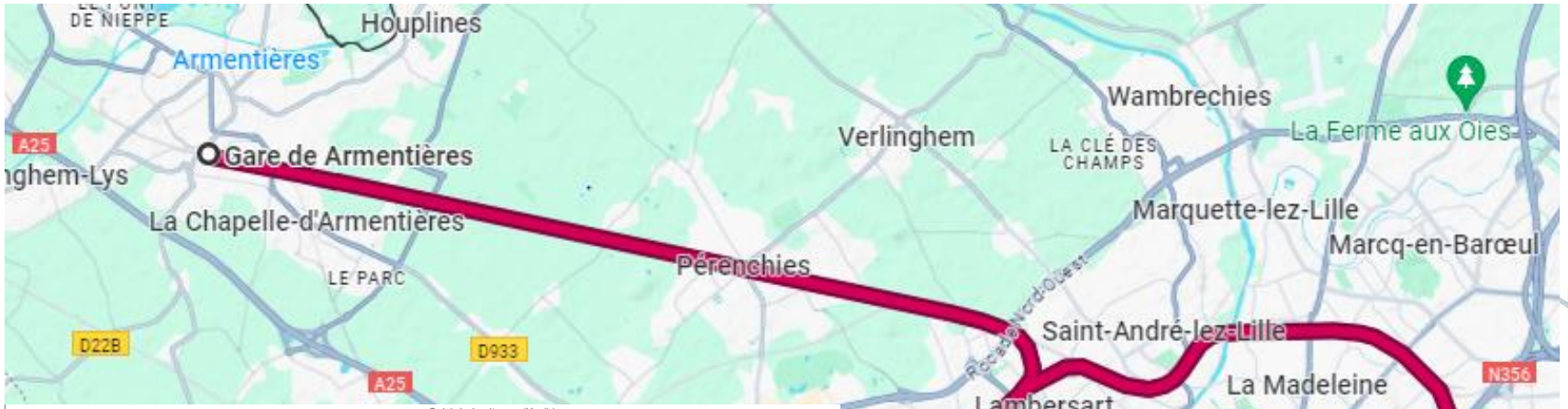
TER
Hybrid

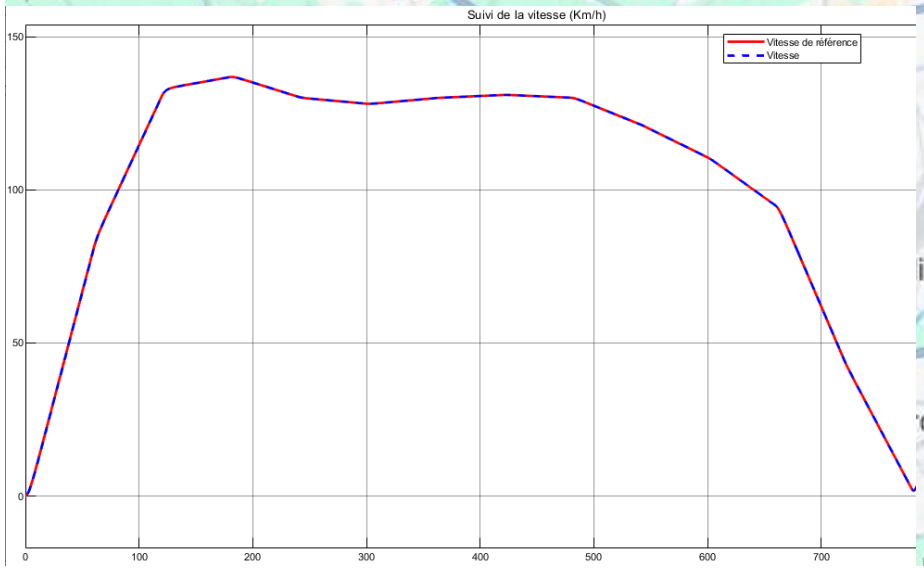


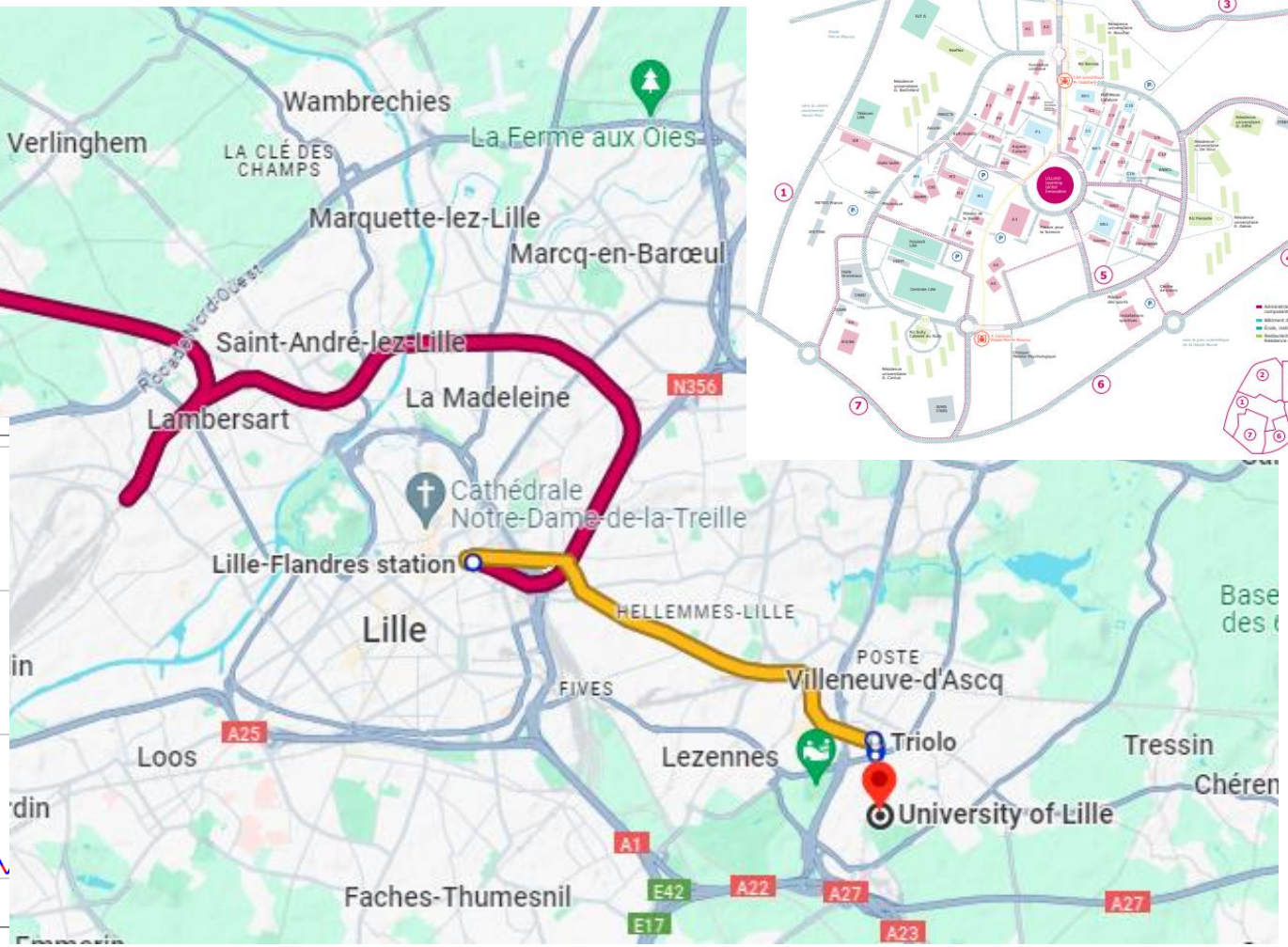
TER
Catenary

TER
Battery

Project Overview and Commute Scenario



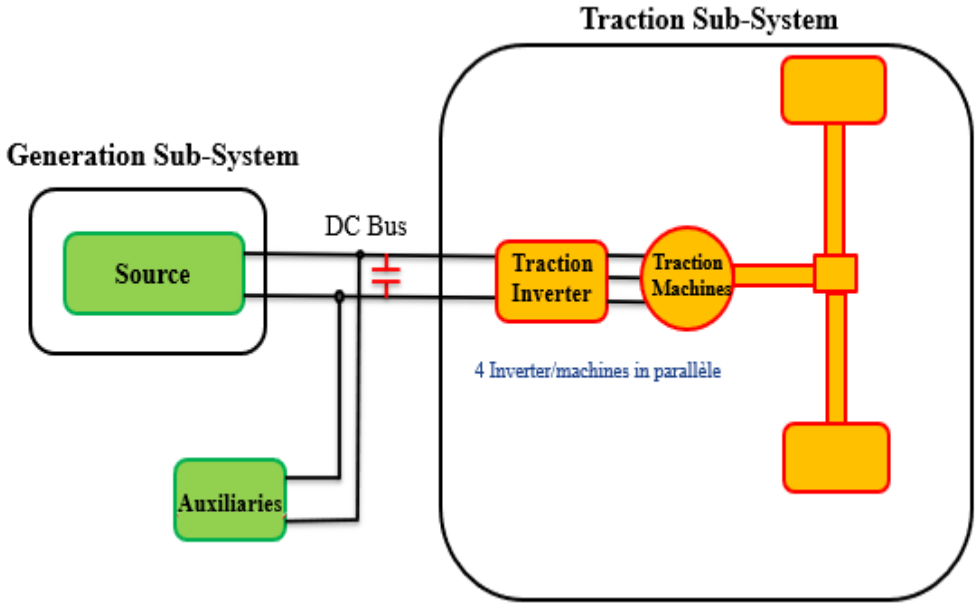


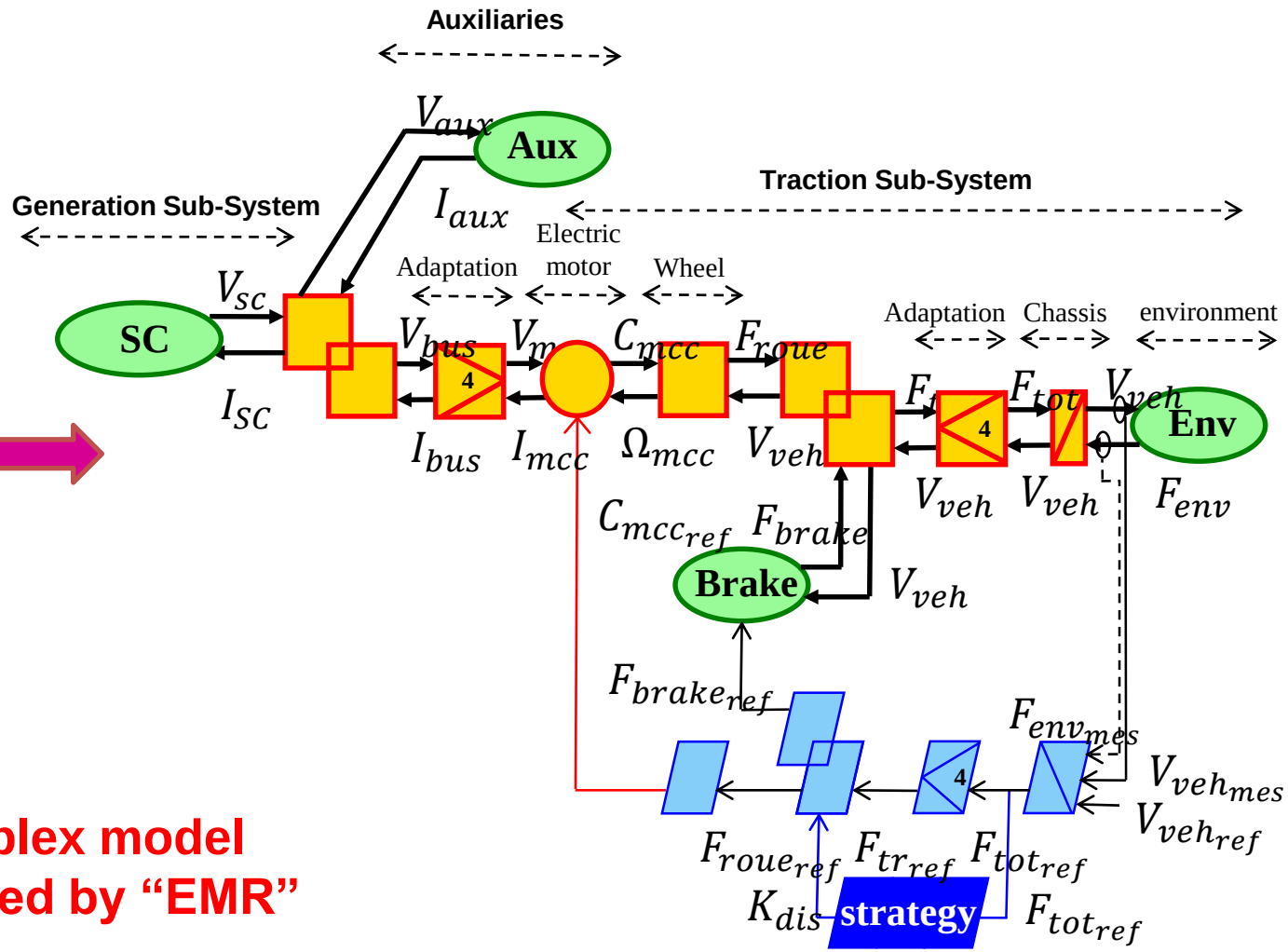


Train Considered

- X 76500 – Bombardier
- Weight : 165 tons
- Capacity : 220 ppl
- Tank : 3000 L
- Max Speed : 160 km/h
- 4 Electrical motors

Model of the traction system

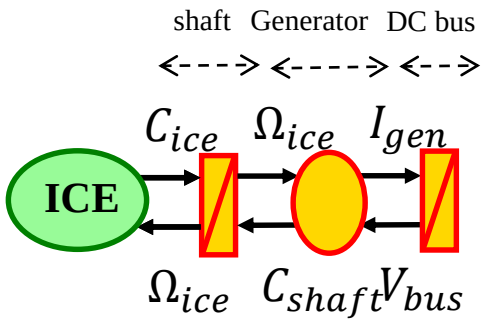




Complex model organized by "EMR"

Study – Generation Sub-System

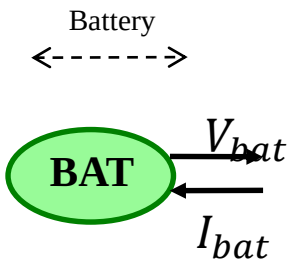
Diesel source



Hypothesis

- The fuel consumption

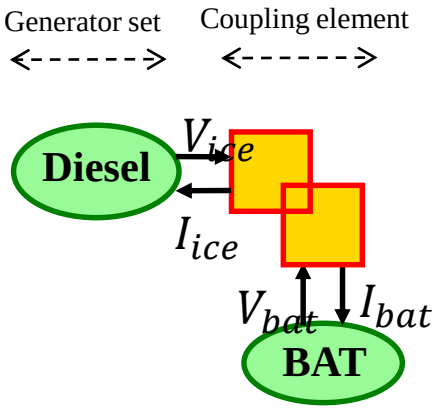
Battery source



Hypothesis

- Joule losses
- Variations in state of charge

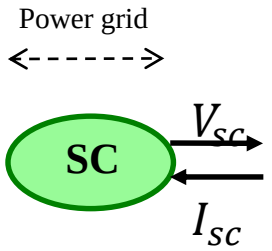
hybrid



Hypothesis

- Battery recharge in each cycle

Catenary source



Hypothesis

- Losses in the network
- Estimated rate of CO2/KWh of electricity generated in France

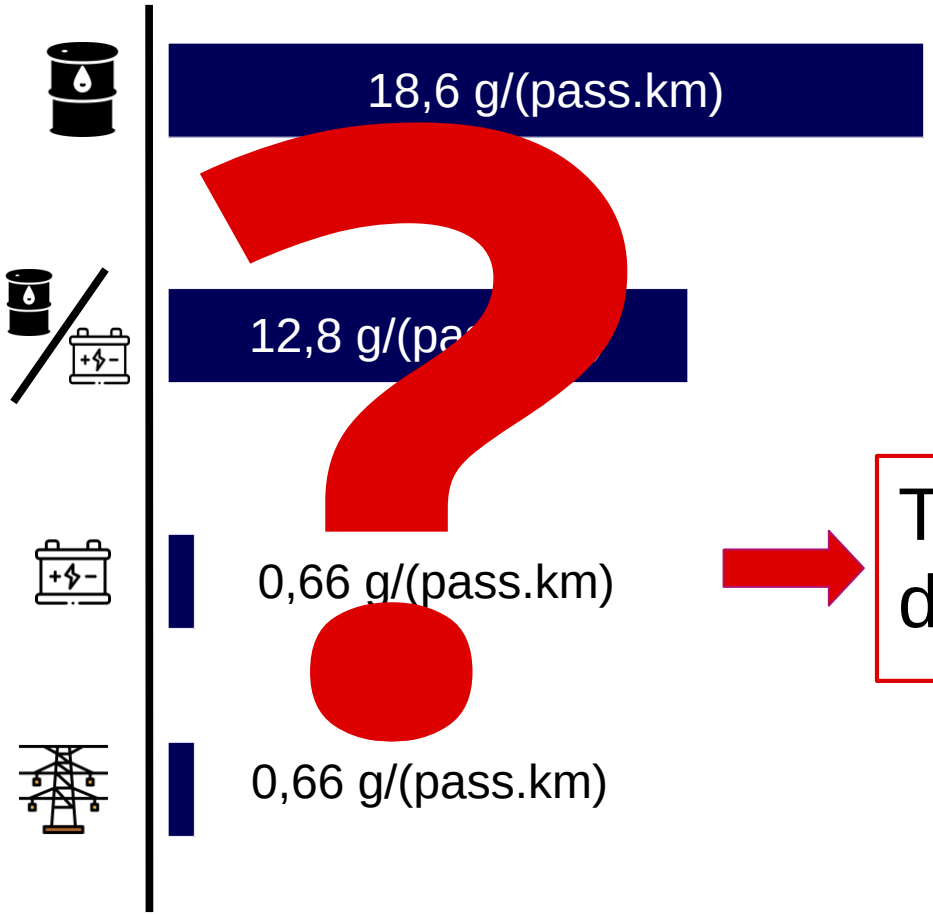
Comparison of the different sources

	Energy cons. (kWh)	CO2eq Well To Tank (kg)	CO2eq Tank To Wheel (kg)	CO2eq by passenger/km (g/pass.km)	Fuel Consumption
Catenary	**52,65**	**1,68**	**0**	**0,66**	
Battery	**52,76**	**1,69**	**0**	**0,67**	
Diesel	**108,3**	**?**	**47**	**18,6**	**17,6 L**
Hybrid	**78,6**	**2,51**	**30,4**	**12,8**	**11,4 L**

50 % occupation = 110 passengers

23 km trip

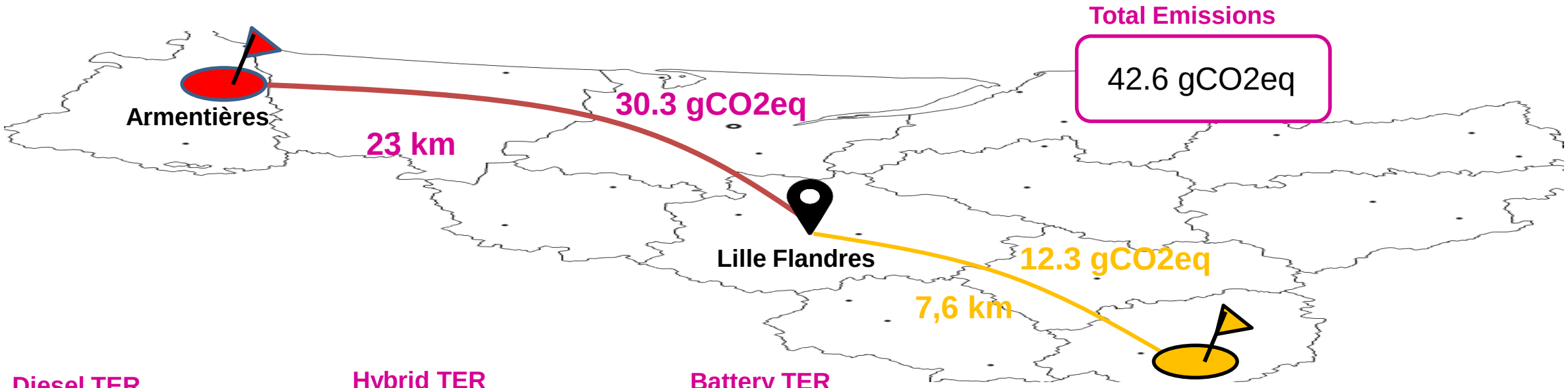
Comparison



CO2eq emitted during production

The GHG emitted during production heavily depends on the dimension of the ESS

Conclusion & perspectives



Total Emissions

42.6 gCO2eq

Diesel TER

868gCO2eq

Hybrid TER

601gCO2eq

Battery TER

43.1gCO2eq

- Optimizing Battery Selection: Assessing Lifecycle, Charging Methods, and Sizing
- Evaluate hydrogen by taking into account its production assumptions

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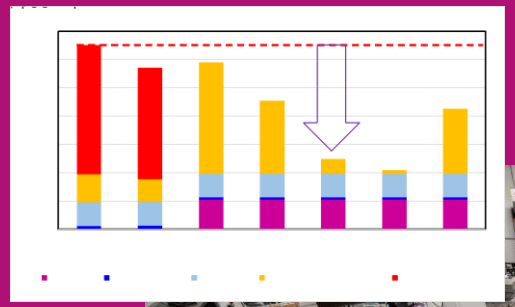

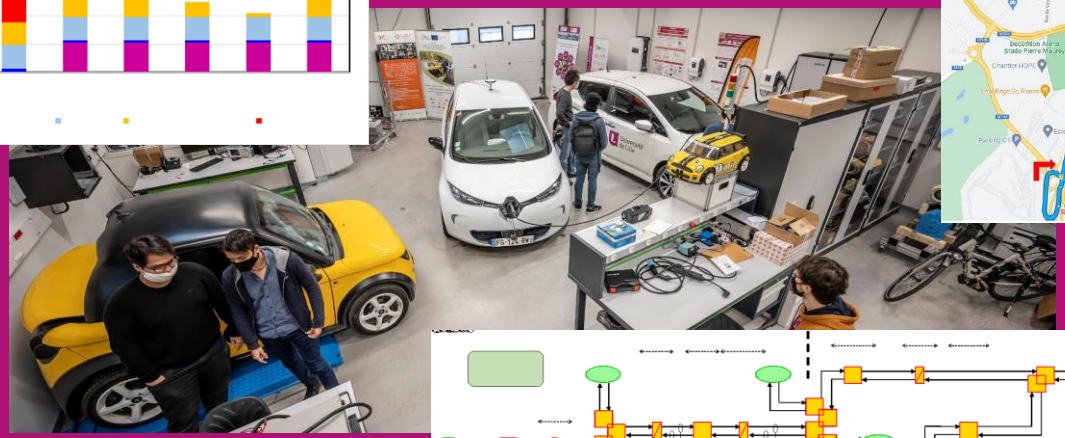

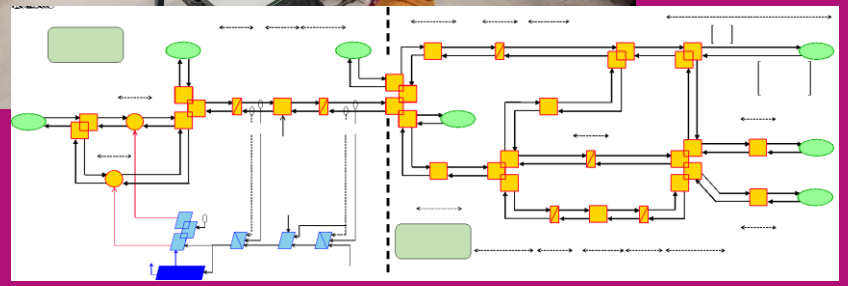

Our university as an exciting living lab towards eco-cities through an innovative transdisciplinary framework !