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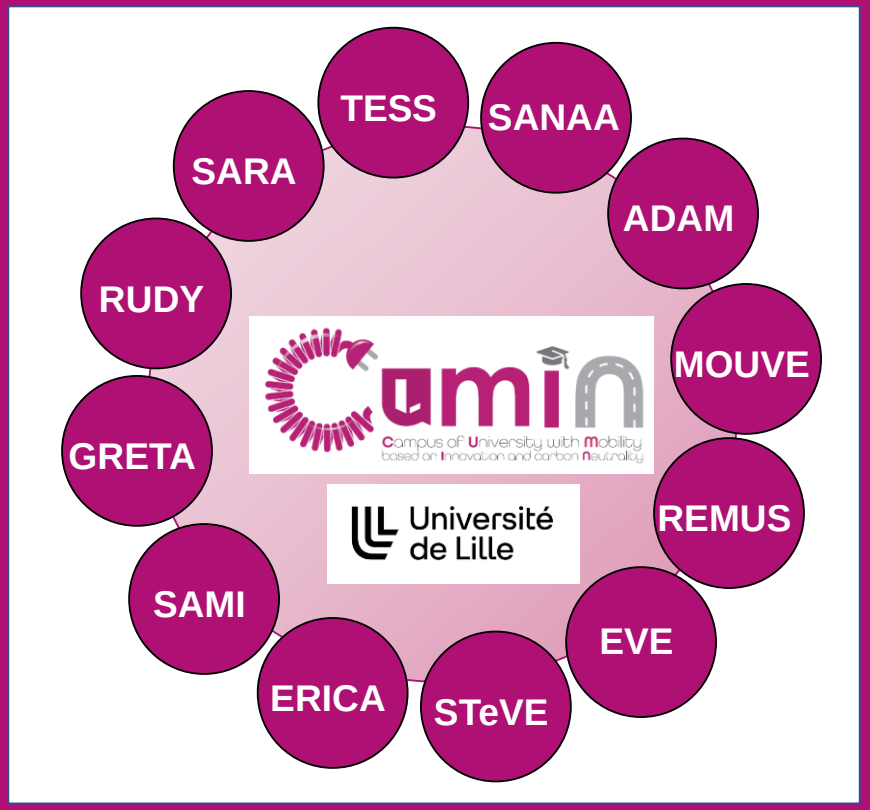
CUMIN – TESSA



TESSA

Techno-Economical Study of Second life batteries for Affordable e-mobility campus

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Elodie CASTEX (TVES)

TESSA brings together different streams of research

Technology research at L2EP on EVs and batteries

Social science research at TVES on transport needs and behaviors

Techno-economic and financial modeling approaches to understand alternatives

The CUMIN-TESSA project comes from our experience in the earlier CUMIN-TESS research

coupling technical and economical models

University

User

Sustainable Urban Mobility Plan (coupling to MOUVE)

First roadmap of campus electrification

?

More detailed roadmap?
Extension to RIT campus?

Battery 2nd life (TESSA)

-Optimal usage
-When to replace
-Availability

-Awareness
-Preferences
(coupling to ERICA)

French case (5 years):
e-car TCO > diesel car TCO

?

extension to US case?
extension to other vehicles?

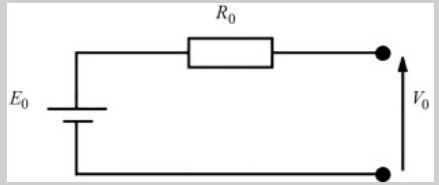
TESSA will extend the ideas of TESS to questions about secondary use of EV batteries

TESSA is funded through the University of Lille WILL International Chair program (awarded March 2023)

4 year collaborative project connecting technical modeling, economic analysis, and EV driver behavior/needs to understand opportunities for second life EV batteries.

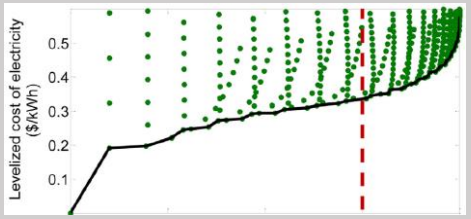
1. How should second-life EV batteries be operated to balance their economic and environmental benefits?

Technical Models



Battery performance = f(operation)
Battery lifetime = f(operation)

Economic Models



Economic value = f(operation, performance, lifetime)

Environmental Assessment

Grid emissions effects = f(operation, performance)
Embodied emissions = f(lifetime)

Driver Behavior and Preferences

Integrated Framework

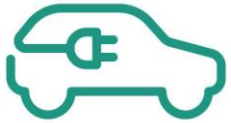
Economic value = f(operation)

Net emissions effect = f(operation)

How should second life batteries be operated?

What are the tradeoffs between economic and environmental benefits?

2. If electric vehicle batteries have a useful second life, when should drivers replace them?

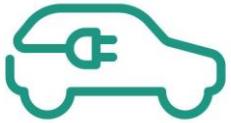


EV battery replacement defined by pre-defined cutoff (80% of original capacity)

Traditional Approach

Discarded

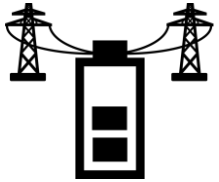
Recycling or scrapping



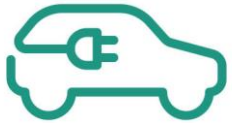
EV battery replacement defined by pre-defined cutoff (80% of original capacity)

Improved Approach

Discarded



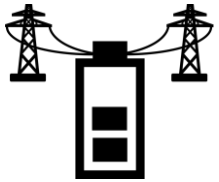
Second life uses discarded batteries for economic or environmental benefits



EV battery replacement defined by EV owner needs & behavior

TESSA Approach

Value of second life affects EV battery replacement



Second life uses discarded batteries for economic or environmental benefits

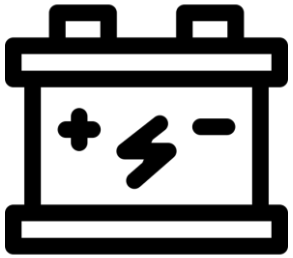
How does this change in perspective affect EV battery design and replacement?

3. What is the overall potential for supply of second life EV batteries in France, EU, US, and the world?

Second life batteries are not “manufactured”

EV battery production = f(EV sales, battery size)

Time (~10 yrs)

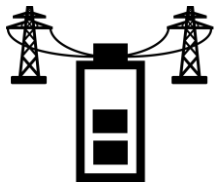


Second life batteries = f(EV sales, battery size, battery lifetime)

Second life battery lifetime is limited

How well will the supply(t) of second life batteries match the demand(t) for grid energy storage?

Decarbonization requires increasing amounts of energy storage



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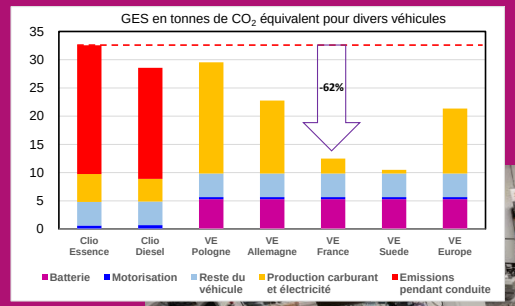

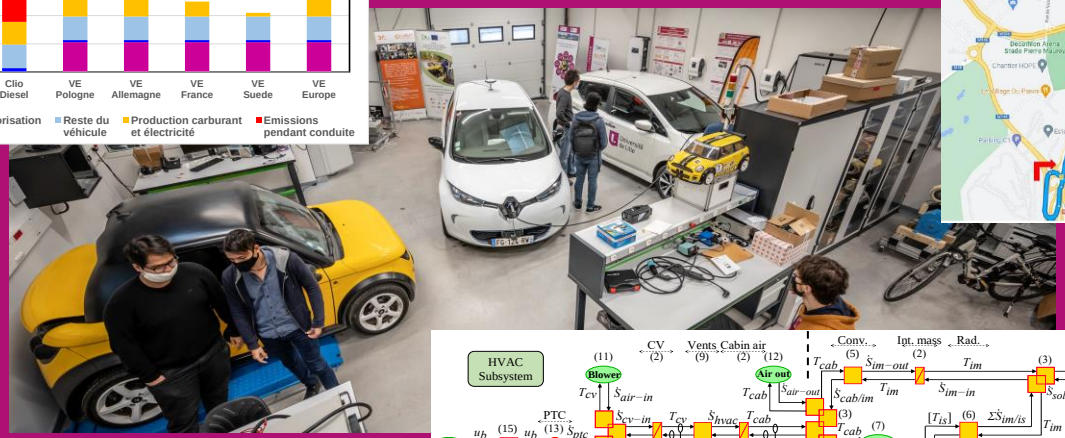

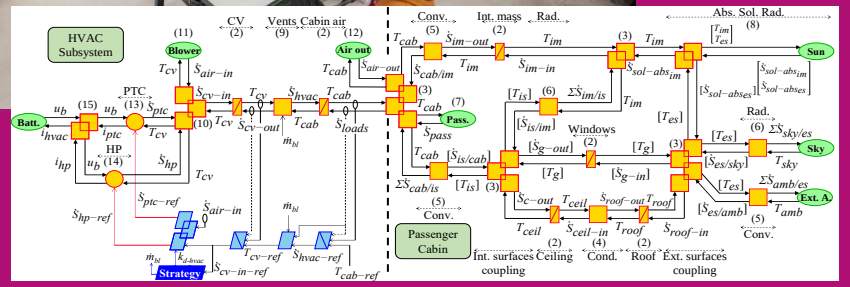

Our university as an exciting living lab towards eco-cities through an innovative transdisciplinary framework !