Road Transport Research in Horizon 2020 projects
SELFIE project

30th November and 1st December 2020
Online

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Summary

- Introduction of the SELFIE project
- Aims & Objectives
- Achievements
- Next steps

Introduction to the SELFIE project

Project Type: Innovation Action

Call: H2020-LC-GV-01-2018

Acronym: SELFIE

Title: Self-sustained and Smart Battery Thermal Management Solution for Battery Electric Vehicles

Coordinator: VUB

Partners (11 from 7 EU countries): ViF (back office), I2M (dissemination), CRF, Valeo France, Valeo Germany, Fraunhofer (IIBS& LBF), AIT, Ikerlan, Imecar, FEV (Polska & Germany).

Start: December 2018

Duration: 42 months

Overall Budget: 5.8 M€

EU funding: 5.0 M€

Aims…

- The aim of the SELFIE project is to develop and demonstrate a novel self-sustained compact battery system, consisting of:
  - A smart modular battery pack, which has...
    - cooling system and thermal storage system (heat buffer) capable to absorb excess heat due to fast charging
    - excellent internal thermal conductivity properties
  - An advanced battery thermal management system, that is capable to…
    - keep the battery temperature effectively within the optimal window and
    - to prevent overheating (and battery degradation) due to fast charging.

Focus on:

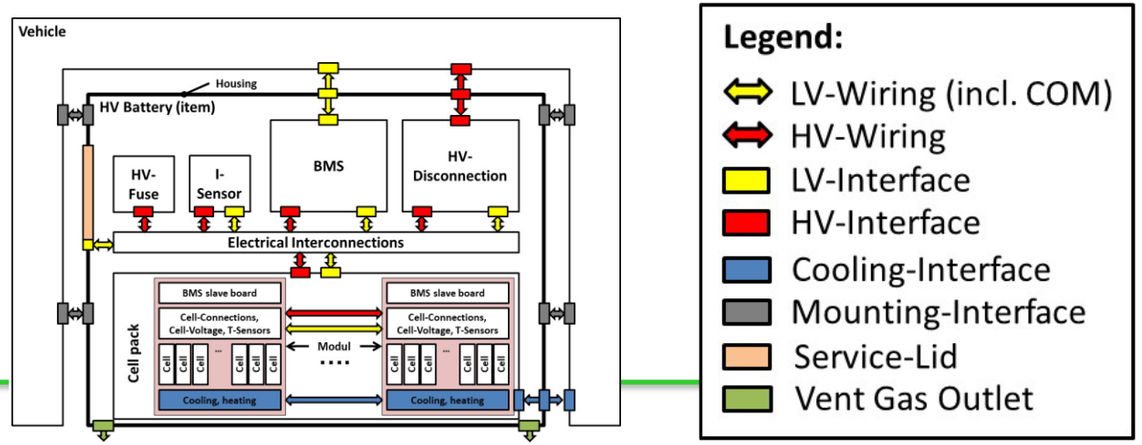
- Safely handle **fast-charging** power up to 140 kW (5C)
- Reduce the charging time to **10 min** @ 140 kW (15 min @ 100 kW) as the SELFIE battery system is capable to effectively absorb the excess heat released during fast charging
- Extend the electric range towards **700-1000 km**

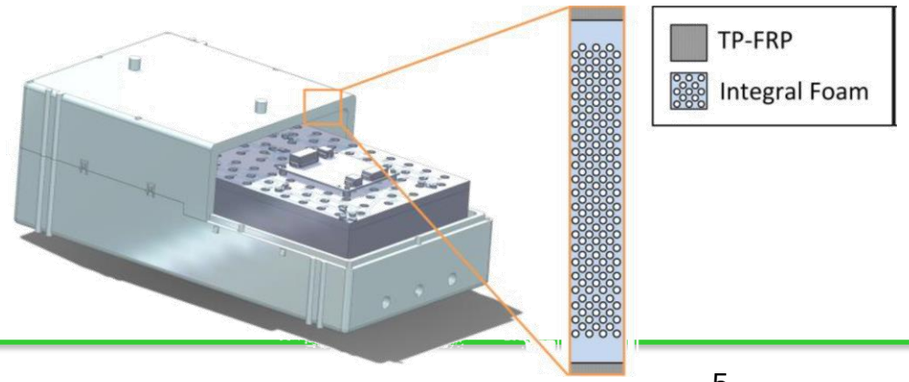
Fiat Doblo

& Objectives

The objectives are:

- Development of new smart heat storage housing (smart and cost-efficient material structures including polymers, phase change materials (PCM) and inserts)
- Development of a novel battery cooling plate (enabling a high-heat transfer rate and good thermal connection from the battery to the cooling and heating system)
- Development of a novel PCM heat buffer (dedicated for fast charging)
- Innovative cooling module in the front end (increase airflow rate, decrease in the energy consumption)
- Development of cold storage (allowing to increase the power of the A/C system during fast-charging and increase the system efficiency)
- Safety validation: Hazard and Operability Study (HAZOP) and risk assessment



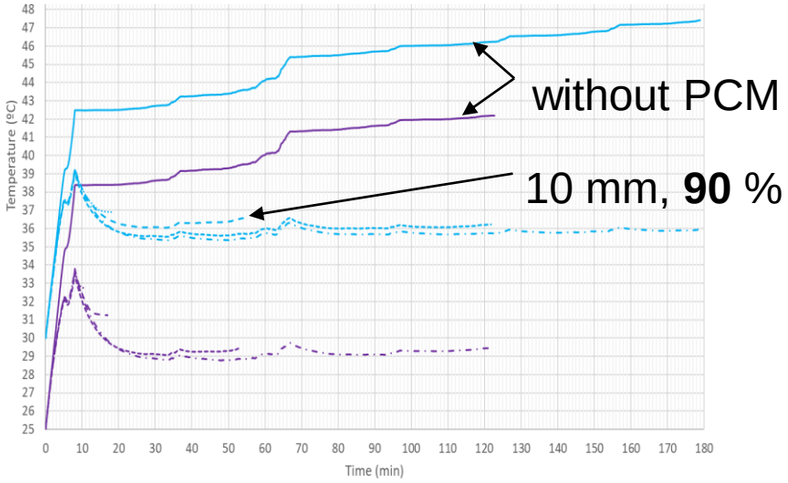


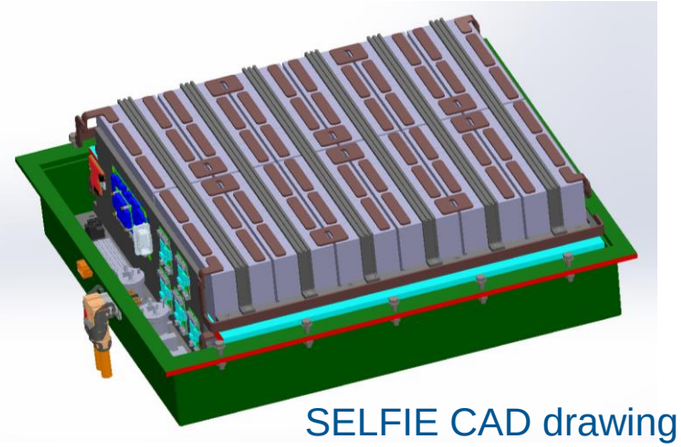
Achievements

Design of the battery pack system

- Selection and in-depth characterization of the cell in terms of heat generation, diffusion and accumulation
- Setup of specific 1D and 3D models to optimize the different components (pressure drop for the coolant flow through the cooling plates, battery system, PCM cold storage device, PCM heat buffer, front-end module, etc).
- Battery pack been designed and dimensioned by finite-element methodology.

Toshiba 23Ah
(https://www.scib.jp)



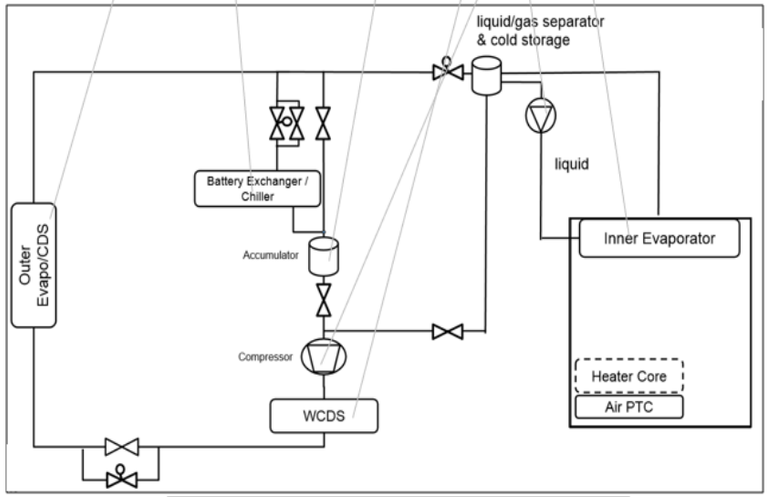


SELFIE CAD drawing

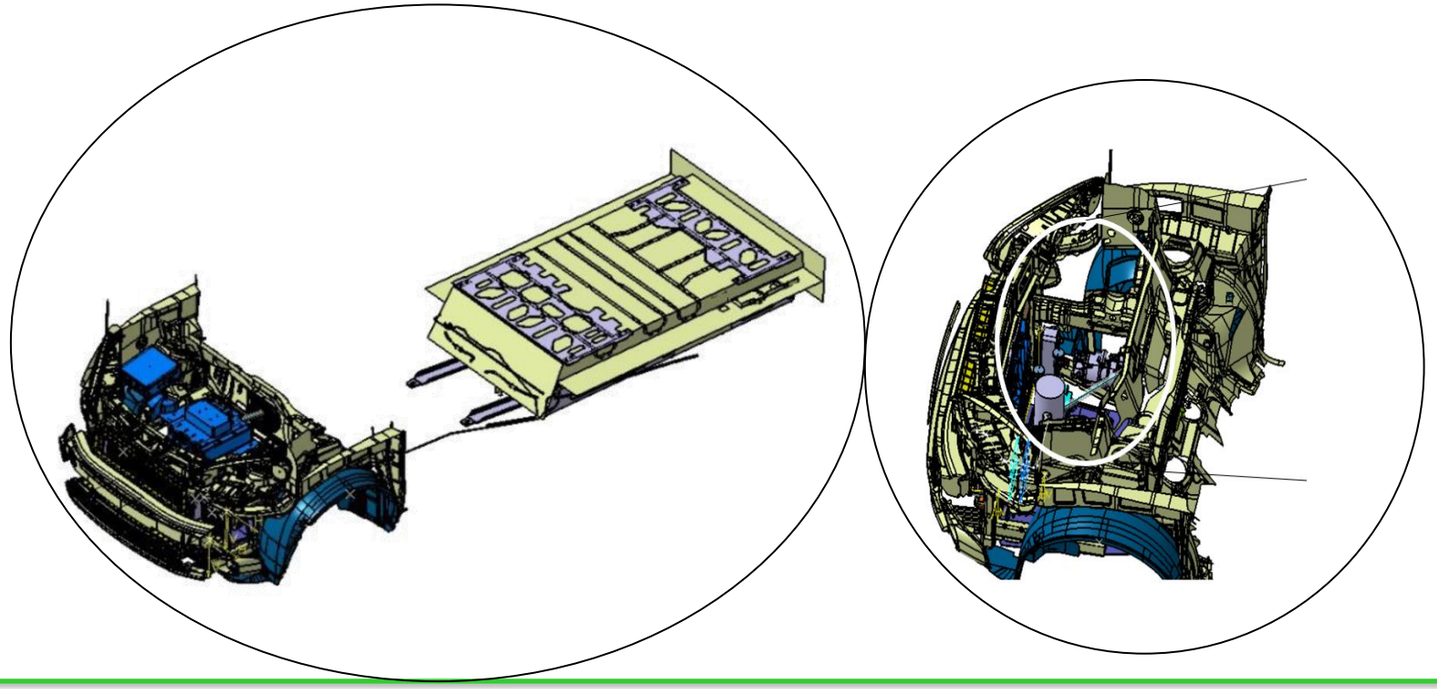
Achievements (cont.)

Design of the thermal management system

- Development of the thermal strategies (1D-modelling envi. software) at system level
- Design of the thermal packaging (hardware)



sketch of refrigerant loop



Achievements (cont.)

Integration and demonstration

- Testing of the baseline vehicle (Torino, Italy)
  - eNV2020: vehicle similar to the demonstrator vehicle
  - Standardized testing:
    - Cabin cooling demand & perf.
    - Cabin heating demand & perf.
  - Comparison with demonstrator vehicle in 2021

			Nissan eNV200
Brand		Nissan	
Model		eNV200	
Car Weight [std A - kg]		1667	
Traction		FWD	
Tires		185/65 R15	
Battery		**Motor**	**Electric**
Capacity [kWh]	40	Power [kW]	80
Max Nominal Tension [V]	406	Torque [Nm]	254
Min Nominal tension [V]	240	Motor Type	Synchronous Permanent Magnet
Weight [kg]		Max speed [rpm]	10500
Charging Time		**Transmissio**	
Home	21 h 30 m	Transmission type	1 -speed
Wall Box 7.4 kW	5h 30 m	Ratio	9.301
Wall Box 22 kW	Not available	Selector Type	Automatic
Wall Box 50 kW (Fast Charge)	40-60 m	Driving Type	Driving/Eco/Braking
Performance		**Declared values**	
Max speed [km/h]		123	
0 - 100 km/h [s]		14	
0 - 50 km/h [s]			
Consumption CEE 93116		**Declared values**	
Consumption [Wh/km]		165	
NEDC electric range [km]		280	
WLTP electric range [km]		200	

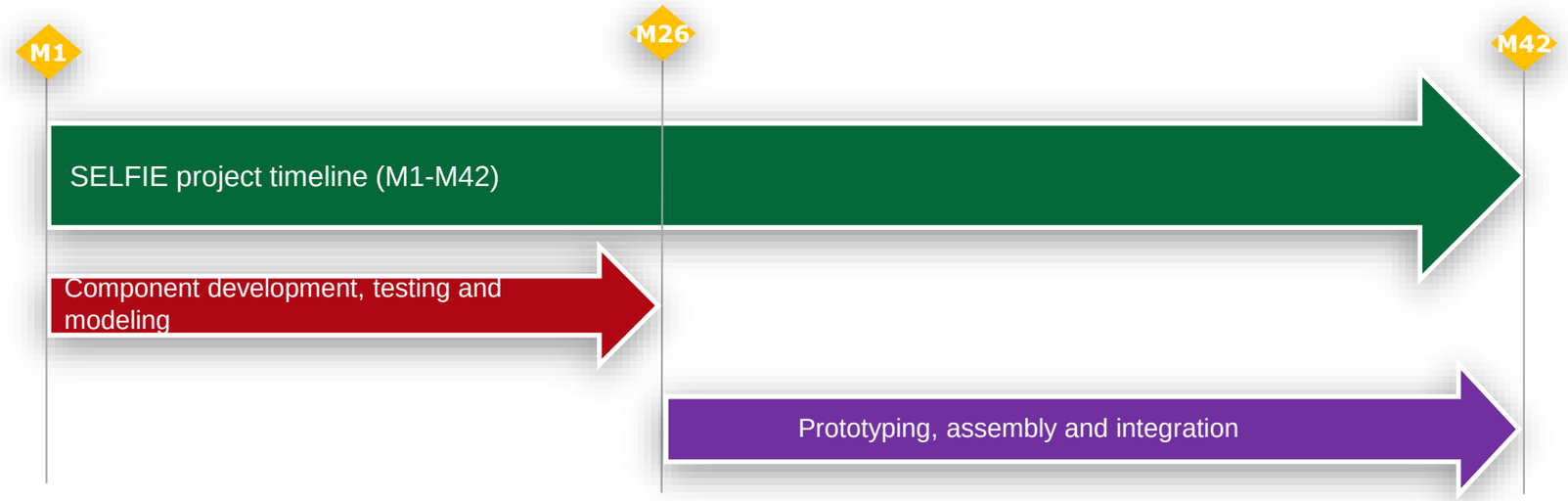
Project next steps

Next steps (technical)

- Battery system
  - Prototyping of the different components (PCM, cooling plates, etc.) & assembly of the battery system in **2021**
- Development and integration of the battery thermal management system
  - Optimisation of system thermal strategies (software envi.) & hardware test-bench development in **2021**.
- Vehicle integration and demonstrator setup
  - Complementary testing of the baseline vehicle & integration in **2021**.

Next steps (mid to long term impact of the project)

- Critical timing: M26
- Market introduction target: **2022**



Project next steps (cont.)

Dissemination

- Website
- Social Media: LinkedIn is active
  - LinkedIn
  - YouTube
- 3rd Newsletter published in October
- Flyer
- 10+ participation at Conferences and workshops
- Several open-access publications:
  - “Thermal management analysis using heat pipe in the high current discharging for lithium-ion battery in electric vehicles.” Hamireza Behi, Joris Jaguemont, *Journal of Energy Storage*. 2020.
  - “Heat pipe air-cooled thermal management system for lithium-ion batteries: High power applications.” Hamireza Behi, Joris Jaguemont, *Applied Thermal Engineering*. 2020.

Stay in touch!

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Thank you for your attention