







Industrial Modular Battery Pack
Concept Addressing High Energy
Density, Environmental
Friendliness, Flexibility and
Cost Efficiency for Automotive
Applications

## **iModBatt**

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 770054



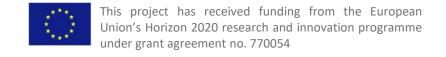
## iModBatt

- Coordinator: CIDETEC Energy Storage
- Overall budget: € 6.351.473,75
- Start date: 1 October 2017 End date: 30 September 2020
- Grant agreement ID: 770054

- 1 CIDETEC San Sebastián, Spain
- 2 Rescoll Pessac, France
- 3 **Tyva Energie** Annonay, France
- 4 Miba Laakirchen, Austria
- 5 Hexagon Studio Besiktas Istanbul, Turkey
- 6 RWTH Aachen University ISEA – Institute for Power Electronics and Electrical Drives Aachen, Germany
- 7 Freemens Grenoble, France
- Austrian Institute
   of Technology
   Wien, Austria
- (9) Cleancarb Sàrl Kopstal, Luxembourg
- ① e.GO Mobile AG Aachen, Germany
- 1) Accurec Recycling GmbH Krefeld, Germany

4 0 (12) 0 (8)

- Pro Automation GmbH Wien, Austria
- (3) CEA Paris 15, France
- (4) Renault
  Boulogne
  Billancourt,
  France



Funded under: H2020-EU.3.4. - SOCIETAL CHALLENGES - Smart, Green And Integrated Transport / GV-06-2017 - Physical integration of hybrid and electric vehicle batteries at pack level aiming at increased energy density and efficiency

The aim of iModBatt is to design and manufacture, with the minimum environmental impact, a high energy density modular battery pack (BP), which is flexible enough to be used in automotive

and small stationary applications.

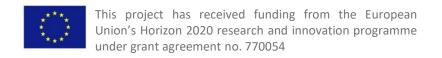
■ SO1: increase BP energy density around 20% compared to the current Renault Zoe EV BP.

• SO2: reduction of the BP integration cost > 20 % if compared to semi-manual assembly methods.

• SO3: BP design is led by European industry.

 SO4: BP design is ruled by eco design recommendations & recyclability.

• SO5: Additionally to Renault Zoe EV and an e.GO Life EV, second use and reuse scenarios are validated in a stationary energy storage application of TYVA.





# SO1: increase BP energy density by around 20% compared to the current Renault Zoe EV BP.

 Selection of Li-ion commercial high energy density cells for the defined application.

Manufacturer (distributors)	Model number
LG	INR18650 MJ1
LG	INR21700 M50
PANASONIC	NCR18650B
SAMSUNG	INR18650-35E
SAMSUNG	INR21700 48G
SAMSUNG	INR21700-50E
SONY*	21700 50EL
SONY	21700 52EM

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			CEA	AIT	RWTH	CID	
	LG	INR18650 MJ1	14	12	8	6	
	LG	INR21700 M50	14	0	8	6+12	
	PANASONIC	NCR18650B	14	12	8	6	
	SAMSUNG	INR18650-35E	14	12	8	6	
	SAMSUNG	INR21700 48G	14	0	8+12	6	
	SAMSUNG	INR21700-50E	14	12	8	6	
	SONY	21700 50EL	14+12	0	8	6	
	SONY	21700 52EM	14	0	8+12	6	

- BP effective packaging to fit to the available volume in the car while keeping modularity concept and energy density optimization:
  - ✓ Renault: 13 modules in 7S28P → 2 strings 13 modules in 7S14P
  - √ e.GO: 13 modules in 7S14P

		N						Power Dch [W]			lCells ner	Module Weight [kg]					Pack Weight [kg]	Pack Wh/kg	Pack Wh/L
eGo	<del>LG-INR21700 M50</del>	1	<del>14</del>	7	<del>14</del>	<del>24,90</del>	74,70	<del>69,72</del>	<del>411,6</del>	<del>245</del>	<del>98</del>	<del>7,43</del>	<del>308,4</del>	<del>153,7</del>	<del>78,15</del>	<del>1372</del>	104,13	<del>239,13</del>	<del>411,52</del>
eGo	LG-INR21700 M50	1	13	7	14	23,12	69,36	64,74	382,2	227,5	98	7,43	308,4	153,7	78,15	1274	96,69	239,13	411,52
Renault	LG-INR21700 M50	3	13	7	28	46,24	138,73	129,48	382,2	227,5	196	14,87	617,8	153,7	78,15	2548	193,39	239,13	417,42

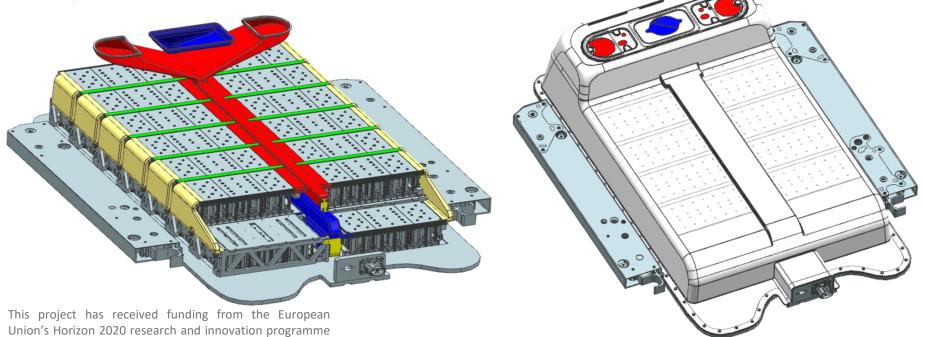
# SO1: increase BP energy density by around 20% compared to the current Renault Zoe EV BP.

- Design of a lightweight modular BP structure.
- Reduction of wiring due to the use of aluminum or copper connection layers on PCBs.

Use of low volume thin materials and thermal interface materials to improve thermal

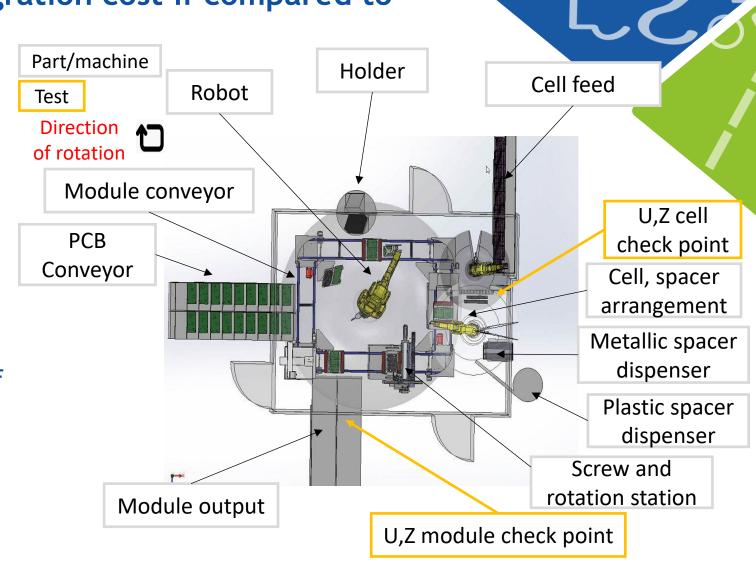
conductivity.

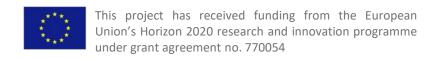
under grant agreement no. 770054



SO2: reduction of the BP integration cost if compared to semi-manual methods.

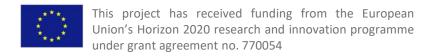
- BP module automated assembly.
- Cell flexibility per module decreases cell availability derived costs.
- BP modularity impacts on production flexibility.
- The increase in the time value of the BP due to the expected life extension reduces the BP production cost.





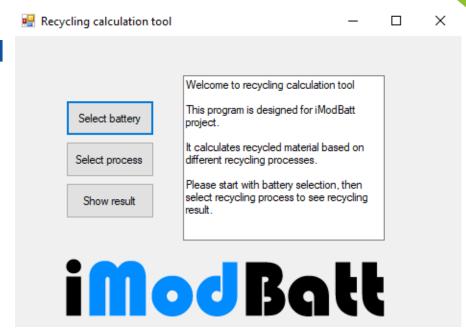
### SO3: BP design is led by European industry.

- TYVA (SME) is the leader of WP3 and WP5, focused on the electrical design and the module automated assembly accomplishment, respectively.
- Freemens (SME) lead the BMS customization and power electronics definition.
- MIBA (IND) is the leader of WP4, focused on the thermal design and more specifically, MIBA design & manufacture the main thermal HW (cooling fins-pipes device).
- Rescoll (SME) is the leader of WP7, focused on the modularity and flexibility validation for automotive application, second life and recycling.
- Accurec (SME) lead the recyclability analysis of the proposed battery pack modular concept.



# SO4: BP design is ruled by eco design recommendations & recyclability.

- A preliminary Life Cycle Assessment was defined and once the bill of materials is ready, it will be updated.
- The BP recycling study has been launched and will be customized for the iModBatt concept. A SW is configured to identify the best recycling method.

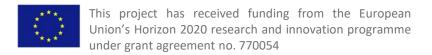


### Next steps in iModBatt in the next 6 months window:

- As a general pending topic, the achieved results evaluation must be compared to the expected results and analyze any deviation.
- Modules and BPs will be assembled and tested at lab level.
- BPs will be integrated and tested in the Renault and EGO vehicles.
- The automated module assembly design will be finished and built.
- The LCA and LCC will be updated according to the last data.
- The recycling tool will be fine-tuned.
- The BP disassembly methodology will be defined.

#### • What are the future research needs identified thanks to your EU-funded project?

- ✓ iModBatt included a side chapter on direct liquid cooling that could be interesting to foster.
- ✓ iModBatt focused on the design and manufacturing of an automated module assembly Unit, but work on the whole BP automated system would be necessary.
- How far are you from a market introduction?
- ✓ Our aim has been to build a realistic BP prototype. However, a more specific analysis on the selected structural materials would be necessary.
- What are the consortium plans to ensure a follow-up to the project activities?
- ✓ It is likely that iModBatt could be the reference for new coming H2020 proposals in 2020.
- ✓ Additionally 2 patent requests have been launched and could be the seed of new products.
- How much time has been gained thanks to the EU-financial support?
- ✓ Specially new expertise has been gained due to iModBatt. Partners faced new challenges that can now open up new business possibilities in new fields.



## Thanks for your attention!

imodBatt would be impossible without the team:



Coordinator: Iosu Cendoya **CIDETEC Energy Storage** 

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