BALIHT

Development of full lignin based organic redox flow battery suitable to work in warm environments and heavy multicycle uses

HIGREEW WORKSHOP – March 2, 2022

Dr. Vicente B. Vert

AIMPLAS – Plastics Technology Center

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 875637.
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The Project

- *Development of full lignin based organic redox flow battery suitable to work in warm environments and heavy multicycle uses*
- *BALIHT (Grant agreement ID: 875637)*
- *RIA - Research and Innovation action*
- *01/12/2019 – 30/11/2022*
- *LC-BAT-4-2019 - Advanced Redox Flow Batteries for stationary energy storage*
- *12 participants*
- *5 countries*

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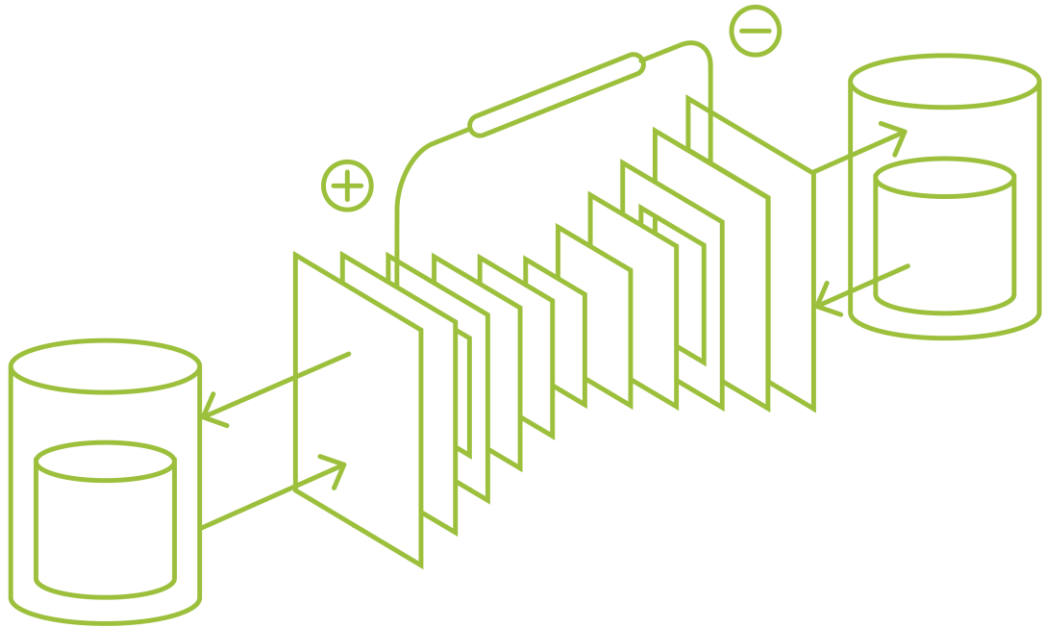
The Project

- ***Development of a new organic redox flow battery*** *suitable to work up to* ***temperatures of 80ºC****, with a self-life similar than current organic ones, but with an* ***energy efficiency 20% higher than current RFB***



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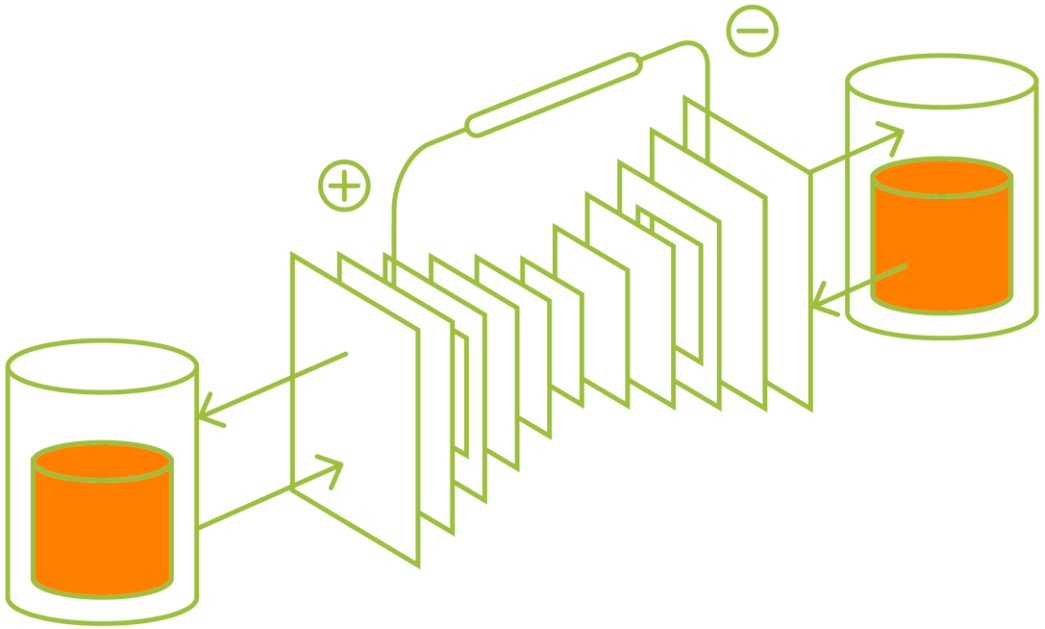
The Project - Innovations

- ***Development of a new organic redox flow battery*** *suitable to work up to* ***temperatures of 80ºC****, with a self-life similar than current organic ones, but with an* ***energy efficiency 20% higher than current RFB***

  - *New organic electrolytes (lignin-based, high temperature stable)*



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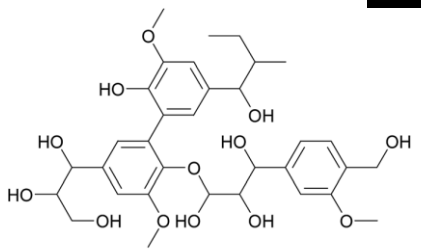
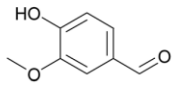
The Project - Innovations

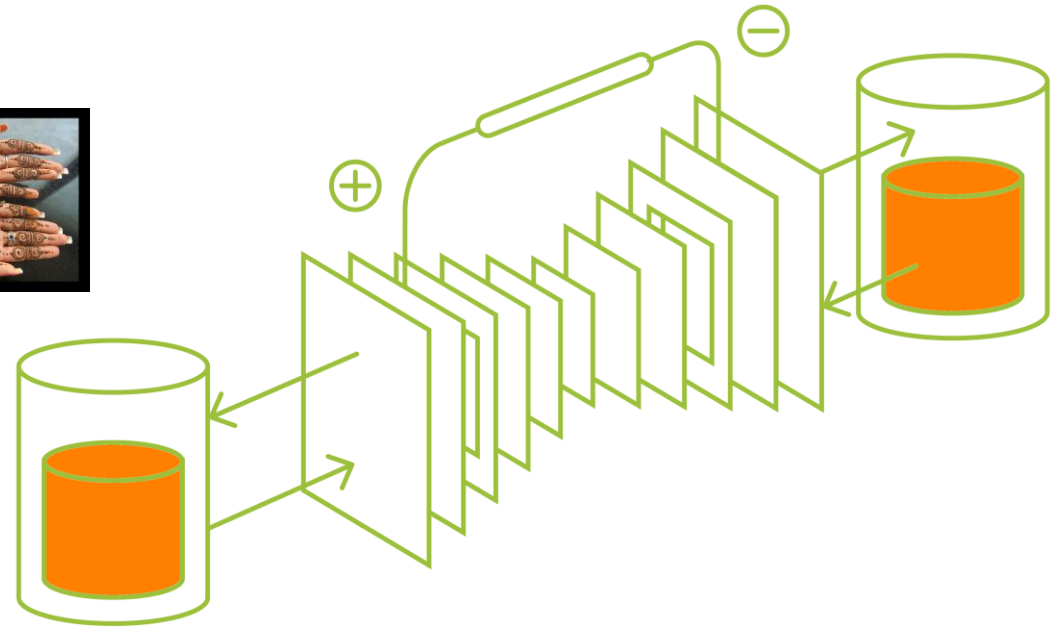
- *Alkaline (basic) media*
  - *Alternative to acidic Vanadium species*
- *Negolytes – Precursors*
  - *Vanilline (from lignin)*
  - *Lawsone (Henna dye)*
  - *Dicarboxilic acids*
- *Posolytes – Precursors*
  - *Aldehydes (from lignin)*
  - *Vanilline (from lignin)*



Lignin



Vanillin



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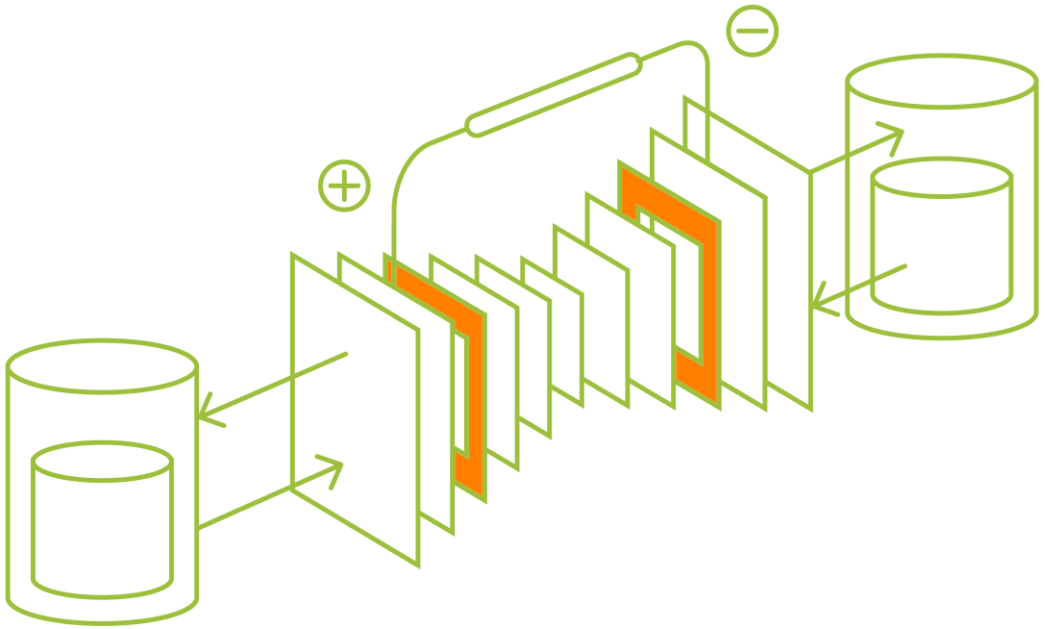

- *Thermal resistant plastic frames*

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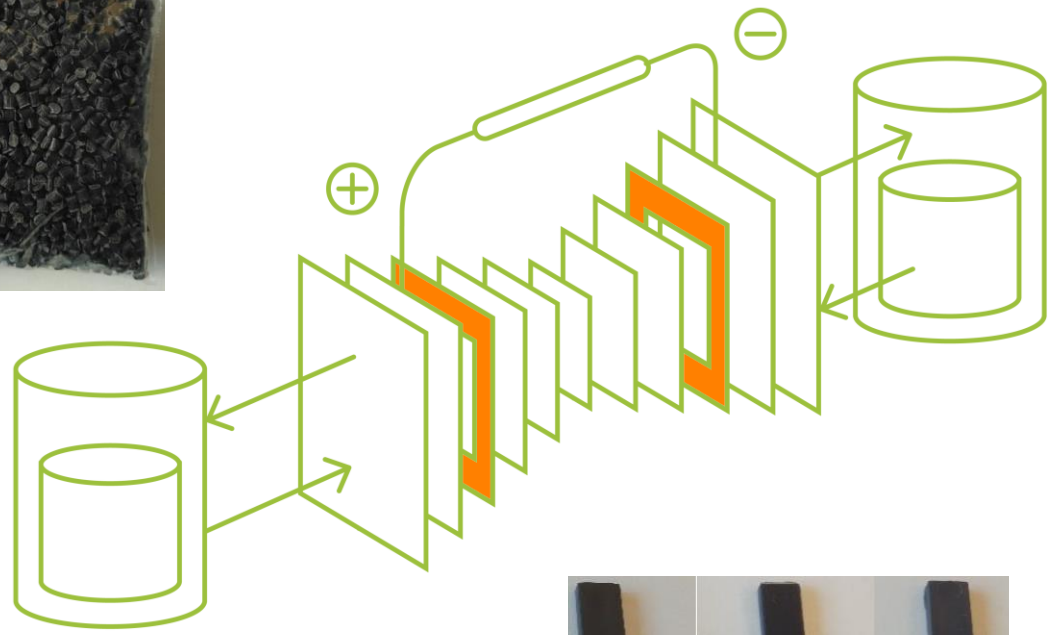
The Project - Innovations

- *Plastics with enhanced thermal stability*
  - *Increasing temperature could lead in creeping/CTE mismatch*
- *Nucleating agents – increasing crystallinity*
  - *Metal oxides / hydroxides*
  - *Minerals*
- *Fibers – increase mechanical stability*
  - *Natural (cellulosic)*
  - *Synthetic*
- *Cross-lining agents – post-treatment (recyclability)*
- *Microwave annealing – increase crystallinity*
  - *Inorganic and organic susceptors*



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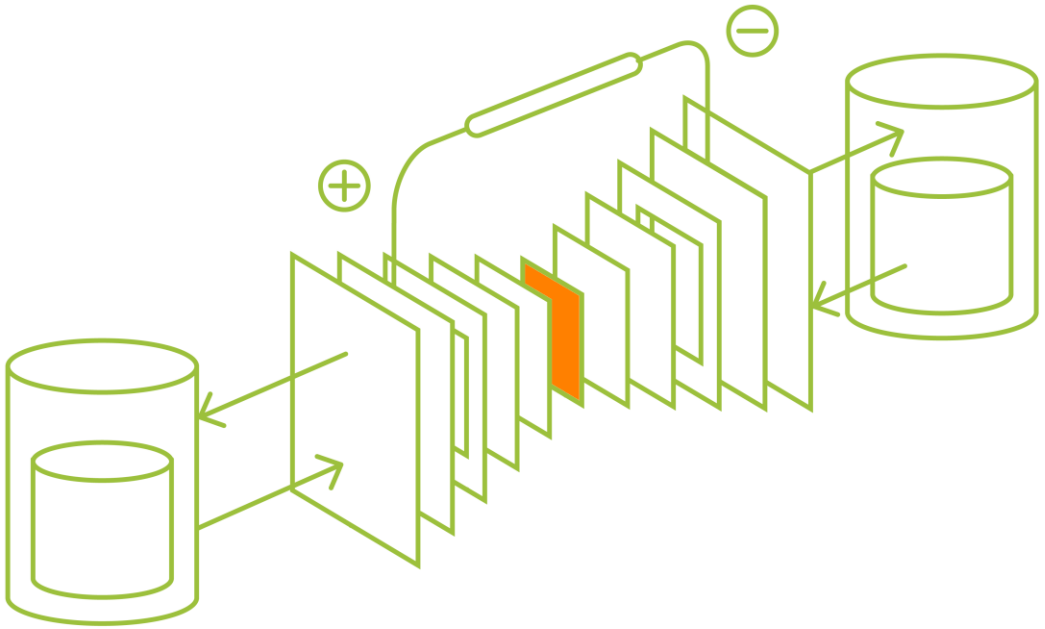

- *Non-fluorinated thin membranes suitable for new conditions*

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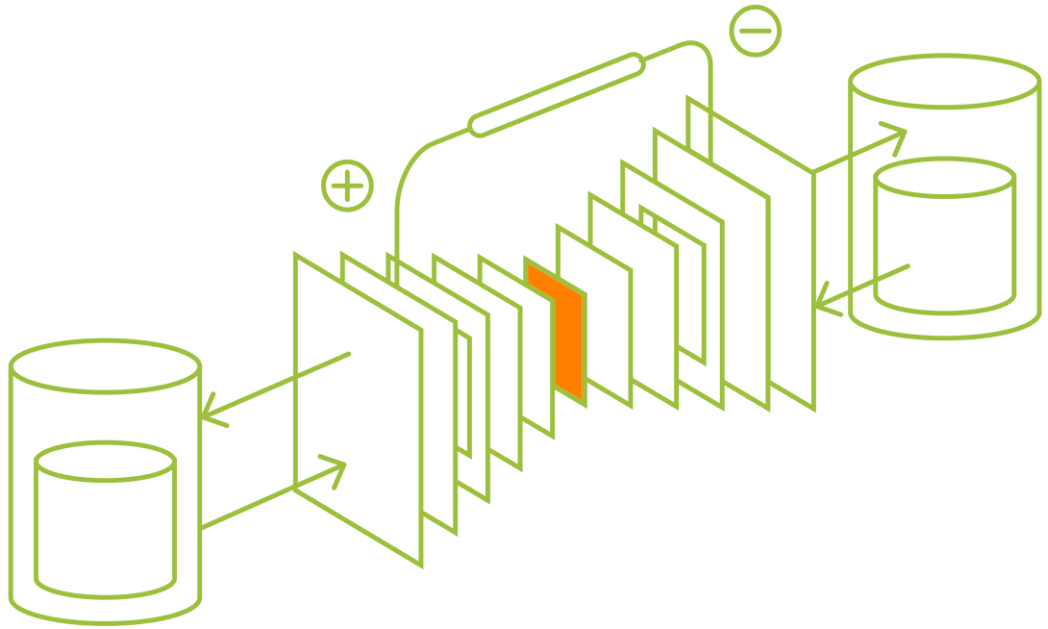
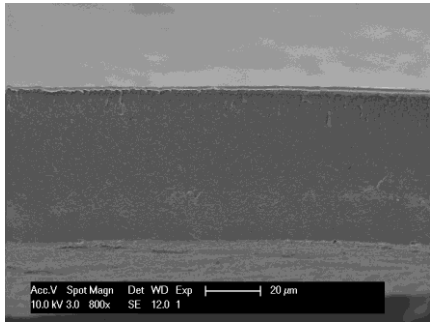
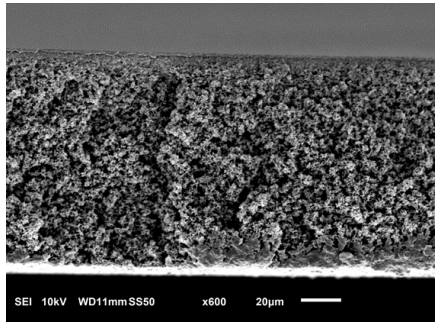
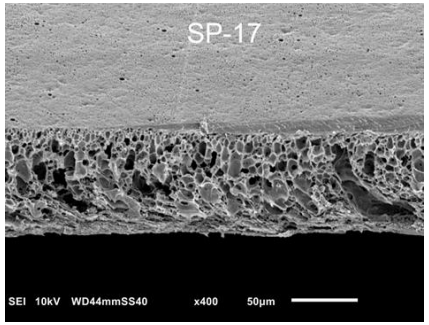
The Project - Innovations

- *Cationic membranes in basic media*
  - *Alternative to Nafion*
- *Polynorbornene (PN)*
  - *Stability in alkaline media*
- *Polyvinylidene fluoride (PVDF)*
  - *Controlled porosity*
  - *Increased mechano-chemical resistance*









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- *Flexible carbon-based extrudable electrodes*

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The Project - Innovations

- *Highly charged plastics*
  - *Decreasing “binder” content*
- *Carbon-based additives*
  - *Carbon allotropes*
  - *Particle shapes*
- *Direct processing*
- *Post-processing*
  - *Structure*
  - *Active layer*

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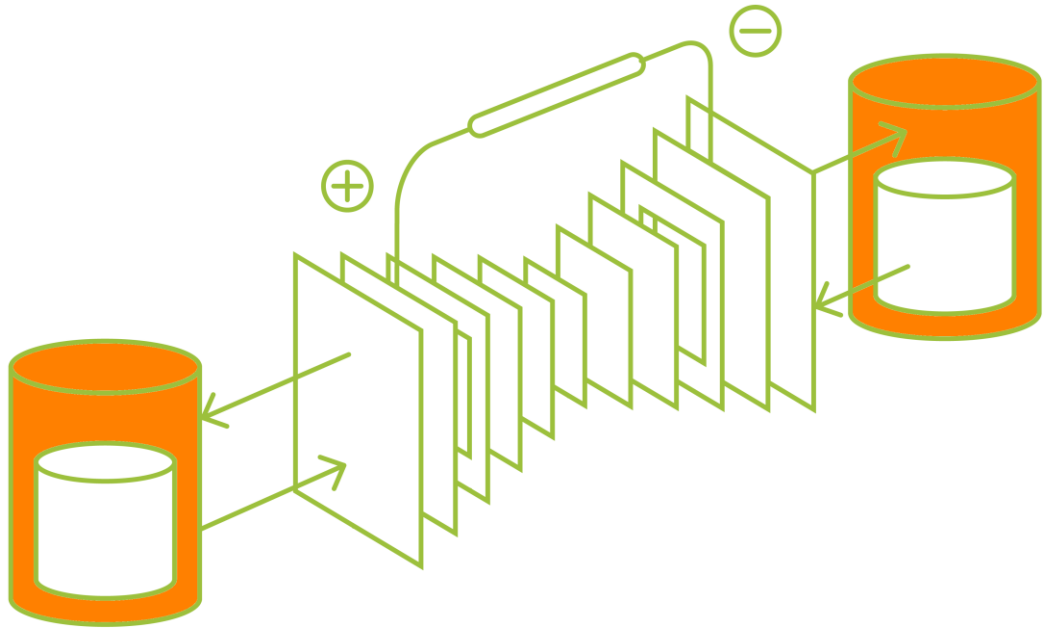

- *Large flexible tanks optimized for new lignin-based electrolytes*

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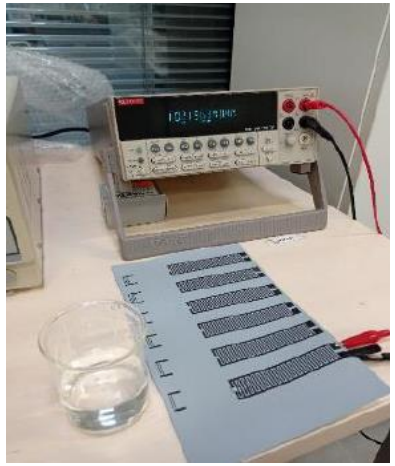
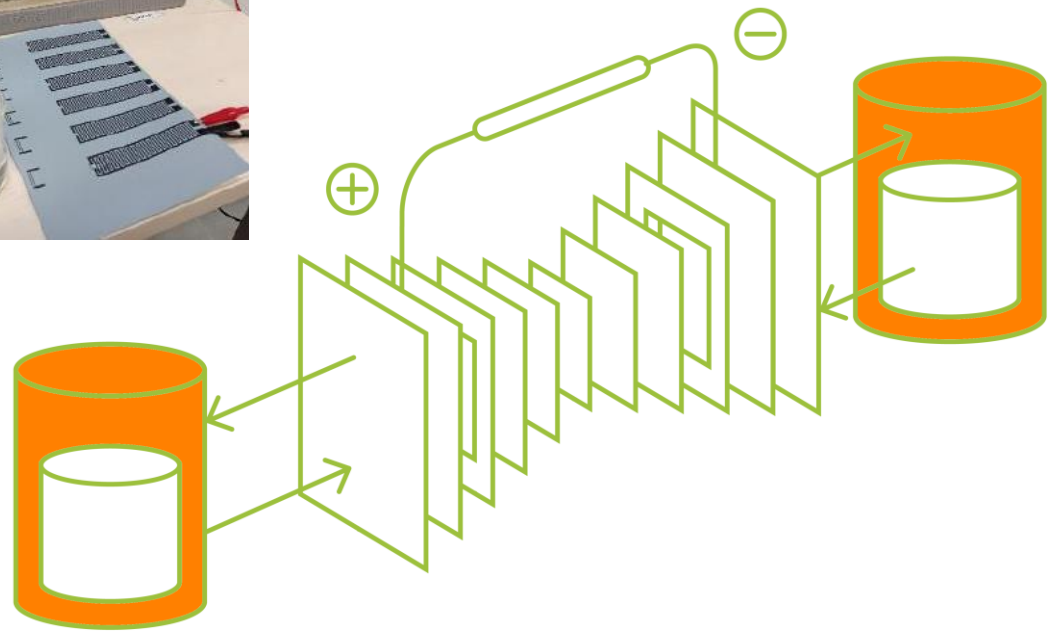
The Project - Innovations

- *Reinforced textiles*
  - *PVC-based coatings of polyester textiles*
- *High temperature resistant (up to 85ºC)*
- *Chemical resistant*
  - *Highly basic media and high temperatures*
- *Further coated with hydrophobic coatings & sensors*
  - *Also provide chemical protection (both directions)*
  - *Leakage control*





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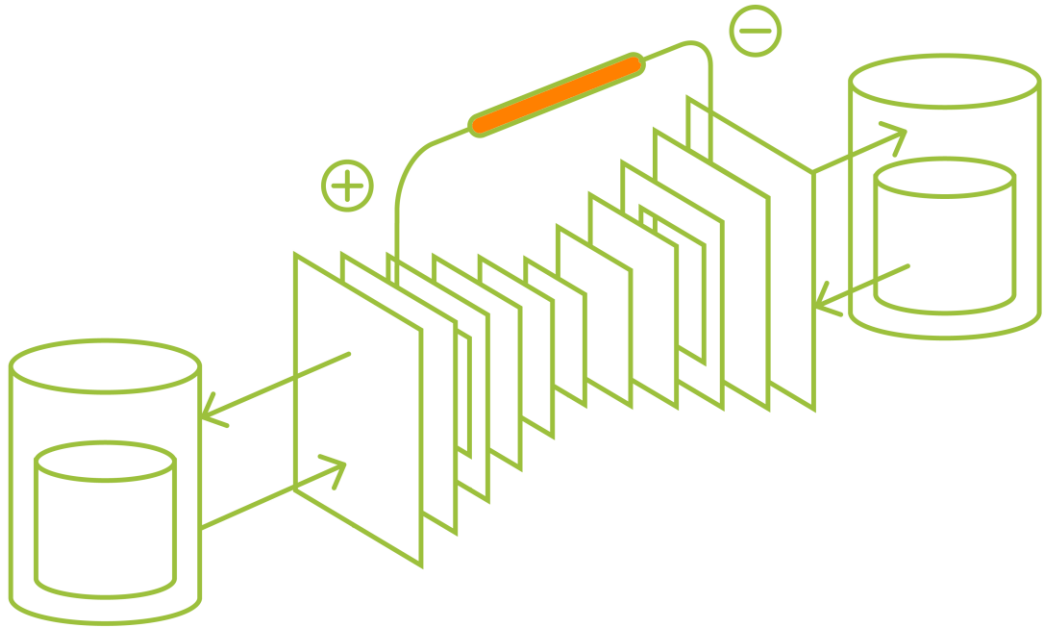

- *Tailored BMS/EMS for heavy cycling and warm environment*

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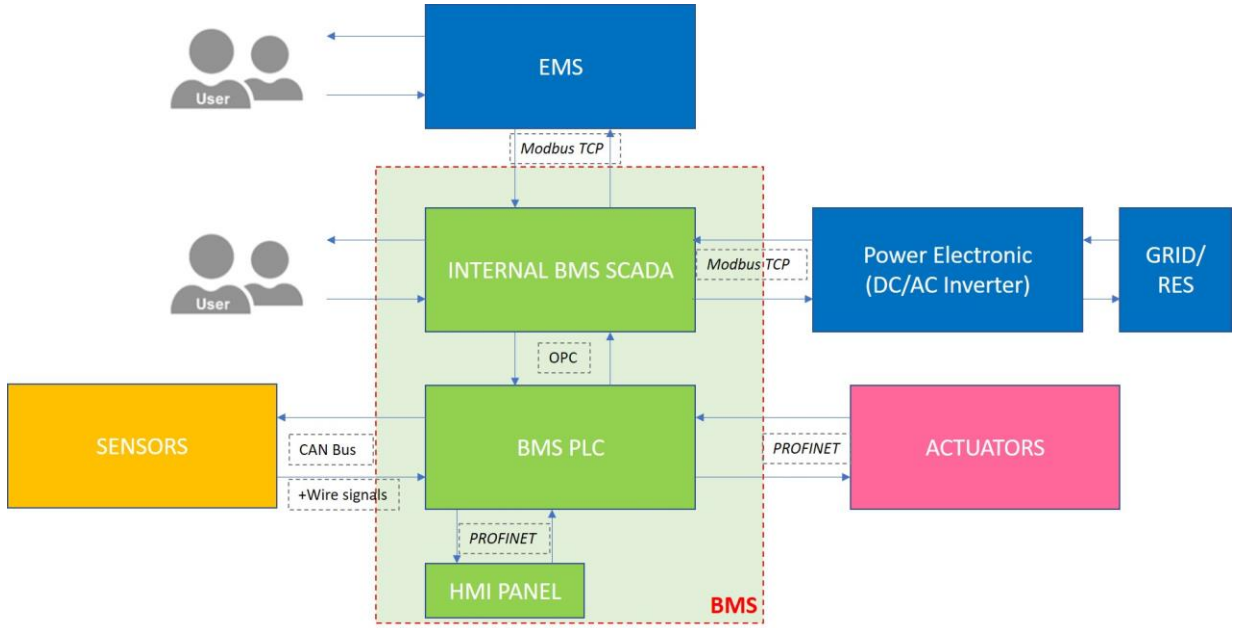
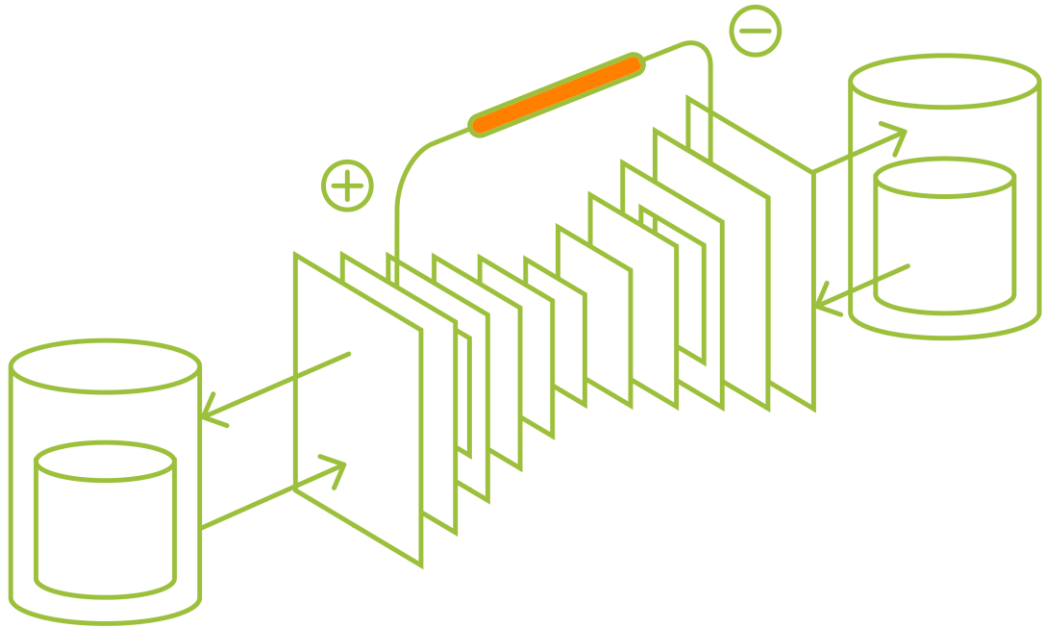
The Project - Innovations

- *Communication protocols defined*
- *PLC and HMI panel programs developed*





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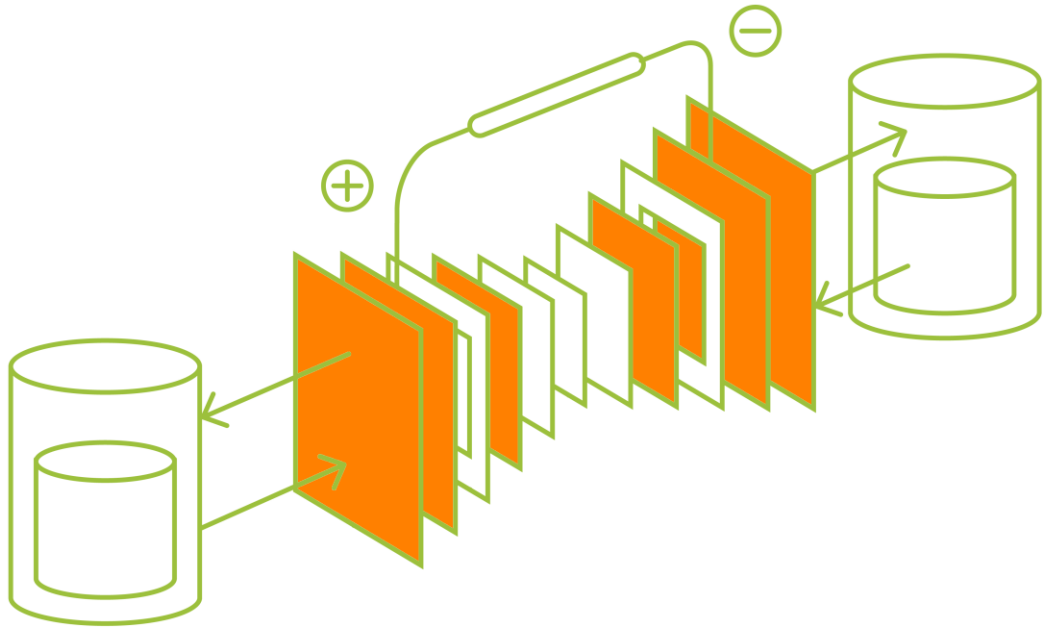

- *Re-design of cell stacking*

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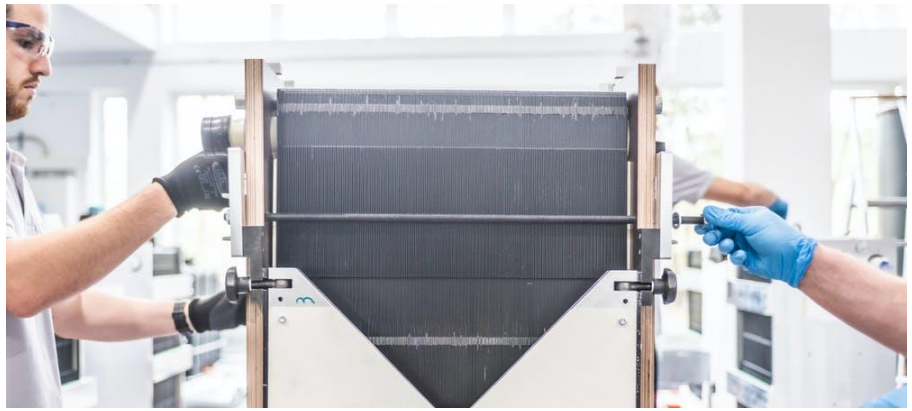
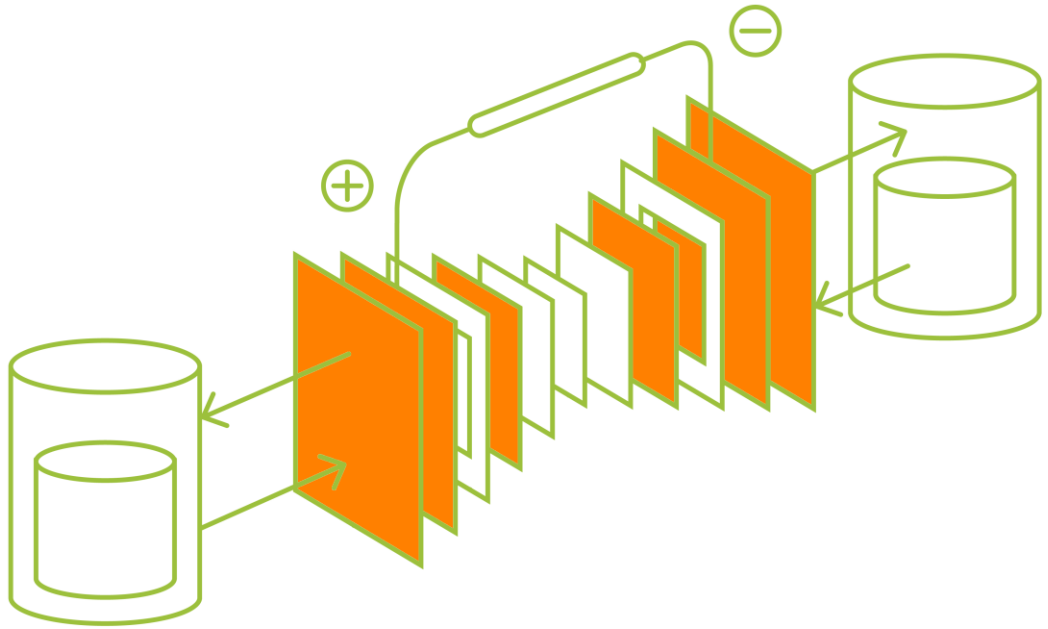
The Project - Innovations

- *Novel design to fit in selected location*
- ***CMBlu protected***
  - *Reduction of shunt currents*
  - *Reduction of risks in the event of leaks*
  - *Better serviceability, maintenance*
  - *Increased battery resilience*





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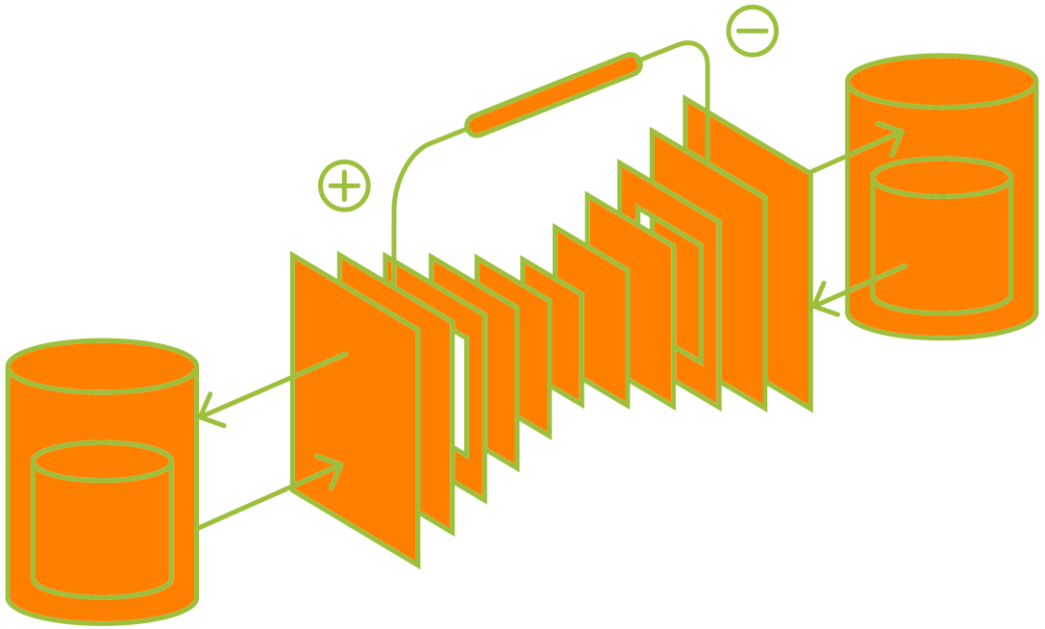

  - *New organic electrolytes (lignin-based, high temperature stable)*
  - *Thermal resistant plastic frames*
  - *Non-fluorinated thin membranes suitable for new conditions*
  - *Flexible carbon-based extrudable electrodes*
  - *Large flexible tanks optimized for new lignin-based electrolytes*
  - *Tailored BMS/EMS for heavy cycling and warm environment*
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The consortium

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The Project - Activities

WP1
Requirements
Use cases

WP2
Lignin-based
electrolytes

WP3
Battery
components

WP4
BMS
EMS

WP5
Prototype
installation

WP6
Impacts
assessment

WP7
Communication
Exploitation

WP8
Project
management

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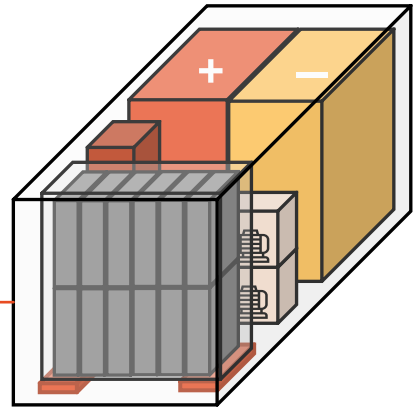
Prototype

BATTERY



100kW@200kWh

GRID

TRAFO

distribution board

PV

DC/AC

AC/DC

CHARGER

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PLASTICS TECHNOLOGY CENTRE

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Děkuji!

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