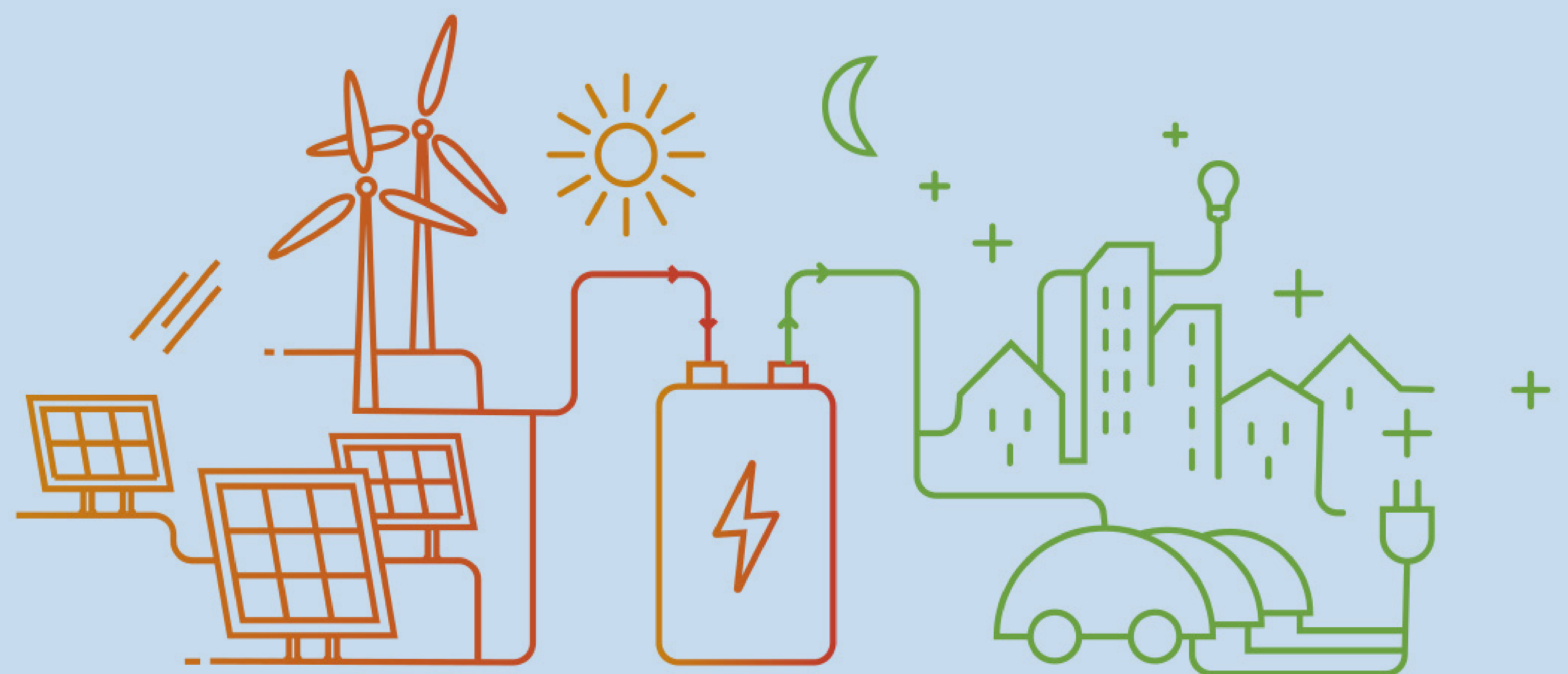


## Battery management system of full lignin based organic redox flow battery suitable to work in warm environments and heavy multicycle uses

### BATTERIES TO ENABLE A LOW-CARBON ECONOMY

With electrification being one of the main pathways to decarbonisation, batteries have a key role to play. At every moment, the consumption of electricity must be matched with the generation of electricity, which becomes difficult with non-continuous renewable sources. Batteries are therefore crucial to store energy when available and release it into the electrical grid when not.



The advantage of redox flow batteries technology is the absence of performance loss with frequent charging and discharging cycles.

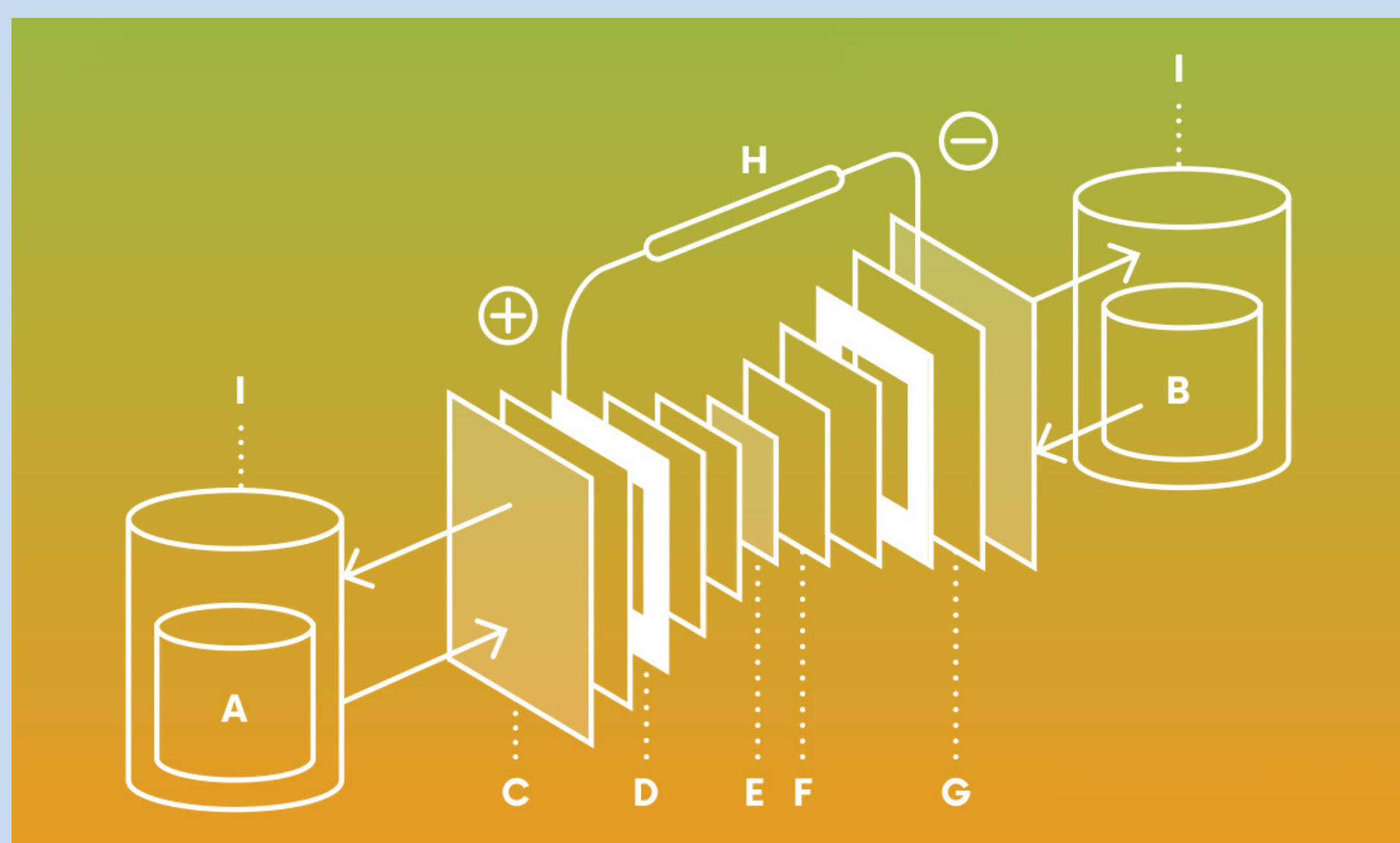
### MAIN INNOVATIONS

**Redox flow batteries are designed to work in temperature of up to 40°C and their electrolyte is based on rare and hard to obtain materials.**

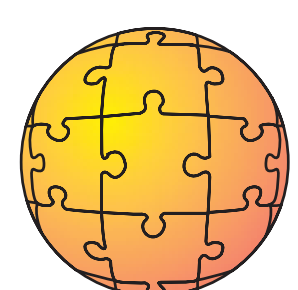
- Using the battery generates heat
- External cooling system is required
- Raw materials for electrolyte are not sustainable
- A demanding electrolyte life cycle problem from production to disposal
- Non-standard and difficult software integration

**BALIHT redox flow battery – developed to work up to temperatures of 80°C.**

- No need for external cooling system
- Maintains performance even in conditions of very frequent charging and discharging cycles
- Suitable for power networks with a high share of renewable energy sources
- Electrolyte raw material lignin is a waste material from the wood processing industry + It is widely available and has barely no alternative use
- Suitable for use in populated areas due to the favorable characteristics of the electrolyte
- Flexible open standards based battery management system (BMS) for easy installation in existing buildings and networks



- A – Catholyte
- B – Anolyte
- C – Cell frame
- D – Thermal resistance plastic flow frames
- E – Thin membranes technology stable up 80°C
- F – High-performance carbon-based electrodes
- G – Current connector
- H – Battery Management System for warm environments
- I – Flexible tanks for easy integration in renewables production facilities



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## A BATTERY MADE OF ORGANIC ELECTROLYTES AND INFLATABLE TANKS

Redox flow battery

- two tanks filled with electrolyte-fluids
- electrochemical reactions for charging and discharging: circulation of electrolyte through two half-cells separated by a membrane

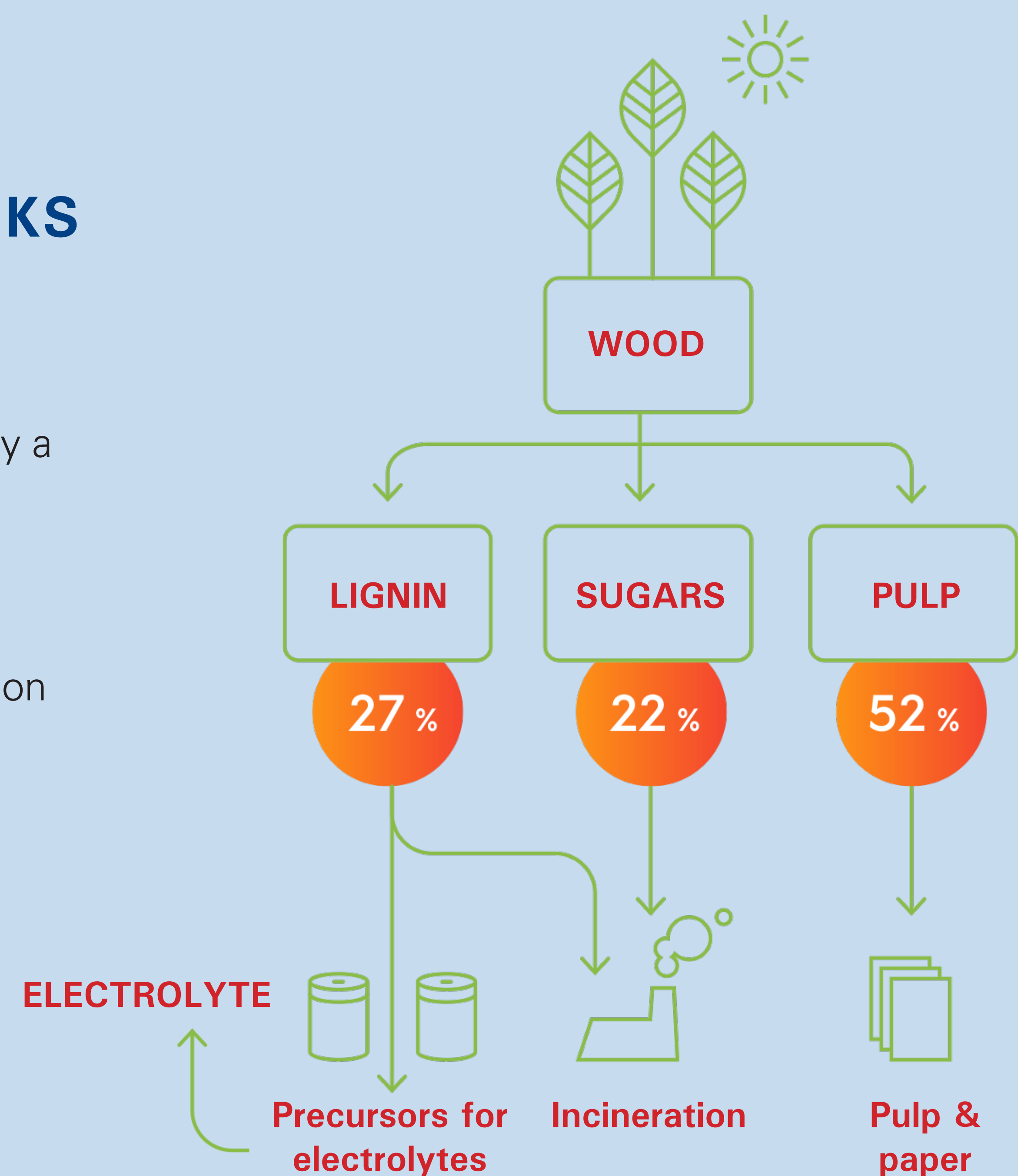
BALIHT battery – organic electrolyte: lignin

**Lignin** – a natural and renewable raw material

- available in sufficient amounts from existing pulp production

**Flexible tanks** – double wall flexible containers

- unlimited and modular size which will permit upscaling the battery's capacity

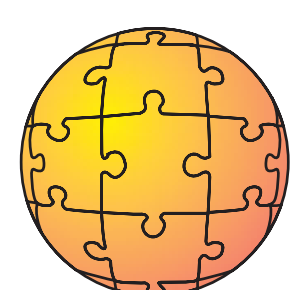
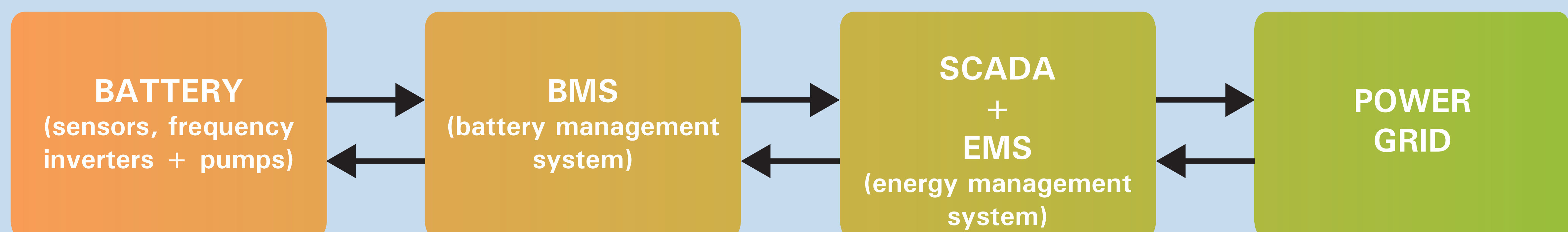


## BATTERY MANAGEMENT SYSTEM (BMS)

Analogue and/or digital electronic device consisting of hardware and software components that fulfils the following essential requirements:

- Data acquisition
- Data processing and data storage
- Temperature management
- Pressure management
- Flow speed management
- Safety management
- Acquisition of voltage and current
- Communication.

Redox flow battery's BMS main function is to control pumps which runs positive and negative electrolyte simultaneously and respectively runs charging or discharging of the battery. While pumps are not running, the battery remains at the last stage of charge. There are certain limits and requirements on different measurement values to be met while running the battery.



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