

# ERNEUERBARE ENERGIE UND DAS SPEICHERDILEMMA

**WERNER SCHLEMMER, STEFAN SPIRK**

Institute of Bioproducts and Paper Technology

Graz University of Technology, Austria

[www.cell-rocks.com](http://www.cell-rocks.com)

# Global challenge: Sustainable energy supply



**We need renewable materials to store renewable energy**

| wind | sun | tides

# Problems with green energy



| production fluctuates  
| transport to customers  
| **storage**



| grid stability, blackouts  
| back-up plants  
| environmental issues

# Large scale energy storage

**Pumped-storage hydropower** (3 GW, Bath County, Virginia)

**Compressed air energy storage** (110 MW, McIntosh, Alabama)

**Flywheels** (20 MW, Stephentown, New York)

**Lithium Ion Battery** (100 MW, Hornsdale, Australia)

**Hydrogen**



# Global challenge: Sustainable energy supply



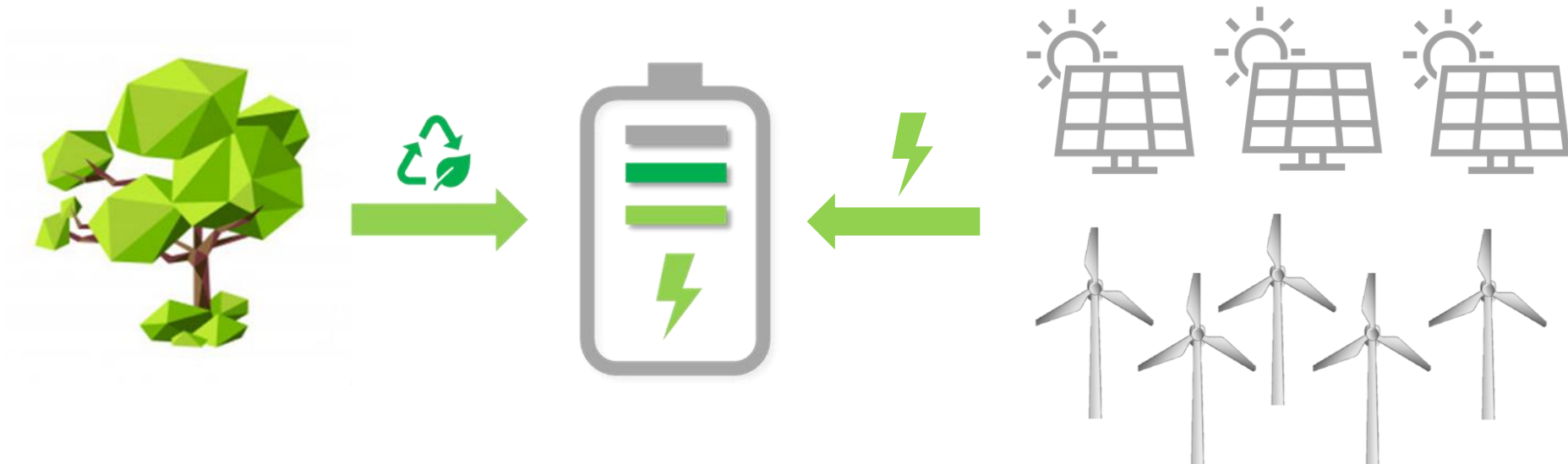
**We need renewable materials to store renewable energy**

| wind | sun | tides

**Wood valuable source for energy storage**

| binders | separators | carbon electrodes | **electrolytes**

# Ecolyte approach



- | waste materials from trees for energy storage components (i.e lignin)
- | large scale energy storage for renewable energy

# Redox-Flow Batteries



<https://www.vanadisbm.com/vrfb>

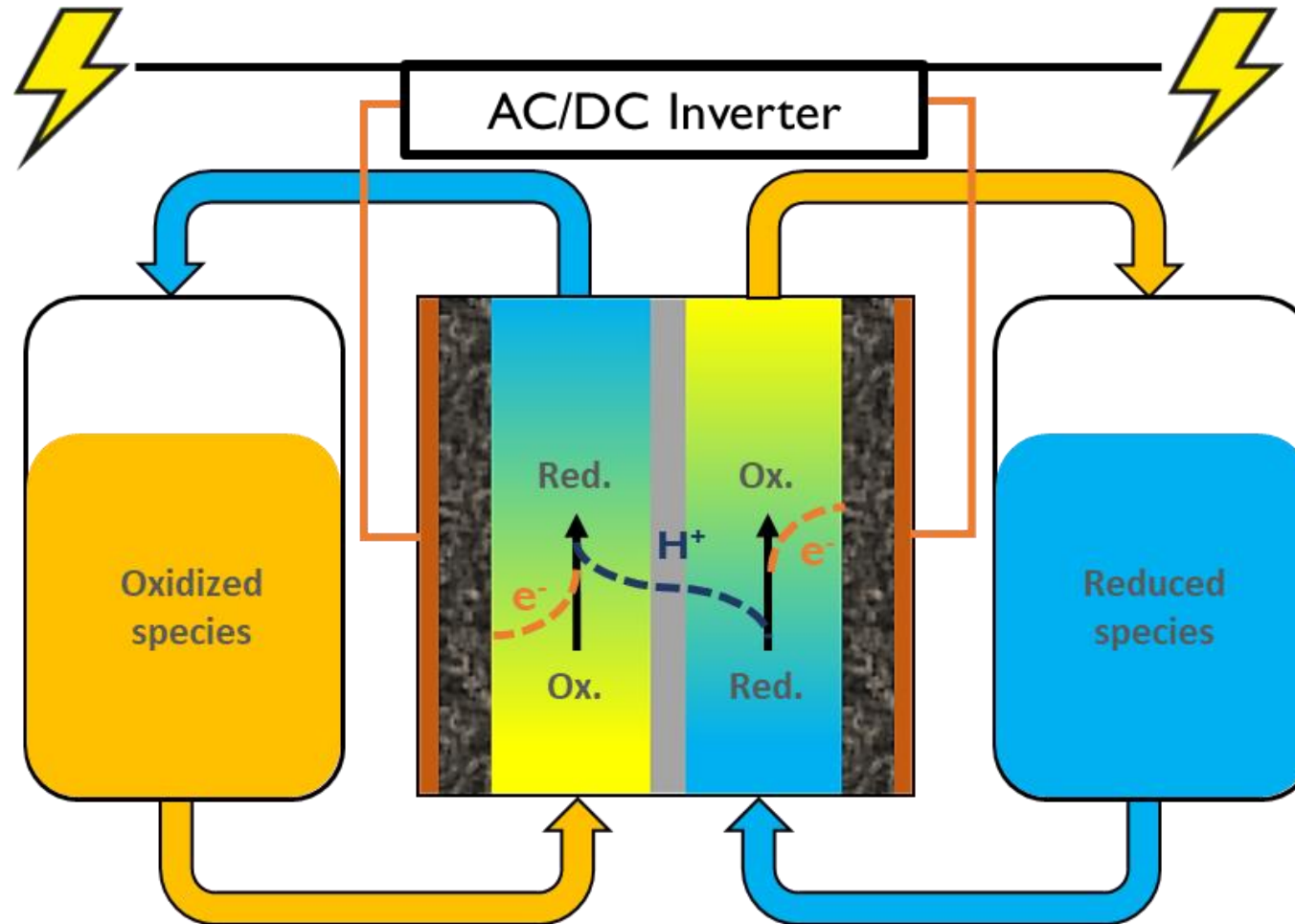


Dalian site China, 200 MW/800 MWh

- | Large scale energy storage
- | Stationary applications (backup for critical infrastructure, buffer storage)



# Redox-Flow Batterien



## Keyfacts

- | Energy density 40 Wh/l
- | Capacity  $\leftrightarrow$  V, c
- | Power  $\leftrightarrow$  Design,  $\Delta U$

## Current technology:

- | Vanadium (75%)
- | Zn/Br<sub>2</sub> (20%)

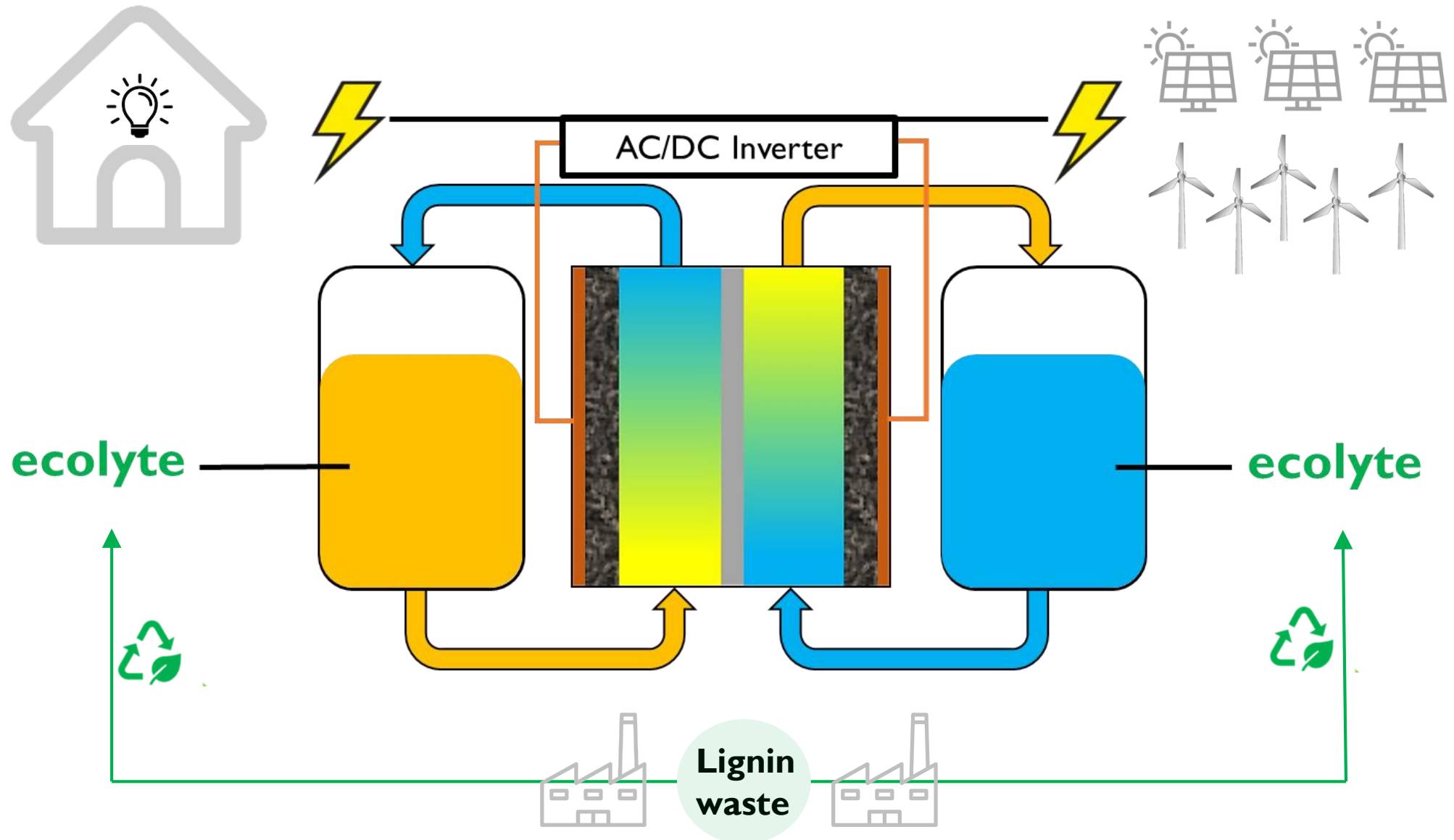
## Disadvantages

- | not renewable | availability
- | transport | corrosive |
- toxic | volatile price**

**Electrolyte accounts for 30-40% of RFB costs**



# Solution: eco-electrolytes for flow batteries



# Patented **ecolyte** Technology



- | Green chemistry
- | Tailor-made continuous flow reactors
- | Regionally available and renewable (average pulp mill: 100000 t lignin /year)
- | Safe handling and recycling
- | Compatible with battery technology

# Ecolyte Process - Flow Chemistry

## **Two reactors, fully scalable**

- | small, continuous production of 1-5 kg/hour
- | large scale continuous production of 160 kg/hour
  
- | process optimization to increase yield and efficiency
  
- | **our advantage: reactor technology and conversion developed without companies**



# Performance of electrolyte full cells

- | Decomposition due to oxygen from air
- | Coulomb efficiency 100%
- | stable over several hundreds of cycles
- | high capacity retention

# Summary

We need sustainable storage technologies

- | renewable
- | regional
- | safe handling
- | scalable

# Summary

We need sustainable storage technologies

- | renewable
- | regional
- | safe handling
- | scalable

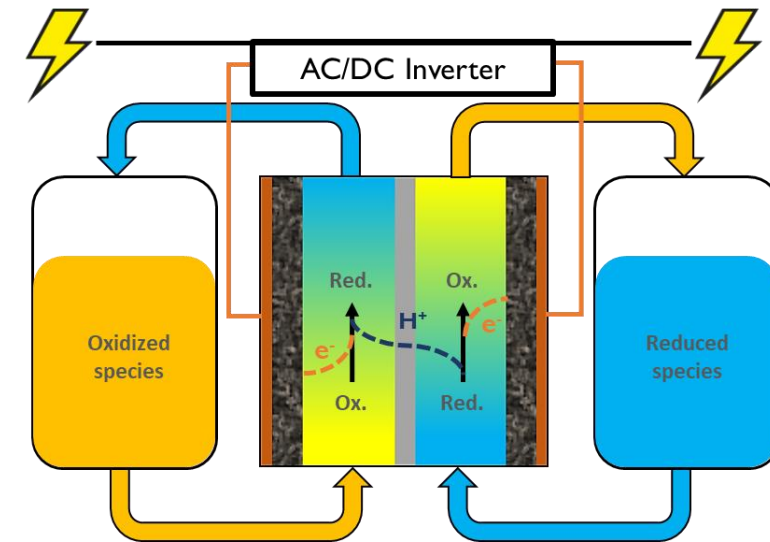




# Summary

We need sustainable storage technologies

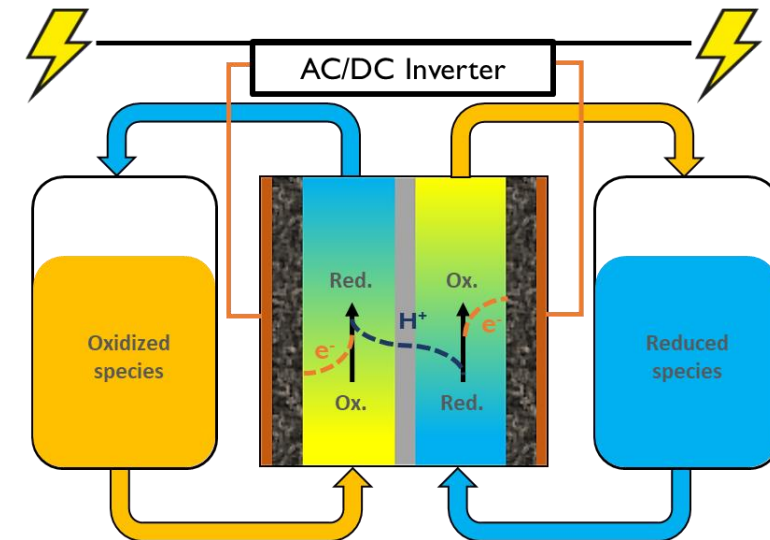
- | renewable
- | regional
- | safe handling
- | scalable



# Summary

We need sustainable storage technologies

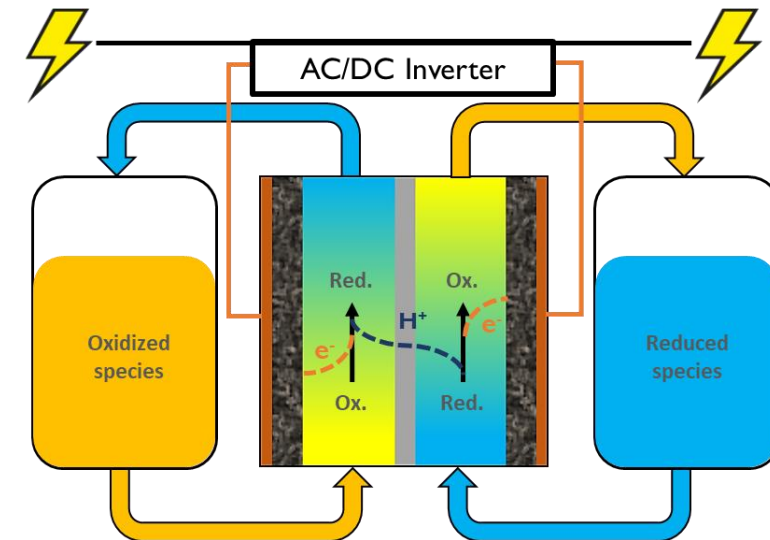
- | renewable
- | regional
- | safe handling
- | scalable



# Summary

We need sustainable storage technologies

- | renewable
- | regional
- | safe handling
- | scalable





# ecolyte Team



**Stefan Spirk**  
CEO  
Prof. in Biobased  
Materials  
Technology



**Werner Schlemmer**  
Chief Technology  
Officer  
PhD in Chemistry



**Georg Rudelstorfer**  
Chief Process Design  
and Developer  
PhD in Process  
Engineering



**Wolfgang Bauer**  
Marketing & sales  
director  
Prof. in Pulp and  
Paper Technology



**Dieter Wurm**  
Marketing & sales  
vice-director  
Market expert



**Leo Arpa**  
Mentor  
Head R&D Mondi,  
Pulp & Paper industry



**Matthäus Siebenhofer**  
Mentor  
Prof. in Chemical  
Engineering,  
TU Graz

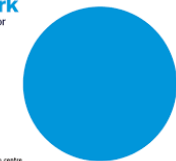


**Wolfgang Zitz**  
Mentor  
Former VP Magna

## Partners



Science Park  
The High Tech Incubator  
Graz





THANK YOU