# SABATLE - Safety Assessment of Flow Battery electrolytes

**2nd BioNanoNet Gold Member Webinar**
31st May 2022

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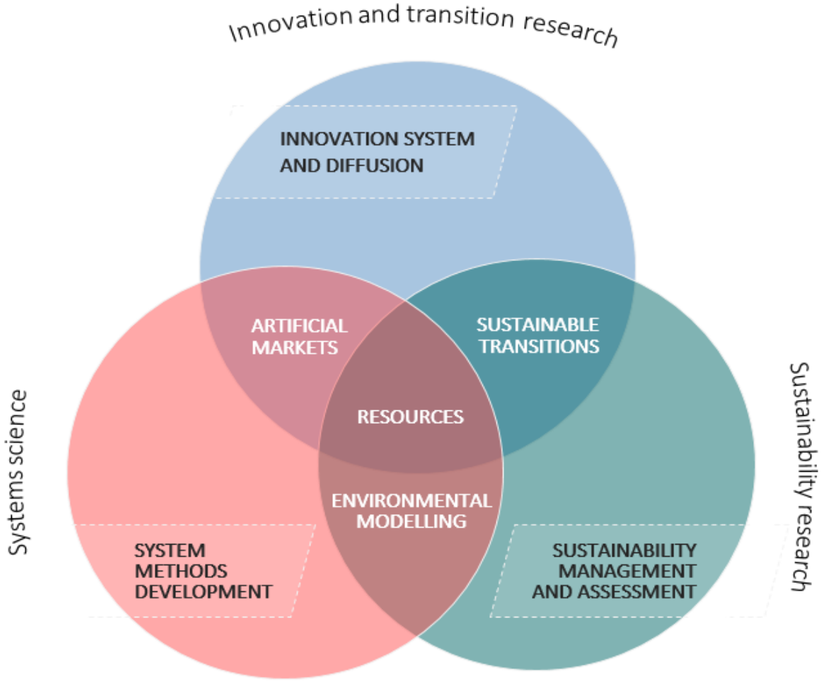
# Institute of Systems Sciences, Innovation and Sustainability Research

## Working Group „Bioeconomy research“

- Prof. Tobias Stern with 3 PostDoc researcher, 6 PhD students and 2 study assistants

- **Research focus**
  - Innovation in the forest-based sector in the light of climate change and circular economy
  - Sustainability and market-related research in public-private research and demonstration projects on bioeconomy
  - Market-diffusion of bio-based innovations
  - Transition towards bioeconomy: indicators, forces, interventions

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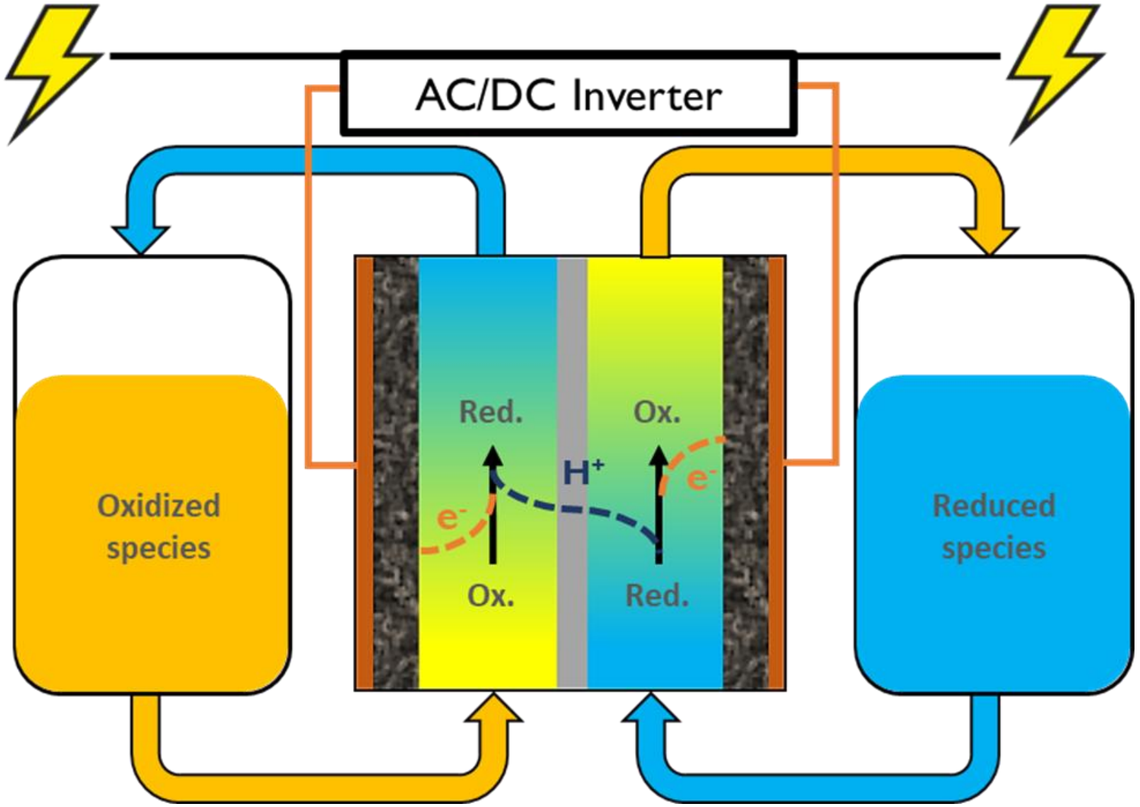
# SABATLE - Safety Assessment of Flow Battery electrolytes (2021-2022)

SABATLE

# Assets of Flow Batteries




Advantages:

- Independent design of power & storage capacity
- Easy scalability to MW regime
- No self discharge
- No capacity fading during cycling
- Long lifetime (20 years+)
- Long discharge times (4-8 h)

Current technology:

**Vanadium flow battery (80%)**

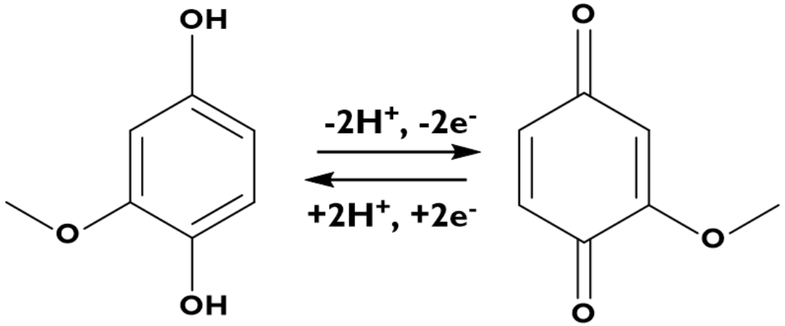
Disadvantages:

- Vanadium availability and price
- Environmental issues

# The patented Lignin/Vanillin based Battery

Lignin

Vanillin




2-methoxy-hydroquinone

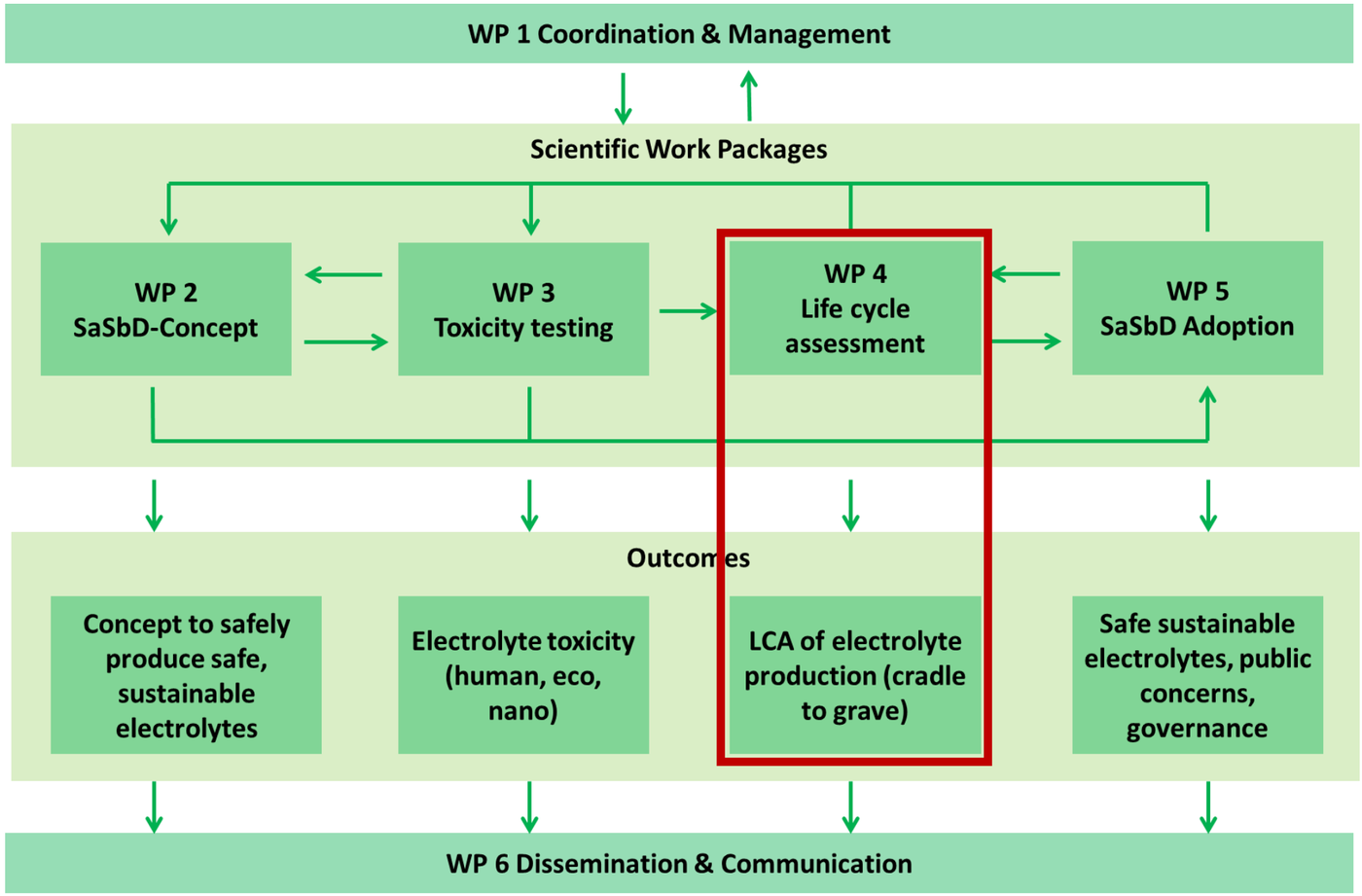
2-methoxy-quinone

Eur. Pat. Appl. (2021), EP 3828975 A1,
PCT Int. Appl. (2021), WO 2021105322 A1

- Tailor-made continuous flow reactors
- Regionally available and renewable (average pulp mill: 100000 t lignin /year)
- Compatible with existing battery technology
- Different types of synergies of SABATLE with other national projects
- Startup was founded in 2022 to commercialize technology (ECOLYTE)

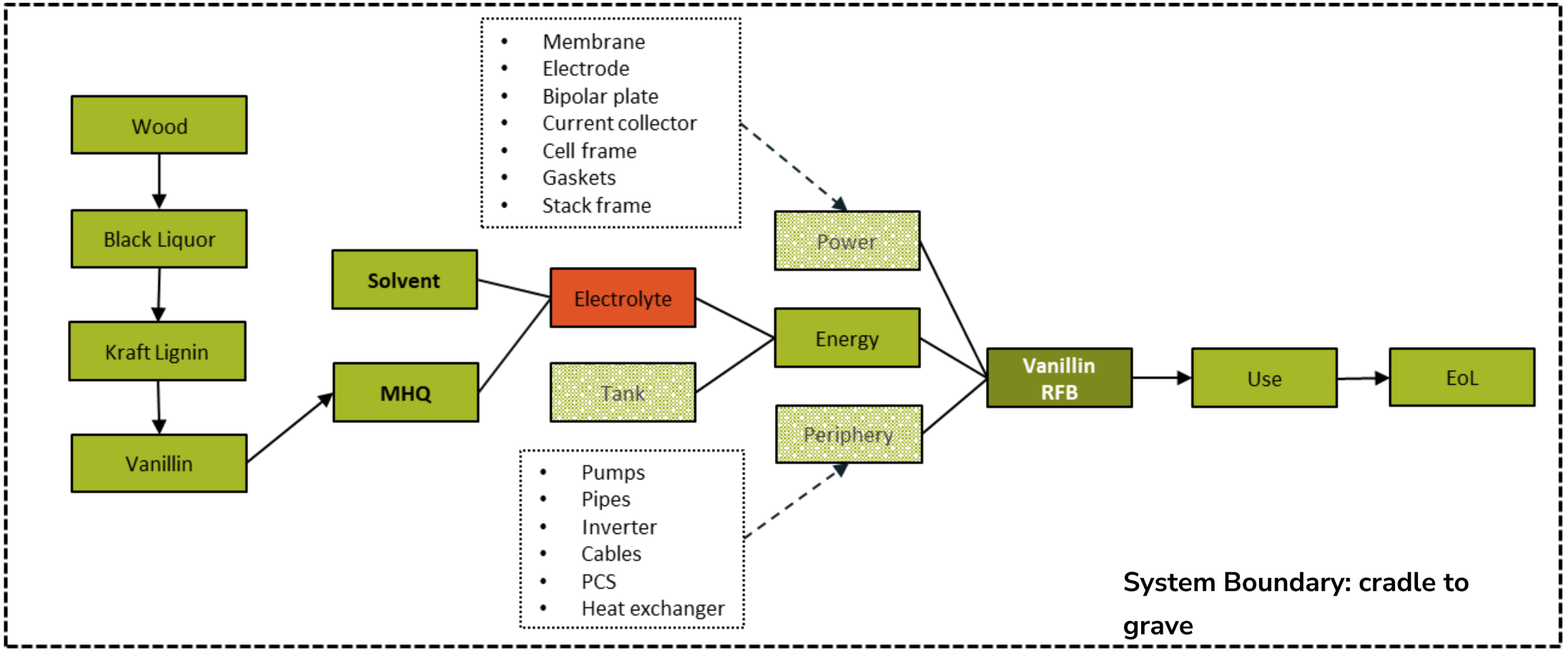
# Goal and Work Packages

- How safe (or dangerous) are current redox flow battery electrolytes?
- How safe are emerging organic flow battery electrolytes from lignin?
- Implementation of safe-and-sustainable-by design principles to mitigate environmental and toxicity impacts



# Life Cycle Assessment

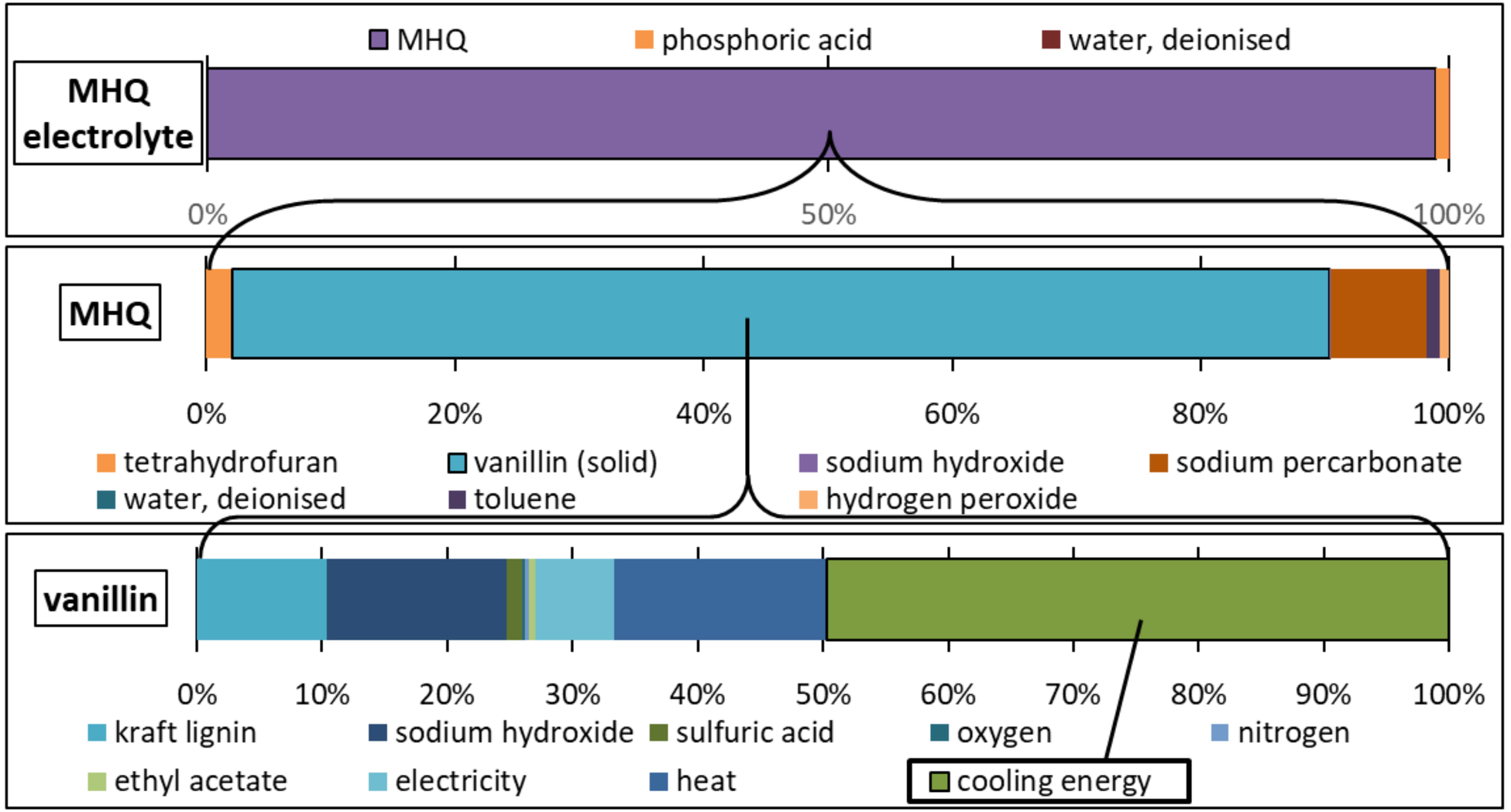
## Goal and Scope Definition




**Functional unit** : 1 MW power, 20 years lifetime of battery, vanadium vs Lignin

# Life Cycle Assessment

## Preliminary Results (work ongoing)



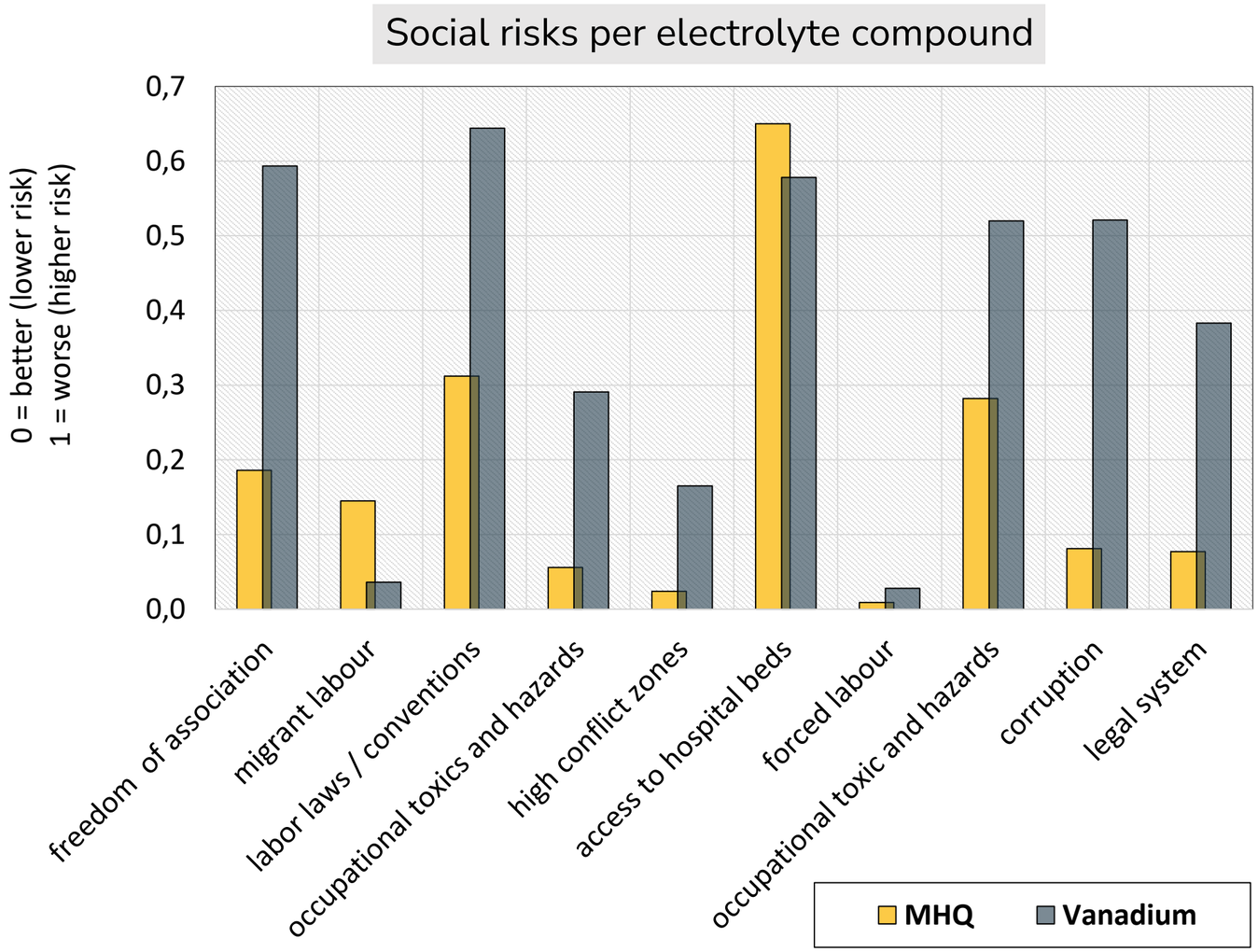

GWP hotspots of the MHQ electrolyte

Relative contribution of unit processes to the respective reference flows.

# Social Life Cycle Assessment

## Preliminary Results (work ongoing)

- Social risks and opportunities in the value chains of lignin and vanadium
- Geographic, sectoral or company-specific context more important than the processes itself
- **Which countries are affected?**
  - **Vanadium:** Russia, South Africa, Brazil, China, Kazakhstan
  - **Lignin:** Sweden, Finnland, USA, Canada



# Discussion and Outlook

**The final results will …**

- … avoid / mitigate unintended negative effects
- … provide a general understanding of the potential sustainability risks of using lignin in energy storage technologies.
- … support the sustainability-oriented development of novel energy storage technologies.

**Outlook**

- finalize the generic SLCA and the streamlined ELCA
- analyse uncertainties for all assessments
- synthesis of results of all WPs
- publish some of the results

# Contact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# Role of BNN in SABATLE

**BNN contact:** Clemens WOLF

**Role of BNN / BNN contribution: Task SaSbD-concept for SABATLE**:

- Creation of a Safety- and Sustainability-by-Design concept that serves as a guideline for safer and more sustainable electrolytes to be manufactured
- The concept will then be applied to the project's modification of electrolytes and processes in an iterative approach.
- Thus, BNNs concept underlines the project framework and guides the project towards a safe and sustainable innovation.

https://projekte.ffg.at/projekt/3845778