Project Title: International Collaborative Study on Next-Generation Grid-Ready Redox Flow Battery Using Nonmetallic Charge Storage Materials (2024-2027*) *scheduled

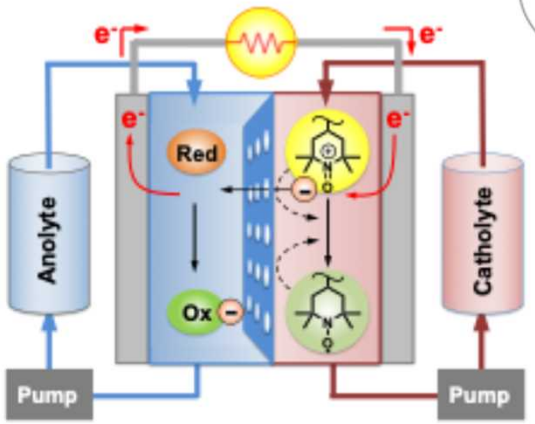
Entrusted Party: Waseda University

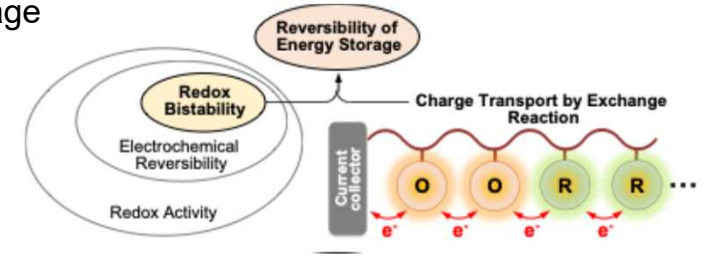
Outline of the Project

Background: There is a need to develop next-generation redox flow batteries (RFBs) for the grid to make renewables main energy sources by 2050 in order to drastically reduce greenhouse gas emissions.

Objective: Develop energy storage materials that don't rely on metals and achieve an all-organic, large capacity, and environmentally-friendly RFB.

R&D Targets: Investigate the concept of bistability related to high-rate, high-density charge and ion storage by organic polymers and create innovative electrolyte solutions for organic RFBs.

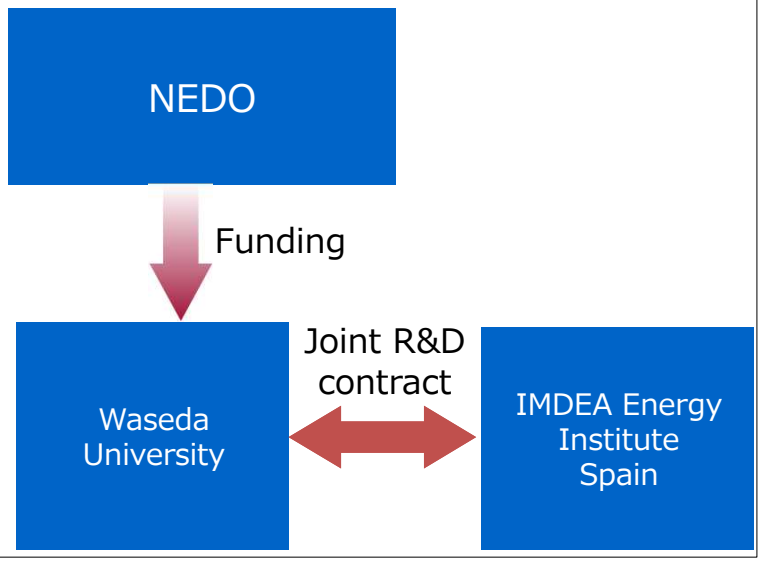




Bistability: highest form of redox activity. Continuous exchange reactions in bistable organic materials lead to reversible, high-density energy storage.

Nonmetallic, All-Organic RFB: batteries using bistable redox polymer solutions and nanoparticle colloidal dispersions as flow active materials.

Project Scheme

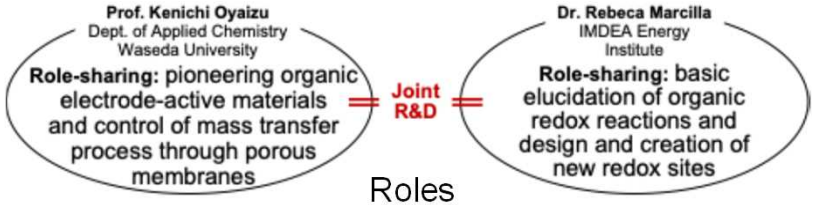


Significance of International R&D

Nonmetallic, organic RFBs cannot be acheived without international collaboration because:

1. Medium- to large-scale demonstration is necessary for real-world social implementation
2. Redox bistable materials need to be standardized and new types developed

IMDEA has expertise designing and synthesizing related materials and is therefore an ideal partner for international joint R&D.



Expected Outcomes

Practical applications in 2040 and beyond

- Reduce reliance on rare earth elements through international establishment of large-scale organic energy storage technology
- Predicted CO_2 reduction of 10 million tons per year

Expected RFB characteristics

- **Safe:** will use neutral aqueous electrolytes that have low environmental impact, are non-toxic, easy to dispose of and replace, and don't need acid resistance for electrode, cell and tank materials
- **Low cost:** under 5,000 yen/kWh
- **High performance:** energy density over 300 Wh/kg, over 10,000 charge/discharge cycles
- **Scalable:** materials and large-scale cell demonstration with stable electrolytes and shelf life over one year