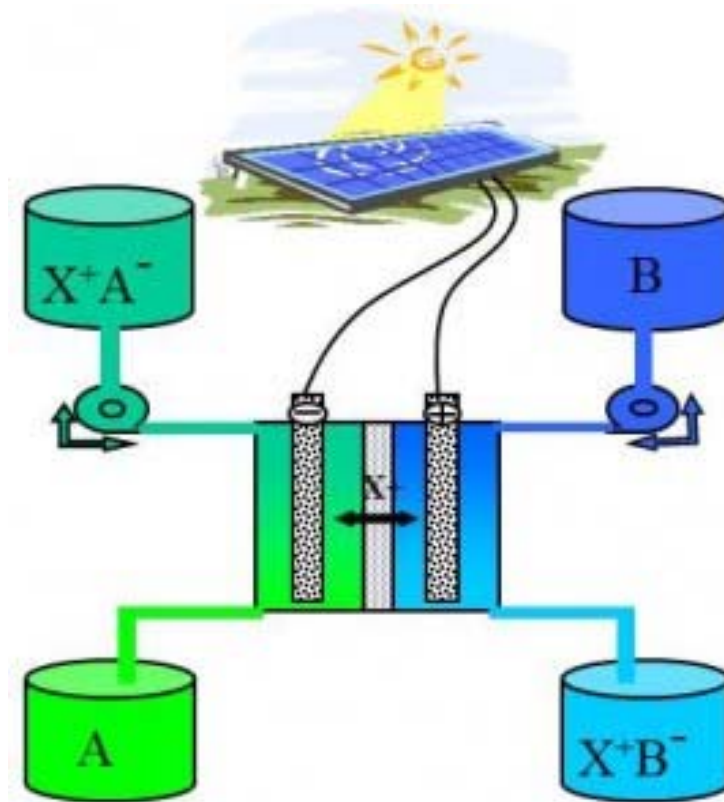


Flow Cells for Energy Storage Workshop



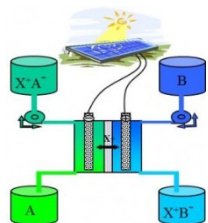
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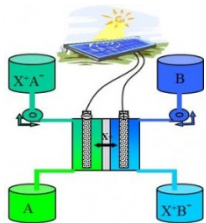
Energy Efficiency & Renewable Energy *With help by:* Office of Electricity Delivery & Energy Reliability





Agenda

Day/Time	Speaker	Subject
Wednesday, March 07, 2012		
8:45-9:00	Adam Weber, LBNL	Welcome and workshop overview
9:00-9:30	Various, EERE, OFCT	Background, approach, and reversible fuel cells
9:30-9:55	Michael Perry, UTRC	Renaissance in flow cells: opportunities
9:55-10:20	Joe Eto, LBNL	Energy storage requirements for the smart grid
10:20-10:35	AM Break	
10:35-11:00	Robert Savinell, CWRU	Revisiting flow-battery R&D
11:00-11:25	Stephen Clarke, Applied Intellectual Capital	Lessons learned and yet to be learned from 20 years in RFB R&D
11:25-11:45	Imre Gyuk, DOE OE	Research and deployment of stationary storage at DOE
11:45-12:05	Mark Johnson, DOE ARPA-E	Flow cell research in GRIDS
12:05-12:30	Tom Zawodzinski, ORNL and UTK	Transitioning fuel-cell technology to RFBs
12:30-1:30	Working Lunch and breakout group instructions	
1:30-3:30	Breakout Groups I	A. Metal/flow systems; B. Novel and nonaqueous systems; C. Traditional single and multiphase systems
3:30-3:45	PM Break	
3:45-5:00	Reports from Breakout Groups I	
5:00-5:15	Summary of Day 1	
5:30-7:00	No-host reception in Meeting Room 2	
Thursday, March 08, 2012		
8:30-8:45	Breakout group instructions	
8:45 - 10:45	Breakout groups II	A. Catalyst/electrode design; B. Membranes; C. Stack, systems, and related components
10:45-12:00	Reports from Breakout groups II	
12:00-12:15	Workshop Summary	



Workshop Overview

☀ Purpose

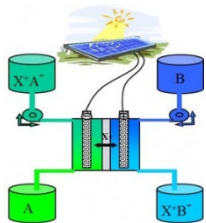
- To understand the applied research and development needs and the grand challenges for the use of flow cells as energy-storage devices

☀ Objectives

- Understand the needs for applied research in flow cells
- Identify grand challenges and prioritize R&D needs
- Gather input for future development of roadmaps and technical targets for flow cells for various applications

☀ Areas outside the scope of this workshop

- Specific chemistries and their specific issues
- Deployment and TRLs > 5
- Basic research and TRL 1



Speakers

☀ Introduction

↳ Sunita Satyapal, Ned Stetson, Dimitrios Papageorgopoulos, EERE OFCT

☀ EES applications and R&D needs

↳ Michael Perry, UTRC, renaissance in flow batteries, opportunities

↳ Joe Eto, LBNL, Energy storage requirements for the smart grid

☀ Past activities and R&D

↳ Robert Savinell, Case Western Reserve University, revisiting flow-battery R&D

↳ Stephen R. Clarke, Applied Intellectual Capital, “Lessons learned and yet to be learned from 20 years in RFB R&D”

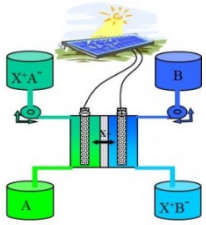
☀ Current R&D

↳ Imre Gyuk, DOE – OE, Research and deployment of stationary storage at DOE

↳ Mark Johnson, DOE – arpa-e, Research in GRIDS

☀ Linking fuel cells with flow cells

↳ Tom Zawodzinski, ORNL and UTK, Transitioning fuel-cell technology to RFBs



Breakout Groups

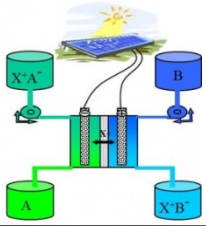
☀ Day 1: Phenomena

- ↳ Things to focus on: performance, power, durability, lifetime
 - ❖ Metal/flow systems
 - ❖ Novel and nonaqueous systems
 - ❖ Traditional single and multiphase systems

☀ Day 2: Components

- ↳ Focus on diagnostics, materials, manufacturing, and modeling needs
 - ❖ Catalysts/electrode design
 - ❖ Membranes
 - ❖ Stack, systems, and related components

- ☀ If discretion is warranted, can come to organizers directly or just put down on 3x5 index card



Breakout Group Instructions

- ☀ Choose a spokesperson and scribe
 - ↳ 20 minute overviews of the discussion and findings
- ☀ Use colored cards for major topics
- ☀ Go around and have everyone put down an idea on the white cards
 - ↳ Sort and categorize by topics
- ☀ Vote or prioritize in some fashion the R&D needs
- ☀ No attribution of ideas to individuals and anyone can come to the organizers
 - ↳ Will not mention anything proprietary
 - ↳ Will have also index cards and write down key comments and issues
- ☀ As much info as possible, pros and cons and what should be working