Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences
Institute for Energy Systems and Fuel Cell Technology

W. Winkler

RFB activities within IEC TC 105

Vienna 6 July 2011

- State of IEC TC 105 activities
- Technical background
- Organizational aspects

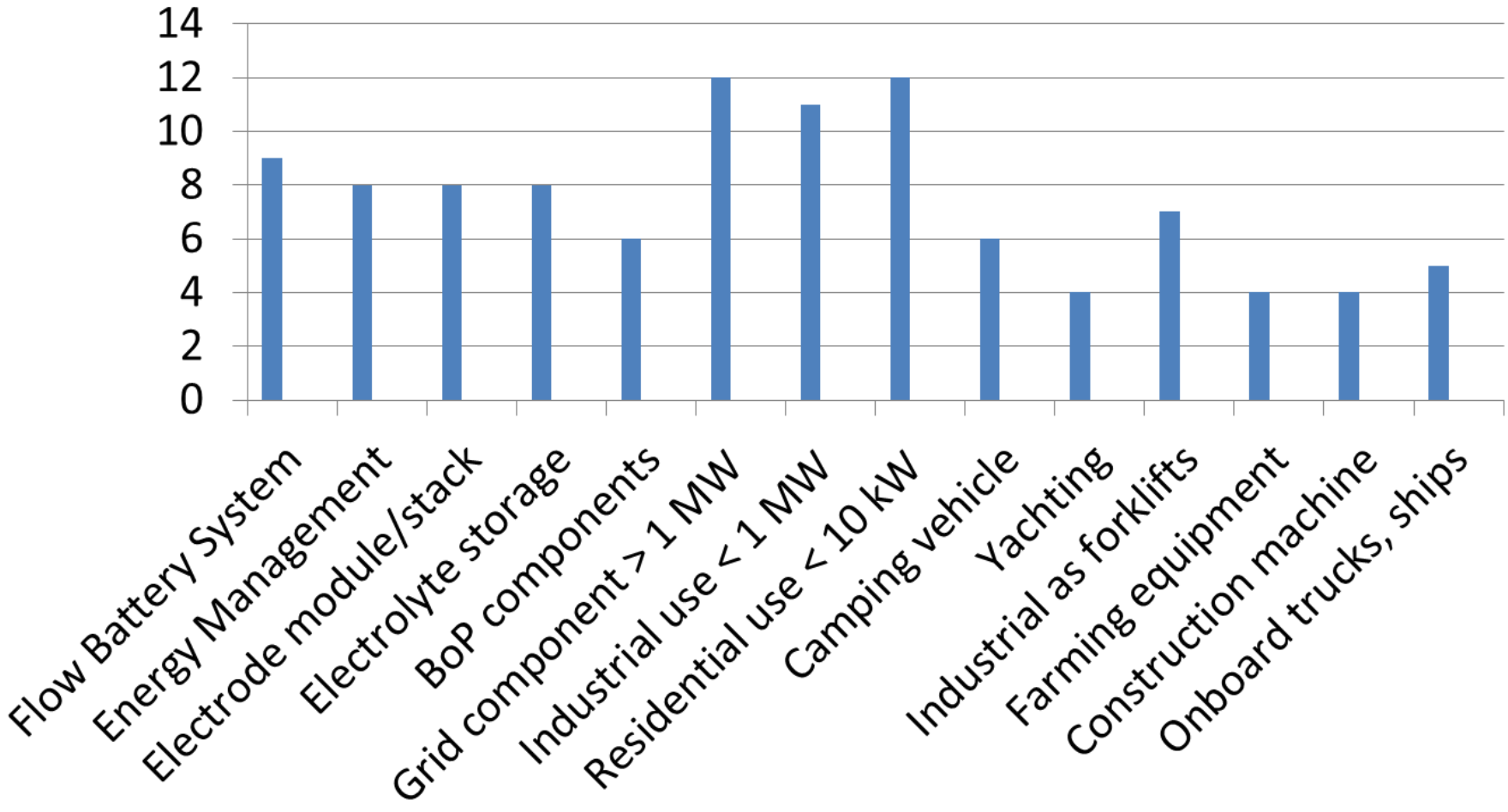
- **State of IEC TC 105 activities**
- Technical background
- Organizational aspects

Decision of NCs

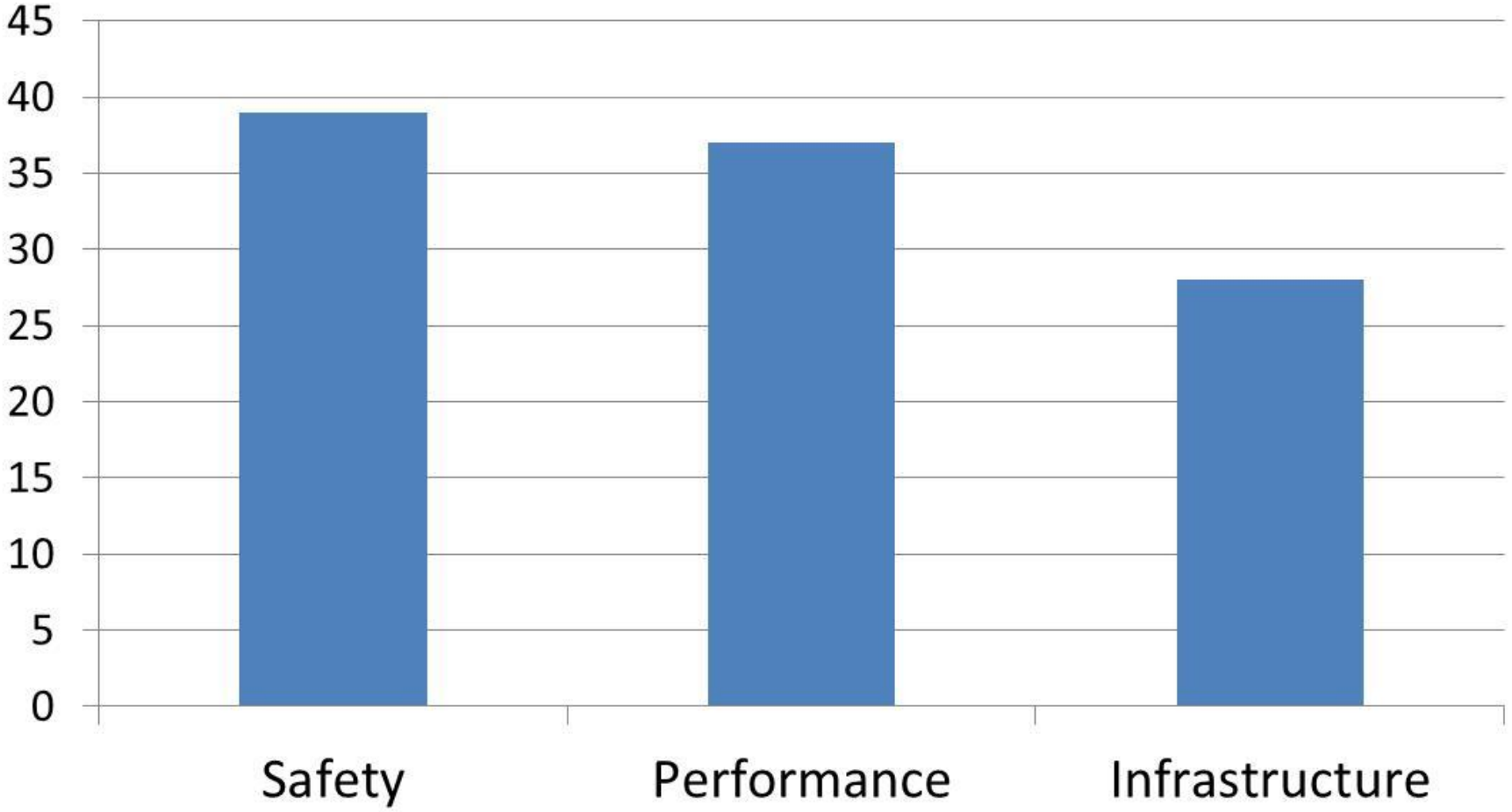
Forming Study Group on Flow Batteries

Country	Yes	No	Abstain
Canada		x	
China	x		
Czech Republic			x
Denmark	x		
Egypt	x		
Germany	x		
Greece			
Italy	x		
Japan		x	
Korea (Rep. of)	x		
Netherlands			
Spain	x		
U.S.A.	x		

Demand by technology



Demand by fields



Study on the Development of International Standards in the Field of Flow Battery Systems

Content of Work 1st Draft Overview

1. **Introduction**
2. **Process Technology of Flow Batteries**
3. **Realization and Pilot Plants**
4. **Safety of Plants**
5. **Installation and Infrastructure**
6. **Performance and Standardization**
7. **Identified Standardization Needs and Proposed Strategy**

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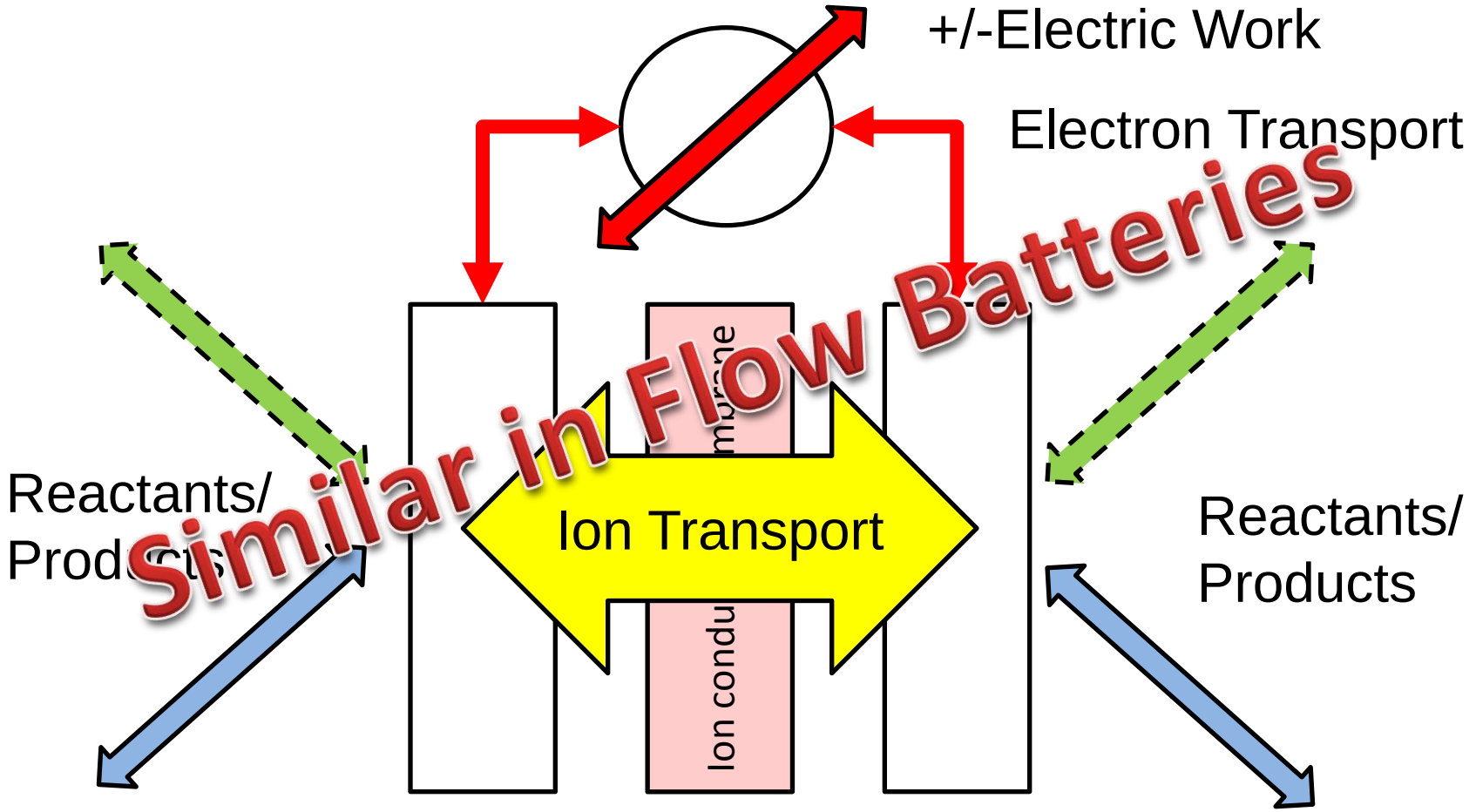
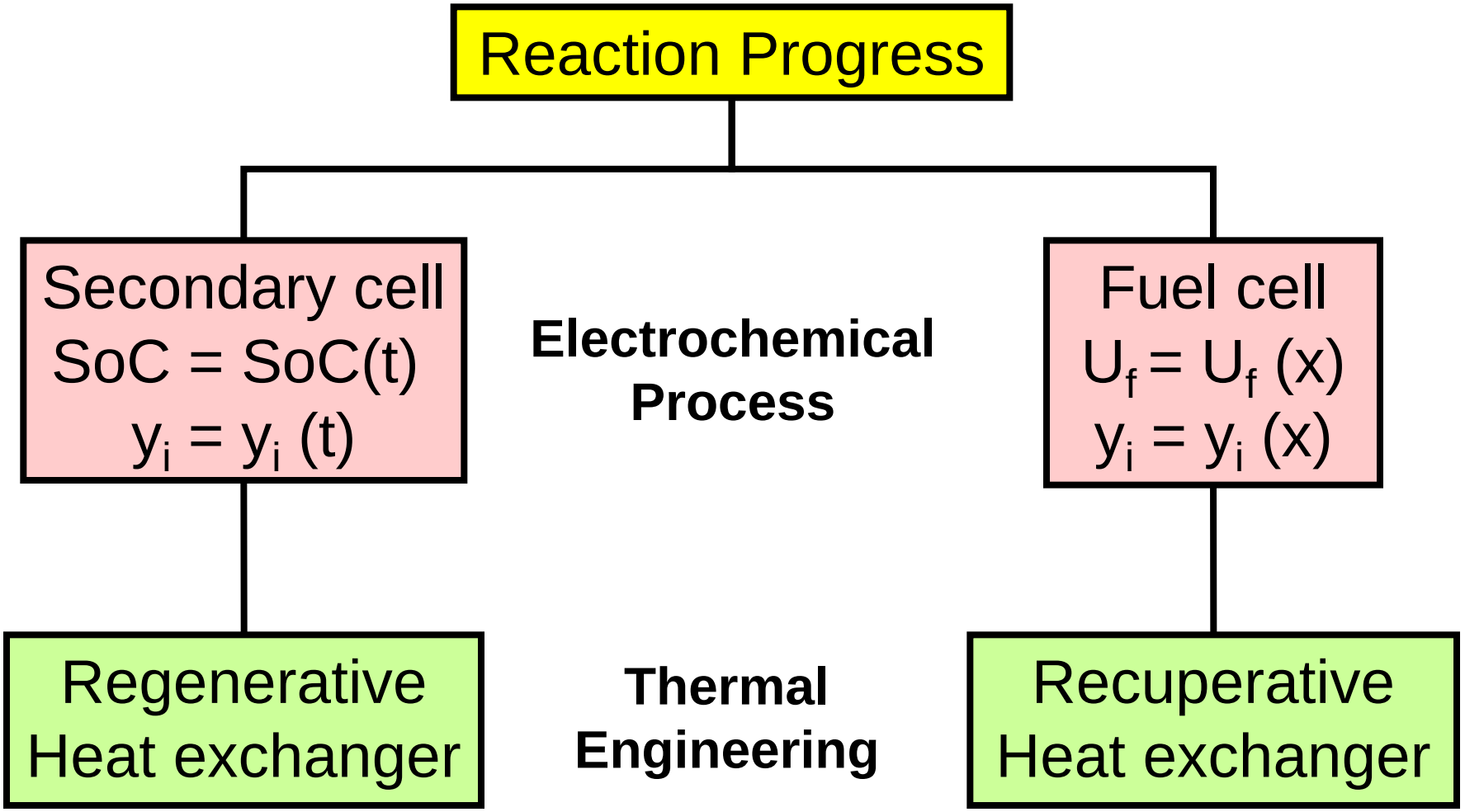
Fuel Cell Process Principle

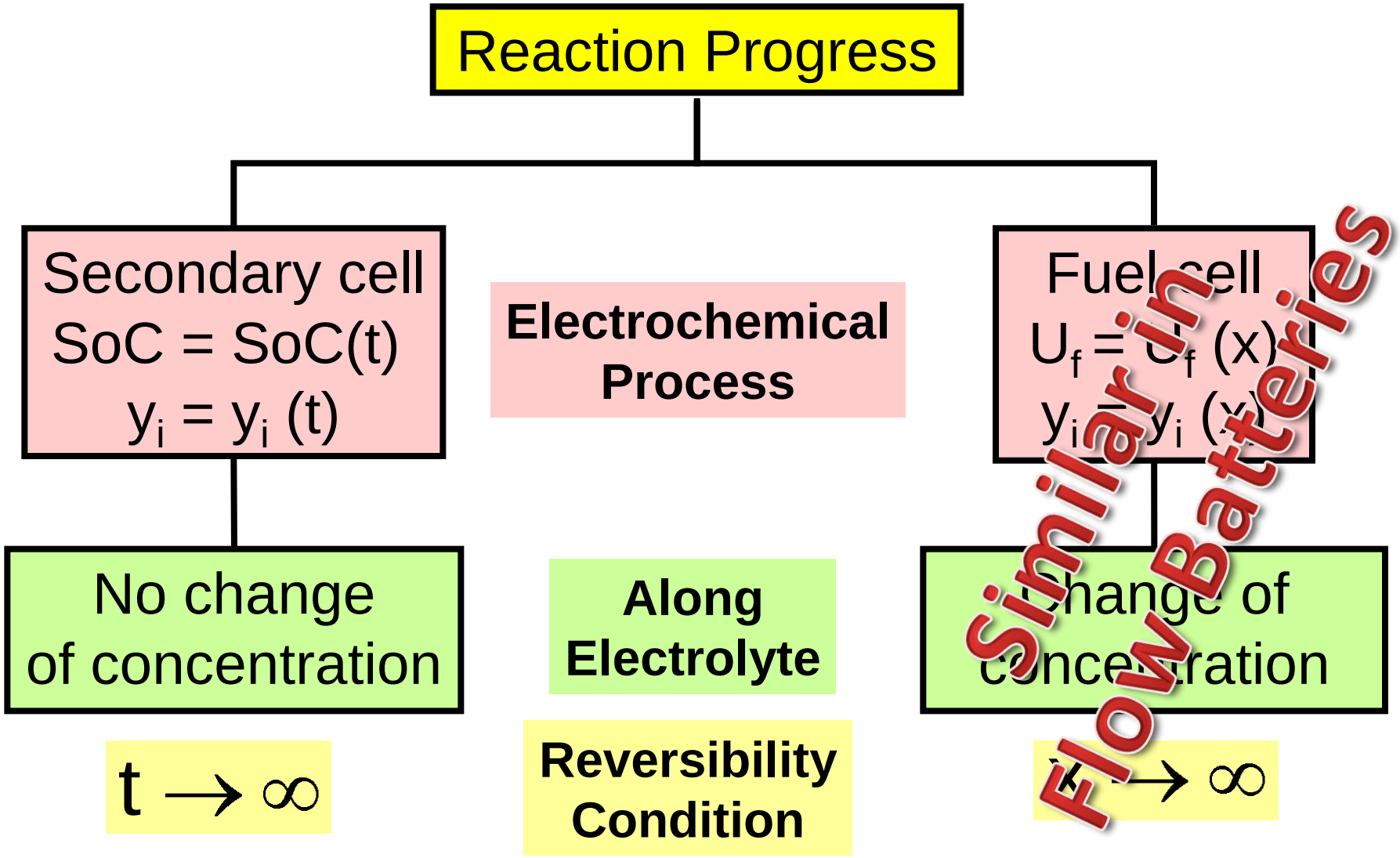


Electrodes are not changed by electrochemical reactions

Electrochemical devices

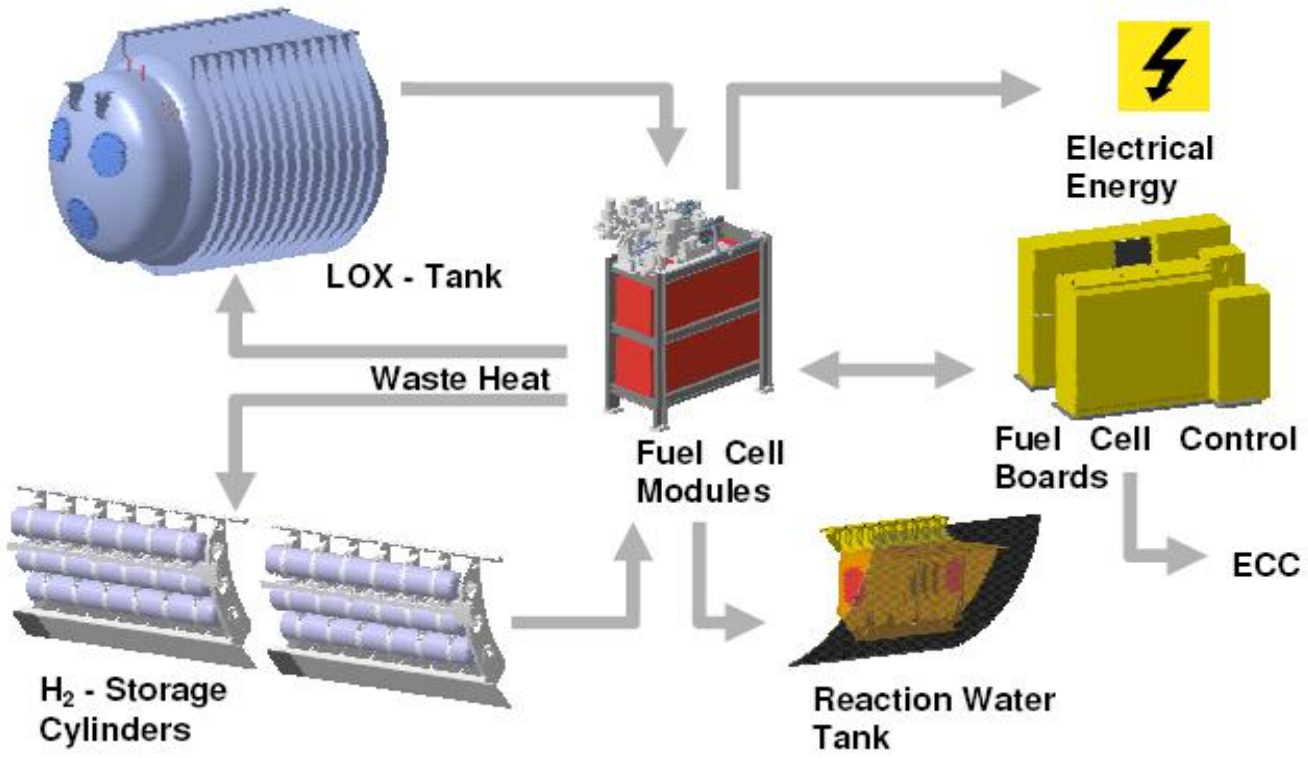


Electrochemical devices



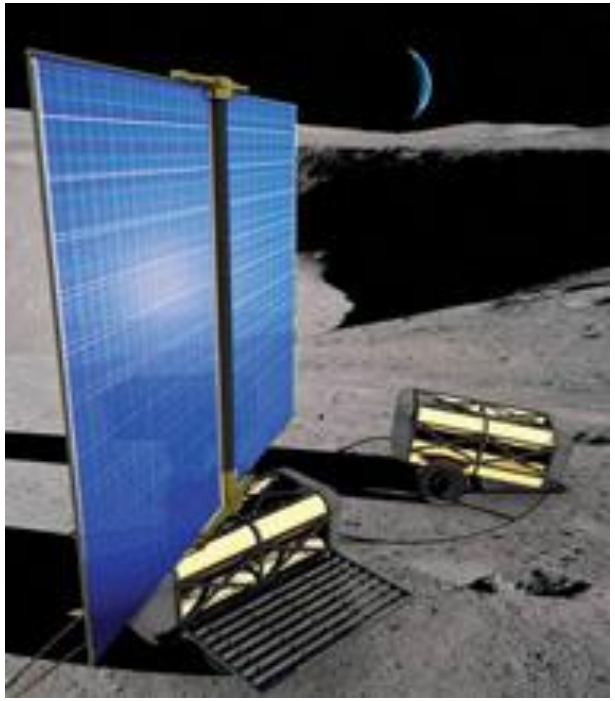
Closed FC Systems I

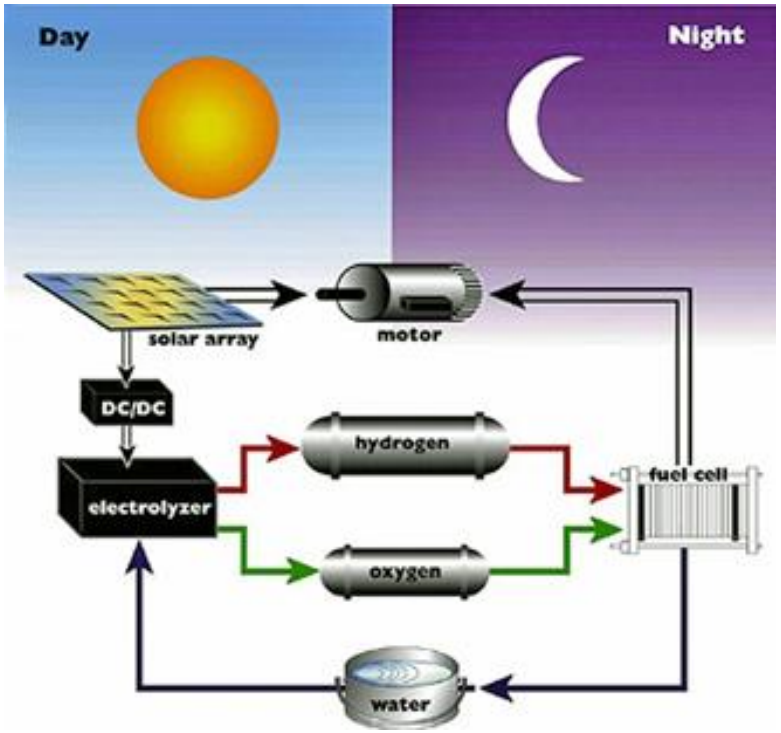
Propulsion underwater vehicles
German Submarine 212/214



Source: R. Teppner

Closed FC Systems II

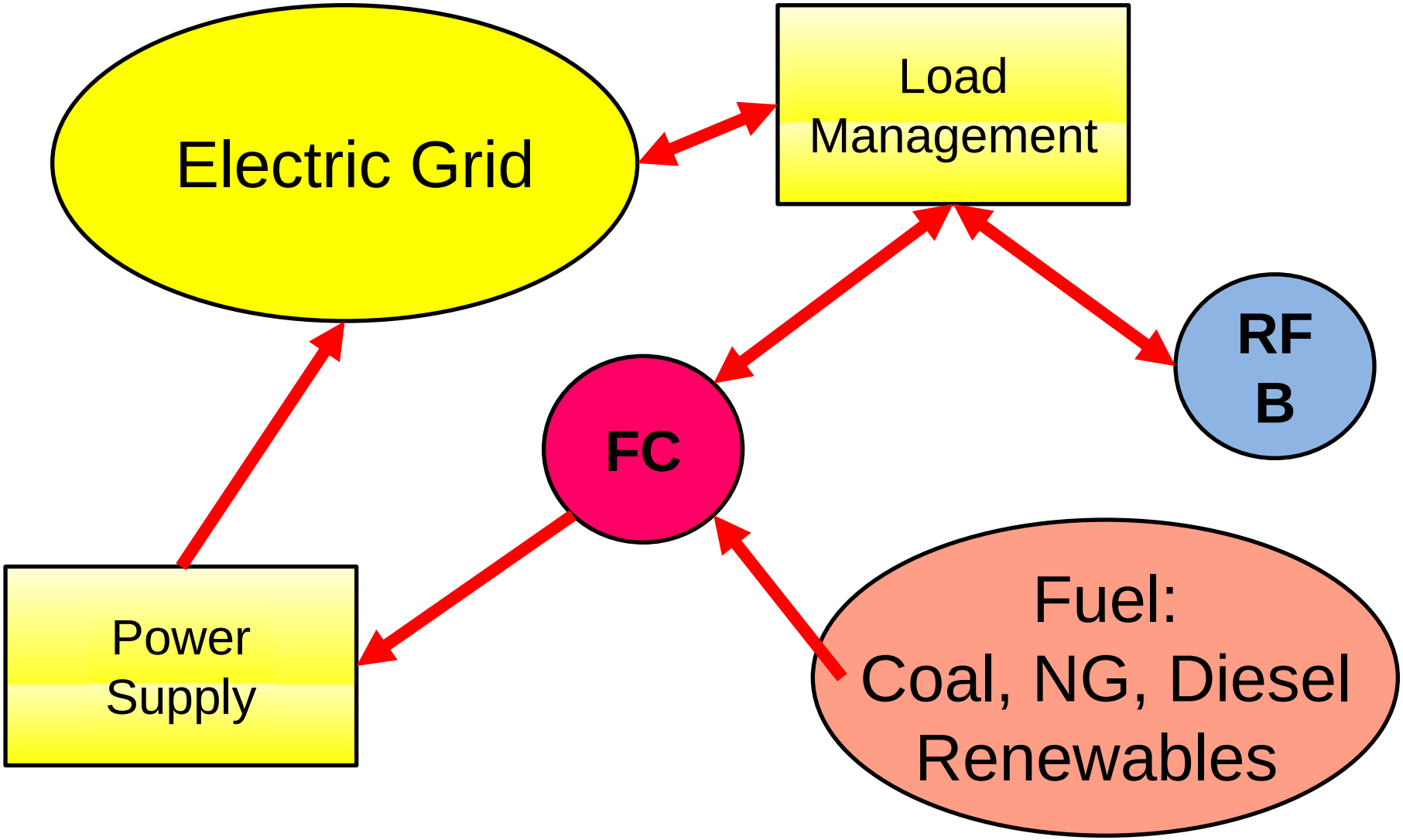




The Space Power Pallet will demonstrate a closed cycle hydrogen oxygen RFC. A regenerative fuel cell uses electricity to divide water into hydrogen and oxygen, which are fed back into the fuel cell to produce more electricity. Instead of using oxygen from the air like other regenerative fuel cells, the closed-loop system reuses the oxygen from the water.

Source: NASA

FC and RFB in Electric Grid



Process Characteristics of Systems

System Characteristic	Fuel Cell	Flow Battery	Secondary Battery
Kind of process	Flow	Flow	Batch
BoP needed	Yes	Yes	No
Ionic transport in membrane	Yes	Yes	
Change of electrodes	No	No	Yes
Reaction progress	$U_f(x)$	SoC(x)	SoC(t)
Open system	Yes	Yes: air/water	No
Closed system	Yes: space/submarines	Yes	Yes

Application Characteristics of Systems

System Characteristic	Fuel Cell	Flow Battery	Secondary Battery
Stationary Converter	Yes	No	No
Stationary Storage	Yes (Regenerative)	Yes	Yes (limited)
Mobile Recovery	No	Not yet	Yes
Range Extender	Yes	Potential (Air/Water)	No
Portable	Mission dependent (Wh/kg and Wh/l for all technologies) defined by device plus reactants		

Requirements of Systems Design

System Design Requirements	Fuel Cell	Flow Battery	Secondary Battery
Needs intelligent liquid management system for operation	Water (PEFC)	x	
Design requires experience in handling explosive gas mixtures and gas/liquid phase transitions	x	H_2??	
Design requires experience in handling phase transitions (liquid/solid and liquid/gas) in confined space	Water (PEFC), Direct Coal	x	x
Design requires experience in handling/moving corrosive liquids (chemical engineering approach)	PEFC, MCFC	x	

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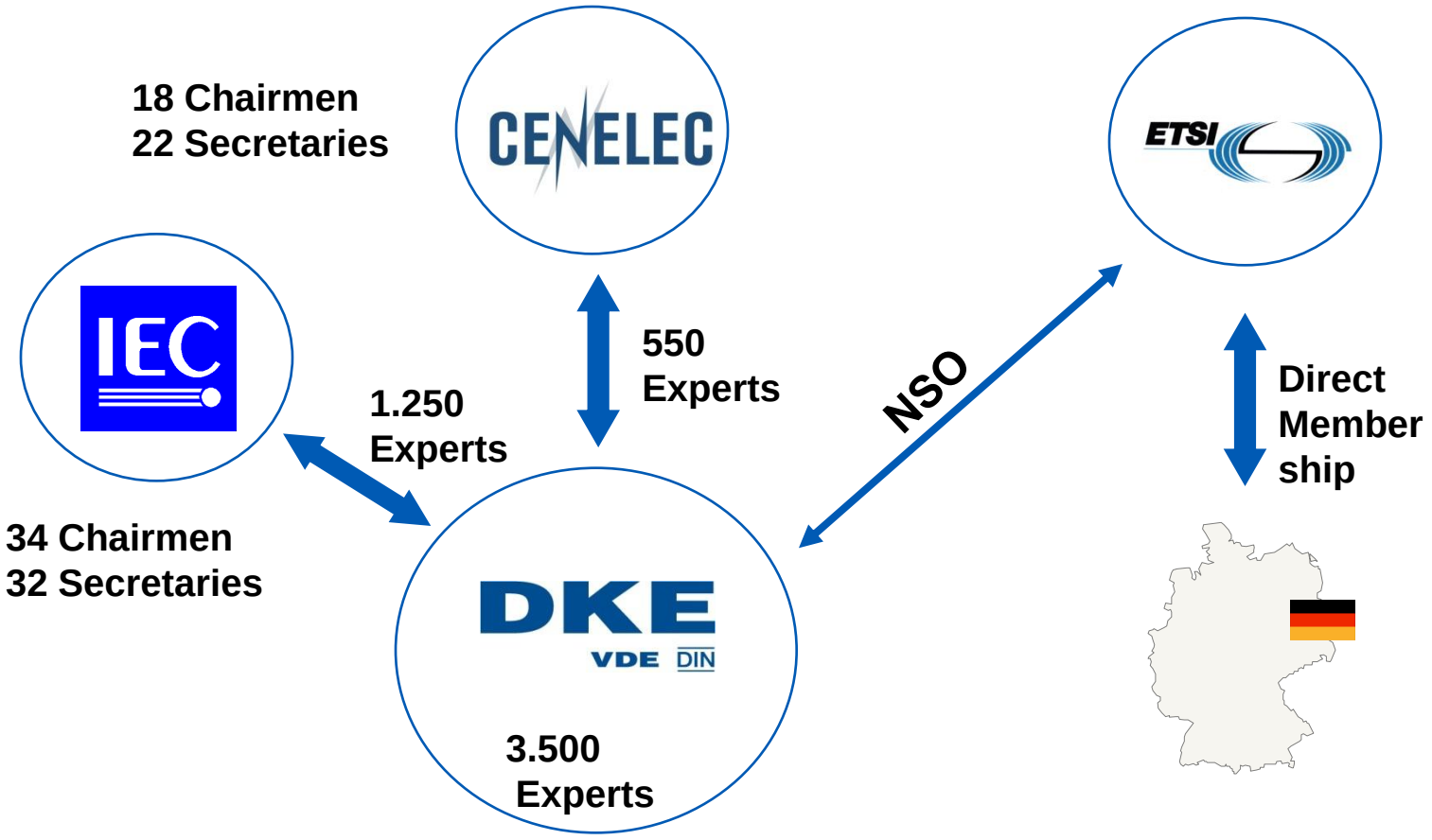
Contribution to standardization work

National example: Germany



Source: G. Imgrund

IEC TC 105 structure

Chairman :	Dr Fumio Ueno (JP)
Secretary :	Prof. Wolfgang Winkler (DE)
Assistant Secretary :	Dr Gerhard Imgrund (DE)
Technical Officer :	Dr Charles Jacquemart

Working Group Structure

Liaisons :
Internal IEC Liaison : TC 8, TC 31
Liaison ISO : ISO/TC 21, ISO/TC 22, ISO/TC 197
Liaison A : EC

Working group structure

Working Group :

WG 1 - Terminology

WG 2 - Fuel cell modules

WG 3 - Stationary fuel cell power systems - Safety

WG 4 - Performance of Fuel Cell Power Systems

WG 5 - Stationary Fuel Cell Power Systems - Installation

WG 6 - Fuel cell system for propulsion and auxiliary power units (APU)

WG 7 - Portable fuel cell power systems - Safety

WG 8 - Micro fuel cell power systems - Safety

WG 9 - Micro fuel cell power systems - Performance

WG 10 - Micro fuel cell power systems - Interchangeability

WG 11 - Fuel cell technologies - Part 7-1: Single Cell Test Method for Polymer Electrolyte Fuel Cell (PEFC)

Advisory Group :

AG 12 - CAG - Chairmen's Advisory Group

ad-Hoc Group :

AHG 1 - Identification of the market needs for standardization work on fuel cell systems for propulsion and auxiliary power units

AHG 2 - Development of guidelines for the use by all WGs in view of harmonizing the requirements concerning safety aspects with respect to explosion