

Draft Business Plan – Version 1 CENELEC Workshop 05

“Flow batteries – Requirements and test methods”

(to be approved during the Kick-Off Meeting on 2011-11-27)

1. Background to the CENELEC Workshop

A CENELEC Workshop is planned as a first step towards standardization in the domain of flow batteries. It is intended to be a stepping stone towards a future European and/or international standard.

1.1 Technology aspects

Flow battery technology was first described in technical literature in the late 19th century. Although individual researchers continued developments it was not until the 1970s that NASA research programmes launched new research activities on this technology. Over the past 20 years, the interest in flow battery technology has grown, because of its potential for mass production of a low cost, high performance energy storage system capable to be incorporated into large scale devices.

A **flow battery** is a form of energy storage device, in which [electrolyte](#) containing one or more electro chemically active species flows through an [electrochemical cell](#) that converts [chemical energy](#) directly to [electricity](#), and/or vice versa . Additional electrolyte is stored externally, and circulated through the electro chemical cells.

The design features in flow batteries must allow the movement of fluids.

1.2 Economic/political issues

There are a number of flow battery manufacturers, typically classified as SMEs, and production is currently at a low level compared to other battery technologies. In addition, there are some larger companies with a direct or indirect interest in the subject. However, some manufacturers are now entering the early stages of automated production, with international collaboration taking place between manufactures, sub contractors, suppliers and developers. There are a number of active manufacturers, researchers and developers in Europe as well as in North America and Asia.

The European Commission aims to promote successful entrepreneurship and improve the business environment for SMEs, to allow them to realise their full potential in today's global economy. This is clearly reflected in the Small Business Act for Europe (http://ec.europa.eu/enterprise/policies/sme/small-business-act/index_en.htm), to which the Member States and the European Commission have committed.

The market for battery energy storage is estimated at 13GW/year of which flow batteries might achieve up to 1GW/year at \$1billion/year.¹

¹ Escovale – Market report on flow batteries

1.3 Environmental aspects

Europe is committed to the 20-20-20 targets to reduce carbon emissions and to secure energy supply. Energy efficiency and renewable energy are seen as key to reach this goal. Both measures call for changes in our energy supply system leading to smart grids as key enablers for the required innovation. To promote this transformation the European Commission has taken a number of actions to increase the production of energy from renewable and low carbon sources and to ensure that such energy can be incorporated into the energy networks. In the USA, there is now significant investment in energy storage, of all forms to ensure high degrees of penetration of renewables and similar measures will be required in Europe and elsewhere. Flow batteries are well suited to the integration of renewable energy as they have the potential to be low cost, with high power and high energy capacity. Flow batteries are already in use in a number of smart grid demonstration installations in Europe and Asia. CEN, CENELEC and ETSI have recently published a report on the need of standards for the smart grid (see <ftp://ftp.cen.eu/CEN/Sectors/List/Energy/SmartGrids/SmartGridFinalReport.pdf>). The smart grid will be further enhanced with smart meters (<http://www.cen.eu/cen/Sectors/Sectors/Measurement/Smartmetering/Pages/default.aspx>) and the needs of electric vehicles (ftp://ftp.cen.eu/CEN/Sectors/List/Transport/Automobile/EV_Report_incl_annexes.pdf).

Flow batteries are a new, innovative product, which can contribute to the greening of Europe and to the needs of the grid to store electricity over short and medium length timescales.

Users and manufacturers of flow batteries will benefit from a unified approach to consideration of the environmental impact of the materials used in the manufacture and operation of flow batteries.

1.4 Helping to bring flow batteries to the market

A CENELEC Workshop Agreement will facilitate the pre-commercial phase, when a potential client needs to compare technical requirements of different types of flow batteries or simply, needs to compare between flow batteries and conventional electricity storage devices. But also the marketing of flow batteries to major customers will become easier if the flow battery is produced in conformance with the provisions of the proposed Workshop Agreement. It will give potential clients certainty and confidence that the batteries are sufficiently robust to meet the requirements of the designated application.

The Workshop Agreement will also provide guidance for conformity assessment bodies to benchmark the flow batteries' conformity with existing directives and other regulations.

2. Workshop proposers and Workshop participants

This Workshop is proposed by:

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Participation in the Workshop will be open to anyone and the opportunity to participate will be widely advertised in advance by its proposers and by CENELEC. A preliminary information session (6 July 2011 in Vienna) was advertised at the International Flow Battery Forum (IFBF) meeting in Edinburgh in May 2011 attended by 100 delegates and at the Energy Storage Association Meeting in June 2011 attended by 450 delegates.

The preliminary session on this process was held in Neustadt, Vienna, Austria on 6 July 2011 and attended by 23 individuals representing flow battery interests from America, Europe, Asia and Australasia.

Dialogue has also been established with other groups developing standards in other electrochemical power sources.

3. Workshop scope and objectives

The overall goal of this Workshop is to provide guidelines in the form of a CENELEC Workshop Agreement to include:

- definitions
- criteria for measuring the battery performance, including efficiency
- performance criteria
- criteria for defining and specifying actions at the end of life
- battery maintenance criteria
- evaluation criteria
- service life guideline for technical description of the flow battery
- etc

Further details of the topics that the CENELEC Workshop Agreement should address are given in Annex A.

The CENELEC Workshop Agreement will not address safety issues.

4. Workshop programme

At the start of the project, relevant source documents will be sourced from a number of international sources. The initial content of the Workshop will be elaborated by the proposers and the Workshop secretariat will ensure that the drafting takes place according to the CENELEC rules and that progress is made in accordance with the planned timeframe.

A voluntary Project Team, on behalf of the Workshop and acting together with the Workshop secretariat, will review source documents and distribute a survey on relevant source materials for the respective organizations. The Project Team will review some materials and propose the first draft of the Workshop Agreement for considerations at the first plenary meeting. Subsequently, this will be worked on electronically and further considered at the second plenary meeting. It is intended that this draft will be available before the next full meeting of the International Flow Battery Forum.

Subject to approval of the Workshop participants, the draft will then be submitted to public comment for a minimum of 60 days. The project team and Secretariat will review the comments and a final draft prepared taking due account of the comments made. This draft will be finalised through electronic comment and approved by registered participants in a final plenary meeting prior to publication.

Meeting/objective	Date	Place	Deliverables
Kick-off meeting	27 November 2011	Berlin	Approved business plan Appointment of Chair and secretariat
First plenary meeting	27 November 2011	Berlin	Presentation and discussion of first working draft
Second plenary meeting, to consider draft for public comment	June 2012	To be decided	Draft CENELEC Workshop Agreement, approve for public comment (60 days)

Meeting/objective	Date	Place	Deliverables
End of public commenting phase. No physical meeting (work continues electronically)	September 2012	By electronic means	Report on comments
Third working plenary meeting, for adopting the CENELEC Workshop Agreement and Workshop Closure meeting	December 2012	CEN-CENELEC Management Centre, Brussels or Amsterdam	Final CENELEC Workshop Agreement (including comments resolution)

Note: In function on the progress of the work, an additional meeting could take place or meetings could be advanced or skipped. In between meetings, the work continues electronically. The present Business Plan will be subject to review at each plenary meeting and amendments agreed as appropriate.

5. Workshop structure

The Workshop language will be English. The outcome of the Workshop, the CENELEC Workshop Agreement – will be published in English.

The Chairman has been nominated by the proposers, and will be approved by the Kick-off meeting.

The Secretariat will be provided by OVE, the CENELEC National Committee for Austria, subject to the approval of the Kick-Off meeting.

The Workshop Project Team referred to in section 4 will be appointed by the Kick-Off meeting from amongst the registered participants.

6. Resource requirements

All costs related to the participation of interested parties in the Workshop's activities have to be borne by themselves.

Companies and organizations participating in the Workshop will be required to pay a fee of XXXX € (**plus VAT**) in order to secure the funding of the secretariat/ chairmanship of the Workshop (note: this fee will be confirmed at the kick-off meeting, but it is estimated to be between 2.500 and 3.000 euro based on the preliminary number of participants)².

On behalf of the secretariat, this fee (XXXX €) will be collected and managed by the company Swanbarton Ltd, who will use this fee to fund the costs of the secretariat/ chairmanship of the Workshop. Swanbarton Ltd will manage the finances through a separate escrow account.

² Participants should pay a preliminary payment of €2000 plus VAT at 20% to Swanbarton Limited by cheque, credit card, PayPal or bank transfer to HSBC Bank, IBAN number 4005 1569 3841 96 (BIC code MIDLGB22). An invoice / receipt will be issued. The total will be confirmed at the kick off meeting.

7. Related activities, liaisons, etc.

This Workshop will seek to establish liaison with CENELEC TC/21X on "*Secondary batteries*" and IEC/TC 105 "*Fuel Cell Technology*"

8. Contact points

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Outline of the proposed content of the CENELEC Workshop Agreement

- Definitions
 - o Flow Battery general definition
 - o Flow Battery Layout (what is included?)
 - o Flow Battery Storage Device (includes Housing, Chargers/Inverters)
 - o Flow Battery Efficiency and cycles
 - o Flow Battery Power Supply System (includes interface electronics to Generators such as PV, Wind, Diesel gen set,)

- Standard Graphs
 - o Voltage (V) versus Capacity (Ah) at different loads
 - o DC input power (W) versus time (h) at different charging powers
 - o DC output Power (W) versus time (h) at different loads
 - o AC output Power (W) versus time (h) at different loads
 - o AC output following a Standard load profile for RAPS (remote area power supply)
 - o AC output following a Standard load profile for grid connected systems
 - o Etc

- Flow Battery Layout
 - o xxxx

- Performance data
 - o DC/DC efficiency
 - o DC/AC efficiency
 - o Number of cycles/day (determined by application)
 - o Time of utilization
 - o Delivered kWh over time of utilization
 - o State of charge SOC
 - o State of health
 - o State of function
 - o AC Power Response time to a fluctuating load (profile must be defined)
 - o Response in cold stand-by mode (fluid in one line moving)
 - o Response in hot stand-by mode (fluid in all lines moving)

- Financial parameters
 - o Initial investment cost
 - o Spare parts during time of utilization
 - o O+M cost (in % of initial investment)
 - o Disposal cost
 - o € / kWh delivered during time of utilization

 - o Etc.