



# Improving Safety and Performance Testing for EV Batteries

**EVS 27 – 19 November 2013**



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Joint Research Centre, European Commission

**EUROBAT** 

# Outline



- **Institute for Energy and Transport (IET)**
- **EUROBAT**
- **Update on Battery Energy Storage Testing for Safe Electrification of Transport (BESTEST)**
- **Overview of Battery safety information tool (BaSIT) single authoritative database of battery safety events**



## Institute for Energy and Transport (IET)



Petten, NL



**~ 375 Staff**  
(285 Petten, 90  
Ispra)



Ispra, IT

**Mission:** to provide support to Community policies and technology innovation related to:

- Energy - to ensure sustainable, safe, secure and efficient energy production, distribution and use; and
- Transport - to foster sustainable and efficient mobility in Europe.

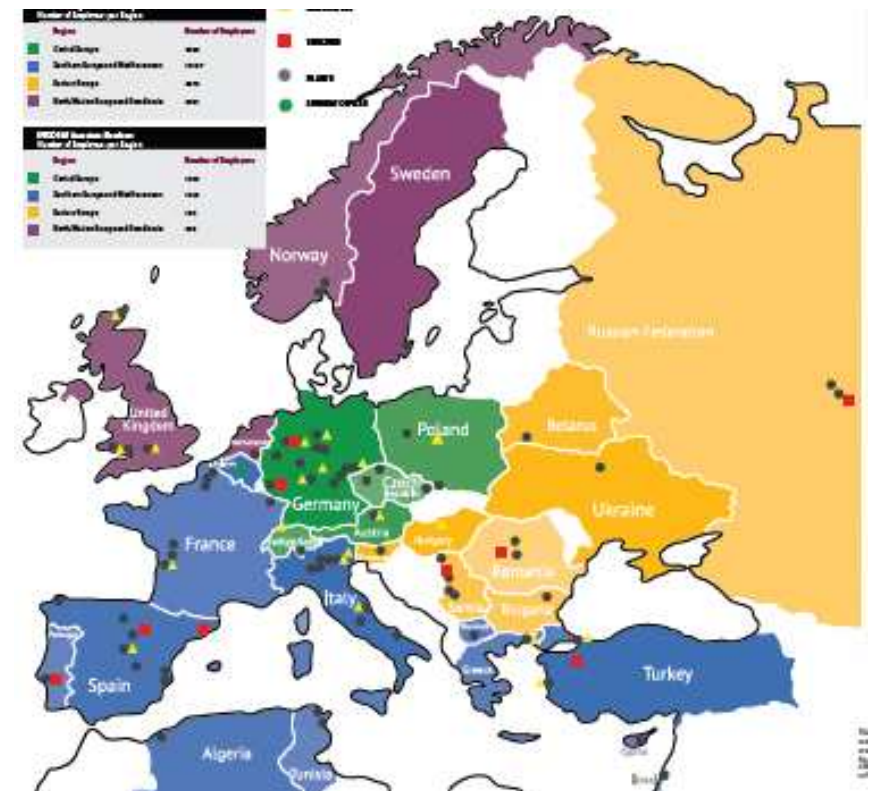
⇒ Independent of national or commercial interests....for the European citizen

**EUROBAT** 

## EUROBAT - Association of European Automotive and Industrial Battery Manufacturers

Composed of over 40 companies operating in Europe to promote interests of European manufacturers and the supply chain of automotive, industrial, and energy storage batteries

Represents four major battery technologies: Lead-, Lithium-, Sodium- and Nickel-based batteries which effectively contribute to many applications in smart grid or off-grid energy storage, transport, mobility from micro-hybrid, plug-in to EV





- ASSAD
- AKOM Group
- Banner
- EnerSys
- Exide
- Eternity Technologies
- FIAMM
- Hoppecke
- Inci Akü
- Johnson Controls Power Solutions
- MIDAC
- Moll
- Mutlu
- S.C. ROMBAT
- SAFT
- Systems Sunlight
- TAB
- Yuasa
- Dow Kokam (Battery System Integrator)

**EUROBAT  
Membership:**

**Battery  
Manufacturers**



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- Abertax
- Accuma
- Accumalux
- Amer-Sil
- Berzelius
- BM Maschinen
- Daramic
- DEKRA Certification
- Entek
- Evonik
- ECOBAT
- Frötek
- Glatfelter
- Hollingsworth & Vose Company
- Hammond Expanders
- HOFMANN Power Solutions
- Mecondor
- Midtronic
- Mitsui Chemicals
- MTH Metalltechnik Halsbrücke
- Nissan
- Recylex
- SOVEMA
- TBS
- Water Gremlin Aquila

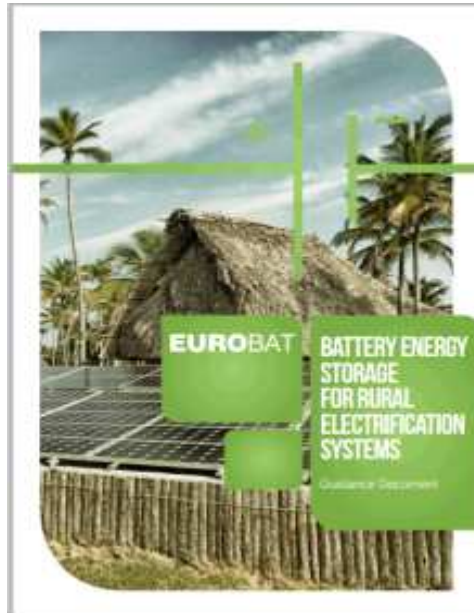
***EUROBAT  
Membership:***

***Supply Industry***



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# EUROBAT Publications



**Battery Energy Storage  
for Rural Electrification  
Systems**



**Battery Energy Storage  
for Smart Grid  
Applications**



**2012 Annual Report**

*For more information  
visit [www.eurobat.org](http://www.eurobat.org) or contact [eurobat@eurobat.org](mailto:eurobat@eurobat.org)*



# Importance of Batteries



## *Growing demand for energy storage in:*

### *Industrial*

- Motive Power – Public Transport
- Electricity Grid Functionality; Energie-wende
- Renewable Energy; Photovoltaic, Wind



### *Automotive*

- Advanced Lead Batteries & Start-Stop
- Range from Micro-hybrid to Full HEVs
- Plug-in Hybrid Electric Vehicles, HEVs, EVs





- *Development of HEV and EV require adequate standardisation and testing specification procedures*
- ***Different actors: CEN CENELEC; IEC; ISO; UN-ECE WP.29***
- Benefits of internationally harmonising safety and environmental testing processes:
- Interoperability of (H) EVs;
- Increased administrative efficiency;
- Increased research collaboration and reduced testing overlap;
- Optimised tests through pooling of resources

# Standards



Several **IEC** and **ISO** standards exist to give safety and test specifications for batteries used in EVs:

- **IEC 62660-1, 2:** Secondary batteries for the propulsion of electric road vehicle. Part 1: performance. Part 2: reliability;
- **IEC 61982:** Secondary batteries (except lithium) for the propulsion of electric road vehicles – performance and endurance tests;
- **IEC 62485-3:** Safety requirements for secondary batteries and battery installations. Part 3: traction batteries;
- **ISO 6469-1, 2, 3:** Electrically propelled road vehicles – safety specifications. Part 1: on-board rechargeable energy storage system (RESS). Part 2: vehicle operational safety means and protection against failures. Part 3: protection of persons against electric shock;
- **ISO 12405-1, 2:** Electrically propelled road vehicles – test specification for lithium-ion traction battery packs and systems. Part 1: high power applications. Part 2: high energy applications

# BESTEST



## Battery Energy Storage Testing for Safe Electrification of Transport (BESTEST)

**BESTEST since 01/01/2013**

### Letter of Intent

Co-operation between the  
United States Department of Energy  
and

the Joint Research Centre of the European Commission  
on Electric Vehicle - Smart Grid Interoperability Centres



**EC JRC-IET**



**US-DoE ANL**

For over ten years, the United States and the European Union have sought to expand scientific collaboration across the Atlantic through their Science and Technology Agreement. Signed in 1997, this Agreement serves as a broad framework for cooperation, enabling some of our most distinguished scientists and best research institutions to collaborate on a wide range of scientific topics and initiate new joint programs. The Agreement encourages cooperation in areas where the United States and the European Union (EU) are doing some of the most advanced research in the world on energy and transport technology.

Following consultations between William Kennard, U.S. Ambassador to the EU, and Dominique Ristori, Director-General of Joint Research Centre (JRC), and exploratory missions of U.S. Department of Energy (DOE) representatives to the JRC Ispra facilities, and of JRC personnel to DOE's Argonne National Laboratory, the JRC and DOE seek to cooperate on e-mobility, focusing on electric vehicle interoperability with charging and smart grid equipment, as follows:

**Interoperability**

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# Interoperability



**Battery Testing**



**NL**



**EV Testing**

**IT**



**Smart Grids**

**NL + IT**

**EUROBAT** 

# Approach



- Establish State of the Art experimental facilities for PNR to address needs
  - *Battery cell performance testing*
  - *EV pack performance testing*
  - *Battery cell abuse testing*
- Engage stakeholders in the process - **relevance**
- Establish strategic partnerships - **complementarity**
  - EUROBAT
    - US DOE NL – Sandia, NREL, Argonne
    - ESA/ESTEC
- Exploit existing IET resources – **fast response**
  - Staff 7 (8)
  - Infrastructure
  - *Equipment*



# Activity areas



- **Support to our policy customers**
  - Global Technical Regulation on EV Safety – UNECE WP29 → DG ENTERPRISE
  - IEA - IA for HEV (Accelerated Ageing Testing for Li-ion Batteries) → DG R&I
- **Standardisation needs**
  - International – ISO/IEC
  - European – CEN/CENELEC
  - Other – SAE/UL/JIS
    - Harmonisation
- **Industry needs**
  - EUROBAT – *MoU signed November 2012*
  - Transatlantic Business Council (TABC)
  - *European Reference Laboratory?*



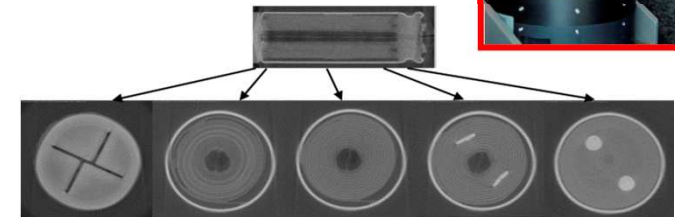
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# Experimental Facilities [1]



- **Battery cell performance testing & material studies**

- Cyclers (2 with 15 channels → 6 with 50 channels)
- 2 environmental chambers, 8 temperature chambers
- IR camera
- Glove box – plus extension
- STA with FTIR&GS/MS analysis
- Micro CT



# Experimental Facilities [2]



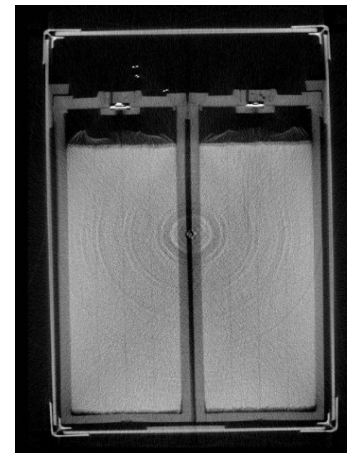
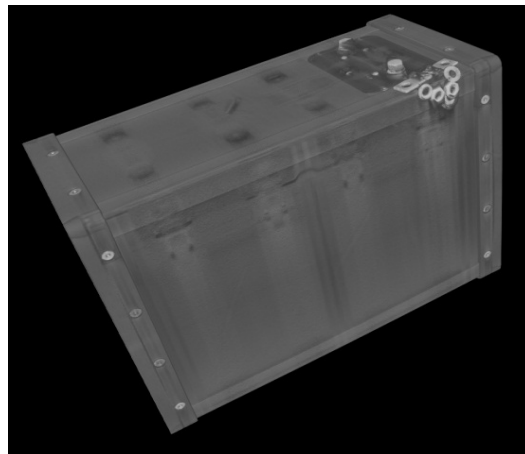
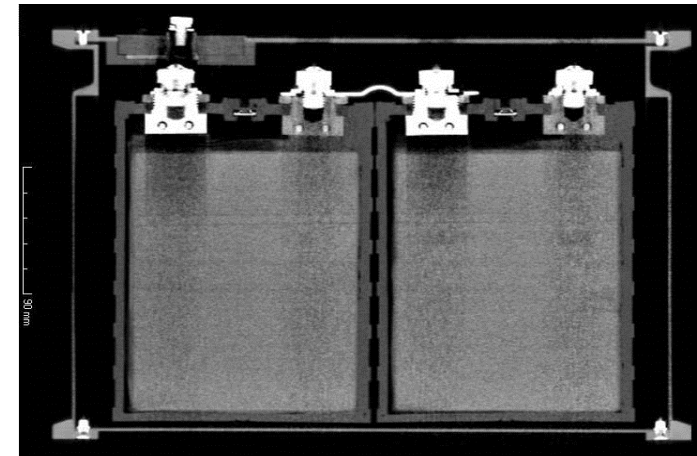
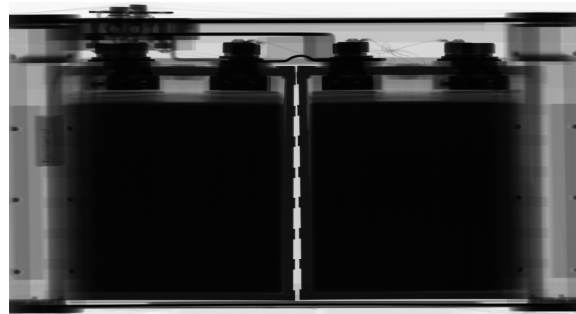
- **Battery pack performance testing**
  - **2 cyclers** (100/160 kW – 2 channels)
  - **Walk in climate chamber** (limit 100 kWh)
  - **X-ray Computer Tomography System** for in-situ imaging of modules



# Experimental Facilities [2]



- SLI battery pack (LiFePO<sub>4</sub>; 160 Ah/12 V; c. 50 cm x 20 cm x 30 cm)



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# Experimental Facilities [3]



- **Battery cell abuse facility**

- **4 abuse chambers** (limit 450 Wh)
- **2 ARCs** – cell and modules
- **Mechanical, electrical and thermal abuse capabilities**
- **FTIR/GC/MS** – gas emission analysis



# Experimental Facilities



- **Movie (virtual + real lab)**



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## BaSIT OBJECTIVE

*Online tool for recording and communicating accurate information on unwanted events involving batteries to advocate safe battery application*

*Tool needs to have (i) recording aspect and (ii) communicating aspect*

*Battery Safety Information Tool  
BaSIT*



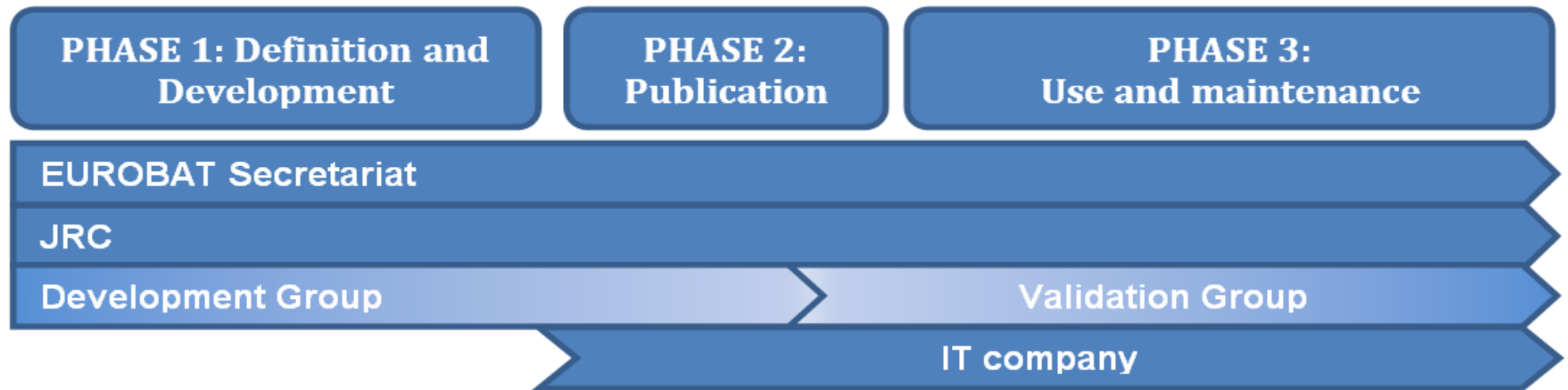
## Vision

- *Single authoritative database of battery safety events*
- *Validated data on the lead up to and outcome of events*
- *Lessons learned shared among stakeholders*
- *Visibly enhance the safe use of battery technologies*
- *Offset proliferation of battery safety misinformation*

## Features

- *Searchable online database describing unwanted/(near)events*
- *Situational background, likely cause, consequences, corrective actions and the lessons learned.*
- *Voluntary and anonymous*
- *Validation process to ensure quality/accuracy*

# BaSIT – Phases



## Development Group

Concept  $\Rightarrow$  Working tool  
Deciding on scope, main beneficiaries, objectives and access

## Validation Group

Event  $\Rightarrow$  Validation  
By battery experts - Source check, information quality

# BaSIT – Actors



**Data Entry**

**\*Validation**

**Publication**



**User/Industry  
member**

**JRC  
EUROBAT Sec.  
Industry members**

**JRC  
EUROBAT Sec.  
IT Company**

**EUROBAT** 

# Conclusions



- *Improving the public awareness and trust will benefit the market deployment and uptake of battery storage technologies*
- *JRC and EUROBAT will be working - with members and other industry stakeholders - to develop BESTEST and validate the BaSIT approach*
- *Your feedback is appreciated*
- *Questions?*

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