

Battery energy storage testing for safe electrification of transport

EC Joint Research Centre – Institute for Energy and Transport (JRC-IET)



Lois Brett, Andreas Pfrang, Juergen Ungeheuer, Marc Steen, Pietro Moretto

www.jrc.ec.europa.eu

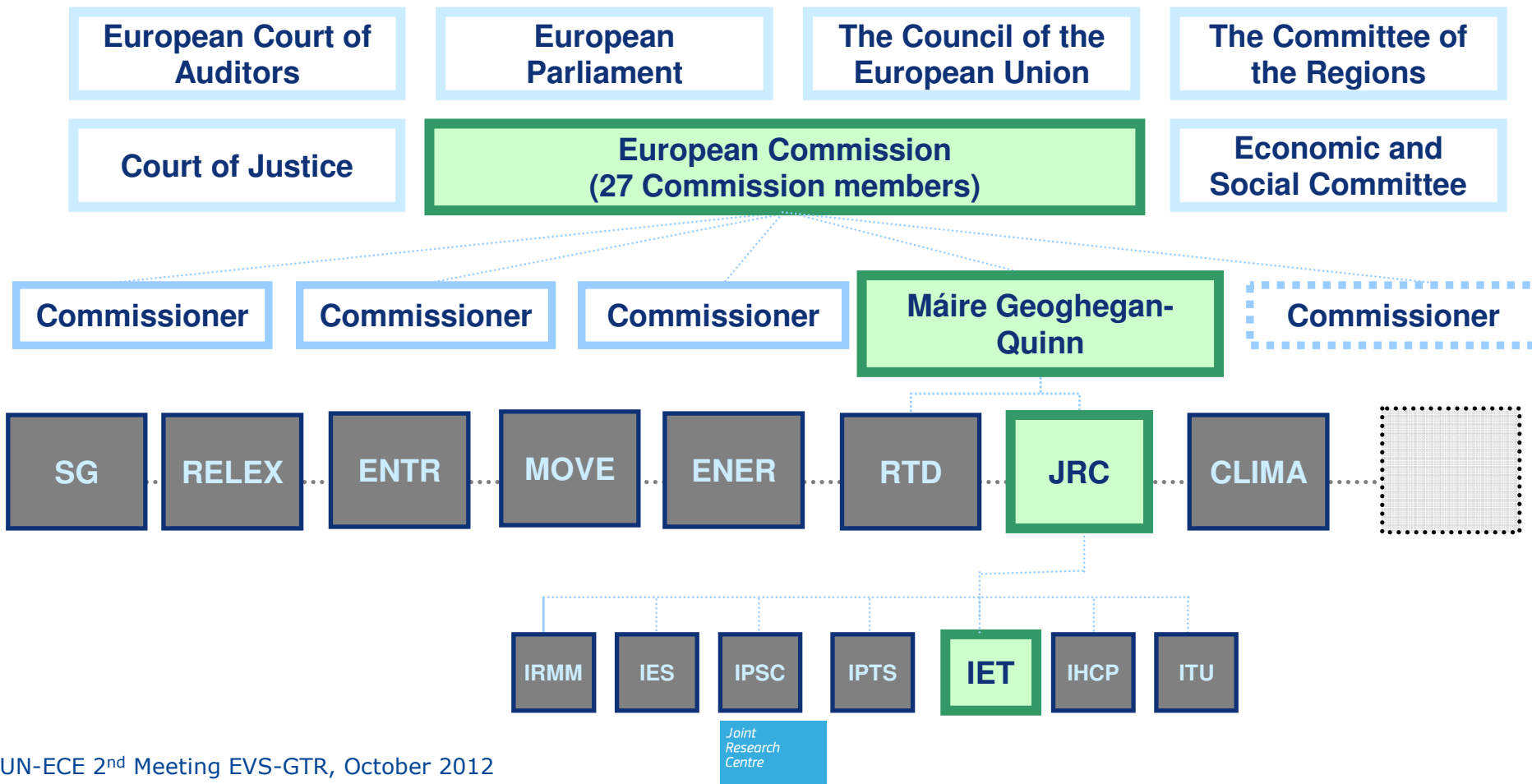
*Serving society
Stimulating innovation
Supporting legislation*



European
Commission



Panorama of the European Union



Institute for Energy and Transport (IET)



Petten, NL

~ 375 Staff
~ 285 Petten
~ 90 Ispra



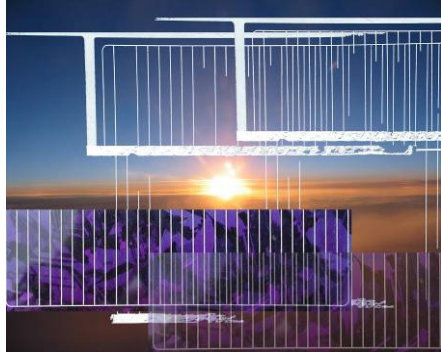
Ispra, IT

Mission:

To provide support to Community policies and technology innovation related to both:

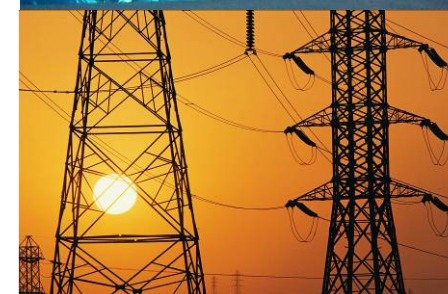
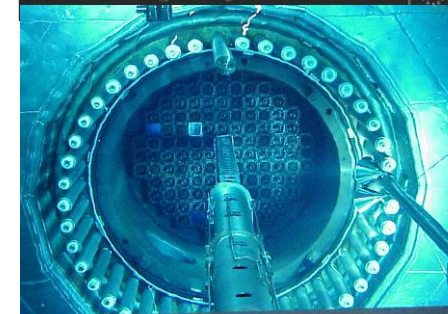
- Energy - to ensure sustainable, safe, secure and efficient energy production, distribution and use and
- Transport - to foster sustainable and efficient mobility in Europe.

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



IET Main Competence Areas

- Renewable energy
- Sustainable & safe nuclear energy
- Security of energy supply
- Energy techno/economic assessment
- Bioenergy including biofuels
- Hydrogen storage and safety
- Fuel cell performance
- Clean fossil fuels
- Sustainable transport
- Energy efficiency



Two pillars in EU energy and transport policy to reach integrated climate and energy objectives ("20-20-20 by 2020"):

- *Legislation*
- *Support to technology innovation (Flagship Innovation Union of Europe 2020 strategy, SET and STT -Plans)*



JRC contributes to technology innovation by:

- Pre-normative research and support to standards
- Independent performance assessment
- Operation of reference laboratories
- Safety evaluation



Current priority: Electrification of Transport

Transatlantic Economic Council - Letter of Intent with US DoE



EC JRC-IET

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

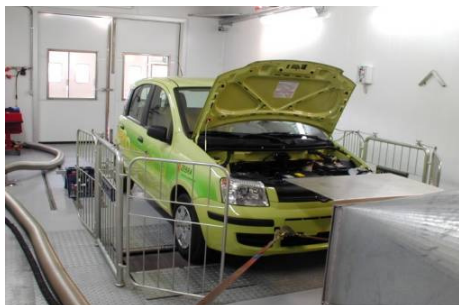


US-DoE ANL

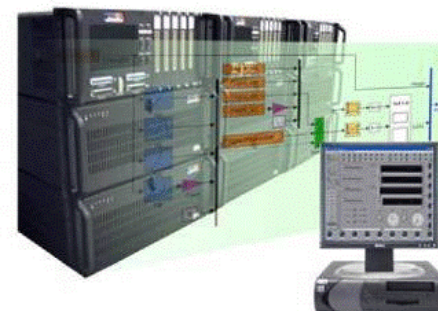
For over ten years, the United States and the European Union have sought to expand scientific collaboration across the Atlantic through their Science and Technology Agreement. Signed in 1997, this Agreement serves as a broad framework for cooperation, enabling some of our most distinguished scientists 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



Electrification of transport



E-Vehicle testing

- EV performance evaluation
- Testing EV charging station
- Road testing EV

ES Component testing



Smart grid

- Grid simulations
- Grid architecture
- Communication interfaces

Component testing..



WHAT? – Battery testing

- Performance validation
- Abuse and safety
- Material

WHO? – Customers/stakeholders

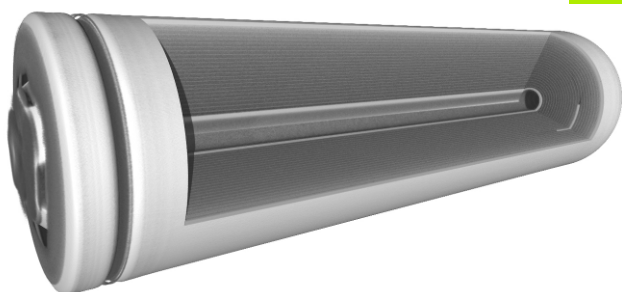
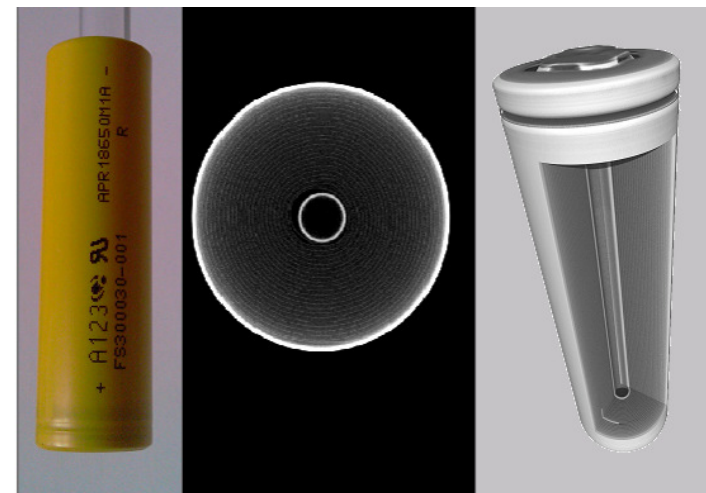
- DG's – MOVE, ENTR
- European industry representatives
- US DoE – LoI
- UN-ECE, ISO, IEC, CEN/CENELEC..

WHY? – JRC role

- Robust policy support – *EV safety!*
- Harmonised RCS
- Support European industry → innovation → jobs

How? - Approach

- New SOTA experimental facilities
- Exploiting existing infra – quick & low cost
- Strategic external relations – visible & effective



Progress 2012.....



So far:

- **Administrative establishment new activity**
 - **Allocation of resources – personnel, budget**
- **Established external relations – industrial, governmental, standards**
- **Decision on activities**
- **Allocation of laboratory space and investments, equipment etc.**
- **Procurement of first equipment**

Progress 2012.....



So far:

- **Administrative establishment new activity**
 - **Allocation of resources – personnel, budget**
- Established external relations – industrial, governmental, standards
- Decision on activities
- Allocation of laboratory space and investments, equipment etc.
- Procurement of first equipment
 - **Internal prioritisation/re-organisation**
 - **Internal recruitments**
 - **External recruitments - ongoing**

Progress 2012....



So far:

- Administrative establishment new activity
 - Allocation of resources -- personnel, budget
- **Established external relations – industrial, governmental, standards**
- Decision on activities
- Allocation of laboratory space and investments, equipment etc.
- Procurement of first equipment
 - **Interoperability Lol with ANL**
 - **Formalising agreements with US DoE labs**
 - **Negotiated MoU European Industry Representative – EUROBAT**
 - **Standards gaps – ISO/IEC**

Progress 2012.....



So far:

- Administrative establishment new activity
 - Allocation of resources – personnel, budget
- Established external relations – industrial, governmental, standards
- **Decision on activities**
- Allocation of laboratory space and investments, equipment etc.
- Procurement of first equipment

- 1. Performance testing battery cells – material diagnostics**
- 2. Performance testing EV battery pack**
- 3. Abuse testing battery cells**

Progress 2012....

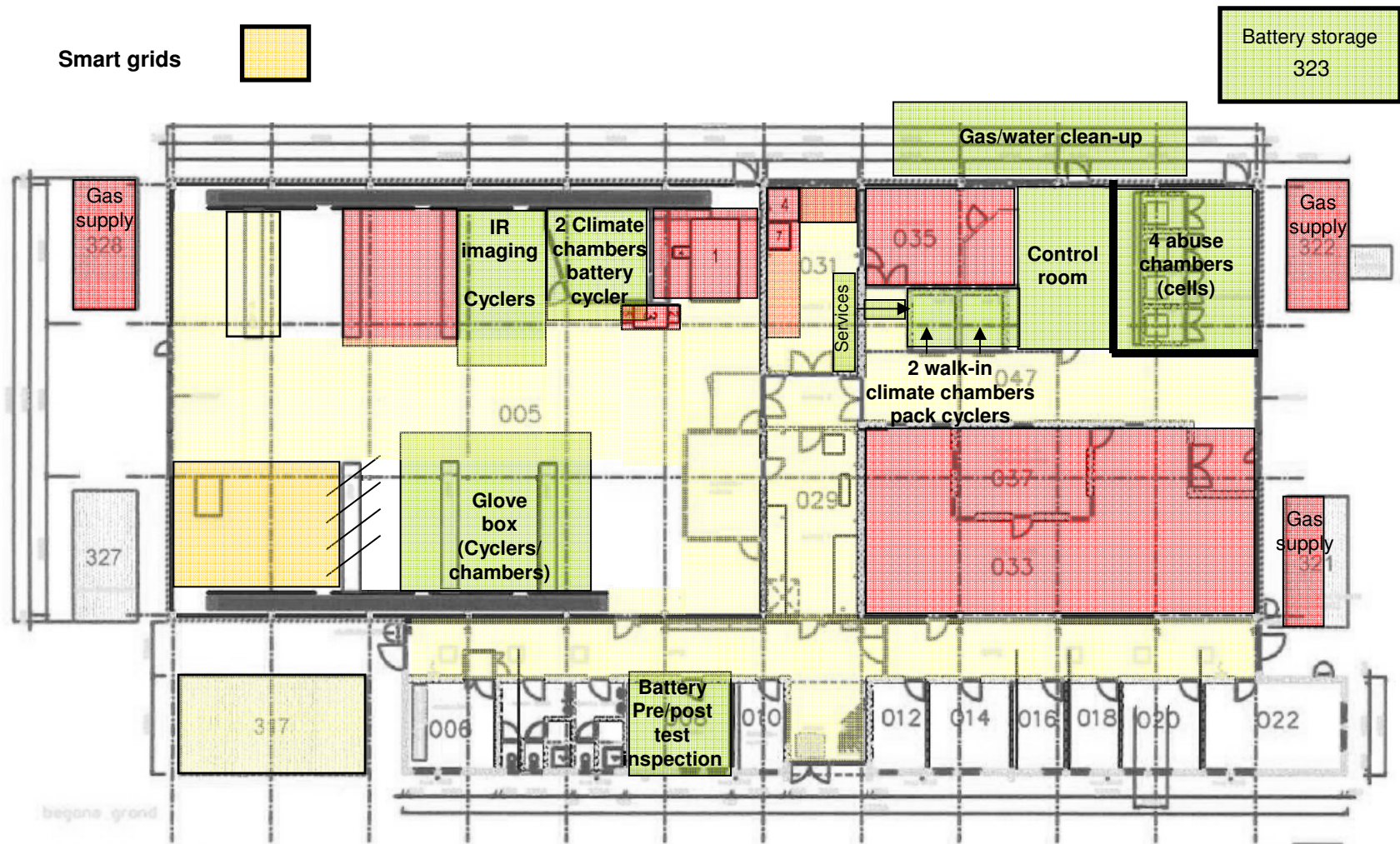


So far:

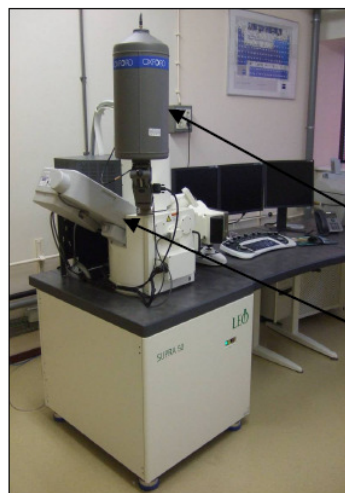
- Administrative establishment new activity
 - Allocation of resources -- personnel, budget
- Established external relations -- industrial, governmental, standards
- Decision on activities
- **Allocation of laboratory space and investments, equipment etc.**
- Procurement of first equipment



Allocations....

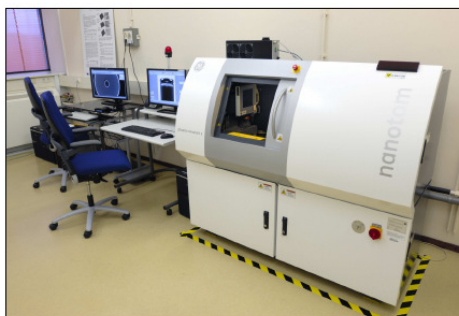


Scanning Electron Microscopy (SEM)



- FEG (field emission gun) system
- Resolution below 10 nm possible (depending on the sample)
- EDS (energy dispersive x-ray spectroscopy)
- WDS (wavelength dispersive x-ray spectroscopy)

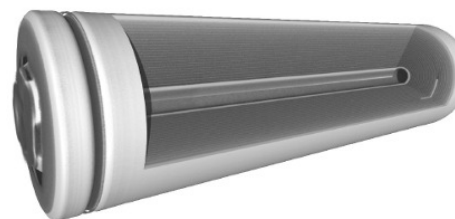
X-Ray Computed Tomography



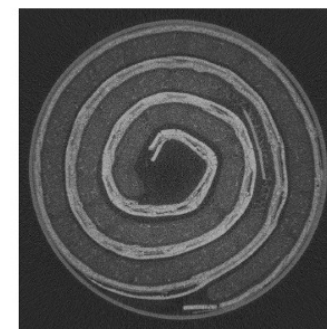
- Determination of 3D structure
- Resolution down to 1 μm
- Non destructive method
- (Almost) no sample preparation
- In-situ measurements possible
- Advanced evaluation software (VG Studio Max, MAVI, GeoDict)



X-Ray Computed Tomography



Li ion 18650 battery (with virtual cut)



Cross section of a NiMH AAA battery

Vibration table



- 6DoF
- 750 kg payload
- Vibration freq < 250 Hz
- Accelerations < 10 g (vert.)
- Mountable area 1.5 m x 1.5 m
- Housed in walk-in env. chamber
- Explosion proof
- - 40 to + 60° C
- 2 K/min
- 15 – 85% RH

Progress 2012.....



So far:

- Administrative establishment new activity
 - Allocation of resources -- personnel, budget
- Established external relations -- industrial, governmental, standards
- Decision on activities
- Allocation of laboratory space and investments, equipment etc.
- **Procurement of first equipment**

- **2 EV battery pack cyclers + cell cycler**
- **Environmental chambers**
- **Stabilisation chamber**
- **Glove box**
- **IR camera.....**



Prognosis 2013....



- **Installation of new equipment – cell, pack cycling**
- **Design of abuse test facility – licensing, risk assessment etc.**
- **Retrofitting of existing concrete cells for abuse tests**
- **Integration into battery testing complex**
- **Purchase of further equipments**
- **Further recruitments**
- **.....**

Thank you for your attention

Contact:

lois.brett@ec.europa.eu

+31 224 56 50 65

JRC

Serving society

Stimulating innovation

Supporting legislation

