Joint Research Centre

the European Commission's in-house science service

Serving society
Stimulating innovation
Supporting legislation

European Commission's Joint Research Centre – Battery-related activities

Joint EC & EGVIA workshop for advanced automotive batteries research – Brussels, 12/10/2016

L. Brett

JRC, Directorate for Energy, Transport and Climate, Petten, NL

www.ec.europa.eu/jrc

European Commission

Outline

- DG JRC and Dir. Energy, Transport and Climate
- Experimental Facilities
- Selected experimental activities
- Non-experimental activities
- Collaborations
- Contact

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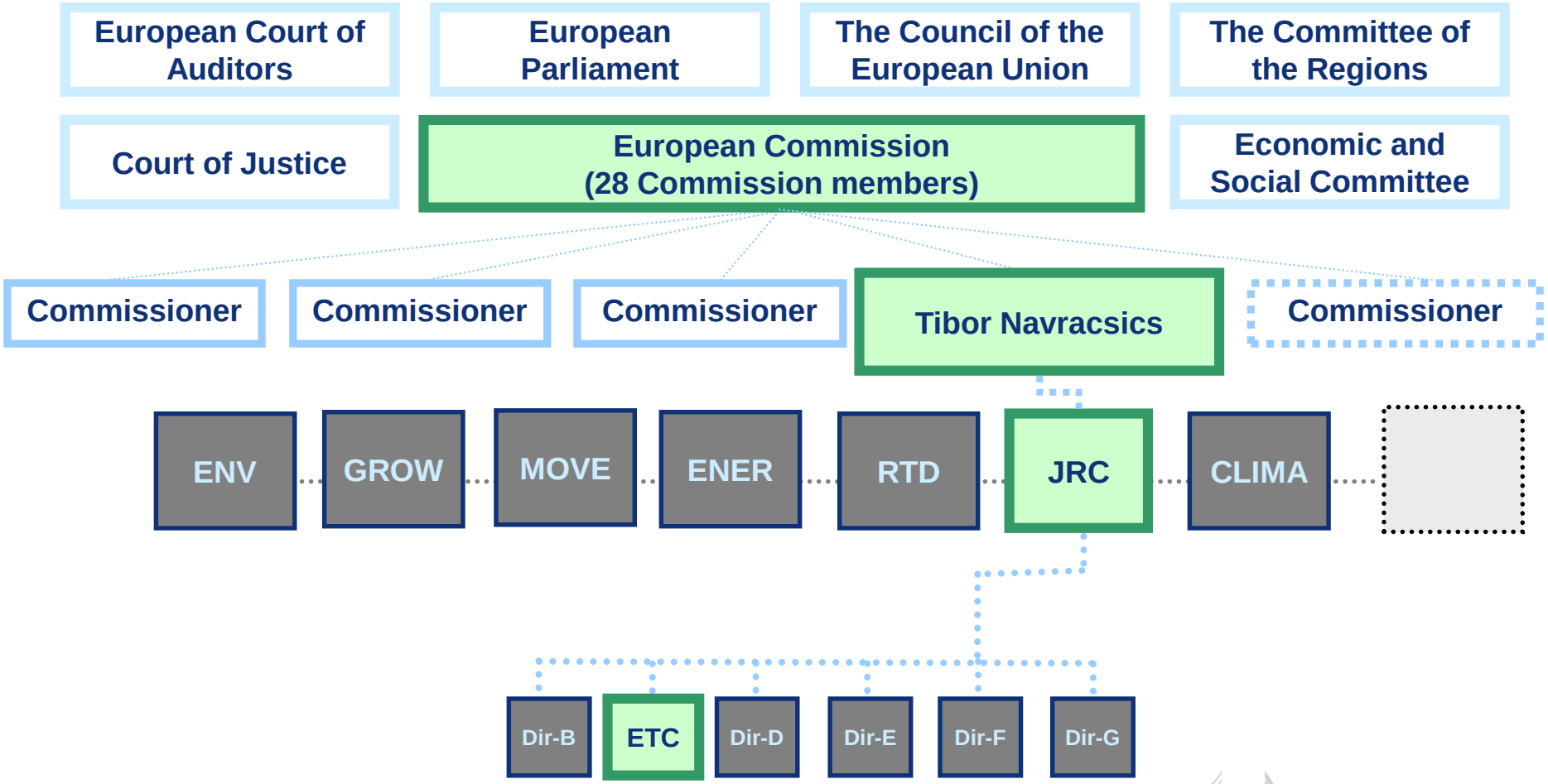
Panorama of the European Union



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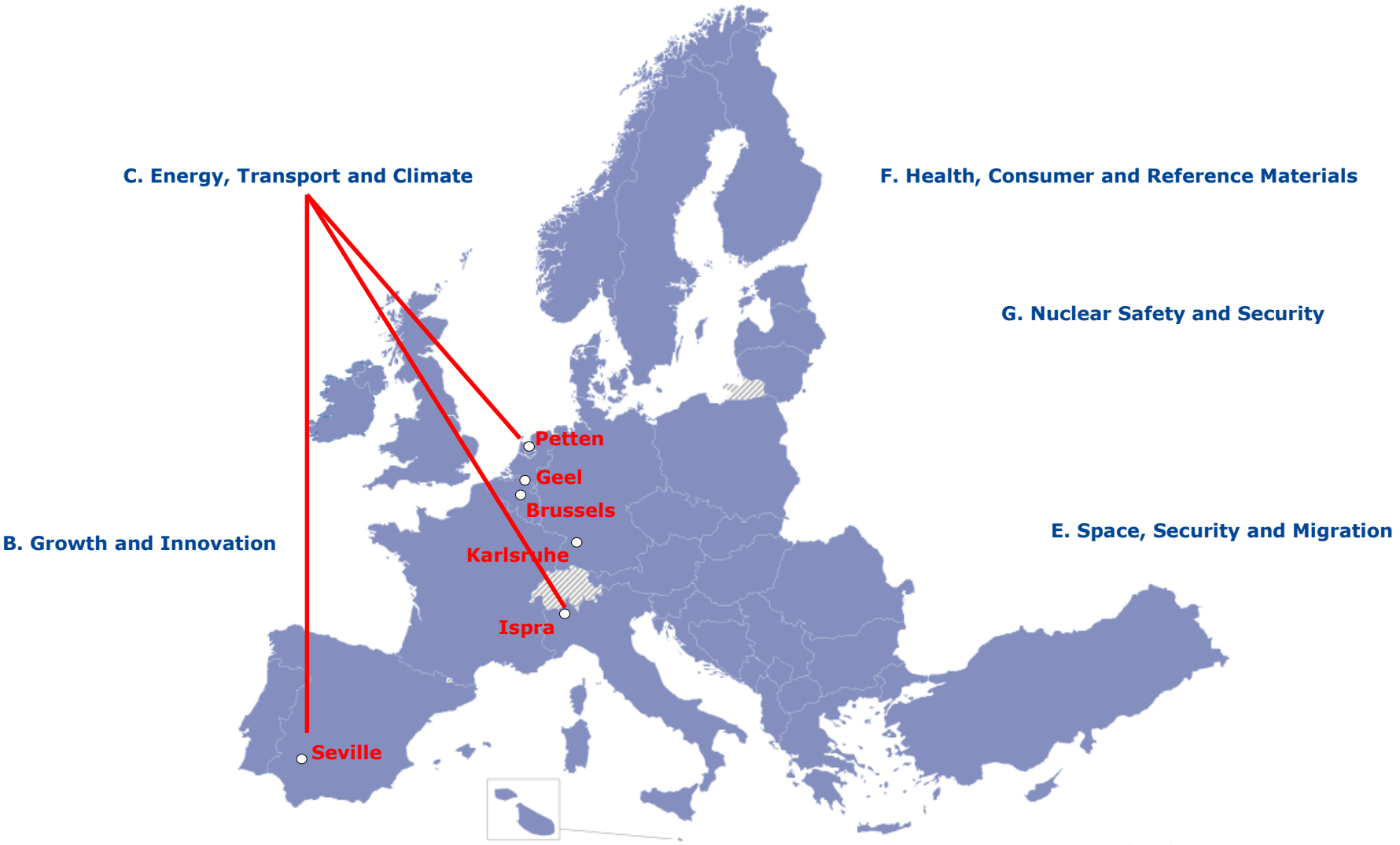
Geographical locations of the JRC sites



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Directorate for Energy, Transport and Climate

Petten, NL

~ 375 Staff
Petten
Ispra
Seville

JRC Mission:

As the science and knowledge service of the Commission, our mission is to support EU policies with independent evidence throughout the whole policy cycle.

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

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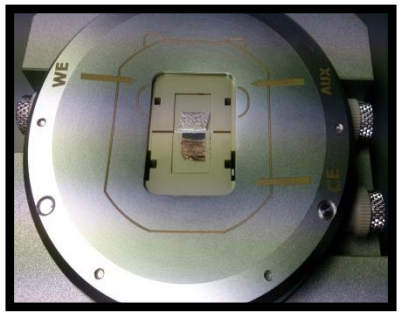
Battery Testing – JRC Experimental Facilities

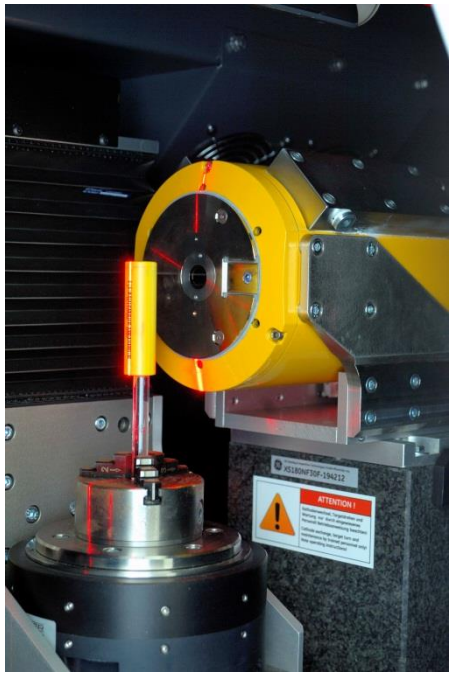
Battery cell performance testing/material studies lab

- Cyclers (4 with 100 channels)
- Potentiostats
- 2 environmental chambers, 12 temperature chambers
- IR camera thermal imaging
- 3 glove boxes
- STA with FTIR/GC/MS analysis
- 2 ARCs with FTIR/GC/MS analysis

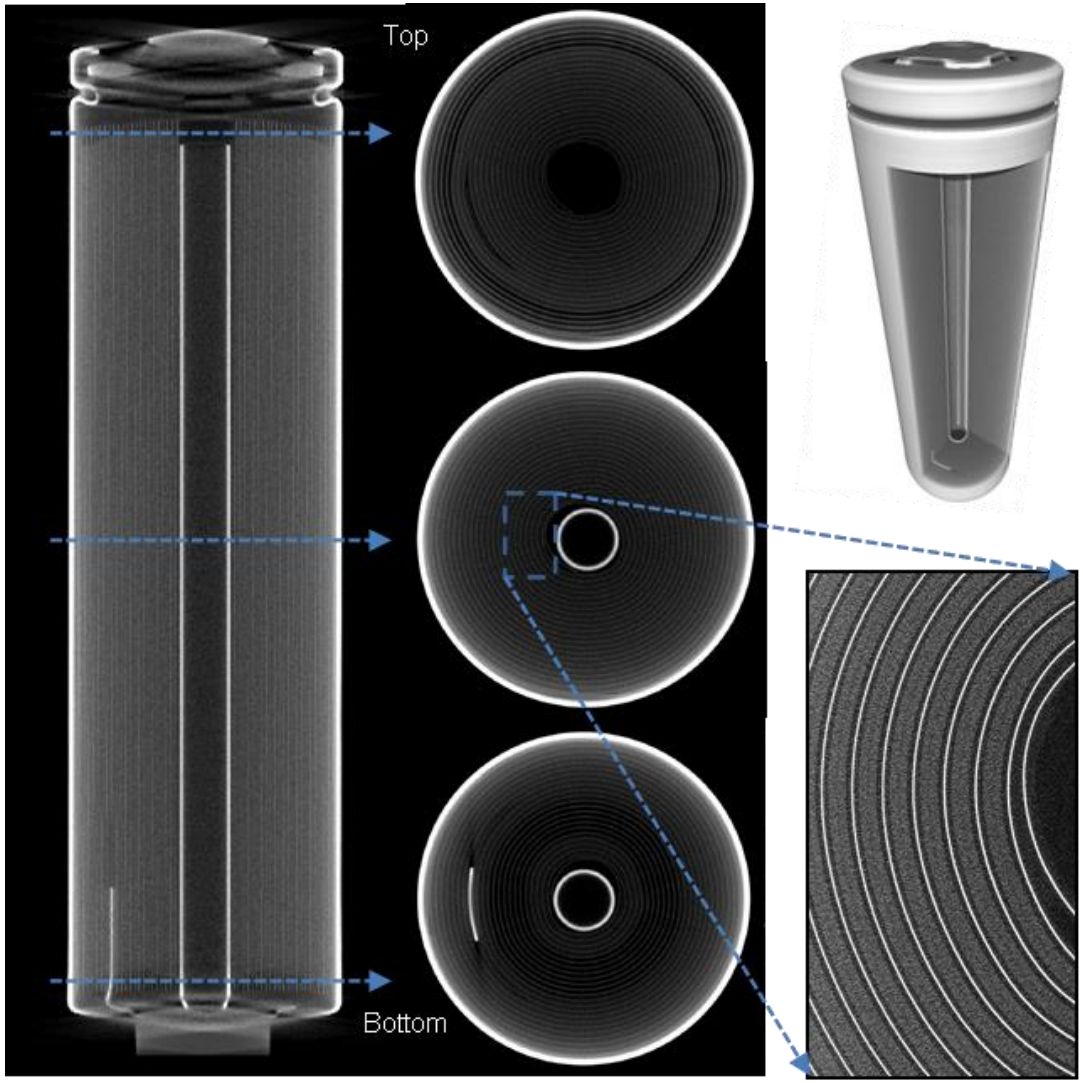


Microstructural analysis techniques

Example:
Micro X-ray computed tomography



A123-APR18650M1
18650 cell



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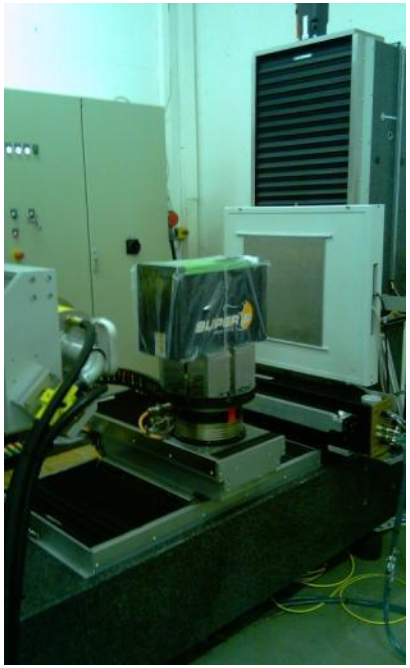
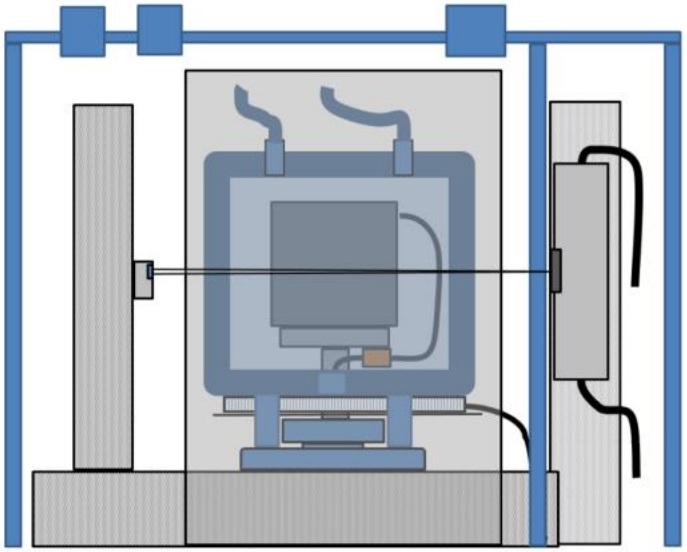
X-ray computed tomography

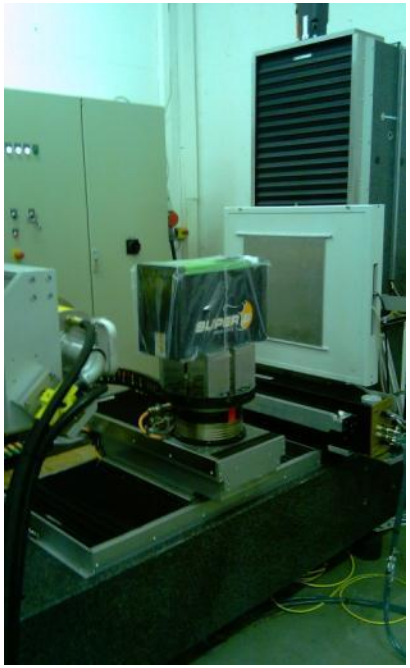
In-situ imaging of modules (limit 25 kWh) – cycling under temperature control (-30°C → + 65°C)

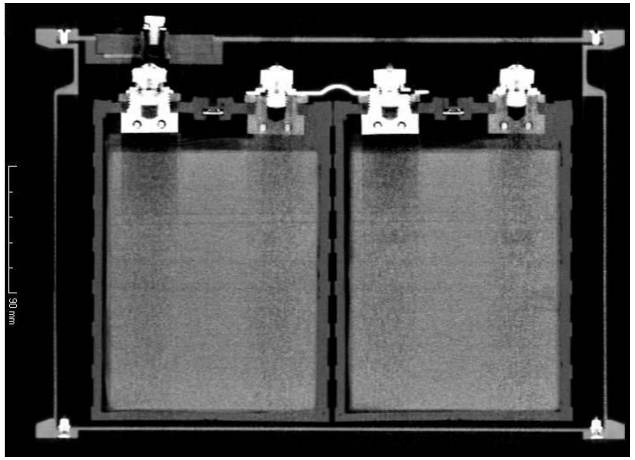


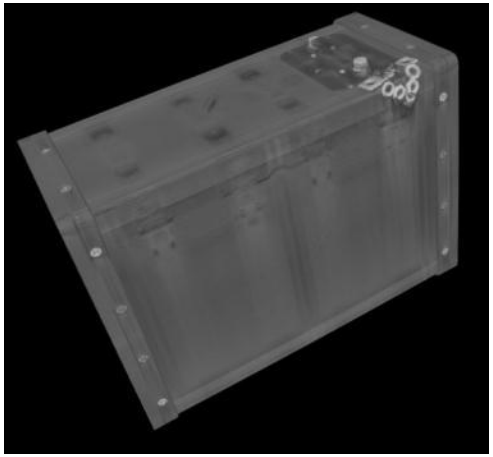


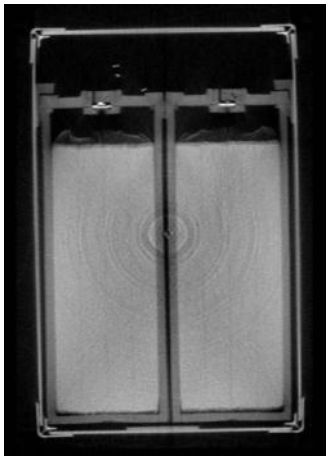
Diondo / Fraunhofer IIS

X-ray computed tomography (ex-situ)









SLI battery pack ($LiFePO_4$; 160 Ah/12 V; c. 50 cm x 20 cm x 30 cm)

Data courtesy of YXLON International

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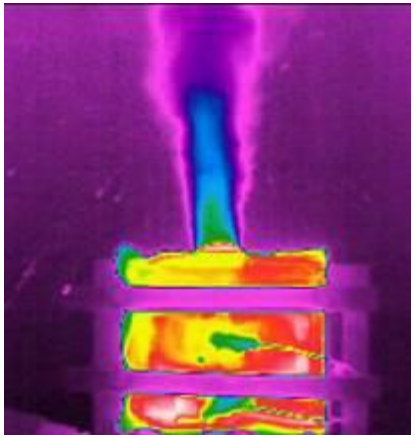
Example experimental studies

External Short Circuit Performance

Effect of ESC on safety performance of Li-ion cells

Electrolyte leakage – free electrolyte

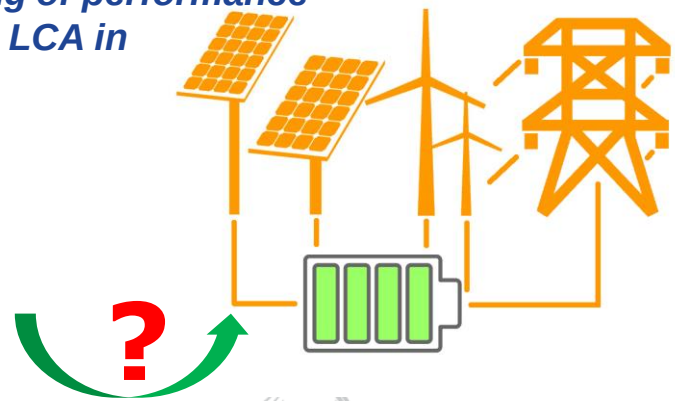
Electrolyte collected from commercial prismatic cell



IR image 10 Ah NMC Li-ion pouch cell during ESC test with 5 mOhm external resistance

SASLAB – second use

Testing & modelling of performance & degradation and LCA in 1st & 2nd use



H2020 – FiveVB

Five VB

Developing the next generation of batteries

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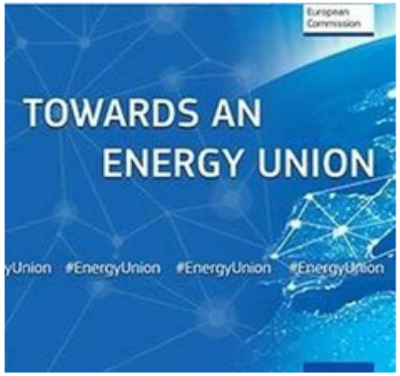
Integrated SET Plan – 10 Actions

ENERGY UNION

Research & Innovation & Competitiveness (R&I&C) priorities



https://setis.ec.europa.eu/system/files/Integrated_Roadmap_Energy_Union_Integrated_SET-Plan_10_actions.pdf

STRATEGIC ENERGY TECHNOLOGY PLAN - 10 Key Actions

Nº 1 in renewables	1. Performant renewable technologies integrated in the system 2. Reduce costs of technologies
Smart EU energy system with consumers at centre	3. New Technologies & services for consumers 4. Resilience & security of energy system
Efficient energy systems	5. New materials & technologies for buildings 6. Energy efficiency for industry
Sustainable transport	7. Competitive in global battery sector (e-mobility) 8. Renewable fuels
	9. Carbon capture, storage & utilisation 10. Nuclear safety

- Defines European R&I Strategy for the EU

- Provide framework for strengthening cooperation in R&I to bring new, efficient, cost-competitive low-carbon technologies faster to the market and deliver the energy transition in a cost-competitive way

- Identifies 10 R&I actions based on importance for the EU energy transformation and potential to create growth/jobs

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Action 7 so far……

Become competitive in the global battery sector to drive e-mobility forward

Issues Paper

EC: JRC, DG RTD, DG ENER, DG GROW, DG MOVE, SET-Plan Secretariat
SET-Plan Bureau

Public consultation

Stakeholders and Member States

Declaration of Intent

EC, Stakeholders and Member States

- **Focus on batteries for e-mobility**
  - ⇒ primarily *road transport*
    - ⇒ *passenger and light duty vehicles*
      - ⇒ *PHEV and BEV*
        - ⇒ *Li-ion and post Li-ion* chemistries
- **Synergies with stationary energy storage**
- **Targets proposed** for:
  - ⇒ Cell and pack performance
    - ⇒ Cost
      - ⇒ Manufacturing

- **Issues Paper published on SETIS website:**
  https://setis.ec.europa.eu/towards-an-integrated-SET-Plan
- **Comments/input was also solicited from 24 stakeholders**
- **All comments/input were considered, individual replies were provided**

- **Declaration of Intent endorsed including targets:**
  https://setis.ec.europa.eu/towards-an-integrated-SET-Plan

Selected Performance and Cost Targets			
	Current	2020	2030
Cell gravimetric energy density [Wh/kg]	90-235	350	> 400
Cell gravimetric power density [W/kg]		700	> 700
Fast recharge time [min] (70-80% ΔSOC)	30	22	12
Pack cost for automotive applications [€/kWh]	180-285	90	75

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Action 7 next steps….

Implementation plan ⇒ jointly defining priorities, implementation and monitoring plan

Temporary Working Group consisting of representatives of Member States, stakeholders and the EC to define:

- **⇒ priorities for R&I&C**
- **⇒ implementation plan, including proposals for funding**
- **⇒ monitoring of progress towards achieving targets**

⇒ early 2017

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Traction battery standards workshop

Putting Science into Standards: "*Driving Towards Decarbonisation of Transport - Safety, Performance, Second life and Recycling of Automotive Batteries for e-Vehicles***"**

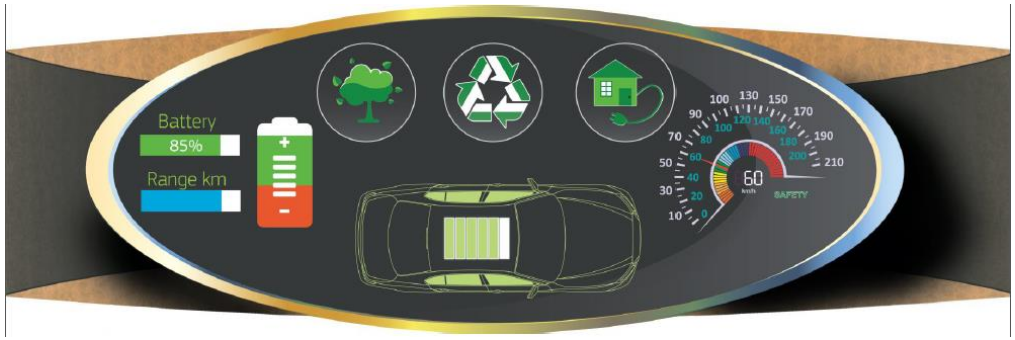
Petten, 22-23 September 2016

⇒ **Safety**

⇒ **Performance**

⇒ **Second-life**

⇒ **Recycling**



https://ec.europa.eu/jrc/en/event/workshop/putting-science-standards-driving-towards-decarbonization-transport

Summary report available in the coming weeks

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EURICS

Research, Innovation and Competitiveness in the Energy Union

⇒ **an integrated Energy Union strategy for R&I&C bringing together existing and on-going work on three interconnected strands:**

- ⇒ **energy technologies**
- ⇒ **transport**
- ⇒ **global competitiveness**

⇒ **Energy Storage**

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Collaborations

EGVI
European Green Vehicles Initiative

UNECE

***EV Safety* - Development of GTR on unique safety risks posed by EVs and their components**

EUROBAT

1997 "Agreement for Scientific and Technological Cooperation between the European Community and the Government of United States of America"

→ **Extended for a 5-year period** (starting 14 October 2013)

Collaborations with US DOE labs and JRC w.r.t.:

- Hydrogen/Batteries (NREL, Argonne, Sandia)
- PVs
- Smart grids/EVs
- Energy efficiency

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Thank you for your attention…

EU Science Hub: ***ec.europa.eu/jrc***

Twitter: ***@EU_ScienceHub***

Facebook: ***EU Science Hub - Joint Research Centre***

LinkedIn: ***Joint Research Centre***

YouTube: ***EU Science Hub***

Movie

Interactive tool

E-mail: ***lois.brett@ec.europa.eu***

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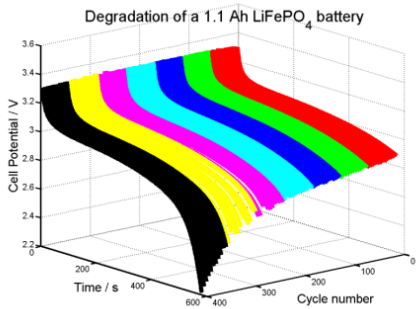
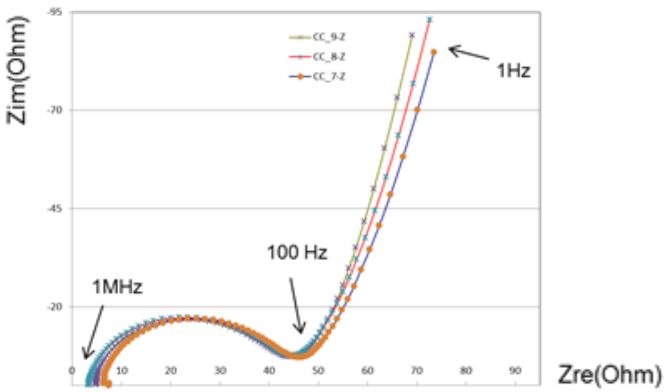
Experimental results

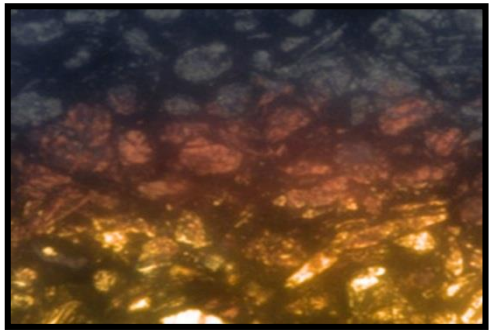
Battery cell performance testing/material studies

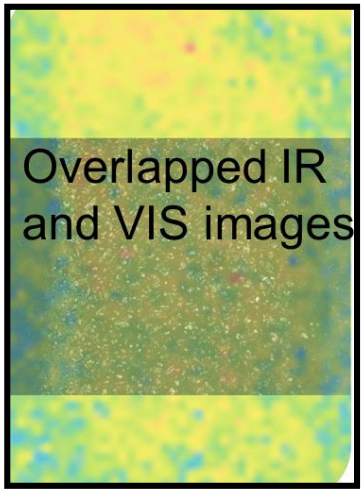


Cell performance testing

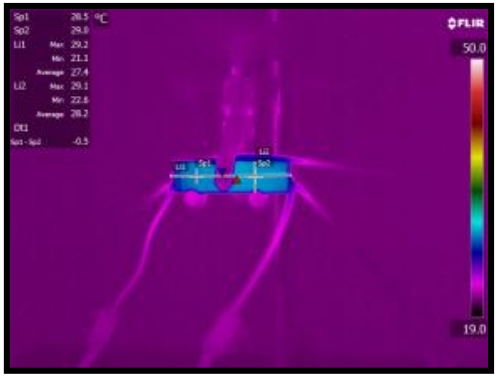


Impedance spectroscopy





Side by side cell with transparent window



IR imaging of cells

Action 7

List of Stakeholders and inputs received

1	ACEA – European Automobile Manufacturers Association
2	Batterieforum Deutschland
3	BEUC – European Consumer Organization
4	CEMR – Council of European Municipalities and Regions
5	CEN – European Committee for Standardization
6	CENELEC – European Committee for Electrotechnical Standardization
7	Covenant of Mayors
8	EASE - European Association for Storage of Energy
9	EERA – European Energy Research Alliance
10	EGVIA - European Green Vehicles Initiative Association
11	EII Grids - European Industrial Initiatives on Smart Grids
12	EMIRI – Energy Materials Industrial Research Initiative
13	EREF – European Renewable Energies Federation
14	ETP Grids - Smart Grids European Technology Platform

15	ETSI – European Telecommunications Standards Institute
16	EUA-EPUE - European Platform of Universities in Energy Research & Education
17	EUCAR - European Council for Automotive R&D
18	EUREC – European Association of Renewable Energy Research Centres
19	EURELECTRIC – Union of the Electricity Industry
20	EUROBAT - Association of European Automotive and Industrial Battery Manufacturers
21	RECHARGE - European Association for Advanced Rechargeable Batteries
22	Fraunhofer IWES - Fraunhofer Institute for Wind Energy and Energy System Technology
23	VITO - Flemish Institute for Technological Research
24	Fraunhofer ISI - Fraunhofer Institute for Systems and Innovation Research ISI
	+ Public consultation process

Comments received also from France, Norway and Belgium