CONFERENCE

Results from road transport research

Sessions Summary
#RTRConference2023

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Summary from: Laura Babio (POLIS)

The lack of accessible transportation can have a negative impact on a person's ability to find job opportunities, access education, maintain a social life, or even receive healthcare. However, innovation and technology have the potential to make transportation more inclusive and accessible, particularly in the realm of digital technology – for these advancements to make a real difference, it is crucial that technical development and funding align with policy and wider societal goals. Projects such as INDIMO, DIGNITY, and TRIPS serve as excellent examples of how technology and digitalization in transport can be inclusive.

INDIMO (Inclusive Digital Mobility Solutions) sought to break down the barriers that people face when accessing digitally interconnected transport systems. It did this by using the architectural concept of universal design and attempting to improve accessibility to digital innovations in mobility. By working collaboratively with communities of practice, INDIMO co-created tools that foster inclusive and accessible universal design, which in turn helped to influence future policies. It is essential to ensure that digital interfaces are user-friendly and accessible to a broad audience, including those who may be at risk of vulnerability, such as people with disabilities, mental health issues, elderly individuals or children. For example, interfaces should consider the need for human contact or ensure (cyber) security and privacy. INDIMO also highlights the importance of going beyond their toolbox to incorporate universal design into the EU transport strategy and local levels through SUMPs. By doing so, we can strive towards truly inclusive and accessible transport systems and cities.

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DIGNITY (Digital Transport In and for Society) longs for a digital transport system where the dignity of all is recognized – digitalization and digital literacy being too often taken for granted. Thus, to overcome this, the focus needs to be on involving users through new governance models in order to achieve sustainable and accessible mobility solutions. The project worked together with four pilot regions providing guidance on how to design mobility services for maximum inclusion. Through quantitative and qualitative research in the regions, the project has tested and validated the DIGNITY approach -consisting of three stages: framing, bridging and evaluating. The practical toolkit offers a range of tools aimed at promoting greater inclusivity and accessibility in digital services, as well as aiding in the development of long-term strategies. By enhancing understanding of the challenges faced by vulnerable-to-exclusion groups, the toolkit promotes the integration of inclusive design practices in the development of mobility policies, products, and services. In addition, the toolkit features a cutting-edge decision support tool, which assists in identifying the most appropriate tools for specific contexts and needs.

The objective of **TRIPS** (TRansport Innovation for vulnerable-to-exclusion People needs Satisfaction) is to build an accessible door-to-door transport system for people with disabilities, which would then actually become a more accessible transport system for everyone. The project used an open innovation process that empowered people with disabilities by participating as equal partners and leading the development process. Although amounting to a huge proportion of the population (87M in the EU and 135M in Europe), people with disabilities face enormous barriers in our transport systems and, overall, lack transport accessibility. Public and transport authorities and operators should establish co-design practices, define priorities (such as accessible journey planners), and find solutions in cooperation with users. To enable the effective implementation of such practices, TRIPS highlighted the importance of training and funding in the field of public transport.

The three projects jointly recommend to focus on users and to involve a wide range of stakeholders. Policymakers should do so when developing strategies, plans and guidelines. In addition, the industry can also play a crucial role in promoting accessibility over profit by adopting Corporate Social Responsibility (CSR) strategies. CSR refers to a business model where for-profit businesses consciously look for ways to generate societal benefits while pursuing institutional goals. Continuity of these measures is crucial for accessible and sustainable mobility transition to really take off.

The questions raised during the discussion have allowed the highlighting of particular points of attention. While recognizing that inclusion and equity is already a subject, to move into the social sustainability era, the challenge is learning how to tackle it. Tools from the different projects also allow for assessing the inclusivity of already existing services. These projects are only a start but will certainly allow for further discussion with cities. Co-creation takes time and resources, but it is essential to achieve accessible designs that are universally shared, the TRIPS speaker remarked on the proposition of setting up the European Design Center in order to communicate with people with different types of disabilities – "nothing about us without us". This is especially important as most people will be, at least one point in their lives – even temporarily or by being a helper or a parent – concerned by disabilities. Considering the population on the continent is ageing, as well as that 50% of people above 65 have disabilities, the risk of exclusion from public transport concerns society as a whole. Money is spent in inclusivity, but not wisely enough and without considering where it would have the biggest difference. It seems too often it is driven by political and operational objectives. Moreover, to achieve a sustainable mobility transition, cities need to attract people to public transport, and therefore must cater for user needs or people will be excluded from the offer. The speakers remarked that is not only a question of social responsibility, but it also makes sense economically to attract a new array of people into public transport, taking into account the difficulties the sector faces after COVID-19. Regarding legal follow-up, the top priority should be to put inclusivity as a procurement standard, to make sure all fleets in all modes are accessible, including micro-mobility, and to ensure both physical and digital access. However, we must ensure to avoid and pay attention to inclusivity-washing.

PARALLEL SESSION 2:
BATTERIES OF THE FUTURE

SUBLIME   HYDRA   SeNSE   MODALIS²

Summary from: Silvia Bodoardo (POLITO)

During the "Batteries of the future" session, 4 projects were presented in relation to the development of battery materials:

SUBLIME "Developing the Next Generation Sulfide electrolyte solid-state batteries for EV applications" was the first project to be presented. This project aims to significantly increase EV adoption by taking on the technical challenges that are presented by the consumer needs – especially the reduction in costs of EVs, increasing their capabilities regarding long distance traveling and fast charging. It proposes the use of high capacity such as metallic Li and high voltage electrode materials NMC based. To reduce the safety issue related to the use of metallic lithium the SUBLIME strategy is to protect it with the use of sulfide electrolyte so realizing a well performing solid-state battery.

HYDRA "Developing High-Performance and Sustainable Lithium Ion Batteries" takes a multi-headed approach to develop the next-generation of high-energy and low-cost Li-ion batteries. The project aims the development of new Co-free hybrid electrode materials & architectures with Enhancing manufacturing processes for production of materials and cells. In particular the development of modeling tools available online as shown.

SeNSE project, "Competitive next-generation European lithium-ion battery technology", enables a competitive European battery industry through research and innovation for a sustainable next-generation lithium-ion battery technology covering the value chain from materials and electrode development and production to cell and

module manufacturing including battery management system and cooling architectures. The project focuses on Nichel rich cathode and silicon anode.

MODALIS² "MODelling of Advanced LI Storage Systems" contributes to cost reduction of next generation EV battery cells based on Generation 3, by paving the way for an all-integrated development process based on numerical tools. Relying on extensive measurement data and material characterization all the way down to micro-structures, new models and tools and innovative methods will be developed.

Interesting discussions arrived in particular regarding the proper use and exchange of data for the modeling and new materials design and optimizations, for finally setting the basis for further developments more industrially oriented. The lesson learned regards the need of collaborations and share results coming from different funded projects to push further developments and industrialize faster batteries in Europe.

Summary from: Roland Uerlich (RWTH Ika)

The third session of the RTR 2023 conference was centred around some of the Green Vehicles projects funded under the 2018 topic "*Integrated, brand-independent architectures, components and systems for next generation electrified vehicles optimised for the infrastructure*" which aim at at accelerating the transition to electrified mobility and improving the user experience.

Four projects have been presented during the session and covered various complementary aspects of the challenges identified in the topic.

The **1000kmPLUS project** (Scalable European Powertrain Technology Platform for Cost-Efficient Electric Vehicles to Connect Europe), presented by Florian Kalleder focused on the supply chains development, centered around 3 areas:

1. *Scalable and highly efficient powertrain technology platform*

   Development of a 800 V three phase permanent synchronous motor, SiC-MOSFET (Metal Oxide Semiconductor Field-Effect Transistors) inverter modules, single speed gearbox.

2. *Fast charging and weight optimized battery system,*

   ~80kWh battery capacity, 800V system, phase change material to provide thermal capacity during performance charging.

3. *Vehicle integration and energy management, including demonstration*

Adaptation of vehicle software and energy management systems, implementation of routing algorithms, build-up and testing of demo-vehicle.

Dimos Gatidis detailed the achievements from the **CEVOLVER** project (Connected Electric Vehicle Optimized for Life, Value, Efficiency and Range). The developments were focusing on improving the user experience, by covering complementary aspects:

- Addressing the identified barriers to user acceptance of electric vehicles: range anxiety, system costs, charging times, charging availability and range prediction through eco-routing and efficiency improvement.
- Design of a holistic energy and thermal management system using new interior temperature control concepts such as local panel heating and the use of a heat pump.
- Testing of eco-routing using the example of a long-distance route ~350 km. Optimised route planning made it possible to save time and increase efficiency.

The third presentation was made by Thomas Geury introducing the **ACHILES** project (Advanced Architectures Chassis/Traction concept for Future Electric vehicles). This project focused on the development of a more efficient E/E control System architecture optimized for 3rd Generation of EVs. One of the main objectives was the development of a novel positive and negative torque vectoring; integrated in a hardware in the loop model, it will improve vehicle dynamics and efficiency at both component and system level.

The ACHILES project investigated more specifically the following:

1. Development and optimization of a novel wheel and braking concept

   Implementation of a pure e-brake system, use of an aluminium brake disc, reduction of brake particles by more than 50% compared to a conventional brake, as well as weight saving of about 19 kg.
2. Development of a novel out of phase control e-drive

   Dissipation of up to 10 kW via the electric motors, even when the battery is fully charged. Therefore, the reduction of the brake (from Objective 2 as presented during the conference) is possible so efficiently.
3. Development of a centralized computer platform (CCP)

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Reduction in the number of ECUs and associated wiring harnesses through the use of fewer central ECUs. Up to 20% weight savings and reduction of system complexity.

The last project is this session was **SELFIE** (sustained and Smart Battery Thermal Management SolutIon for Battery Electric Vehicles) presented by Theodoros Kalogiannis. It focused on the development of a new type of battery conditioning system with improved thermal system properties. One of the key innovations is the modularisation of the system with the aim of later scaling and integration of a phase change material as an additional heat buffer.

An evaluation of the cooling capacity of different systems using a prismatic battery cell (metal meshes aluminium and copper, heat pipes and phase change materials at a charging load of 5 C) has been performed. The PCM graphite material showed the best performance. This approach was scaled up to module level as a proof-of-concept.

In the overall result, a temperature reduction of 15% was achieved by using the PCM material compared to the comparison system. Likewise, the use of the optimised conditioning strategy showed the possibility of reducing the cooling capacity of the vehicle by 20%. The validation at vehicle level was still pending at the time of the presentation.

The impact of low battery temperatures (below 0 degrees Celsius) on the battery range has been extensively discussed. At the cell level, life expectancy and performance drop significantly without conditioning. Preheating programmes offer a good opportunity to counteract this effect. However, this topic was not the focus of the projects presented in this session, even though it is essential for some application scenarios. The other possible activities to increase the efficiency of recuperation were also discussed: the effects on the battery life are decisive here. However, a detailed investigation is not known here either.

The next discussion point related to the potential to bring PCM materials into application. Currently, the presenters are not aware of any application, as there are still some challenges regarding the additional weight and the conductivity of the material that need to be addressed before series integration.

Finally, the panel discussed the differences in design requirements arising from the requirements of fast charging and the V2G approach. For example, the BMS must be designed differently to meet both requirements. So, there are different requirements, although their exact differentiation was not currently part of the projects presented.

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PARALLEL SESSION 4: CCAM – NEW MOBILITY SERVICES AND FUTURE DATA MANAGEMENT NEEDS

Summary from: Margriet van Schijndel (TUe Eindhoven)

From the introduction onwards, it was clear the session covered topics beyond "classical" automation topics. This broader scope included how automated vehicles are impacting urban mobility and logistics services. Furthermore, the increasing data dependency, brought by many of the CCAM applications discussed, was a returning issue.

Some highlights from the project presentations include:

o **AVENUE** - Autonomous Vehicles to Evolve to a New Urban Experience:
   ▪ Lessons learned on e.g., legal and regulatory issues, as EU frameworks are not adapted to public transportation on-demand services. Moreover, public authorities and public transport operators are not yet fully oriented towards an integration of new mobility solutions in their future planning.
   ▪ In setting up and providing public transport services, on demand and door to door, it is essential to have an understanding of the actual service to be offered, and to whom.
   ▪ Knowledge on business models for such services is missing.
   ▪ Practical examples were given of regular, on-demand services offered.
o **AWARD** - All Weather Autonomous Real logistics operations and Demonstrations:
   ▪ Ongoing work on four real life condition demonstrations was presented and discussed.
   ▪ Challenges towards actual implementation of these demonstration services, e.g. in logistics processes were discussed.

- o **MobiDataLab** - Labs for prototyping future Mobility Data sharing cloud solutions:
  - ▪ The presentation showed ongoing work on labs for prototyping future mobility data sharing solutions, and the related transport cloud architecture prototype. This work focusses on making data findable and useful for users/cities, linked also to the currently expanding service catalogue.
- o **nuMIDAS** - New Mobility Data and Solutions Toolkit:
  - ▪ A co-creating process was shown, to develop services for cities, addressing their needs. Examples of the needs for such services were given, like planning issues for shared mobility means, and validation issues.
  - ▪ The consortium developed a joint approach for data handling, initially for use within the consortium.

The questions from the audience were diverse. This led to the following key inputs from the Q&A with the audience:

- o Though the projects are not formally connected to the CCAM Partnership, it was clear they feel being part of a bigger picture, and are contributing to CCAM related developments within a larger framework,
- o The importance of specific, relevant and challenging use cases was stressed, especially use cases which address actual needs and questions from city authorities, while at the same time building a coherent chain of actions towards implementation.
- o Skills for future steps on project results, in a joint European approach, are lacking,
- o The projects showed a similar struggle to transform data into an actionable source of information.

PARALLEL SESSION 5:
ADVANCED LIGHT MATERIALS AND THEIR PRODUCTION PROCESSES

Summary from: Thilo Bein (Fraunhofer)

Except UpScale, all presented projects are part of the Enlight EVs cluster with common dissemination activities running until 2024.

o **Fatigue4Light –** Boosting the use of lightweight materials in electric vehicles' chassis

The objective of Fatigue4Light was the weight reduction of the vehicle chassis through applying eco-design and Circular Economy (CE) approaches, new materials and advanced test and simulation methods. Up to now, materials for the chassis components have been selected only on basis of eco-design approaches. For these materials, methods have been developed to reduce the effort for material characterization and to improve simulations taking into account manufacturing effects. In the final year, findings will be implemented in the eco-design of selected components.

o **ALMA** – Advanced light materials and processes for the eco-design of electric vehicles

ALMA is addressing the eco-design of vehicle structures supported by Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) considering advanced steel and Sheet Moulding Compounds (SMC). Through optimization the best material in the best location has been identified and parts re-designed for lightweighting and recyclability. Regarding End of Life (EoL) approaches, debondable adhesives and health monitoring has been implemented. A weight reduction of 23% on vehicle structure has been predicted.

o **REVOLUTION** – Supporting the electric vehicle revolution…. through optimization of recycled plastics and advanced light materials

This project aims for increased use of recycled plastics in injection moulding processes for high-quality automotive parts utilizing machine learning and artificial intelligence. Post-consumer recyclates (PCR) of various polymers have been introduced in crash-relevant structural parts. Up to now, the upscaling is partly completed whereas the validation on selected parts is on-going.

o **LEVIS** – Light materials for electric vehicles

LEVIS is looking into eco & circular design concepts from the design phase to the end-of-life stage. In hybrid designs of selected structural components new bio-based, recyclable and recycled materials have been introduced obtaining 25- 35 % weight reduction at component level. Upscaling to full vehicle, weight savings of 25% are predicted. Besides, health monitoring systems and debondable-on-demand concepts have been introduced.

o **Flamingo** – Fabrication of lightweight aluminium metal-matrix composites and validation in green vehicles

The objective of Flamingo is the development of nanoparticle enhanced aluminium alloys for low pressure die casting and green sand casting. Up to now significant enhanced material properties could be achieved leading to weight reduction between 30 – 50% of selected component of a small commercial EV.

o **UPSCALE** – Upscaling product development simulation capabilities exploiting artificial intelligence for electrified vehicles

UPSCALE has been finished in 2022 demonstrating that by implementing artificial intelligence methods the computational effort can significantly be reduced. Introducing data-driven equations and Machine Learning (ML) / Artificial Intelligence (AI) approaches, complex models can be parameterised and order-reduced, enabling e.g., real-time aerodynamic prediction (e.g. 80% in solving one Computional Fluid Dynamics (CFD) simulation) or short-circuit prediction of battery packs under crash conditions.

Conclusion

The Enlight EVs cluster projects clearly demonstrated the feasibility of lightweighting by means of eco-design principles and secondary materials. Important is to consider the full life-cycle and take into account EoL strategies already in the design phase. However, upscaling and implementation in commercial product development still needs further research along the value chain and life-cycle.

PARALLEL SESSION 6:
AIR QUALITY: FROM TECHNOLOGY TO USER INVOLVEMENT

Summary from: Gaetano De Paola (IFPEN)

The session was introduced by Georgios Tzamalis from DG MOVE, who provided an overview of European directives related to air quality. The Air Quality topic was explored through 5 projects and under several point of views: anti-tampering systems, remote emission sensing, driver's behaviour, powertrain technology.

- **DIAS** project focuses on smart and adaptive tampering diagnostic. Analysis shows that even a small percentage of tampered vehicles (1%) can lead to a huge increase in fleet emissions (+60% for 2040). For that reason, it's very important to limit the tampering, and solutions could make the tampering economically unattractive and therefore reduce emissions via detection, prevention, and reporting countermeasures. DIAS project also provided legislative guidelines for future emission compliance framework, involving vehicle manufacturers, type approval and other authorities (i.e. Periodic Technical Inspection, Roadside Inspection), authorities, Member States, and the vehicle owners.

- **CARES** main goal is to reduce the hurdles for practical applications of remote emission sensing (RES) and to make it a widespread means of both monitoring and enforcing improvements in road vehicle emissions, contributing to cleaner air. The project current achievements are an improved accuracy of measurements of particulate matter (tested in Milan, IT) and improved detection of high-emitting vehicles (observed in Brno, CZ); in addition, a specific remote measurement system was developed with a potential lowered cost, and an easier use by unskilled personnel to achieve a broader deployment. The project also supported local air quality plans (e.g., design and implementation of Low

Emission Zones) and established a novel and proper remote emission sensing data infrastructure.

- o **MODALES** is researching and demonstrating technologies, legal aspects, training, driver support and awareness to achieve lower emissions from road vehicles. The project focuses on ways to reduce emissions from powertrain, brakes and tyres, especially from older ICE vehicles. During the sessions recent results on vehicle inspections were presented, as well as anti-tampering recommendations and ongoing trials of the MODALES low-emission driving app and associated training materials.
- o **uCARe** main target is the reduction of the overall pollutant emissions of the existing combustion engine vehicle fleet, by providing vehicle users with simple and effective tools to decrease their individual emissions; and to support stakeholders in local air quality policy by selecting feasible intervention strategies leading to the desired user behaviour. The project follows a data-based approach to emission modelling using vehicle signals and a wide range of emission measurement data.
- o **PHOENICE** project aims to demonstrate the maximal potential of a plug-in hybrid vehicle, optimised to reduce both fuel consumption and pollutant emissions in real driving conditions. The presentation illustrated the technical approach for the powertrain, and specifically the development of a lean combustion system, based on the Swumble™ motion, the e-turbo, a long route EGR and a new injection system; the after-treatment integrating an electrically heated catalyst; and a waste heat recovery system.

Following the presentations, an extensive and lively discussion ensued moderated by Gaetano de Paola (IFPEN).

Air Quality improvement needs a complex systemic approach. Antitampering systems allow a quick and significant reduction of the emissions especially in the urban and peri-urban areas. The effort should be done from the regulatory side, including the adoption of remote sensors, reinforced by the involvement of drivers which is crucial: to limit the tampering from one side, and adapt the behaviour on the other, in order to control emissions and fuel consumption (CO_2) through an optimal driving style. Finally, the technological development is still central in order to maximise the efficiency of the vehicles, e.g., plug-in hybrid ones, limiting pollutant emissions in real driving conditions.

PARALLEL SESSION 7:
CITY-LED INNOVATION FOR A RENEWED URBAN MOBILITY

Summary from: Karen Vancluysen (POLIS)

Cities are key actors in reaching the climate objectives of the European Green Deal. Integrating innovation and new technologies in local urban mobility policies and properly governing these will be instrumental. The CIVITAS projects presented during this session each created valuable tools to develop integrated short and long-term sustainable mobility policies, plans and solutions, enhance evidence-based and data-driven decision-making, and accelerate city-led innovation.

o **SUMP Plus**'s objective was to equip cities with tools to deliver zero carbon goals and achieve their mobility visions. To achieve this purpose, guidance to authorities was made context-specific and caters to cities of all sizes, different sectors and stakeholders. Mobility transformation pathways (20-30 years horizon) are recommended for authorities and are meant to interact with shorter-term SUMP cycles. While a long-term vision is crucial for radical policy changes, it can only be possible if regulations are continuously well implemented. SUMP Plus provides tools, training and policy briefs.

o **SPROUT** (Sustainable Policy Response to Urban Mobility Transition) produced knowledge and tools to enhance local mobility policy-making and formulate adequate city-led policy responses to technological innovations rendering mobility more sustainable and attractive. Three layers of cities (pilot, validation, associated cities) were involved, from the development to the enrichment phase. Co-created future mobility scenarios have proven to be a powerful tool to revise SUMPs in view of a better urban mobility transition.

o **REVEAL** (Regulating Vehicle Access for Improved Livability) looked at different types of Urban Vehicle Access Regulations and compiled best practices. This

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resulted in a structure of 33 building blocks applicable to all UVARs, accompanied by guidance on regulations and user-friendly tools for cities. Raising awareness of UVARs allows seeing the opportunities brought by these regulations, rather than solely the restrictive aspect. Collaboration resulted in the development of knowledge regarding planning, implementing, and evaluating access regulations.

- o **MOMENTUM** (Modelling Emerging Transport Solutions for Urban Mobility) developed new data analysis methods and tools to capture the impact of new transport solutions and services. The tools cover diverse data capability scenarios, and the project stresses the importance of cooperation through community of practices. Modelling efforts take into account the local context, and MOMENTUM tools and approaches proved useful to the pilot cities involved.
- o **HARMONY** (Holistic Approach for Providing Spatial & Transport Planning Tools and Evidence to Metropolitan and Regional Authorities to Lead a Sustainable Transition to a New Mobility Era) developed harmonised spatial and multimodal transport planning tools to support the sustainable mobility transition. This takes the form of model suites and recommendations for SUMP updates, analysing interventions for passenger and freight mobility in European metropolitan areas. Strategic, tactical, and operational choices in relation to new opportunities and services are envisioned and implemented.

The range of tools and innovations presented proves that there is not a universal response to renewed urban mobility. Each tool can indeed start a conversation and contribute to the involvement of new stakeholders and the integration of new solutions. Collaboration is key and the public and private sectors need to jointly work towards innovative and sustainable mobility in cities. The importance of an integrated approach through Sustainable Urban Mobility Planning is crucial in this respect and allows for the smart use of innovation as part of an overarching mobility vision and in line with policy goals.

Points of attention raised during the Q&A and discussion included the need to look at the functional urban area and also take into account incoming traffic, for example from commuters. It was also highlighted that a better interaction between freight and passenger mobility needs to be prioritised. In discussing the tools and solutions, it was recognized that the local context plays an important role and one-size-fits-all solutions

are not realistic. Overall, it was agreed that city-led innovation to help reach public policy goals is key, i.e., framing and governing innovation in a way that it does not undermine policy goals but reinforces them. The challenge of introducing restrictive measures such as UVARs and obtaining citizens' support for those was discussed, while the need to internalize the external costs of polluting traffic to society was at the same time recognized. However, restrictions should be accompanied by complementary measures and valuable alternatives should be in place. Ultimately, sticks become carrots because the aim is to make everybody's life better and improve mobility for all.

PARALLEL SESSION 8:
GV – NEXT GENERATION ELECTRIFIED VEHICLES FOR URBAN AND SUBURBAN USE

Summary from: Marco Pieve (Piaggio)

During this session, 4 projects presented their activities aiming at contributing to the development of electrified vehicles to answer to three needs for urban and suburban use:

- need of personal mobility;
- right-sized transport of goods for first/last mile;
- flexible passenger mobility.

Two of them, **Leonardo** and **DREEM** are dealing with micromobility solutions, while **URBANIZED** and **REFLECTIVE** fall respectively under right-sized vehicle for commercial uses and light and flexible multipassenger vehicles.

o The concept of **Leonardo** project was developed by putting together, in a smart way, existing solutions while taking the best features of the monowheel and e-scooter to achieve a better vehicle stability without affecting drivability. It could be considered a good example of incremental innovation. Up to date, vehicle concept design has been defined and some prototypes have been realized, that are light and foldable. Further steps are pilot design and execution, both in sharing and standalone mode, as well as business plan development.

o **DREEM** project (February 2021 – January 2023) approached the challenge of micromobility in a different way, by delivering an innovative three wheelers electric kick-scooter equipped with a collision alert system based on rear camera

and coupled with an inflatable helmet. Despite the fact the prototype weight is not negligible, it is foldable and transportable like a trolley.

The DREEM solution was successfully tested in three pilot locations in Europe. Among the main results of the project and feedback from pilots, 6 mobility profiles and 3 business models have been proposed.

o   Focusing on a holistic design approach working at systems, vehicle and fleet levels, **URBANIZED** offers a comprehensive modular solution for last-mile delivery of retail. URBANIZED project is going to

- deliver high performance scalable e-drivetrain (right power),
- to implement Energy Management System that integrates 4 ECO functionalities at different system levels (right energy),
- to design a swappable modular cargo-body system (right payload).

o   **REFLECTIVE** aimed at developing a light electric (L7e category) vehicle, that is reconfigurable from passenger to goods transportation and is rightsized for urban cases and missions. Comfort and usability aspects have also been considered, such as different charging strategies (plug-in conductive and wireless) as well as automated driving functionalities (e.g. parking) to further support charging and operability in urban scenarios. Up to date, vehicle design and reconfigurable interiors have been defined and the main components and systems (e.g. modular scalable powertrain) designed and selected.

URBANIZED and REFLECTIVE share some aspects on vehicle design and on crash safety developments (e.g., strategy for airbag and seatbelts) aimed at meeting Euro NCAP ≥ 4 Stars requirements.

During the Q&A session, many questions and lively and interactive discussions occurred between audience and speakers, particularly focusing on affordability and environmental sustainability of the proposed solutions. Projects contributed to bring further knowledge on users' needs and mobility profiles. Affordability and environmental sustainability should be further investigated, by developing business plans at systemic level. One of the lessons learnt is that sustainability of micromobility sharing scheme with urban system should be reconsidered. Even though projects show some advances, safety is still an open issue, still to be addressed also considering the lack of knowledge on accidents statistics.

Summary from: Denise Tapler (AVL)

In this session the objectives and achievements of four different projects were presented, all funded under call H2020-LC-BAT-10-2020 – Next generation and realization of battery packs for BEV and PHEV.

o **LIBERTY** – **LI**ghtweight **B**attery **S**ystem for **E**xtended **R**ange at Improved Safe**TY**. LIBERTY, presented by Eduoardo Miguel from IKERLAN, started in January 2021 and the project's goal is to upgrade battery performance, safety and lifetime from an overall lifecycle and sustainability point of view. This should be achieved by a compact and safe battery pack based on high energy density cells and crash resistant lightweight materials housing, a versatile battery management system over the system's total life (1st and 2nd life), high accuracy state estimators that allow fast charging, enhance range and lifetime and guarantee safety, and a thermal management system ensuring safety and preventing battery degradation during fast charging.

o **MARBEL –** Manufacturing and assembly of modular and reusable EV battery for environment-friendly and lightweight mobility.
MARBEL was presented by Eduard Piqueras-Jover from EURECAT and the project's goal is built on the three pillars design for circularity, performance improvement and testing, validation, dismantling. The actual achievements for the design for circularity include lightweight and sustainable battery housing, a modular design for an easy and safe (dis-)assembly, new weldless busbars for cell-to-cell connection and a methodology for Eco-Design. Battery performance

is addressed by ultra-fast charging strategies and enhanced thermal management system and a battery management system, which is adaptable to 2nd life applications. Testing, validation and dismantling is covered by a flexible and versatile EV battery pack test bench platform (eVIL), a set of future procedures for characterization and validation and a safe and efficient process for dismantling. It should be mentioned that the Eco-Design principle is a key element throughout the entire project.

o **ALBATROSS** – **A**dvanced **L**ight-weight **BAT**ter**R**y systems **O**ptimized for fast charging, **S**afety and **S**econd-life applications.
The presentation of the ALBATROSS project was given by Irem Sapmaz from YESILOVA. This project is based on the further development of a BMW i3 EV. A 20% reduction in weight, 25% charging time reduction down to 30 minutes and increased driving range should be achieved through a combination of light-weighting approaches with integrated cooling and further developments regarding BMS and Sensing like AI based battery modelling, early warning battery failure detection software and anode controlled charging algorithm. Further highlights of the project include the creation of a flexible advanced battery management system capable of being used on different types of packs and mid-sized vehicles, the development of a very fast safety detection and prevention technology and the development of solution and processes for sustainable dismantling/recycling of battery packs/modules using robotic tools.

o **HELIOS** – **H**igh-p**E**rfomance modu**L**ar battery packs for susta**I**nable urban electrom**O**bility **S**ervices.
The project HELIOS, presented by Corneliu Barbu from Aarhus University, aims at developing and integrating innovative materials, designs, technologies and processes to create a new concept of smart, modular and scalable battery pack for a wide range of electric vehicles used in urban electromobility services, from mid-size full-electric vehicles to electric buses, with improved performance, energy density, safety and Levelized Cost of Storage (LCoS). Further, optimized EV charge and discharge procedures as well as the creation of new designs and processes for ease of battery reuse in second life and recycling at EoL are addressed.

In conclusion, the presented results seem very promising, and it can be stated that good progress was shown by all projects toward the further development of electric battery systems. All four European projects are part of the COLLABAT cluster, which aims at virtually clustering independent R&D projects jointly addressing the technical scope areas of the LC-BAT-10 topic.

In the subsequent discussion the numerous questions have highlighted the importance of the adaptability of new module/pack designs to different cell geometries and future cell technologies like solid-state batteries – also with regard to disassembling. Challenges clearly identified in relation to the project results consisted of the sourcing of battery cells for research and how to handle the rapid further development at pack level shown by competitors (e.g., cell to chassis in addition to cell to module and cell to pack) that could not have been foreseen at the time the project proposal was submitted.

PARALLEL SESSION 10:
DRIVER BEHAVIOUR AND ACCEPTANCE OF CONNECTED, COOPERATIVE AND AUTOMATED TRANSPORT

Summary from: Ingrid Skogsmo (VTI)

As introduced by Suzanna Kraak from EC DG RTD, driver behaviour and acceptance are key when it comes to deploying CCAM systems and services. There are many public concerns that arise. Besides how to handle increased automation and connectivity as a driver or user, there are also considerations in terms of the wider effects that CCAM can have on data privacy, ethics, safety perception, etc. The deployment of CCAM affects different groups in different ways. This also depends on different use cases and modes of transport. The presented projects dove into their findings regarding the human-machine interaction and acceptance of CCAM.

o **SuaaVE** project (presented by Jose Solaz – IBV) has developed a model, ALFRED, evaluating the human reaction to understand emotion detection and ethics; adapt eHMI, ambient comfort, cognitive smart assistant, and ride comfort. The focus was on achieving an emphatic vehicle. Expected impact: recommendations for policies and strategies, and guidelines for the development of AVs.
o **DriveToTheFuture** project (presented by Lila Gaitanidou – CERTH) has developed models of behaviour, training tools, and optimized HMI. Demonstrations were organised in pilots covering road, rail, workboat, drones. AV "drivers" were involved in co-creation. Results of the project include the following statements:

   ▪ Low speed is both safe and unsafe (strong incitament for overtaking),

- Training affects willingness of use, not so much trust,
- Even experienced users got new knowledge from the training activities.

Expected impacts of using training are: enhanced user acceptance, safety & security.

o **Trustonomy** project (presented by Alessandro Barisone – algoWatt) tested SAE levels L1-L4 technologies, tools, training curricula and trust in four pilots covering five European countries.
The project established guidelines for increased awareness, skills development and driver training, user acceptance understanding, policy recommendations regarding the use of simulator, and HMI guidelines for intervention requests. Expected impacts of the project are enhanced trust and acceptance of AVs.

o **PASCAL** project (presented by Friederike Kühl - Smart Transportation Alliance / Etelätär Innovation) aimed at enhancing driver capacity to operate CAVs and increasing public acceptance. It developed HMI that will bridge the emotional and cultural gaps that may exist between expectation and reality. Main outcome of the project is that training is important to explain, and to re-explain. Project also created the Guide2Autonomy: 100+ recommendations for connected and automated mobility: https://www.pascal-project.eu/G2A. Expected impacts include input to enhanced vehicle design, human-machine interface layout and a more holistic organisation of the transport system.

The session provided a wide view of driver behaviour and acceptance factors: emotional assessment, psychological aspects, driver state monitoring, training, and different kinds of tools. Following the project presentations, Ingrid Skogsmo from VTI moderated a discussion with the audience. It was concluded that more research is needed into cognitive distractions (still relevant in L4 & L5 context), interaction of passengers with the system, HMI (not to over-complexify it), as well as integration of CCAM with connectivity, AI, and cybersecurity. At the end, what does automation mean, and to whom? We have to align our vision of automation between the entire stakeholder community, to agree on how it can support the transport sector. This will help us to make sure our expectations are the same, and that these new technologies are acceptable to society.

PARALLEL SESSION 11:
FREIGHT TRANSPORT: FROM NEW METHODOLOGIES TO INNOVATIVE SOLUTIONS

Summary from: Fernando Liesa (ALICE)

Overview of the topic discussed and relevance of this R&I area according to the policy developments

The session **Freight transport: from new methodologies to innovative solutions** was framed in the policy context of the **Sustainable and Smart Mobility Strategy[1]** including an action plan of 82 initiatives to get transport ready for the digital transformation, climate change mitigation and adaptation. This includes actions in all transport sectors as well as for cross-modal data sharing logistics ecosystems building on the developments of the Digital Transport and Logistics Forum[2]. At the end of 2021 the European Commission launched new transport proposals targeting greater efficiency and more sustainable transport[3], particularly addressing revised guidelines for the TEN-T development and **the new EU Urban Mobility Framework[4].** Additionally, the Greening Freight Package[5] is expected to be launched in the second quarter of 2023.

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[1]   https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0789
[2]   Digital Transport and Logistics Forum, DTLF (*www.dtlf.eu*). Commission Expert Group (E03280).
[3]   https://ec.europa.eu/commission/presscorner/detail/en/ip_21_6776
[4]   European Commission (2021). The New EU Urban Mobility Framework. COM(2021) 811 final. https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12916-Sustainable-transport-new-urban-mobility-framework_en
[5]   https://commission.europa.eu/strategy-documents/commission-work-programme/commission-work-programme-2023_en

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These projects were presented during the session:

- **STORM** - *Smart freight TranspOrt and logistics Research Methodologies.*
- **SENATOR** - *SENATOR Smart Network Operator Platform enabling Shared, Integrated and more Sustainable Urban Freight Logistics.*
- **ePICenter** - *Enhanced Physical Internet-Compatible Earth-frieNdly freight Transportation answer.*

Results highlight of STORM project

The following trends and topics of interest for the freight and logistics community have been identified and investigated:

- Modelling a European charging infrastructure network for heavy duty electric trucks Innovative logistics concepts with zero-emission vehicles, based on experiences from Finland and Czechia.
- Future policies recommendations developed by agent-based policy assessment tool.

Results highlight of SENATOR project

Senator is in the mid-term of the project.

The project is working on a digital tool to aid more efficient urban logistics systems, particularly applying the synchromodality and physical internet concepts to city logistics, aiming at:

- making a better use of resources,
- reducing barriers and increasing interoperability across systems (e.g., working on synergies between postal and parcel networks of CORREOS (Spain),
- implementing new models to distress the system (e.g. deliveries made 24/7).

Results highlight of ePICenter project

ePICENTER aims at enabling resilient, efficient and greener supply chains through new technologies applications in freight transport and logistics including: blockchain, autonomous transportation, hyperloop, modular containers and units connectivity. The project also develops and tests logistic software solutions and new transport technologies to increase the efficiency of global supply chains.

In the session, the advances on these technologies and applications were shared.

Conclusions / lessons learnt / future research needs

The projects address relevant challenges and support important policy objectives.

The projects aim for integrated solutions addressing those challenges and objectives by combining technologies, concepts, innovative business models and interaction between stakeholders.

As part of the discussion the focus was on data sharing and digital ecosystems. Due to the broad community in the room, it was clear that the meaning and understanding/implications of data sharing were very different and it was complex to reach a common understanding.

PARALLEL SESSION 12:
GV – EV CHARGING SOLUTIONS: GET THE USERS ON BOARD

Summary from: Evangelos Karfopoulos (ICCS)

The session "GV – EV charging solutions: get the users on board" has been opened by Monica Giannini from CINEA. Transport electrification introduces a considerable change in the transport era and, thus, a holistic approach should be adopted. Apart from the technology and research innovation, a new user-centric design/operational framework is needed to facilitate user's perception and behavioral adjustment to this new reality.

The three projects (User-CHI, eCharge4Drivers, Meister) in this session focus on the transport electrification from the user's perspective.

USER-CHI aims at providing solutions for charging infrastructures with a user-centric design. Quantitative and qualitative indexes should be considered for the design of the future charging stations.

The project developed 5 technological solutions (charging location planning, charging and parking platform, smart charging tool, solar charging station for Light electric Vehicles (LEV), inductive charging) and 3 non-technological solutions (station of the future handbook, interoperability framework, e-mobility replication and best practice platform) to address these challenges.

The project is currently performing the demonstration activities.

The main objective of the **eCharge4Drivers** project is to improve EV charging experience in urban areas by designing and developing user centric and interoperable charging technologies and services.

In order to achieve this objective, the project developed several solutions:

- charging technologies for different vehicle types to serve their charging needs/preferences (modular ultra-high fast charges with enhanced user interfaces, multi-user charging stations for passenger and LEVs, Vehicle to Grid (V2G) enabled charging stations, battery swapping for LEVs),
- E-mobility services to improve user's accessibility to the charging network (route planning service, booking) and user's experience (PnC authorisation, smart charging),
- decision support tools to support Charging Points Operators (CPOs) and public authorities to sustainably develop/extend their charging network (location planning tool, tariff/incentive schemes).

The project is currently transitioning from the verification phase to demonstration one.

MEISTER developed innovative business models to reduce the cost of charging infrastructure deployment and facilitate the EV mass roll-out.

Six business models have been demonstrated in Berlin, Stockholm and Malaga: smart park and charge, e-car sharing as housing service and in municipal fleet, home care services with EVs, city e-logistics.

Indicative quantitative achievements: -20%CAPEX, -40%OPEX, +15% usability, -20% charging prices, -10ktn CO_2.

The project has been completed in February 2022.

The number of EV users increases rapidly; however, the challenges today remain more or less the same: user's trustfulness to charging technologies and e-mobility services to facilitate charging accessibility and enhance EV driver's charging experience.

As an example, 30% of the charging stations in the USA is not operable but e-mobility apps present them as available: the maintainability and reliability of the public charging network is crucial for the EV users' experience and the sustainability of e-mobility business models.

Users' concerns for V2G services, such as battery charging level at departure time, battery degradation, etc., should be considered and addressed in the decision of V2G profiles.

Accessibility to public charging infrastructure is crucial. A special focus should be given to accessibility and usability for people with impairments (e.g., new regulation under preparation in Spain).

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PARALLEL SESSION 13:
SAFETY OF ALL ROAD USERS

Summary from: Peter Urban (RWTH Ika)

The projects presented in this session focussed on two important aspects of road safety: safe driver behaviour including fitness to drive on the one hand and crash safety on the other hand.

o   The **VIRTUAL** project presented the world's first set of open-source human body models based on both the average male and the average female, facilitating the biomechanical representation of both genders in virtual crash testing. The availability of such open-source models for product development and, in future, for regulatory tests and rating schemes in virtual environments is an important step towards inclusive crash safety and towards sharing the respective knowledge. These models come in various body postures, so that they can represent seated vehicle occupants as well as cyclists, pedestrians and standing passengers in public transport. They are available on the OpenVT platform, which has been developed in the VIRTUAL project, as well. In addition, the VIRTUAL project presented the Seat Evaluation Tools SET 50F and 50M, representing the average female and the average male, as the physical counterparts of the respective seated human body models.

o   The **i-DREAMS** project introduced the concept of keeping the driver in a safety tolerance zone by in-vehicle and post-trip interventions to achieve a safe driving style. These interventions are derived from monitoring the driver, the vehicle and the environmental context. Drivers then receive warnings in case of hand-held mobile phone use, sleepiness, illegal overtaking, speeding and tailgating. In addition, i-DREAMS has developed a gamified driver-coaching platform to deliver post-trip advice based on driver style profiling. The i-DREAMS concept

has been tested in simulators and in real world field trials with an impressive number of more than 500 drivers in five European countries covering both road and rail transport. Although not all drivers have improved their driving styles, evaluation results are overall positive with regard to user acceptance.

- ○ While i-DREAMS has its focus on driving styles, the **PANACEA** project focuses on commercial drivers' fitness to drive as an important factor in road safety. PANACEA designs, develops and tests a comprehensive set of tools for driving ability assessment amongst others for bus, truck and taxi drivers as well as courier service riders. These are offered as coaching and supporting solutions, also involving operators in the improvement of driver behaviour. The ambition is to facilitate in future the assessment of fitness to drive, both pre-driving and during driving as well as at the roadside by detecting alcohol, drugs, fatigue, stress and inattention.

In addition, the challenge of detecting and measuring distraction, as an important cause of road crashes, was highlighted in the Q&A part of the session. GDPR was discussed as an important issue for driver monitoring, as not everything that might be technologically feasible in future will be acceptable from a personal and an ethical perspective. How to gain maximum acceptance for road safety measures, in particular for monitoring and coaching measures, was identified as a need for further research. Nudging, conveying positive experience and further developing organisational safety cultures are promising approaches in this regard.

With regards to protective safety, the importance of virtual testing was highlighted in the discussion as the most suitable means to fully consider human heterogeneity, including different age groups, in the development and more and more also in the assessment of crash safety systems. The need for a stronger focus on avoiding disabling injuries was also underlined in this context.

Moreover, panellists agreed on the importance of cycling safety as a topic of growing concern. Possible measures for improvement span from building safer cycle-paths to better enforcement of traffic rules and from driver coaching to new detection systems on motor vehicles.

Finally yet importantly, speakers put emphasis on the usefulness of cooperation in road safety research both between European projects and internationally as an effective means to challenge their own results and gain additional insights.

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PARALLEL SESSION 14:
FULL AUTOMATED INFRASTRUCTURE UPGRADE AND MAINTENANCE

Summary from: Thierry Goger (FEHRL)

The projects presented in the session "Full automated infrastructure upgrade and maintenance" are supposed to contribute to the Vision Zero: the EU's long-term goal to move as close as possible to zero fatalities in road transport by 2050. Making road works automated should be an important step in this direction. Claudia Ciuca from CINEA introduced the session and expressed hope that when concluded, the cluster of projects will demonstrate the potential for reduced risk of road workers, increased availability of the road network and reduced costs of road works.

The projects, entitled **InfraROB**, **OMICRON** and **HERON**, addressed the potential of automation and robotisation in optimising the inspection, upgrade and maintenance operations. The projects follow a similar scientific approach and cover several technological areas: automated and robotic solutions, digital-twin, intelligent inspection framework, modular robotic applications, prefabrication and decision-making tool.

The projects will deliver critical patents (e.g. autonomous paver sensors-control system) and IPs to secure the European competitiveness in the field.

The projects will contribute to important impacts. They will contribute in the long-term to the reduction of fatal accidents by 50%, the reduction of traffic disruption by 20% and 20% reduction of routine maintenance; all in all leading to a 20% increase of the network capacity.

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More specifically, **InfraROB** developed a prototype of autonomous robotized head to repair potholes and cracks and is working on several other machines, **OMICRON** prepares an intelligent road asset management platform, and **HERON** develops a system able to identify road defects, isolate the area of intervention and execute road intervention tasks.

As those three projects are still in progress, the Q&A session after projects' presentations, led by Thierry Goger from FEHRL, was mostly focused on clarifications of projects' plans and targets. An additional impact was brought up: the potential better performance of infrastructure thanks to automated or robotized work. The belief is that with repetitive tasks, the automated or robotized road works machines could perform as good as a human being or even be more effective.

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PARALLEL SESSION 15:
INNOVATIVE SOLUTIONS TO ACHIEVE SUSTAINABLE MOBILITY IN URBAN AREAS

Summary from: Ivo Cré (POLIS)

This session examined how European cities are piloting and testing innovative solutions, leading the way towards sustainable urban mobility. The three projects, **CityChangerCargoBike**, **Handshake** and **Park4SUMP**, provided a good picture of the tangible tools they developed to tackle challenges and support the improvement of mobility and also the quality of life in European cities.

o   Samuel Pierce from CIE, presented how **CityChangerCargoBike** (CCCB) fostered the potential of cargo bikes with the involvement of public and private actors, exploring a growing industrial and professional market. With strong community and public authorities engagement, CCCB could showcase the clear health and environmental benefits and the versatility and inclusiveness of cargo bikes. The project has inspired around 37 mayors throughout Europe to incorporate cargo bikes in their cities.

o   With solid knowledge sharing and transnational cooperation network, the **Handshake** project presented by Pascal van den Noort (Velo Mondial) facilitated the **transferability of cycling innovations** and assessment of their implications, thus helping accelerate the cycling transition. Complementing its set of tools, Handshake also promotes an **International Cycling Community of Practice that can encourage lasting changes in cities.**

o   Patrick Auwerx (Mobiel 21) talked about the new innovative approach to park management from **Park4SUMP**. The project's main goal was to strategically integrate parking management into SUMPS, allowing the transition to improved use of the public urban space. The project developed the **ParkPAD** tool for cities to assess their parking situation, helping to move from an emotional response to **building a rational consensus** over parking. As a result, cities can reorient their parking policies, enabling them to achieve other SUMP objectives and broader sustainable targets, suggesting that this could be a **game changer** for resilient cities and **European goals**.

The three projects converge very well together, bringing forward the relevance of improving cities' hardware, software and orgware structures for a sustainable future. They touched upon issues and solutions for infrastructure, standards, awareness, education, training, new institutional frameworks, legislation and policies.

As the audience suggested, challenges are still present. For example, allocating space and providing proper infrastructures for cycling and walking, making cargo bikes (and e-bikes) more economically accessible (e.g. stronger subsidies and funding schemes), bolstering the European cycling industry, revising park standards, reinvestment of parking money and not less important, a shift of mindset.

However, with the high transferable potential of all three projects, they provide evidence and practical resources to assist other European cities in tackling these and other possible challenges. Furthermore, the projects' resources are crucial in assessing cities' current situation, with their shortcomings and strengths, allowing them to take the right steps to advance with innovation and sustainability for urban mobility and quality of life.

PARALLEL SESSION 16:
GV - MATERIALS FOR FUTURE ELECTRIC VEHICLE BATTERIES

Summary from: Ian Faye (BOSCH)

The session entitled "Green Vehicles – materials for future electric vehicle batteries" ended the round of parallel sessions during the RTR 2023 conference and complemented the other battery related session organised during the event on "batteries of the future" and "next generation of battery packs for BEV and PHEV". Two projects funded under the European Green Vehicles Initiative (EGVI) have been presented in this session: Si-Drive and LISA, both working on new materials to improve performance of batteries, and ultimately of vehicles.

Si-Drive demonstrates the scaleup of the nanostructured Si anode up to 594 cm^2 and the increase of the loading of the active material above 1 mg/cm^2. The optimal composition of the ionic liquid (IL) electrolyte showed to be the best performing one, both for the anode and the cathode. The IL electrolyte was also successfully incorporated into an UV-cured crosslinked polymer matrix. The increase on the yield and volume of the IL electrolyte was also demonstrated. The Li-rich cathode showed the 80% of capacity retention, at 500 cycles with the IL electrolyte at 1C, and the ongoing test are revealing that the same value could be maintained at 1000 cycles. The synthesis of the cathode active material was increased up to 5 Kg. The Si-DRIVE chemistry demonstrated the best performance in the full cell configuration. The test on the TRL4 prototype (pouch cell 1Ah) are ongoing and the fast charge protocol is going to be refined.

LiS is a promising alternative to Li-ion battery as it is free of Critical Raw Materials (CRM) and non-limited in capacity and energy.

In **LISA project**:

a) two lithium manufacturing processes have been successfully demonstrated at pilot and lab level (by PLD & infiltration);

b) ceramic/polymer hybrid solid state electrolyte (HSE) has been developed and tested. The HSE has been up-scaled (more than 300m) by coma bar;

c) four types of S/C cathodes manufacturing processes have been developed, including low- and high-density cathode, based on ink and coating or dry manufacturing without the use of solvents (DRYtraec©). At least three S/C cathode types have been developed at pilot level;

d) 18Ah pouch cell of 410Wh/kg and 450Wh/L has been demonstrated in the framework of LISA. Other 6Ah pouch cells have reached > 1.200 cycles of the 80% BoL and 50% DoD.

In summary, beyond the well-presented comprehensive project status and results, it is positive to see the progress of these novel approaches to work with the materials. It is clear that the projects have set ambitious goals and are establishing timelines for exploitation even in the early TRL phase. Improving the charging capabilities will be critical for success as well as tackling the challenge of maximum recyclability.

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