

EFFICIENT URBAN LIGHT VEHICLES

EU-LIVE
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LIGHT VEHICLES



www.eu-live.eu

MOBILITY THAT INSPIRES

COMPREHENSIVE MODULAR STRATEGY

CHALLENGE

Future urban mobility calls for more space for people and less space for cars as well as for environmentally compatible vehicle concepts, saving resources and minimizing local noise and air pollutant emissions. Here, motor vehicles in the L-category offer an interesting complementary solution to public transport, walking and cycling. Yet, at present, L-category vehicles are still not sufficiently attractive to end users due to their relatively high prices.

VISION

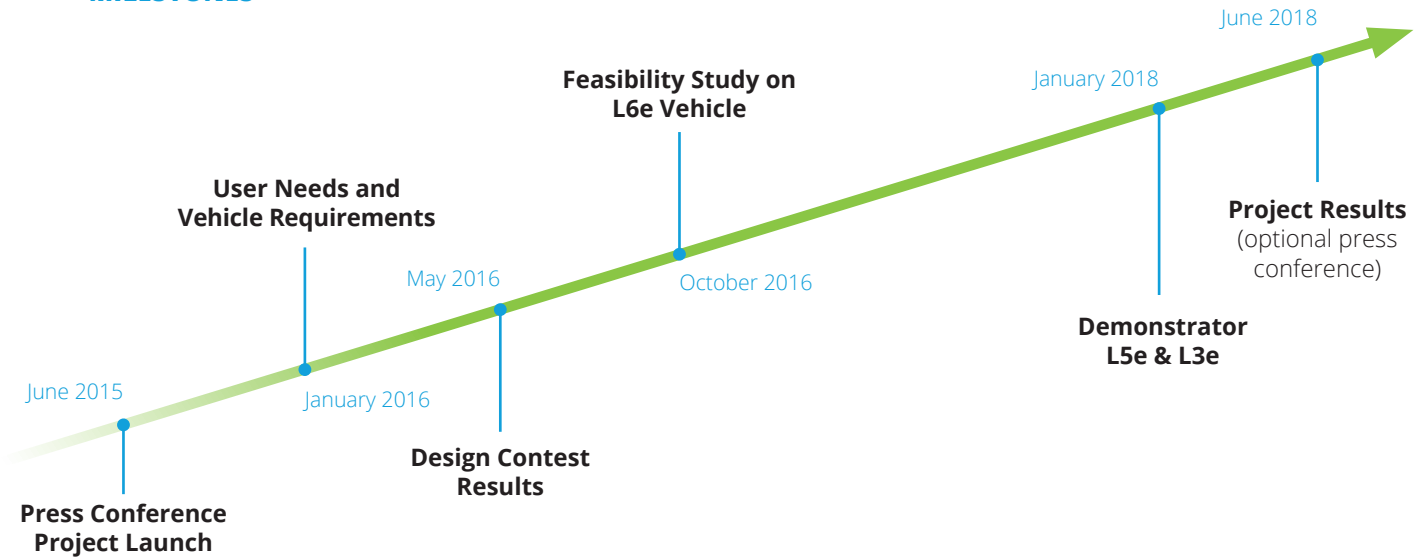
EU-LIVE – "Efficient Urban Light Vehicles", a European R&D project funded by the EU (Horizon 2020), will come up with a comprehensive solution covering a wide range of L-category vehicles i.e. a comprehensive platform for the next generation of electrified, cost- and energy-efficient light urban vehicles. It will enable economies of scale by providing modular powertrains as well as bodies and an integrated modular co-simulation platform. Thus, EU-LIVE will enhance the competitive position of the European vehicle industry and make an important contribution to a sustainable future mobility system.

*The L-category is comprised of motor vehicles such as scooters, 3-wheelers and light 4-wheelers, weighing less than 450 kg

INTERNATIONAL CONSORTIUM

The EU-LIVE project is carried out by an international consortium with comprehensive expertise in the areas related to vehicle research and development. It consists of major European manufacturers of passenger cars and L-category vehicles, Tier 1 suppliers of components and sub-systems, SMEs and research centres specialised in mobility and the automotive sector. The know-how of this interdisciplinary think tank ensures the sustainable market exploitation of the project results.

MILESTONES



THE EU-LIVE MODULAR PLATFORM

FLEXIBLE AND ELECTRIFIED POWERTRAIN SYSTEM

The EU-LIVE consortium has developed a highly flexible powertrain system, specifically designed for L-category vehicles, focusing L3e, L5e and L6e. With the **EU-LIVE Modular Platform** a trans-disciplinary approach shows the best technology from the scooter and automotive industry. The fundamental powertrain system includes a combustion engine with a highly innovative transmission, a newly developed battery and a rear arm that combines the features of an in-wheel motor and braking system.

COMBUSTION ENGINE AND TRANSMISSION

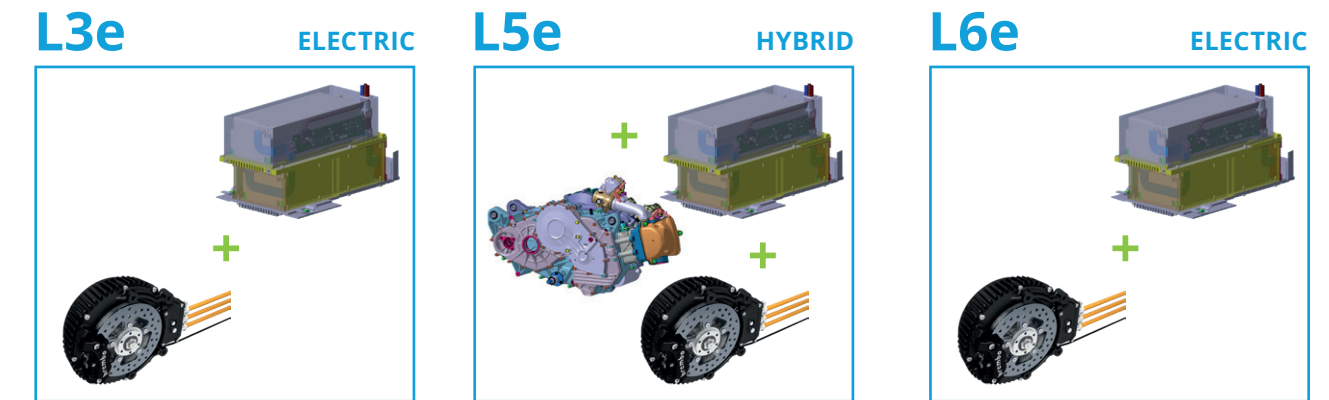
The EU-LIVE concept integrates a new 400cc four-stroke mono-cylinder engine and a new transmission concept. These two concepts use components "off the shelf" to limit costs but also integrates major developments to reach requirements and meet integration constraints (crankcases, cylinder head, lubrication system) of the target applications:

- ▶ A new air loop, timing devices (camshaft) and electronic throttle body to improve engine performances
- ▶ Low friction coating and a more fluid engine oil to improve cold start operating conditions
- ▶ A dry sump to reduce the overall height and therefore the center of gravity of the vehicle
- ▶ An efficient multi-ratio transmission concept to improve fuel efficiency
- ▶ Automatic shifting without torque interruption to maintain fun-to-drive

BATTERY DEVELOPMENT HIGHLIGHTS

The development of battery systems for electrified light vehicles was extremely challenging due to the high performance requirements, the needs of different L-category vehicles, the limited available packaging space and most of all the trade-offs between all three.

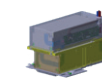
- ▶ Base: 48V battery
- ▶ Using "off the shelf" components where



MODULAR POWERTRAIN COMPONENTS



Combustion Engine and Transmission



Battery



Rear Arm with In-Wheel Motor

possible (cables, connectors, fuse, relay, a.o.) and using the same management systems as well as communication interface

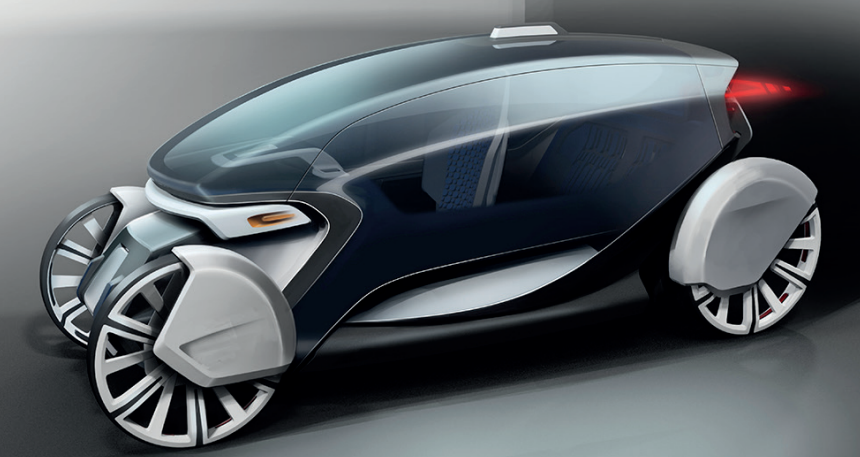
- ▶ Modularization approach
- ▶ Innovative passive cooling surface designed for an optimal thermal conductivity

REAR ARM WITH IN-WHEEL MOTOR (IWM)

The joint development effort resulted in a modular, air-cooled, 48V in-wheel electric motor, which reaches an astonishing 256 Nm of direct-drive torque (no gearbox necessary), delivering upwards of 25 kW of power per wheel. The assembly also

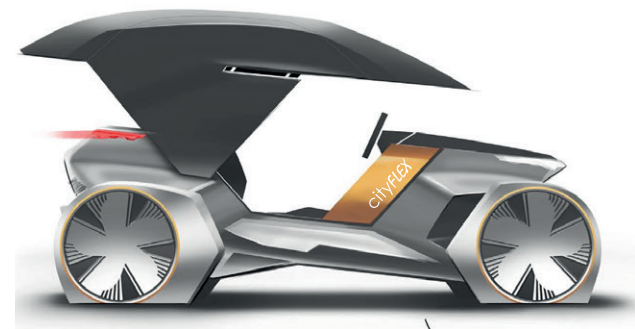
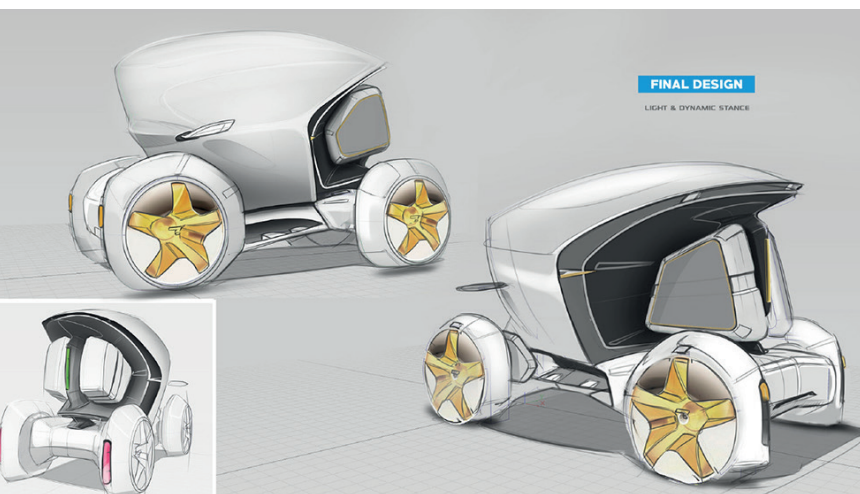
integrates an innovative aluminium caliper on the motor's stator, resulting in superior wheel-end compactness.

- ▶ For the L3e demonstrator (battery electrical vehicle – BEV) the IWM is able to reach 130 km/h maximum speed and 100 km of range.
- ▶ For the L5e demonstrator (plugin hybrid electric vehicle – PHEV), suited for urban and semi-urban areas, the plugin hybrid powertrain is able to reach 130 km/h in hybrid mode and 70 km/h in electric mode (Zero Emission) having 300 km of overall range.

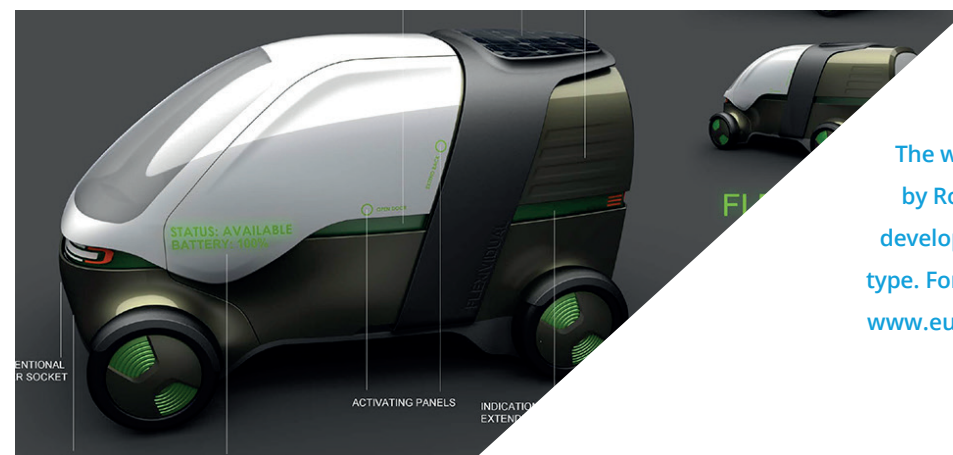
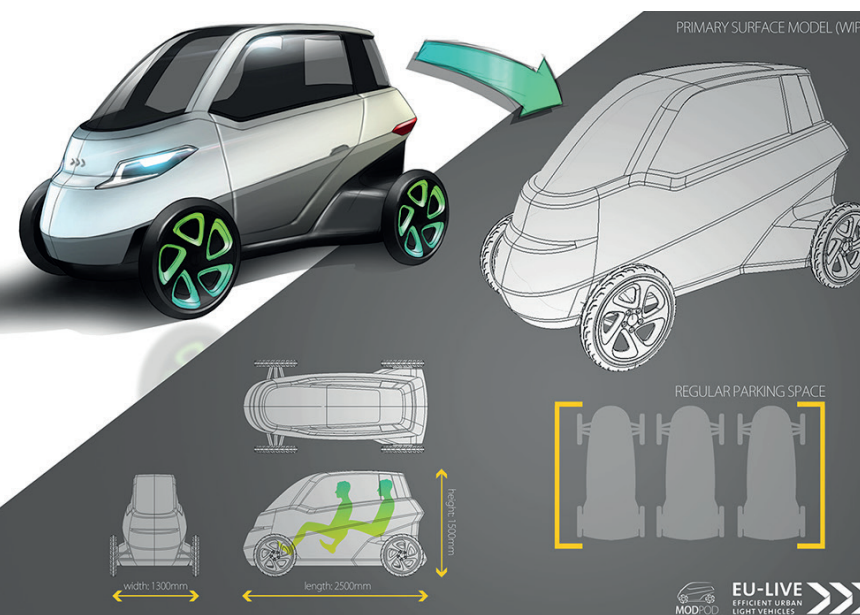
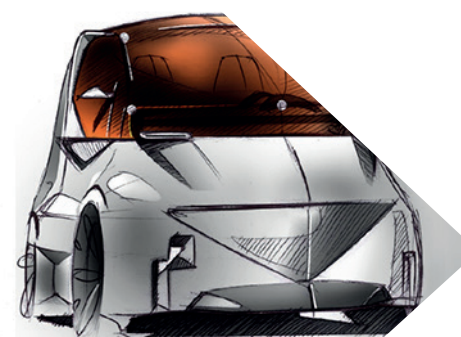
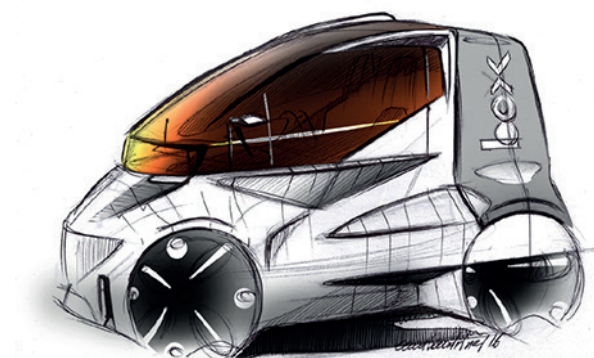


L6E VEHICLE

OPEN DESIGN CONTEST AND VIRTUAL DEMONSTRATOR



With the initiation of an international open design contest, the EU-LIVE project had the vision of creating a vehicle that makes the combination of environmental friendliness, urban compatibility and energy efficiency not only a possibility, but reality. The open design contest was the foundation for the L6e vehicle and its virtual demonstrator. Integrating the EU-LIVE powertrain and carry-over components provided by the project partners, a feasibility study has further been conducted on the virtual L6e demonstrator. With this proof of concept, the consortium showed the modularity between the radically different vehicles.



The winner concept, cityFLEX by Robert Hahn, was further developed into a virtual prototype. For more information see: www.eu-live.eu/designcontest/



L5E VEHICLE

REAL DEMONSTRATOR

Positioned between the two-wheel and four-wheel segments, the L5e demonstrator is equipped with a plugin hybrid electric vehicle (PHEV) powertrain (including two electric in-wheel motors inside rear wheels and a petrol internal combustion engine with robotized 4 gear gearbox). In leading the research and manufacturing phases for the new L5e demonstration vehicle, the project partners have expanded their expertise beyond the automotive industry.

Thanks to its silhouette and hybrid technology, the new EU-LIVE electrified mobility solution can be used on all roads and offers drivers a wide array of benefits:

- ▶ Its tilting mechanism offers superior handling, making the vehicle as easy to drive as a three-wheel scooter. This, and the roll-control technology, account for more than half of the 13 patents filed by members of the EU-LIVE consortium. The system notably makes use of hydraulic components and hydropneumatic suspension.
- ▶ The vehicle's small footprint (2.4 metres x 0.85 metres) and rotating doors facilitate perpendicular parking and free up road space. As well as an enclosed, heated cabin, the vehicle also features seat belts and an airbag, making helmets, gloves, waterproof jackets and other protective gear unnecessary.





L3E VEHICLE

REAL DEMONSTRATOR

This L3e demonstrator, a two-wheeler BEV (battery electrical vehicle), comes along with the L5e plugin hybrid electric vehicle, and in order to show the modularity of the EU-LIVE flexible and electrified powertrain system, it carries over the main components: battery (same architecture), inverter, rear arm, in-wheel motor and braking system.

The L3e vehicle with 10,6 kW power at the wheel, is the result of the integration of the main powertrain components into an existing, fuel-powered vehicle, adapted in order to reach the EU-LIVE project goals.

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RESEARCH & INNOVATION
HORIZON 2020 – GV5

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