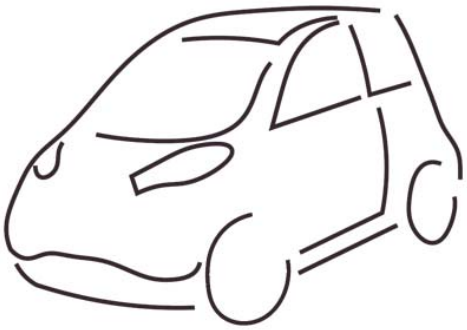
STEEL Solutions for Safe and Smart Structures of Electric Vehicles



Brochure 2

STEEL S4 EV: Main results

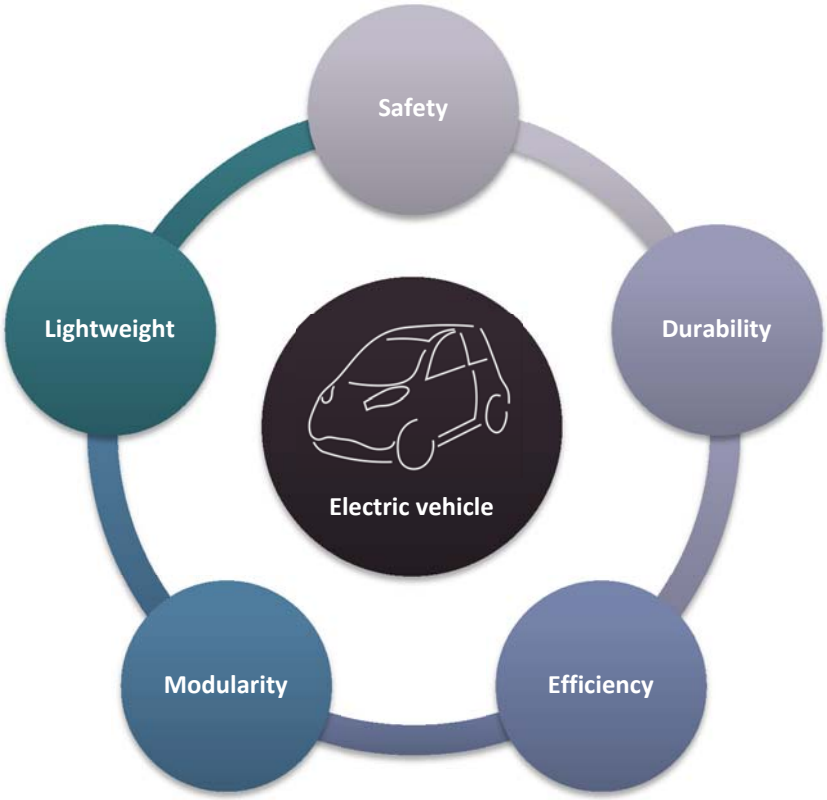
Project description and objectives

STEEL-S4EV completes the research on a new trend in EV vehicles manufacturing based on advanced high strength steels. Principal features of the project are the urban electric vehicle design and its novel manufacturing environment.

The vehicle chassis design is based on **advanced high strength tubular steels**, which are meant to comply with crash regulations and Euro NCAP demands. Research for **weld joint design** and welding methodologies has been carried out to maintain the material properties in the weld areas, ensuring robustness and long term durability.

The microfactory is a cost-effective, energy-efficient and low-investment manufacturing approach, allowing a flexible response to the market demands of different vehicle architectures (passenger vehicles with three or four wheels, pick-ups, delivery vans, taxis, etc.) with a single chassis. This will be achieved by a **modular and flexible** structural design based on a 3D skeleton frame of welded tubes bent with high accuracy using programmed laser cuts.

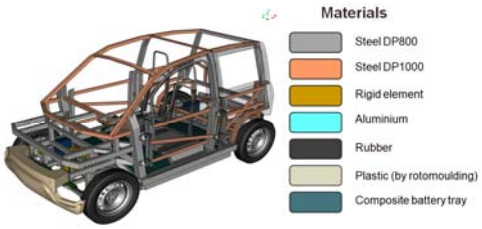
The aim is to satisfy the needs of the great majority of people without compromise on safety, automotive quality standards, ergonomics, smartness, aesthetics or costs.



Final results

SELECTION OF MATERIALS, TECHNOLOGIES AND NOVEL MANUFACTURING APPROACHES

Vehicle structure based on Advanced High Strenght tubulars Steels (AHSS).



Modular design...

...regarding the structure

Three or four wheels passenger vehicle, delivery vans, pick-ups…

...regarding the powertrain

4WD through two identical motorized axles

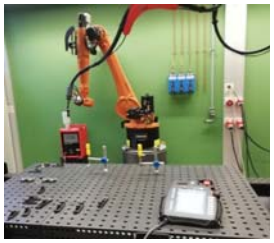
...regarding the battery pack

Modular battery pack up to 50 kWh to satisfy different market demands.

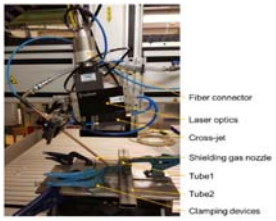
WELDING PROPERTY OPTIMISATION

Several advanced welding technologies and post-weld heat treatments are developed for joining dissimilar high strength steel grades.

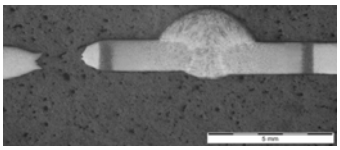
MIG/MAG welding



Laser welding



The processes aim to minimize the material degradation in the heat affected zone, improving the fatigue behaviour of the joints.



LCA AND PLM

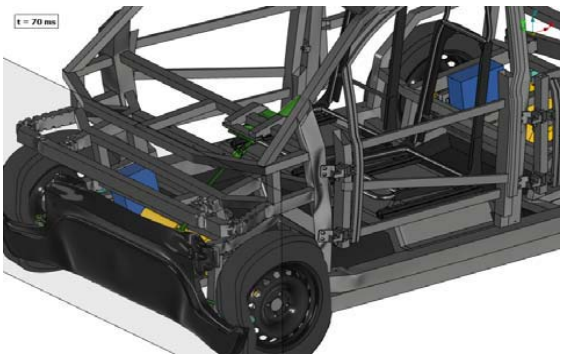
Integration of CAD software with a Product Life Cycle Management software, finding the right trade-off between technical, environmental and economic criteria for the design of urban electric vehicles

DESIGN OF NEW VEHICLE TYPES: WEIGHT OPTIMISATION, FULLY INTEGRATED SAFETY, VULNERABLE USERS PROTECTION

Vehicle designed and tested under Euro NCAP protocols & UNECE Regulation for M1 vehicles.

Frontal crash (targets)

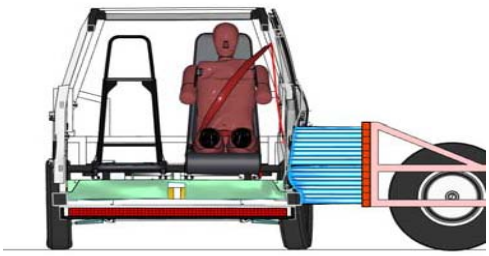
- ► OLC: 44.2 g
- ► Intrusions:
  - Floor areas < 40 mm
  - Steering column < 60 mm
  - Cockpit < 50 mm
- ► Suitable biomechanical values



Most energy absorbed by collapsible elements.

Lateral crash (targets)

- ► Maximum deceleration < 45 g
- ► No important intrusions
- ► Suitable biomechanical values



Most energy absorbed by B pillar.

FUNCTIONAL AND SAFETY TESTING

Fatigue test

Vehicle structure maintains torsional and bending stiffness requirements after 1.000.000 cycles fatigue test (equivalent to 250.000 kms)

Frontal crash (results)

- ► OLC: 38.9 g
- ► Intrusions:
  - Floor areas < 18.8 mm
  - Steering column < 24.0 mm
  - Cockpit < 14.8 mm
- ► Suitable biomechanical values for R137 and R94 crash test configuration.

The structure's integrity is maintained

Lateral crash (results)

- ► Maximum deceleration < 29.5g
- ► Very low intrusions: 6.1 mm
- ► Biomechanical values lower than threshold.

The structure's integrity is maintained

Conclusions

The STEEL S4 EV project has achieved its challenging objectives during its three years duration thanks to the RFCS funding programme in which the project is performed, and to the work of the six partners.

The main outcomes of the project are:

- Advanced High Strength Steels (AHSS) structures based on welded tubular profiles
- Optimised modular vehicle design to adapt it to customer needs
- Selected manufacturing processes to maintain the material properties in welds of Advance High Strength Steels
- Good safety performance for vehicles occupants and vulnerable road users
- Minimum environmental impact and costs



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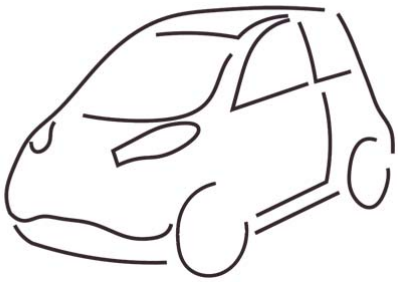

STEEL S4 EV

Partners

Cidaut

I-FEVS

BI research
Belgian Welding Institute
Joining your future.

Luleå Tekniska Universitet

MA

sphera

RFCS

The Project has received funding from the Research Fund for Coal and Steel (RFCS) under grant agreement nº 800726. The RFCS provides funding for high quality Research, Pilot and Demonstration projects which support the competitiveness and sustainability of the European industries.

Research Fund for Coal & Steel

European Commission