



# European Green Vehicles Initiative Impact Assessment

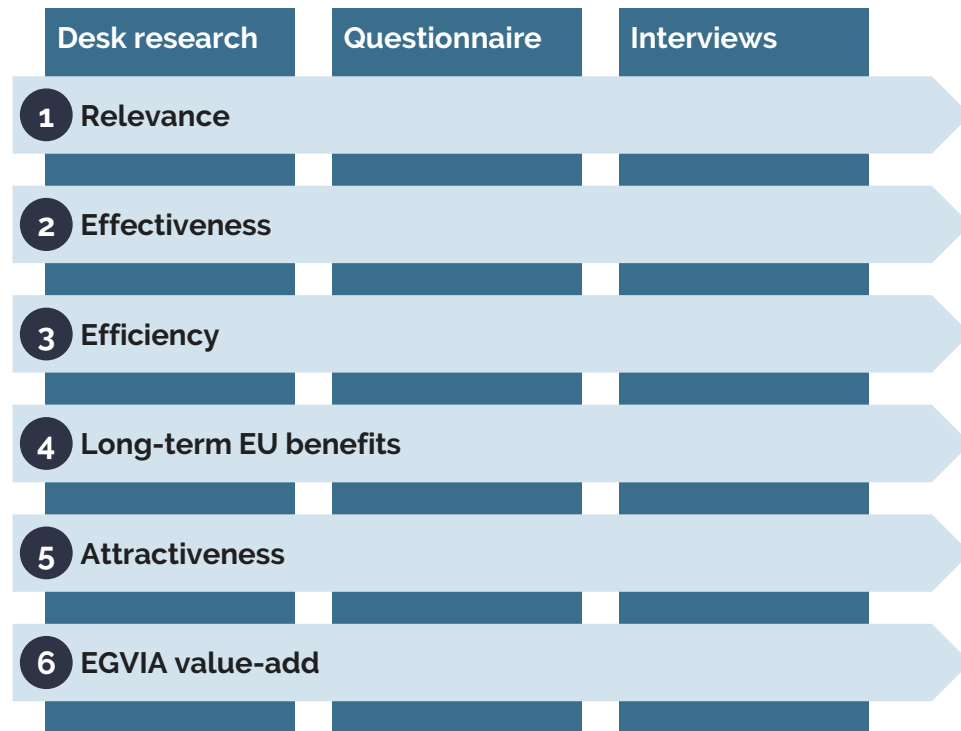
Webinar



# In 2023, SE completed an impact assessment to better understand the outputs and added value of European Green Vehicles Initiative and its projects

## Introduction and Background

- EGVI was a contractual public-private partnership launched in 2013 as part of Horizon 2020
- Its objective was to promote European R&I, increase the energy efficiency of road vehicles and encourage a transition to alternative powertrains
- SE completed an impact assessment for the EGVI programme in 2023 to better understand outputs and added value of the initiative and its projects
- This assessment implemented a framework of six criteria, which were evaluated and corroborated using three separate data sources



EGVI achieved its objectives, laying the foundations for today's EU-funded R&I initiatives and generating tangible and intangible benefits for the EU transport industry

## European Green Vehicles Initiative: Key Impacts



EGVI contributed to ongoing road transport decarbonisation through the integration of advanced technologies



EGVI's has legacy provided an enduring boost to EU economic growth and employment through improved industry competitiveness



EGVI supported growth of the EU-wide scientific research community and improved its strategic alignment

# Road transport decarbonisation projects have increased technical innovation, targeted critical topics and contributed to transport decarbonisation in the EU



## Road Transport Decarbonisation Achievements

1.

- **R&I programmes led to innovation:** EGVI projects supported the decarbonisation of road transport through innovative R&I that led to, for example, demonstrations of improvements in driving range across many vehicle types

2.

- **Topic focus targeted impactful technology:** Technology topics critical to decarbonisation were targeted by EGVI, including the demonstration of a 2x improvement in energy density and 20-30% cost saving at the battery level

3.

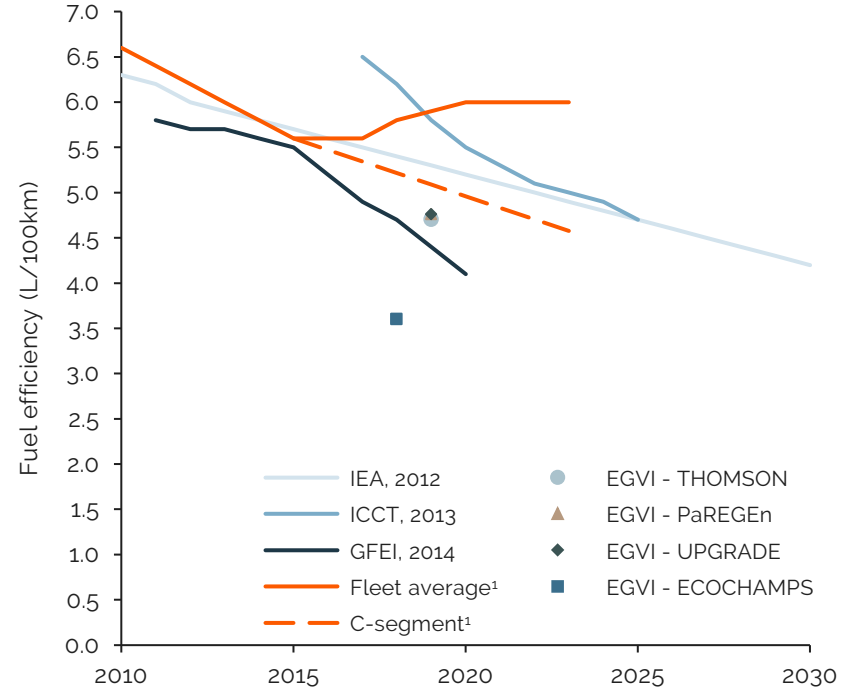
- **Technology integration accelerated vehicle electrification:** By integrating 35+ innovative technologies in green vehicles, EGVI may have contributed to the achievement of close to 5 million electrified vehicles on the road in 2020

# EGVI projects supported the decarbonisation of road transport through innovative R&I that led to, for example, driving range improvements across many vehicle types

## 1. R&I Programmes Led To Innovation

- **Ensured topic diversity:** Development programmes addressed solutions at holistic system and vehicle level, not just focussing on individual technologies
- **Supported pre-competitive R&D:** Investing in foundational early phase R&D, creating the environment for ideas to reach value add formats
- **Created technology adoption pathways:** Developed innovative technologies with clear commercialisation pathways and applicability

EGVI projects demonstrated fuel efficiency improvements



1) Demonstrated production technology

EGVI: European Green Vehicles Initiative; R&I: Research and Innovation; EV: Electric Vehicle; R&D: Research & Development; ICE: Internal combustion engine

Source: BloombergNEF 2020; Fraunhofer, Advanced Propulsion Centre, EGVI, Total Battery Consulting

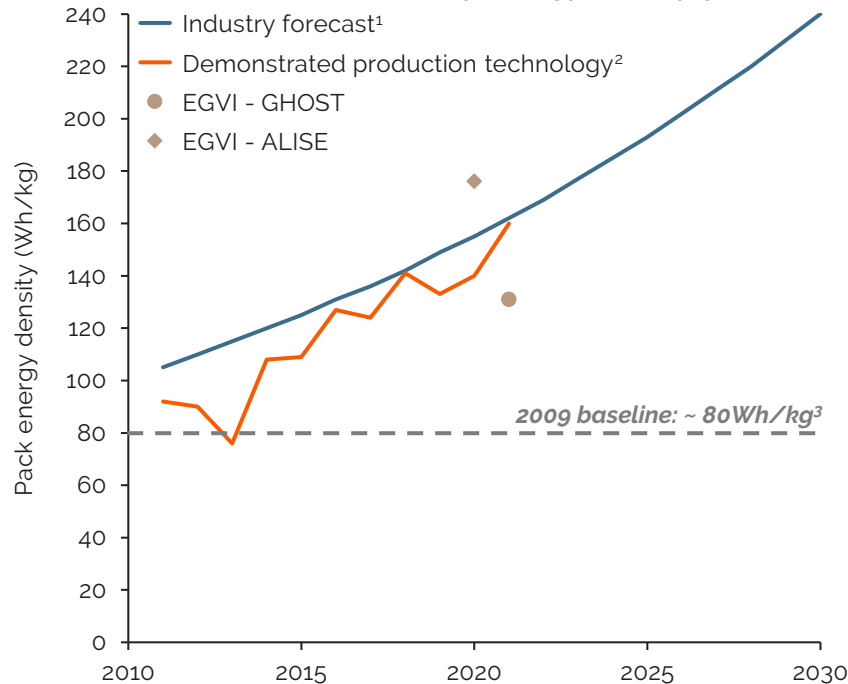
Technology topics critical to decarbonisation were targeted, including demonstration of a 2x improvement in energy density and 20-30% cost saving at the battery level



## 2. Topic Focus Targeted Impactful Technology

- **Defined targets:** EGVI projects tackled key challenges like range anxiety in EVs by aiming for and achieving real-world driving range increases
- **Measured progress:** Projects were structured in such a way as to progress with key gateways and measures supporting tangible outputs and benefits
- **Achieved breakthroughs:** Significant breakthroughs were achieved e.g. over 2x improvement in battery level energy density and over 20% cost reduction

### EGVI projects showcased battery energy density gains

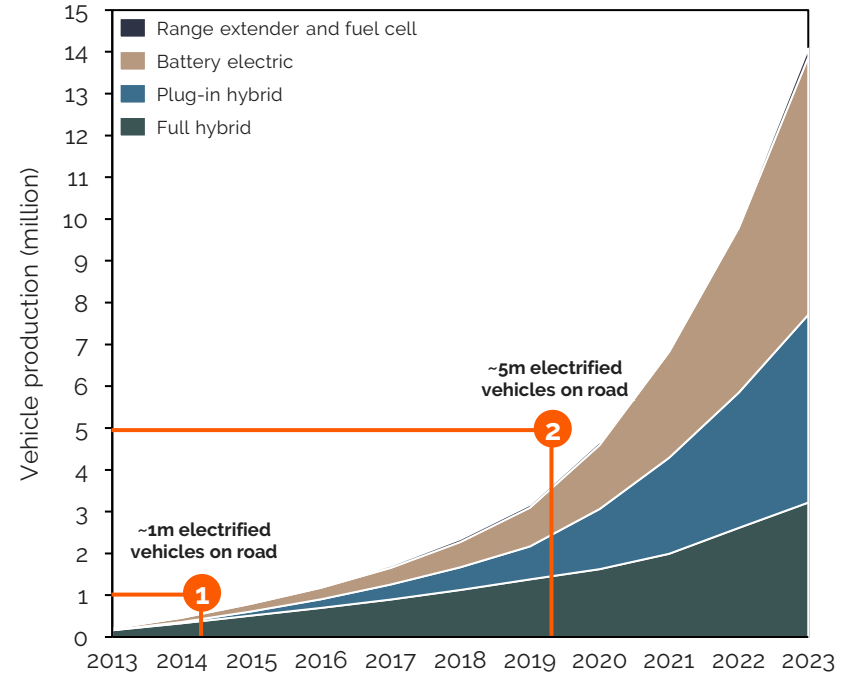


By integrating 35+ innovative technologies in green vehicles, EGVI may have contributed to the achievement of close to 5 million electrified vehicles on the road in 2020

### 3. Technology Integration Accelerated Vehicle Electrification

- **Integrated technologies:** Projects integrated 35+ innovative technologies in vehicles and mobility solutions, contributing to the state-of-the-art
- **Contributed to electrified vehicles:** EGVI may have contributed to Europe reaching ~1 million electrified vehicles on the road in 2016 and ~5 million in 2020
- **Impact on a global stage:** EGVI's achievements and collaborations have broad implications for electrified vehicle adoption and global decarbonisation efforts

Observed increased electrified vehicles on road in the EU



# OPTEMUS exceeded its stated objectives, delivering a real-world capability demonstration; technology reached TRL 6 and further commercialisation plans were developed



## Project Success Story: OPTEMUS

### Background

- **Topic:** Optimised energy management and use via a vehicle-occupant-centred approach to passenger comfort and component cooling to reduce range limitations
- **Duration:** 1<sup>st</sup> June 2015 to 31<sup>st</sup> August 2019
- **Total cost:** €6,390,633.75 (EU contribution: €6,390,633.75)

### Objectives

- Technical targets: Energy consumption reduction of 30% for component cooling and 50% for passenger comfort
- Economic targets: 8.7 MWh energy savings per A-class vehicle lifetime which saves roughly 1500 € for the customer
- Lower exhaust gas and noise pollution in urban areas

### Successes

- Objectives exceeded for real world for driving range, component cooling, passenger comfort and traction energy consumption
- Technology maturity increased through to TRL 6 with plans for commercialisation developed by participants
- Private research continuation and further developments to project outputs in other applications e.g. FTI programme
- Supported further research developments in DOMUS and SELFIE
- Led to further research funded at a national level i.e. mobileM

### Participants<sup>1</sup>

- 4 universities, 5 research organisations and 14 private entities



### Quantified achievements

- At least 30% real driving range increase<sup>2</sup>
- Energy consumption decreases of
  - At least 32% for component cooling
  - At least 60% for passenger comfort
  - 15% for traction

### Network



Including participants from across 7 countries



1) Not all participant logos are shown; 2) For extreme weather conditions  
TRL: Technology readiness level; FTI: Fast Track to Innovation (EU programme)

Source: SE, CORDIS #653288, EGVIafor2Zero



# EGVI contributed to improved industry competitiveness by fostering crucial skills, improving knowledge sharing and accelerating innovation processes



## Improved Industry Competitiveness Achievements

1.

- **Fostered skills boosted EU competitiveness:** EGVI fostered crucial green vehicle technology skills in six key areas across its projects, supporting a more capable, adaptable and competitive EU workforce

2.

- **Better collaboration strengthened the EU automotive industry:** A more diverse and collaborative R&I network, could potentially attract battery production back to the EU and generate economic value of ~€6 billion in 2030

3.

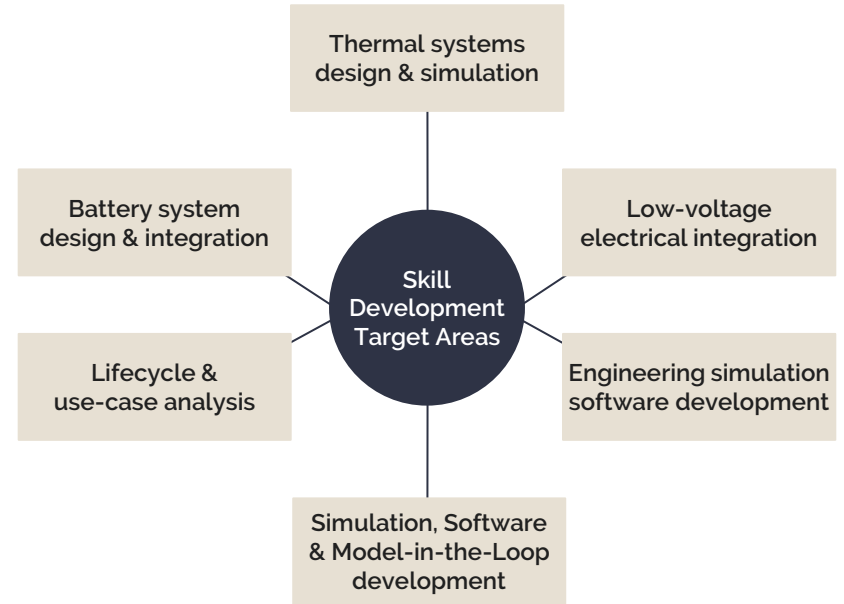
- **Faster innovation supported new jobs:** EGVI could have helped quicken EU time-to-market capabilities by over 12 months, potentially generating €24 billion in additional revenue and helping generate 16,000 high-value green vehicle jobs by 2030

# EGVI fostered crucial green vehicle technology skills in six key areas, supporting a more capable, adaptable and competitive EU workforce

## 1. Fostered Skills Boosted EU Competitiveness

- **Targeted skill development:** EGVI identified six crucial skill areas for green vehicles, supporting development of relevant educational
- **Accelerated R&D processes:** Projects realised advancements in design and simulation processes that could more efficiently support R&D activities
- **Enhanced workforce capability:** Improved skills and knowledge gained from projects enhanced EU workforce capability

Improved Industry Competitiveness 

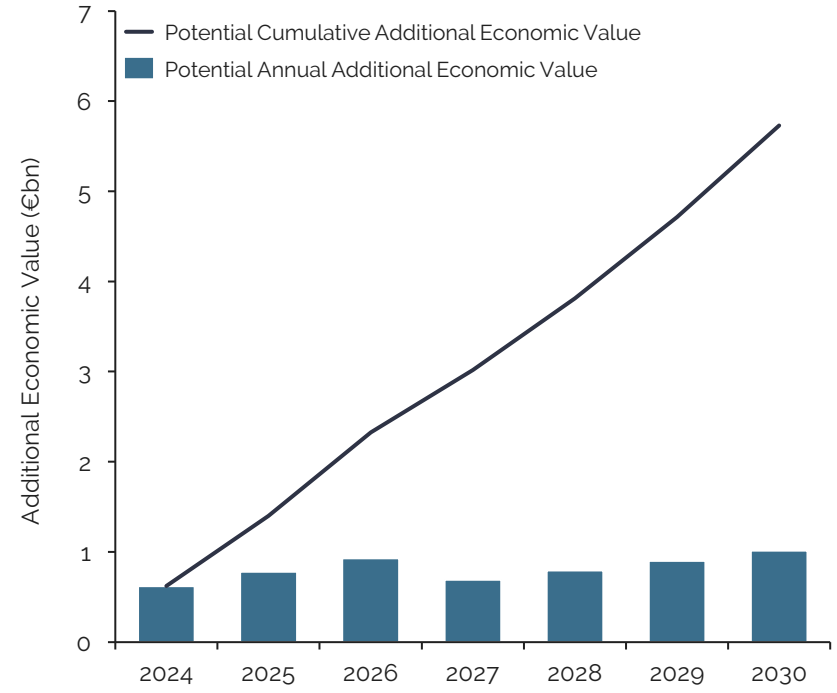


A more diverse and collaborative R&I network, could potentially attract battery production back to the EU and generate economic value of ~€6 billion in 2030

## 2. Better Collaboration Strengthened the EU Automotive Industry

- **Better network collaboration:** The initiative led to a broad range of networking events and collaboration opportunities built around EGVI projects
- **Diversified R&I ecosystems:** Increased participation and benefits for businesses created a more diverse and resilient automotive industry
- **Built competitive advantage:** Improved knowledge and skills in battery technology could potentially entice battery value chain relocation back to the EU

Estimated value from increased European battery supply



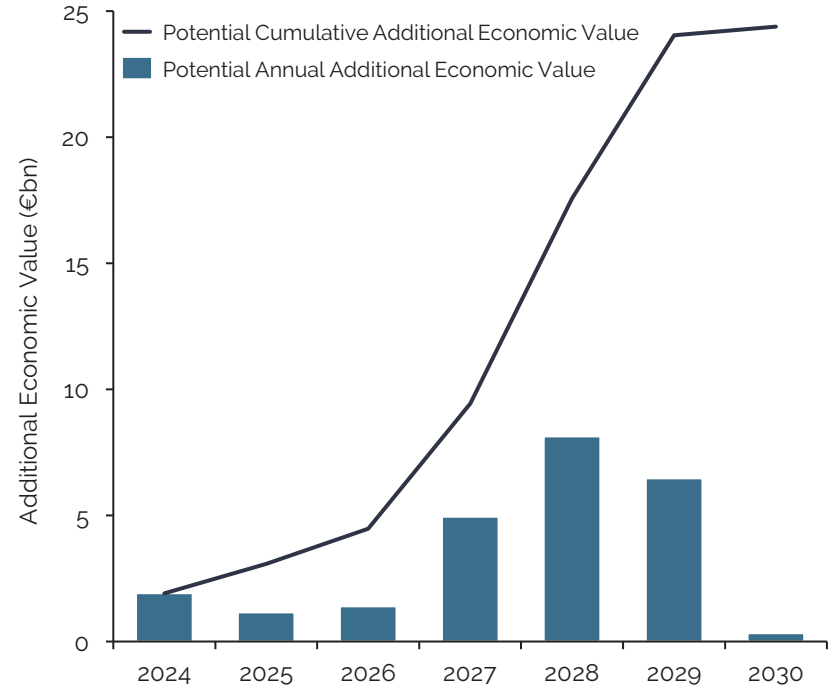
# EGVI could have helped quicken EU time-to-market capabilities by over 12 months, potentially creating additional revenue and high-value green vehicle jobs

Improved Industry Competitiveness 

## 3. Faster Innovation Supported New Jobs

- **Developed time-to-market advantage:** EU time-to-market capabilities may have been improved by over 12 months, potentially generating €24 billion by 2030
- **Increased investment efficiency:** Achieved an estimated 40x return on investment compared to total public-private partnership funding
- **Supported green job creation:** 16,000 new skilled jobs could be created in green vehicle technology sectors by 2030 based on additional revenue

Potential economic gains from faster time-to-market



# DOMUS developed guidelines and approaches to improve the cabin design process, increasing operating efficiency and delivering a 20% uplift on driving range

## Project Success Story: DOMUS

### Background

- **Topic:** Improving user experience by developing and validating user-centric EV design guidelines and approaches that deliver processes and solutions to lower vehicle energy demand effectively
- **Duration:** 1<sup>st</sup> November 2017 to 31<sup>st</sup> October 2021
- **Total cost:** €8,958,010.00 (EU contribution: €8,958,010.00)

### Objectives

- 25% EV driving range increase compared to 2016 reference
- Minimisation of energy consumption from cabin systems
- Design guidelines for future EVs: comfort vs. efficiency
- Deeply understanding users' comfort perception
- Develop an active system reacting to user characteristics & condition

### Successes

- Development of new cabin components, systems and control strategies for energy efficient, safe and comfortable future EVs up to TRL 5/6 – maturing technology for commercialisation
- Partial achievement of objectives to improve upon state-of-the-art cabin conditioning systems and increase vehicle range by 20.2% UC28 and 15.4% WLTP
- Further commercial projects with participants and other partners and additional research proposals stem from this project

### Participants<sup>1</sup>

- 2 universities, 5 research organisations and 16 private entities



### Quantified achievements

- Integrated virtual simulation range increase of 20.2% UC28 and 15.4% WLTP
- Development of a technology demonstrator vehicle for physical validation
- Demonstrator vehicle range increase of 9.7%

### Network



Including participants from across 12 countries



1) Not all participant logos are shown

EV: Electric vehicle; WLTP: Worldwide harmonised light vehicles test procedure; TRL: Technology readiness level

Source: SE, CORDIS #769902, EGVI4for2Zero

Standardisation frameworks and recommendations from EGVI helped develop consensus that supported the development of the recognised industry targets seen today



## Research Network Development Achievements

1.

- **Information sharing contributed to standardised solutions:** EGVI projects helped develop consensus in the EU transport sector and provided standardisation guidance through frameworks and recommendations

2.

- **Facilitated collaboration drove competency growth:** Competence growth was enabled across the EU with EGVI facilitating collaboration that boosted efficiency, reduced risks through resource sharing, and diversified expertise

3.

- **Diverse participants increased interconnectivity:** Broad outreach and impactful projects attracted diverse participants, resulting in new partnerships, private investments, and a more interconnected R&I ecosystem

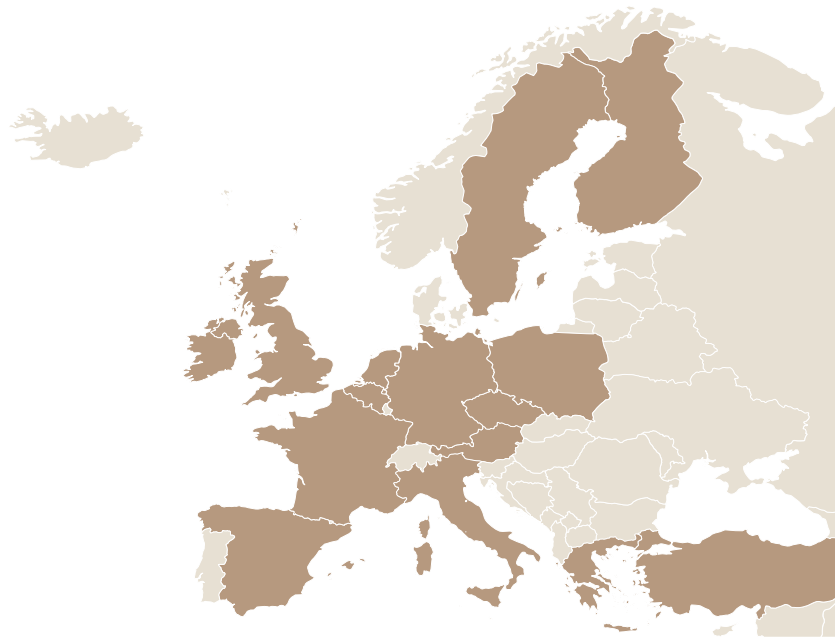
# EGVI projects helped develop consensus in the EU transport sector and provided standardisation guidance through frameworks and recommendations



## 1. Information Sharing Contributed to Standardised Solutions

- **Broadened international focus:** Projects often involved diverse stakeholders, tackling challenges and providing solutions applicable on a global scale
- **Standardised solutions:** EGVI contributed to industry-wide standards and regulations through initiatives like AEROFLEX
- **Ensured global competitiveness:** EGVI helped EU companies develop high-quality, cost-competitive solutions for international markets

### Breadth of EGVI stakeholders



# Competence growth was enabled across the EU with EGVI facilitating collaboration that boosted efficiency, reduced risks through resource sharing, and diversified expertise

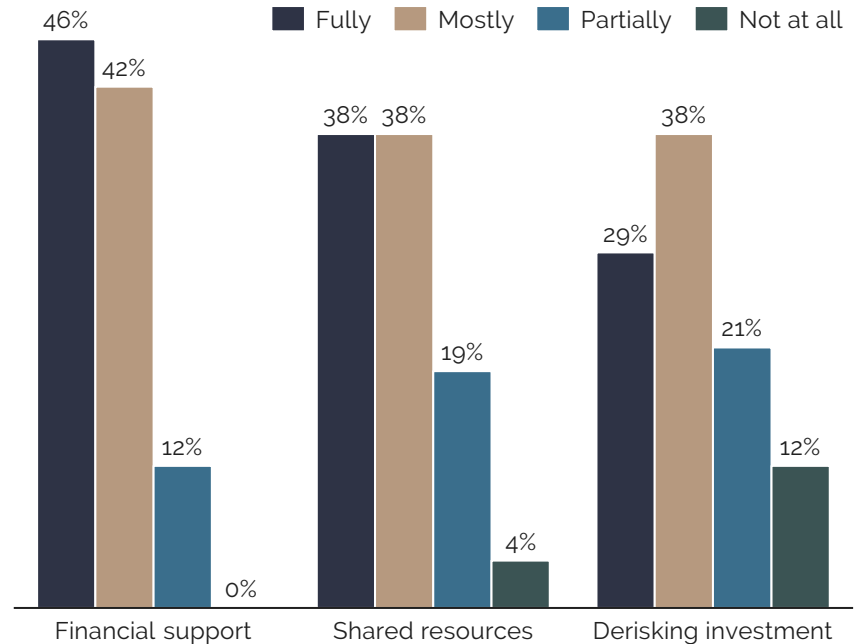
## 2. Facilitated Collaboration Drove Competency Growth

- **Delivered efficiency gains:** Collaboration enabled diverse perspectives and knowledge sharing, leading to resource optimisation and faster problem-solving
- **Reduced R&D risk:** Collaborative projects allowed participants to share resources and expertise, reducing R&D risks – leading to ambitious goals
- **Increased stakeholder inclusion:** EGVI supported R&D beyond large private entities, empowering businesses and academic institutions to contribute

### Research Network Development



### Stakeholder development benefits from participation in EGVI projects<sup>1</sup>





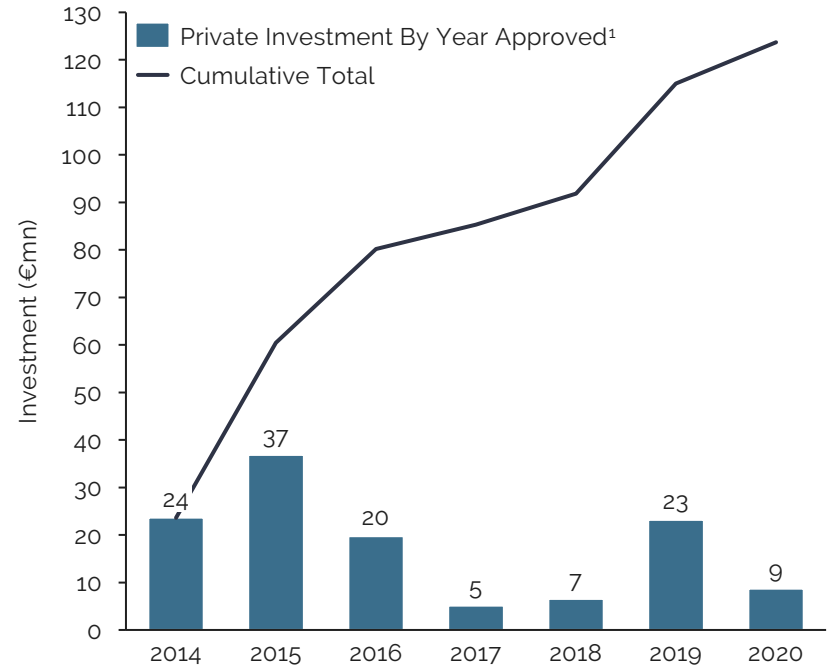
# EGVI's broad outreach and impactful projects attracted diverse participants, resulting in new partnerships, private investments, and a more interconnected R&I ecosystem



## 3. Diverse Participants Increased Interconnectivity

- **Encouraged new partnerships:** Networking events led to long-term partnerships and pilot studies, fostering better innovation
- **Committed private investments:** EGVI's success in attracting private investments not only developed technology but also led to new facilities and jobs
- **Strengthened ecosystem:** Network analysis showed EGVI members had better connections and data flows, making for a stronger automotive ecosystem

Private investment by year across EGVI projects



# Zero-emission vehicle adoption was encouraged in the medium and heavy-duty classes through the creation of interoperable high power charging infrastructure standards



## Project Success Story: ASSURED

### Background

- **Topic:** Boosting electrification of urban commercial vehicles and their integration with high power fast charging infrastructure, evaluating several infrastructures in different cities to encourage adoption
- **Duration:** 1<sup>st</sup> October 2017 to 31<sup>st</sup> March 2022
- **Total cost:** €23,401,888.77 (EU contribution: €18,657,433.06)



### Objectives

- Developing next generation modular high-power charging solutions<sup>2</sup>
- Providing high interoperability between buses, trucks & fast chargers
- Standardising conformance and interoperability test protocols
- Producing smart tool & fleet energy/charging management strategy
- Demonstrating solutions: 6 OEM, 5 eBuses<sup>3</sup>, 2 eTrucks, 1 eVan, 5 cities

### Successes

- Produced and used demonstrator charger with eFleet – reducing charge time, lowering TCO and CO<sub>2</sub>, and improving grid stability
- Developed conformance and interoperability test protocol standards for vehicles and chargers e.g. pantograph or floor mount
- Released a pre-normative technology roadmap and disseminated throughout the industry
- Furthered the development activities of project ZEEUS from EGCI to bring tested and interoperable urban transport solutions to market

### Participants<sup>1</sup>

- 2 universities, 7 research organisations, 35 private entities and 2 others



### Quantified achievements

- Produced technology demonstrators and proved out concepts
  - Up to 45% energy saving
- Demonstrator for high power wireless charger >100kW and >94% efficiency
- Developed a fleet simulation and management tool

### Network



Including participants from across 12 countries

1) Not all participant logos are shown; 2) Including efficient wireless charging solutions >100kW and >90% efficiency; 3) 12m and 18m variants

EGCI: European Green Car Initiative; TCO: Total cost of ownership

Source: SE, CORDIS #769850, EGVIafor2Zero

EGVI achieved its objectives, laying the foundations for today's EU-funded R&I initiatives and generating tangible and intangible benefits for the EU transport industry

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Further benefits could be realised by increasing the speed of the project approval process and by rebalancing R&I focus to reduce technology cost

## Lessons Learned

- Some projects suffered from the lengthy duration between topic publication and project kick off
- Long lead times on technical outputs reduce their competitiveness and benefit to society
- However, it was noted that Horizon 2020 procedure was fully respected and met by EGVI and the EU

**Increased speed of EU approval processes to support a more competitive time to market**

**R&I rebalance from functional improvement projects to those reducing technology costs**

- Several EGVI projects concentrated on the affordability of solutions, which could ultimately provide cost savings to the end customer
- Despite this, with an increased focus on cost efficiency across projects, wider adoption of decarbonised technology might be realised



# European Green Vehicles Initiative Impact Assessment

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