

Material Efficiency along the
Automotive Life Cycle

FINAL
REPORT
2014

ecology

sustainability

mobility

efficiency

technology

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Introduction

In the S_LIFE project, partners examined the vehicle life cycle, proposing measures and solutions to improve the sustainability of the material value chain. It is a European Region of Knowledge project under the Seventh Framework Programme of Research and Development. Seven partner organisations from six countries teamed up in **S_LIFE (European Synergies and Cooperation for Sustainable vehicle along the Life-Cycle)** to assess the challenges, map the available knowledge and stakeholders, and propose adequate support and research actions. The automobile industry produces about 20 million vehicles per year and represents over 12 million jobs. It also represents a quarter of the EU's industrial R&D. Nonetheless, the targeted market is highly competitive.

So it goes without saying, that they are constantly aware of efficiently managing their resource input and output. The increasing number of personal vehicles – more than one out of two people own a vehicle in Europe, which is no less than 280 million vehicles in circulation – combined with the scarcity of some natural material resources are widely regarded to be among the most economically and ecologically challenging trends. Over the years, this led the European Commission to set ambitious reuse, recovery and recycling targets for end-of-life vehicles, for instance, in its directive 2000/53/EC. In addition, innovation in vehicle design and composition requires innovative raw materials and their choice is partly conditioned by life cycle analyses.

Combining bottom-up from stakeholders, and top-down approaches from scientific studies, European Commission and ministries gave the consortium the measure of the existing challenges as well as the priorities to be treated. Life cycle innovation is strongly dependent on the skills developed by the industrial, academic and political infrastructures.



Actions under the umbrella of S_LIFE address three key factors:

- improved knowledge distribution among European countries
- research and development on innovative resource-efficient materials and products
- coherent policy development.

They should drive competitiveness of automotive stakeholders through reducing the use, replacing and recycling of materials.

In S_LIFE, both ecological challenges and economic interests are combined with the ultimate objective of the highest material resource efficiency against highest industrial competitiveness.

The automotive value chain is already regarded as an optimal and stable resource cycle. Therefore, the threshold for further improvement is high, and can only be improved through a multilateral effort of entrepreneurs, authorities and academic institutes.

Yours sincerely,

A stylized, handwritten signature in black ink, consisting of several fluid, overlapping strokes.

Rodolphe Gié
Project Co-ordinator S_LIFE



S_LIFE Regions – Opportunities and Threats

S_LIFE represents six European regions sharing experiences and developing new concepts to improve resource efficiency along the automotive life cycle.

Overview of the Regions

Alsace and **Franche-Comté** have a long-standing industrial tradition including car manufacturing. Today, the whole territory is a European hub for the automotive industry, attracting different types of players, from original equipment manufacturers (OEMs) to international and local suppliers (Tier 1, 2 and 3 suppliers). They also make up the first private R&D centre specialised in ground transportation in France.

Bavaria is a high-technology state with extensive R&D resources that could be put to use in a European effort to improve sustainability and resource efficiency. Existing cluster and network structures are well-suited to provide a framework to improve collaboration beyond Bavaria across Europe including industry, associ-

ations, R&D and universities. The fact that three major manufacturers AUDI, BMW and MAN along with their supplier networks are located in Bavaria is of great benefit. The recycling industry deserves more attention and should be better integrated into sustainability efforts. Recyclers use state-of-the art technologies; however, they suffer from overcapacities and from the fact that many vehicles do not end up at their facilities.

Baden-Württemberg is characterized by a strong industry and high export ratio. It is home to global players such as Daimler, Porsche, Bosch and IBM Deutschland. But the structure of its economy is characterized primarily by its strong backbone of medium-sized enterprises. The state is also home to many leading

network
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research institutions, including the Institutes of the Max-Planck Society, the German Cancer Research Centre in Heidelberg, the German Aerospace Centre, the Centre for Solar Energy and Hydrogen Research Baden-Württemberg and the Institutes of the Fraunhofer Society. Key areas for growth within the economy of Baden-Württemberg extend beyond classical sector and industry boundaries, offering enormous potential for innovation. These primarily include four future areas: sustainable mobility, environmental technology and resource efficiency, health and healthcare as well as embedded systems and IT services.

Today, the economy in the **Netherlands** is the fifth-largest economy in the Euro-zone and is noted for its stable industrial relations, moderate unemployment and inflation, a sizable trade surplus, and an important role as a European transportation hub. Industrial activity is predominantly in food processing, chemicals, petroleum refining, and electrical machinery. The Netherlands is well known as one of the world's most densely populated countries. Due to this fact, advancement on waste management and efficient mobility and supporting infrastructure has been progressive.

Piedmont has an important history and a unique position right at the centre of the system of European development. As part of the European Union, compa-

nies located in Piedmont have access to the world's richest consumer market of 500 million people, over 330 million of whom work in the single currency. The economy is characterized by its strong propensity for innovation and internationalisation. Not only because of its geographical location, but also due to a number of historical and cultural factors and the long tradition of its manufacturing industry, Piedmont has been able to establish and maintain close commercial and trade links with neighbouring countries and with others further away. It continues to be one of the Italian regions with the highest rate of internationalisation of its economy, with exports accounting for about 28 % of the regional GDP.

The Republic of **Slovenia** is situated in Central Europe at the crossroad of main European cultural and trade routes. It borders on Italy to the west, Austria to the north, Croatia to the south and southeast and Hungary to the northeast. It covers 20,273 square kilometres and has a population of 2.05 million. It is a parliamentary republic and a member of the European Union and NATO. Relative to its geography, history, economy, culture and language, it is a very diverse country distinguished by a transitional character. It is characterised by a high economic and social level.





Our Approach

A deeper understanding of each region's position was prerequisite for the definition of existing bottlenecks, elaboration of a joint vision and mutual agreement of a common Joint Action Plan (JAP). The SOWT (Strength Weaknesses Opportunities and Threats) and SOAR (Strengths Opportunities Aspirations and Results) analyses are main instruments to gather insight into the regional structures of S_LIFE partnering regions.

Each region has been analysed in detail following a common structure. In addition to the SWOT analyses, aspirations and results have been collected expanding the investigation to a "SWOT/SOAR analysis". This approach supports the clusters to define a strategy to be followed for the S_LIFE project regarding the future perspectives and vision of the market.

The regional analyses performed during the first year of S_LIFE show similarities between some clusters, but complementarities and differences as well. Insights gathered by the SWOT/SOAR analyses result in a better mutual understanding of interests and challenges addressed by stakeholders in each region. Main findings are summarised below without any claim for completeness. These analyses deliver insight into the availability of skills in the regions, showing overlaps and differences in positioning of the automotive life cycle. In general, an efficiently functioning vehicle life cycle depends on the cooperation between authority (the regulator), industry (the market developer) and academia (the innovator). Inefficient processes can be traced back to a lack of cooperative effort of one of the parties.



Complementarities and Similarities

Shared	Differences
S Strong presence of the value chain in all regions, but with different characteristics and orientation S Sustainable production and resource efficiency regarded as key innovation areas S E-mobility and new materials are regarded as growth areas S Strong cooperation between research institutes and automotive sectors W Regional car sales under pressure in all regions W End-of-life chain under increased pressure of high exports of vehicles and ELVs	S Availability of influential OEMs and large suppliers differs between regions S Availability of S_LIFE-related funding instruments varies strongly from region to region W Organisational and infrastructural performances strongly developed in the Netherlands – not in other regions W Variation in performance on crossborder research projects W Access and influence towards decision-makers show strong difference W Performance of the end-of-life chain shows strong diversification

All five automotive clusters cooperating under S_LIFE cover the whole value chain. This confirms their positioning to the major automotive regions in Europe. In the scope of S_LIFE, the most important complementarities are the power of end-of-life research and organisation in the Netherlands, the leading edge production in Southern Germany (Bavaria and Baden-Württemberg) and Alsace/Franche-Comté in

combination with advanced research for new materials in Alsace/Franche-Comté, Bavaria and Baden-Württemberg.

All regions are used to cooperating in European networks and show strong experience in several European funding schemes.





General Opportunities and Threats

Shared	Differences
- O Growing awareness regarding ecological end-of-life structures - O Industrial innovation and research strengths are capable to improve life cycle performance - O Strong motivation to cooperate on a European scale - O Overall resource efficiency along the value chain receives higher attention - T Competition from emerging markets affects industrial performance along the value chain	- O Variation in advanced raw material industries - O Strong variation in funding instruments and availabilities for research and innovation - T Variation in organisational performance of the end-of-life chain - T Strong difference in the political willingness to improve recycling sectors and processes

Resource/material efficiency is becoming a priority in regional activities. Added value could arise from European networking in order to moderate regional efforts and to close material loops. Furthermore, material flows need to be organised across different sectors if cost efficiency should be maximised.

A major threat in all regions is the unstable flow of recyclates, both in quality and quantity, which contradicts the requirements of up-to-date automotive production (just in time / just in sequence) with its high quality standards.

As vehicles normally have a life span of 12 to 15 years, predicting the demand for recyclates from end-of-life (EoL) vehicles is rather difficult as at least five new model generations have entered the market during this period.

All clusters are facing the threat to develop joint activities which do not result in additional regulations on a European and national level, causing higher production and service costs and thus reducing global competitiveness of the European automotive industries.

technology

sustainable
mobility

Aspirations and Results Preparing the Basis for our Vision

Shared	Differences
- A Improve the economic performance of SMEs along the value chain - A Improvement of the supply chain to increase use of second-hand parts - A Better cooperation between sectors and regions considered as key to improve material efficiency - R Fulfillment of legal demands, especially the ELV Directive - R Better overview of regional, national and European best practices - R Improved tracing and tracking of materials, vehicles and end-of-life vehicles (ELVs)	- A Improvement of automotive production not seen as national challenge but focus on added value (NL) - A Improvement of environmental performance of recycling industries is diversified between regions

This proves that all regional cluster organisations will work on supporting their partners in the transition to meet the 95 % end-of-life vehicle target (recycling and revalorisation) in 2015.

All partners agree in the general aspiration to reduce the dependency on foreign raw materials. In order to achieve this, the primarily identified route will be to increase/improve:

- Material efficiency in production, giving the European automotive industry a competitive advantage on global markets
- Reused and re-manufactured parts market to reinforce its supply loop.





Empowering the automotive life cycle

The S_LIFE project is all about translating regional strengths and weaknesses into concrete collaborative actions; with regard to research initiatives as well as to the development of interregional networks. In the second work package of the project, the regional situations analysed in and feedback supplied by stakeholders along the value chain during the first phase of the project culminated in the release of a Vision Document, a Strategic Research Agenda and a Joint Action Plan. This documentation provides the theoretical grounds for future S_LIFE activities

Companies offering products and services along the automotive value chain are facing a variety of challenges relating to sustainable processing of raw materials. Automotive innovation combines values relative to new trends, such as lowering fuel consumption and CO₂ emissions through lightening or electrification and smart connectivity, with classical items such as comfort, durability and safety.

As one of the most contributing industrial value chains to the European economy, the automotive sector is strongly dependent on an efficient and stable raw material supply. Whether it is constructed, repaired or recycled, the impact of the passenger car is extensive to materials and parts. Raw materials drive innovation, especially in complex consumer goods. Therefore, we consider this value chain as the lifeblood of technological and organisational innovation, which is adding to Europe's global competitiveness.



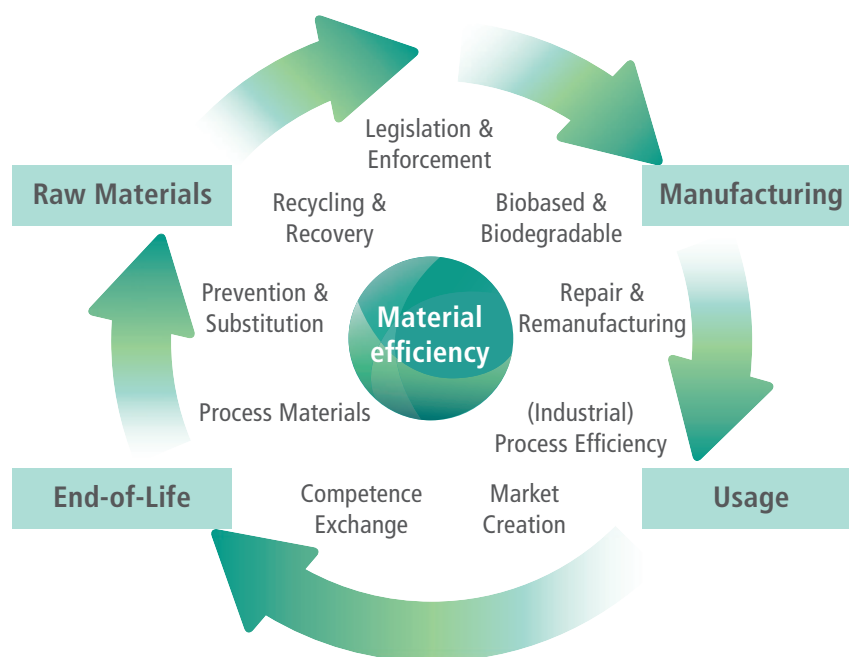
Raw Material Phase ○ Availability of primary /secondary resources (from a European perspective) ○ Impact of secondary material changes on raw material production ○ Manufacturer/political strategies impacting resource consumption	Manufacturing Phase ○ Vehicle manufacturing trends and statistics ○ Resource efficient production environments – including secondary materials and reused products ○ Main European and OEM strategies and their impact on the raw material cycle
Usage Phase ○ The role of reused materials for consumers, B2B and manufacturing ○ The implications on vehicle registration differences within the EU ○ Priorities of actors in the use phase of the vehicle ○ Trends around export of vehicles and parts ○ Increasing corporate and consumer awareness	End-of-Life Phase ○ Technological improvements needed for the future value chain ○ Impact of hazardous material streams ○ New vehicle strategies and implication for Eula (end-user licence agreement) management ○ Knowledge dissemination ○ Conflicts between reuse and compatibility

The S_LIFE Vision Document (VD) describes an ideal situation we wish to aim for. It takes the new low emission vehicles into account and explains how it could align itself to a sustainable chain of materials. In short, it envisages an industry where end-of-life-vehicles are 100 % recovered, where materials are chosen at design stage following that objective and where awareness is such that it allows every link in the value chain to play its role in collecting sorting and re-using materials. Since 20 % of the vehicle's cost price involves basic materials, constructors (suppliers, assemblers) are highly aware of the efficient use of energetic and non-energetic resources. However, in the vehicle use- and end-of-life phases, there are considerable opportunities to improve the material life cycle.

The Strategic Research Agenda (SRA) takes the aforementioned 'vision' to a higher research level. It lays down an academic oriented roadmap, describing the most critical research needed to achieve this "vision" by 2030. These researches were sorted through six strategic research objectives:

- Optimising industrial manufacturing and recycling processes to achieve improved material efficiency
- Developing new materials and sustainable technologies for closed loop material management
- Improving cross-border chain management and transfer of data on vehicles, batteries and waste
- Influencing market interests and end-user behaviour
- Analysing economic development and cost calculation to gain full understanding of cost and benefit of material efficient processes
- Stimulating level playing field and regulatory harmonisation

These objectives and their related research themes aim at improving technological development, fundamental scientific research, societal behaviour, value chain organisation, analysis of economics and simplification of regulations.



Joint Action Plan

As the most concrete work package result, a tailored Joint Action Plan (JAP) and associated Business Plan have been developed. The JAP is based on the existing state of the value chain – an automotive resource cycle which is widely regarded as efficient and structured through regulations and economic incentives. Therefore, it does not aim at creating new regulations and “reinventing the wheel”. The chosen perspective is to exploit open technical and organisational gaps along the value chain involving one or more stakeholders.

These gaps or “bottlenecks” arise especially at the intersection of automotive developments and material efficiency. The balance of materials is gradually shifting from metallic towards polymeric, whilst combustion engines are giving way to motors and other alternatives.

In the JAP, 15 actions are developed. These proposed actions by S_LIFE take these trends into account, suggesting the earliest possible anticipation.

technology

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recycling

They involve all steps of the value chain: raw materials, manufacturing, vehicle use, and end-of-life valorisation. Actions are of various natures: some support actions will facilitate knowledge building, networking and clustering of knowledge for stakeholders. For example, knowledge on resource efficiency and sustainability in the automotive sector starts with proper education and training, especially of students who will work in car retail and maintenance, or end-of-life vehicle treatment facilities. In the S_LIFE network,

a study programme has been created and held, highlighting resource efficiency in the workshop as well as the importance of car recycling. The others, more R&D oriented, consist in analysis (for example, of regulatory obstacles to recycling or impacts of new mobility strategies on end-of-life), development of tools, lobbying or even product development (new products from automotive shredding residues or sorting technologies for polymer separation).

Results

This part of our mission generated more discussions and debate than any other. Yet what was anticipated to be difficult, turned out to be the source of extremely rich exchanges. The different approaches from country to country, from each partner and different constraints to the various stakeholders forced us to get to the essential. We need to highlight the continuously open attitude and strong involvement of

the advisory board here. The main achievement was to obtain a solid strategy, which can actually make a difference to the value chain. Benefitting from a well-structured process, the JAP offers concrete opportunities to overcome the difficulties highlighted by the stakeholders themselves, which made it easier for them to adopt when the time came to implement them.

It is not the beauty of a building you should look at; it's the construction of the foundation that will stand the test of time.

David Allan Coe

The S_LIFE partners committed to further exploit the actions during S_LIFE and after the official project period. Actions are described and ranked by necessity, practicability, and other key criteria. Partners are attracting authorities' attention to support projects and to turn the theoretical actions into actual projects.





The Path to Resource Efficiency

Once the Joint Action Plan (JAP) had been defined, the S_LIFE consortium set on the task of prioritising and implementing these actions. Eighteen months were dedicated to the elaboration of a road map to identify the real social, scientific, industrial and economic development impacts.

A business and financial plan was added to the road map in order to outline the potential financial resources from both public and private funds to support the implementation of the JAP actions. Mapping of the existing financial tools and an investigation of

future project financing opportunities through calls for proposals launched under the framework of EU programmes including Horizon 2020 was one of the key elements to define future sustainability.

Business Model and Business Plan

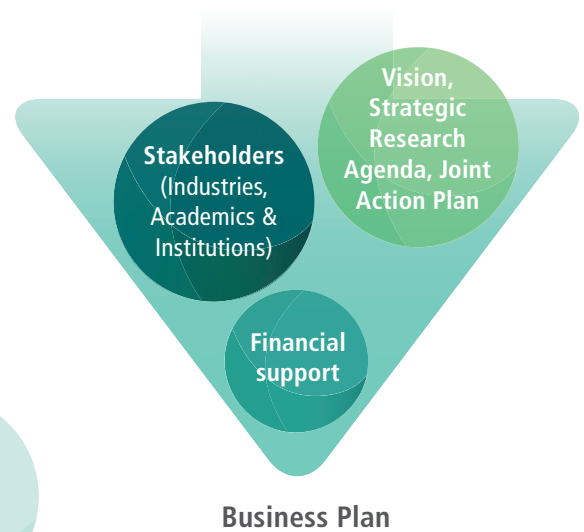
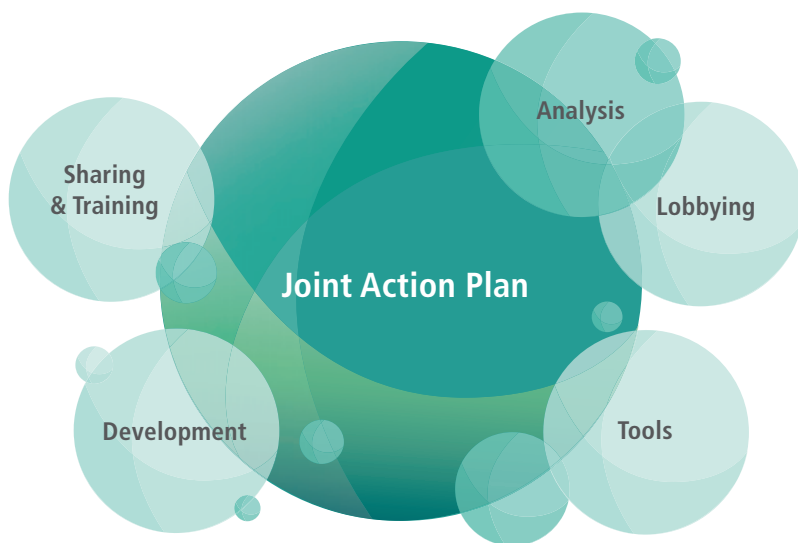
The activities foreseen in the Joint Action Plan while having common final objectives – namely recycling and reuse of all materials as well as increased environmental and energy sustainability – are much diversified.

They include academic studies, development of new technologies and equipment, software and methodologies, training programmes but also specific actions aimed at sensitizing both, industry and public opinion as to the adoption of green and eco-friendly behaviours and solutions.

new materials

value

recycling



The nature and typology of the JAP actions were crucial in the finalization of a comprehensive and synergetic action plan including road map, business and financial plan.

Actions were first prioritized in terms of importance, feasibility and impact. A further step was to define a new business model, adapting the traditional approaches to the peculiarities of the S_Life project.





It is clear that such a diverse set of actions could not be treated under a unique business model. It will therefore have to be a canvas woven from the addition and interaction between the various action models.

A specific aspect has to be taken into consideration: European directives issued over the past 15 years show that a remarkable number of actions have been undertaken in terms of recovery and recycling of ELV (end-of-life vehicle) materials. Attested statistics reveal that on average over 85 % weight of the ELV materials in Europe is now being recycled or reused (Eurostat year 2012). It is evident that most of the easily recyclable or valuable materials have already been subject to rapid development of technologies in order to answer the market demand.

Nowadays, the remaining 15 % of ELVs weight includes such components, that technological and operational limitations of the material separation process make it particularly complex. Overcoming these limitations will require time and financial resources

from specialized private operators; something that can only be achieved in a context of profitability. This is a reality check.

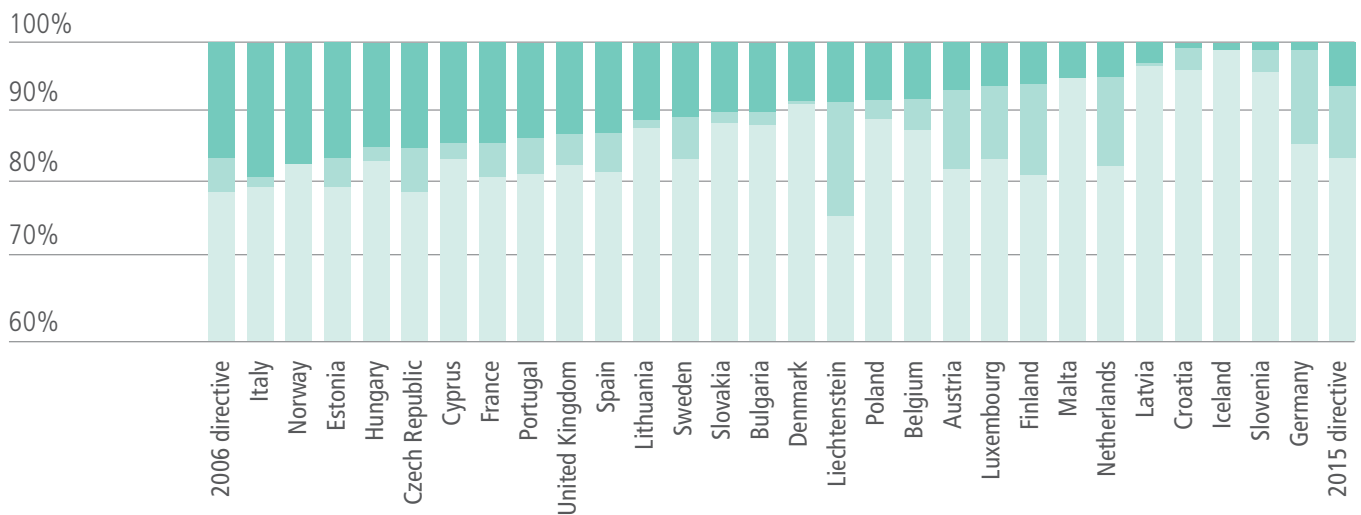
So far, most of the progress has been made through separate actions in each stage of the life cycle. Yet to reach the bar of 95 % reused or recycled materials, the approach has to be revised to integrate the whole value chain. So far, technology-push was the main factor for increasing the recycling rates. We now need to associate the market pull in the equation in order to restore profitability and allow for further technical developments to be financed.

Given the nature and typology, the JAP actions are more suitable for public rather than private funding. For the implementation of the business plan, all possible financing levels sources were taken into account – regional, national and European, including those deriving from Horizon 2020 programmes.



Recycling and Recovery Rate (source Eurostat 2012)

- Recycling & Reuse
- Energy Recovery
- Landfill





Matchmaking Platform

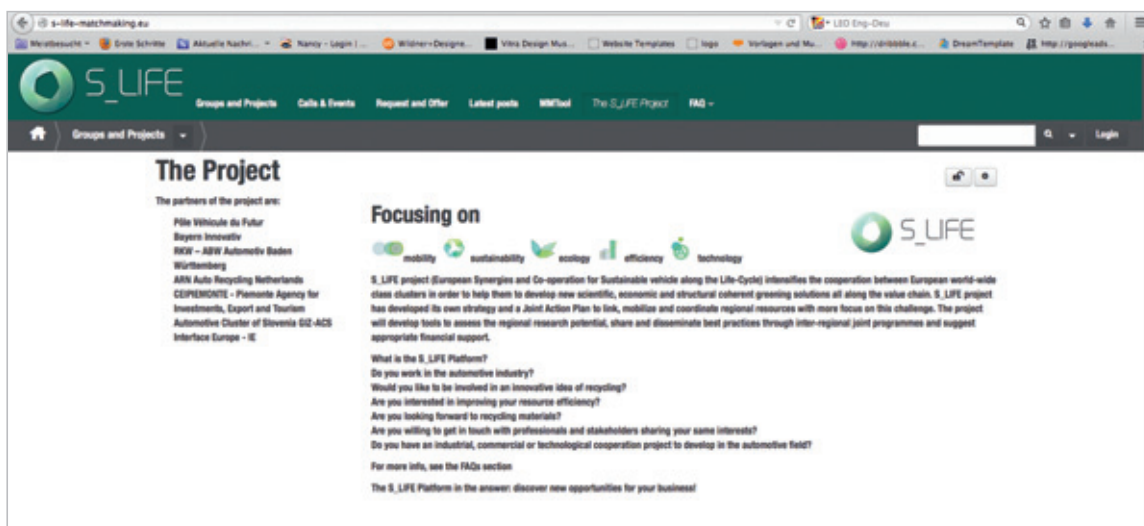
A collaborative interactive web platform was created to strengthen networking, cooperation, information and sensitivity among both professionals and general public in Europe. Key issues related to the recovery and recycling of ELV materials will be addressed there, such as legislation or regulations as well as the impacts on life cycle efficiency and sustainability.

The matchmaking platform is freely available on the website: www.s-life-matchmaking.eu.

It is structured as a virtual community where online working groups can animate thematic discussions,

exchange project ideas or business-to-business cooperation proposals. 17 thematic groups have been structured divided by sector and by competence including: recycling and methodologies, technologies and processes, material and components, environmental and social impact. Consortium partners kick-started the working groups by taking their leadership according to their expertise and knowledge.

Additionally to the platform, the Matchmaking Tool (MMT) can be used for the organization of B2B meeting agendas on the occasion of specific events matching offer and demand.



technology

mobility
value chain

Future Plans

For future sustainability, the basic concept is to maintain the integrated approach that has been the backbone of the whole project. This leads to a mix of actions that are very different from one another – and therefore require different “business” approaches – but are also aimed at the same objective. Some calls for proposals have been identified and discussed with S_LIFE partners in order to anticipate the submission of future joint projects stemming from S_LIFE’s achievements, ideas and actions.

Two projects proposals have already been submitted on Horizon 2020 calls, one of them was successful. Four more are under preparation, refining the frame and the consortium of each one before the submission date.

One covers most of the support actions, and will allow perpetuating the efforts started under S_LIFE in stimulating the value chain. Another will concentrate on the polymer value chain as this is a highly cross sectorial topic which could benefit not only the automotive value chain but all consumer goods. It could be a great lever for progress in the recycling rates.

On more local projects however, work has already started. The example here is this of a training curriculum for dismantlers, which has been tested in the Netherlands already as continuing education; whereas in France the existing related curriculums are being updated to reflect the evolution of a profession. The process is launched, but this is only the beginning.

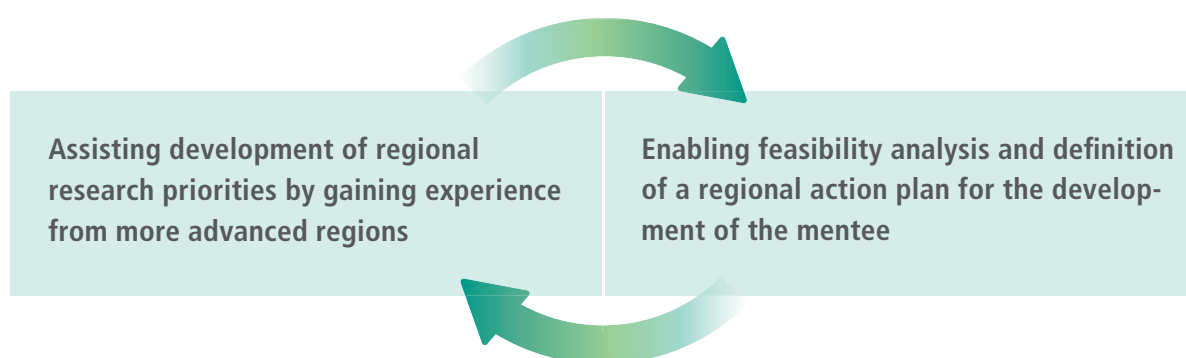




Knowledge Exchange

One of the specific characteristics of Region of Knowledge programmes is that they encourage collaboration between various organisations and clusters across Europe. Depending on the different areas, some are more or less advanced on specific topics. This can be related to different business models, size of organisation, technical focus, and generates a lot of experience exchanges among them.

In S_LIFE, we integrated a so-called “less advanced region”: Slovenia. The support brought to this organisation was the object of work package five. This work package had a dual objective:



science

resources
knowledge

new materials

The Contribution of the S_LIFE Consortium:

The target of the current task is the Slovenian partner, GIZ-ACS. The aim is to optimise their support to the authorities involved in the design and implementation of regional research to development RTD (research and technological development) and cluster policies and those deciding on RTD investment.

Therefore, the proposed mentoring activities provided opportunities of mutual learning for policy-makers, researchers and cluster experts encompassing aspects from broader RTD and clustering policy framework to specific instruments and policies in the S_LIFE area.

Partners' roles

- Pôle Véhicule du Futur (PVF) as triple helix cluster led this activity and ensured its efficient implementation of this work package.
- ARN, Bayern Innovativ, RKW-BW as well as CEIP-iemonte were also involved as mentors, performing some audits and/or hosting some study visits.
- The mentee region Slovenia was looking for an opportunity to accelerate the development of its cluster (GIZ-ACS) thanks to a direct Europeanisation of its network. The region should learn from these activities how to define a strategic regional R&D plan in the field of car life cycle and how to position the region towards existing initiatives to be completed.

Tools

Staff exchanges were a mix of training and exchange sessions between the mentee and one of the mentor partners. They presented the perfect opportunity for both parties to learn from one another's practises and experiences.

Study visits were the chance for Slovenian stakeholders (industrials, policy-makers, academics and/or researchers) to benefit from the network created via S_LIFE and to study some of the best practises observed throughout Europe from up close.



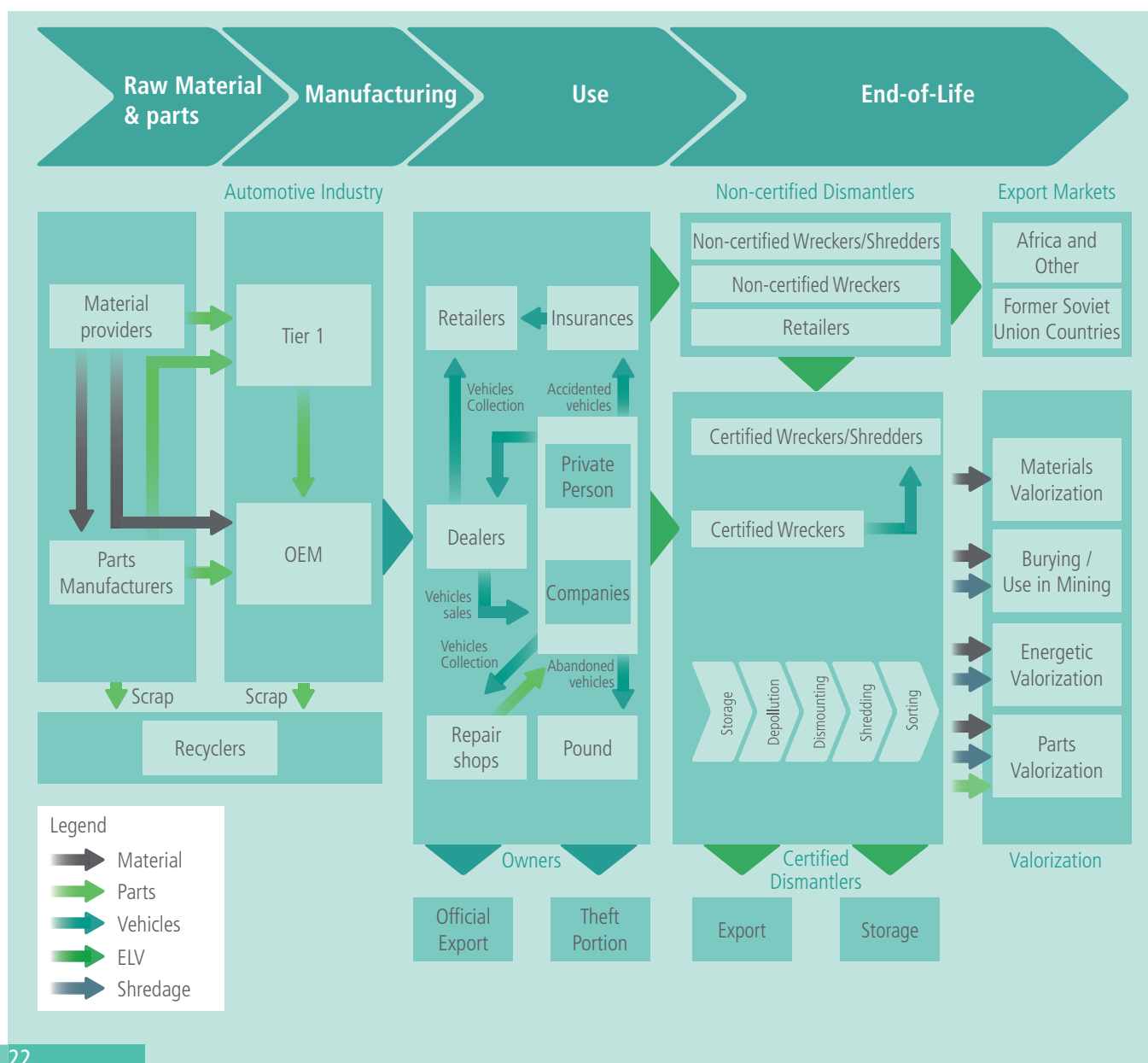


Action

The first step in supporting the Automotive Cluster of Slovenia was to identify the gap between their practises and those of the other S_LIFE partners. Hence, the first task to be undertaken here was an audit.

As it was performed, it appeared that innovation, funding and support management were already close to what was done in most of the so called "more advanced" regions from the S_LIFE consortium. However, with different practises regarding the support programmes at regional/national levels, benchmarking appeared the most important task in order to implement some innovative ideas.

ACS's 7th Annual Convention was the perfect opportunity to reach members of the Slovenian triple helix. Rodolphe Gié, S_LIFE project coordinator, presented the project and its context. Explaining the European Commission's directive 75/442/CEE applicable at the time, but also the new forthcoming 2000/53 directive which will be applicable from the 1st of January 2015 was a key stage to help the participants understand the stakes here. Showing the extreme complexity of the impacted value chain of which parties only have partial knowledge of. Giving the first results of the project's work through the list of bottlenecks and challenges faced by the automotive life cycle value chain.



This boosted awareness among the political, scientific and industrial classes, thus giving Slovenia all comparative grounds in order to develop their own support systems towards a circular economy within their automotive industry.

Back on a cluster-to-cluster basis, specific topics were chosen by ACS and treated by either one or several partners in order to provide the best possible overview.

- Innovation management: boosting local innovation by guiding and supporting SMEs in the process. Regional funding or support is well developed in certain regions of Europe. In Slovenia, due to several factors, such as the size of the country, public funds are not available to local businesses, and they must face competitiveness issues from a completely different perspective. However, information about intellectual property, networking and technology transfer are things that can be supported by the Slovenian cluster and will be developed.
- Cluster services: extending general cluster services, both basic (included to the membership fee) and additional (payable extra). Not only a European benchmark, these discussions allowed ACS to skip part of the learning curve by learning the services that were appreciated, and how best to set them up. Avoiding mistakes committed by others in the past will allow them to progress faster and make considerable savings.
- Operation on new markets: supporting members in entering new geographical markets and/or new market sectors. The process can be exhausting both financially and humanly. However, with the right methods and appropriate support it can become a highly successful endeavour. With all cards in hand, GIZ-ACS will be able to disseminate good practises and point the right partners locally to their stakeholders.
- Training on recycling activities: practises in the S_LIFE regions, their advantages, limits, disparities from one material to another and the role of the cluster in that matter. Historically more present on the materials and manufacturing phases of the automotive life cycle, this helped ACS position itself towards the use and end-of-life phases, possibly enlarging its activities' scope.





Activities towards this new perspective were started through S_LIFE by giving Slovenian companies the opportunity to discover best practises around Europe. Study visits took place in Italy, Belgium, the Netherlands and Germany. They allowed participants to visit great sites such as the Fiat Research Centre (Turin), the tyre recycler Rumal (Montfoort), the BMW Recycling and Dismantling Center (Munich) or the Daimler recycling facility (Stuttgart). The needs of the Slovenian stakeholders had been identified early with three main topics selected: materials, which included material recycling, secondary materials as a resource and

benefits of using new secondary materials, second life which covered both components reuse/re-manufacturing, looking ahead which dealt with the emergence of our future vehicles including advanced internal combustion engines their parts and components and their material life cycle.

The overall feedback from these study visits was very positive. When we asked Franci Lenart, Director of EKOMOBIL (coordinator of the Joint Plan for the Treatment of the end-of-life vehicles in Slovenia) regarding his impressions, he replied:

“At Ekomobil, we are pleased with the opportunity to participate in the study visit to Belgium and the Netherlands within the framework of the S_LIFE project. Because of the ineffectiveness with collection of the ELVs in Slovenia, we were excited to hear the experiences in these countries and at the same time we also established a business contact with project partners. I am convinced that the implementation of the project contributed to the achievement of the initially set objectives, also in the area of processing of vehicles at the end of their lifespan.”



Retrospect

Due to little opportunity of public financing of their activities, Automotive Cluster Slovenia had little room for manoeuvre so far. Their integration into Regions of Knowledge programmes presented them with the unique opportunity to accelerate their learning pace by benefitting from other clusters' experiences. The S_LIFE project also expanded collaborations within the region's automotive industry.



Dušan Bušen, Managing Director of Automotive Cluster of Slovenia

"Study visits organised in Piedmont (Italy), Belgium, the Netherlands as well as Bavaria and Baden-Württemberg (Germany) fully justified the high expectations that Slovenia, as a learning region, had in the framework S_LIFE project. We had a chance to take a closer look of how the EU directives and regulations are practically implemented in a variety of advanced EU regions and to exchange experience in the whole value chain in the process. Participating companies have gained many new experiences that will be included in their core processes. In the future, it would be reasonable to connect such study visits to any major event and thus obtain additional synergies for participating companies and institutions!", said Dušan Bušen, Automotive Cluster of Slovenia.





Communication and Knowledge Transfer

The S_LIFE project is really ambitious in its objectives and actions. All actions required first a strong communication at regional level to involve the research stakeholders and members of the clusters.

The aim of the consortium was also to extend and replicate further in Europe:

- the developed systematic approach of S_LIFE
- actions and projects from S_LIFE Joint Action Plan
- involvement of research, innovation and business possibilities from the main project outcome.

The overall aim was to create an integrated value chain of the life cycle of sustainable vehicle involving all types of stakeholders. The dissemination and multiplication of this approach ensures to boost economic, ecologic and societal changes in the automotive sector and will have a positive impact on the EU transport policy. Therefore all project activities were disseminated at regional, national and European levels.

A strong communication and dissemination strategy was developed by Bayern Innovativ with its Clusters Automotive and New Materials. It included the organization of communication tools, such as website www.s-life-project.eu as well as conferences, workshops, publications and matchmaking events. Against this background both clusters, automotive and new materials build a strong basis for communication, dissemination and exploitation and contributed intensively to reach the goals of S_LIFE project.



Major S_LIFE Events

1st Public Conference S_LIFE – Key subjects are Sustainability and Resource Efficiency

The 1st public conference of the S_LIFE project took place on 11th November 2012 at the IS2M - Institute of Materials Science at the Centre National de la Recherche Scientifique de l'Alsace in Mulhouse, France. More than 30 representatives from companies, authorities and scientific institutes were participating, focussing on sustainability, resource efficiency, CO₂ reduction in production and vehicle life cycle, material innovations as well as the recycling of old cars. Major bottlenecks and hurdles, already identified by the consortium so far, were discussed:

- variable supply of recycled material
- modern joining technologies which are complicating the recycling processes
- increasing flows of recyclable materials leaving the EU

Furthermore, the trends and challenges of new materials for future sustainable mobility were highlighted as well as the exploration of future vehicle recycling challenges. At the end of the conference the participants took the occasion and visited the labs of IS2M.

2nd Public Conference S_LIFE – Controlling environmental impacts more effectively

S_LIFE project organized its 2nd public conference as an official partner of the eCarTec Munich from 15th to 16th October 2013. The conference for electric and hybrid mobility presented high profile experts from the automotive industry, research and development.

The related trade fairs of eCarTec and MATERIALICA saw 479 companies presenting their products in the fields of electric vehicles, electronics, energy storage technology, energy and infrastructure as well as lightweight design and smart materials over an area covering 22,000 square meters of exhibition space to over 12,000 visitors.





From the start of design and at every stage in the life cycle, measures have to be taken to limit the environmental impact of its vehicles by limiting fuel consumption and CO₂/pollutant emissions, for example, as well as by moderating its use of natural resources, increasing recyclability, explained Sophie Richet,

Eco-conception Manager, PSA Peugeot Citroen, Paris (F). Looking beyond efforts to ensure that the vehicles comply with the environmental regulations in each of the countries where they are sold, OEMs have to be one step ahead.

Remanufacturing Possibilities within New Mobility

Following the recent technological improvements, electric vehicles are now well introduced and further market penetration can be expected. But in the perspective of wider use of battery-powered electrical propulsion systems, new challenges arise for both the classic automotive industry and further new players. Due to the various application cases of electric vehicles currently discussed, numerous business models can emerge. This would lead to new shares in the value creation and involve new participating players. Consequently, the individual stakeholders are uncertain as to which business models are most effective with regard to targeting a profitable concept.

Prof. Dr. Carsten Bucker, Managing Partner and CEO of BU Bucker Unternehmensgruppe Holding and Vice Chairman of Automotive Parts Remanufacturing Association APRA, Lingen (Germany), concluded saying that electromobility is going to cause basic technical changes around power units and lead to the development of new products. With these new products, new challenges will arise for the entire vehicle's lifecycle. However the risk of an early "electronic total loss" in modern vehicles is, in the perception of the vehicle owner, a great danger in terms of cost effectiveness.

Conference Automotive Recycling – End-of-Life Vehicles

The conference brought together around 50 people from industry, research and local authorities on 26th of March 2014 in Mulhouse, France.

The conference aimed to give an overview of the actions lead by the S_LIFE consortium in three thematic workshops:

- sorting for better recycling
- looking ahead together: national coordination on recycling
- training for the future of the automotive value chain

The end-of-life value chain must seize opportunities in order to structure itself and find its best possible business model, thus creating added value and jobs.

Nowadays, 85 % of the ELV mass is already revalorised (second hand parts, material recycling and energetic valorisation). From January 2015, it is 95 % that will need to be recovered dividing by three the mass of products needing to be buried.

“Nonetheless, recycling of raw materials with respect to the reconditioning ability of mechatronic and electrical parts has a sustainable importance for the success of the market penetration of electric vehicles.”



Professor Carsten Bücker, Vice Chairman of Automotive Parts Remanufacturing Association (APRA)

Sustainable Automotive Technologies

The 5th International Conference on Sustainable Automotive Technologies (ISCAT) drew special attention to the research and practice of meeting the challenges of sustainable mobility.

Key topics where the automotive responsibility for mobility with its elements sustainability, recycling, responsibility and production. Prof. Dr.-Ing. Joerg Wellnitz, Dean of the Faculty of Engineering at the Technical Hochschule Ingolstadt was conference chairman.

The ICSAT is the world's leading conference on sustainability of automotive technologies and took place from September 25 to 27, 2013 in Ingolstadt, Germany with participants from five continents.

This conference offered an excellent opportunity to present the S_LIFE project.





Outlook

Consumer goods are the biggest material resource in Europe at the moment. Our underground resources are insufficient to satisfy the local production and consumption needs. Other countries have also understood and anticipated this for their own soil and are already trying to exploit our waste as a resource for themselves. We cannot let this value escape from our hands.

In a Region of the world where 16 million cars are being manufactured each year and about 280 million are being used, we cannot go ignoring the challenges that arise from the usage of resources that automotive represents. Of course, a passenger car has a longer life time than most of the goods that turn to waste every year. However, it is the most complex object that

any of us will personally own. Our vehicles are made of countless different materials, and with few natural resources on the European soil, we face the risk of letting ourselves become more and more dependent from other countries or continents. So can we let over 6 million tons of material go to waste?

new materials

resource

science

knowledge

Phases of the Life Cycle

Lightweight vehicles, along with price competition among manufacturers and tier suppliers, already drive the innovation in terms of material design and material savings. Once considered as a sign of lower range, poor quality, and cheapness, the use of recycled materials has started to become a well perceived feature. It now bares an environmentally friendly image, and bio based materials are following the same path. This enthusiasm pulls the use of these materials in just about all consumer goods, and the automotive industry is neither the last nor the least of them.

It therefore seems that, in the **manufacturing phase**, only the design for recycling remains an area for significant improvement. Just as design for maintenance was a topic in the 90's, design for recycling is one of the challenges that the industry will have to embrace in the 2010's, and it represents a considerable investment of time and efforts. But it is not the only one: fuel consumption, security, comfort and connectivity of the vehicle are also very hot topics at the moment, and unlike the first one, they impact each brand's market positioning. Design for recycling is being looked into, as well.

During the **use phase** of the automotive life cycle, parts and fluids are regularly replaced from the vehicle. Fluids and tires are generally being collected and treated in Europe, however other parts, although they sometimes are subject to clear sorting and collection rules, are not always treated correctly. Utilisation of parts issued from reuse or remanufacturing can still be strengthened. With the costs of repairs constantly moving up as the financial capacities of the owners are decreasing, it is likely that these practises will spread. Several national and European organisations are already pursuing this aim. Two factors will clearly contribute to the development and democratisation of these practises: ICTs (Information and Communication Technologies) which will give accessibility and flexibility, and the support of the insurance sector which alone is in a position to massively inform their customers of the available benefits.





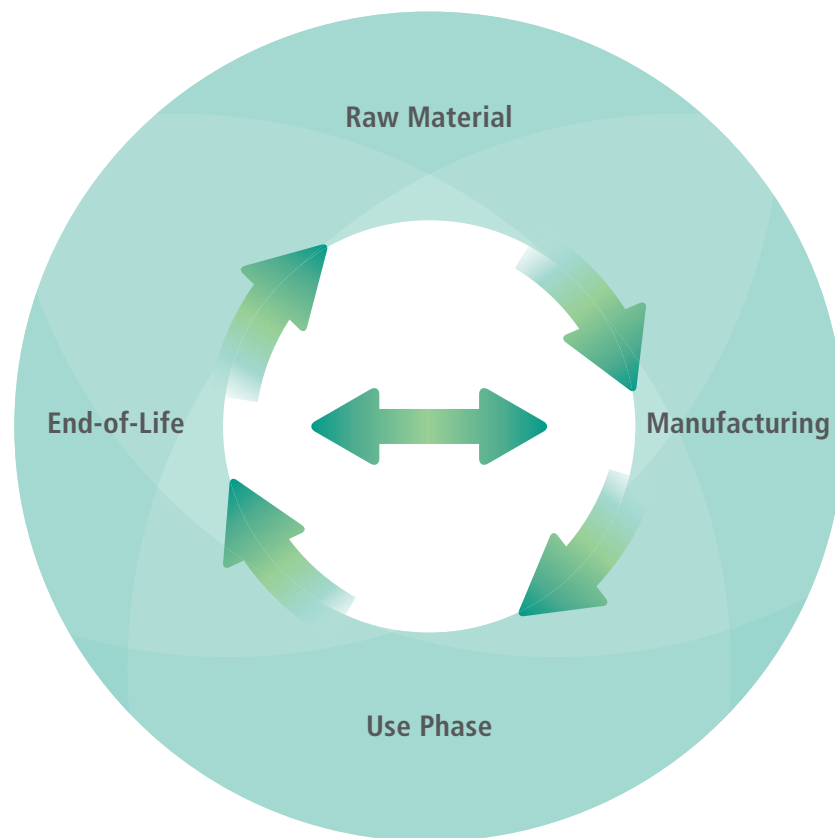
The end-of-life phase is the one which is evolving the most: it is a dynamic sector for which a lot of rules have recently changed and is in the process of adapting to its new role. In fact, the development of this particular know-how seems to be key: recovering parts and materials in the most efficient manner. The first equilibrium to be found is the one between dismantling and shredding. It is this very competence that will allow us establishing an economically steady balance between several ways of turning ELVs into new resources:

1. Dismantling

- part reuse
- part remanufacturing
- material sorting and recycling

2. Shredding

- material sorting and recycling
- energy recovery
- minimum landfill



Dismantle too much and the costs will be too high, shred too early and potential valuable items may be destroyed. Finding the right balance is the only way to ensure the sustainability of the industry involved in

the automotive life cycle. Of course, it will need to be constantly readjusted due to scientific and technological progress such as development of sorting methods, new recycling processes or new applications.

Polymer example

Efficiently separating the numerous grades of polymers present in an ELV at a reasonable cost is an objective that is still to be reached.

Automotive Shredding Residue example

After the sorting and shredding process, residues remain which are composed of tiny pieces of just about anything (copper to fibres to rubber and plastics). This is generally the fraction where no viable and qualitative recycling outlets are available, yet there are ways to either separate it further or use it as it is.

But there is no secret to it, in the light of increasing incineration and landfill tariffs, it must be a sound investment with market potential.

Closing the loop

The collaboration between the end-of-life sector, still artisanal in most of cases, and the European automotive giants, needs to be reinforced. To date, direct collaboration is still difficult. However, bringing them together would break the practical barriers. They need to understand each other as they are set to become "end-customers" of one another to a certain extent.

By developing a sustainable secondary materials value chain, not only the automotive industry, but the European industry as a whole will benefit from two complementary effects:

- High standard regular supply of materials drastically decreasing the effects of transport costs and potential geo-political risks. This will strengthen the industry sector which tends to weaken in some countries.
- Developing new supply chains on the European soil which cannot be relocated and generates value.

A huge potential remains to be uncovered here, the work has already started but there is still so much to be done. We have to keep in mind that, to make things happen, it is mandatory to have profitable economics. We bear in our hand a unique opportunity to recreate an economic and industrial dynamic by relocating well needed added value and well needed jobs within our borders.



Project Partners

automotive-bw/RKW

Foundation: 2010



Key issues:

- Mobility concepts of the future like: e-mobility, lightweight construction and efficiency technologies
- Network of clusters across Baden-Wuerttemberg reaching out to more than 2.000 companies in the automotive sector
- Global competitiveness of companies all along the automotive value chain through innovation support, technology transfer and technology advice

The network operated by automotive-bw brings together vehicle manufacturers, suppliers, regional bodies, research centers and universities in the automotive sector from all over Baden-Württemberg. The main objective is to stimulate and moderate innovation processes and cooperation along the value chain of automotive production. The cluster is focused on three thematic areas, which are all directly related to the topics of S_LIFE: reduction of GHG emissions through improved drive

trains (including HEV, PHEV, BEV and Fuel Cell concepts), lightweight structures, and process optimization in production and the value chain. With the implementation of its TecNetGroups automotive-bw offers a specific format to foster horizontal and vertical cooperation in the automotive sector.

Why joined the project?

automotive-bw wants to secure the leading role of South-West Germany as the leading cluster for future automotive concepts by exchanging experience and fostering cooperation with other European clusters.

Role within the project

automotive-bw led WP1 and was responsible for roadmapping, the SWOT analyses and S_LIFE best practice report. Further, automotive-bw contributed to the elaboration of the Vision Document, the JAP, the MMP and organised study visits to OEMs and staff exchanges in the Stuttgart Region.



Contact

automotive-bw
co. RKW Baden-Württemberg GmbH
Dr. Rolf Reiner
Dr. Beata Wloch-Ortwein

Königstraße 49, 70173 Stuttgart
Phone: +49 (0)711 22 99 842, Fax: +49 (0)711 22 99 855
Mail: rolf.reiner@region-stuttgart.de
www.automotive-bw.de

Automotive Cluster of Slovenia

Foundation: 2001



Key issues:

- Automotive Cluster of Slovenia is an association of companies from automotive sector in Slovenia
- Business supporting actor, representing Slovene automotive industry on national and international level
- Fostering maintaining of development competences in Slovenia and globalisation of Slovenian know-how

ACS provides support for its members to integrate into the global automotive industry and to improve the range of their products and services. Therefore it accelerates the efficiency of its members by providing adequate R&D and co-operating with expert development and scientific institutions both in Slovenia and abroad.

ACS enhances activities connected with the R&D of new products and services with greater added value. ACS also provides important links between members, supporting synergy with suppliers and promotes joint members' activities to improve products and operations in R&D, production, quality assurance and to achieve and maintain business excellence.



Contact

GIZ ACS - Automotive Cluster of Slovenia
Dušan Bušen, Managing Director
Tina Igličar Kubalik,
Development Coordinator

Why joined the project?

ACS joined the project to accelerate the learning pace by benefiting from other clusters' experience. ACS significantly benefited from study visits and staff exchanges that were organized within the project as well as from other research results that were disseminated among key stakeholders.

The region should learn from these activities how to define a strategic regional R&D plan in the field of car life cycle and how to position the region towards existing initiatives to be completed.

Role within the project

ACS contributed to all content related work packages of the project, however, its main role was in the WP5 that was dedicated to the knowledge exchange.

Mentoring activities provide opportunities of mutual learning for policymakers, researchers and cluster.

Experts encompassing aspects from broader RTD and clustering policy framework to specific instruments and policies in the S_LIFE area.

Bayern Innovativ GmbH

Foundation: 1995



Key issues:

- Open Innovation and sustainable networks
- Bavaria's Corporation for Innovation and Knowledge Transfer
- A network of 80,000 customers from 40,000 companies and 80 organisations, on national and international level

Innovations originate where expertise from various disciplines comes together. Bayern Innovativ GmbH capitalizes on this phenomenon and connects potential cooperation partners from different industries and technologies in order to drive innovations in small- and medium-sized enterprises in particular. Bayern Innovativ brings together experts from industry and science at all levels of the value chain and offers customised

services to help them to close existing gaps in technologies, supply chains and sales channels.

The activities centre on digitalisation, energy, health, material and mobility.

Why joined the project?

Bayern Innovativ joined the project to share its experience with other experts in the areas of materials and automotive and to network the Bavarian stakeholders on international level.

Role within the project

Bayern Innovativ (BI) developed the project communication strategies and tools, disseminated activities and outcomes for future sustainability of S_LIFE network and actions. Moreover BI contributed and supported the SWOT analysis, JAP and its roll-out as well as the mentoring by organising staff exchanges and study visits.



Contact

Bayern Innovativ GmbH
Dr. Kord Pannkoke
Head Mobility

Gewerbemuseumsplatz 2, 90403 Nürnberg
Phone: +49 (0)911 20 67 11 59
Mail: pannkoke@bayern-innovativ.de
www.bayern-innovativ.de



Interface Europe

Foundation: 2004



Key issues:

- Created by former EC Officers at the heart of European District (Brussels) and Networks
- Internal expertise in: Energy, Transport, Environment, Materials, ICT, Health, MSCA, FET, ERC, etc.
- + 2000 research & Innovation stakeholders trained

Interface Europe provides all European stakeholders with high added value services required to successfully develop and manage European R&D strategies and projects throughout the European and national funding programmes dedicated to research and innovation. Our experts are senior scientists supported by project managers, financial officers, exploitation managers, communication officers and lawyers with proven track-record in EU and national funding programmes and maintain business excellence.



Contact

Interface Europe
Lucie Beaumel

Why joined the project?

Interface Europe joined the project to share its experience in EU projects and to give the opportunity to partners to benefit from its know-how in project management.

Role within the project

Interface Europe, as WP leader, has been responsible for the assessment of the work performed by partners (assessment of results, effects and impacts). IE also provided methodologies and tools to partners to support them in the writing of key documents (SWOT, Vision document, SRA, JAP) as well as management support (administrative, financial & legal aspects).

Rue du Trône, 12, 1000 Brussels
Phone: +32 (0)22 13 00 30, Fax: +32 (0)22 13 00 39
Mail: lucie.beaumel@interfaceeurope.eu
www.interfaceeurope.eu

ARN Holding BV

Foundation: 1994



Key issues:

- Managing the processing chain for end-of-life vehicles in the Netherlands, through a network of dismantlers, shredders and recyclers
- Operating one of the most advanced post shredder technology (PST) installations, recovering fractions for material recycling
- Recognised as an international Knowledge Centre on recycling technology, chain management and new mobility

ARN (Auto Recycling Netherlands) is a unique organisation – combining all knowledge aspects on processing of end-of-life vehicles.

Originally started as a Producer Responsibility Organisation (PRO), fulfilling legal obligations of contracted vehicle importers; ARN has outgrown towards a well known expert in the field, serving also non-automotive recycling sectors and the mobility chain.



Contact

ARN Holding BV
Gert-Jan van der Have

The external services of ARN include consultancy on deployment of recycling processes and recycling chains, on Life Cycle Analysis (LCA) and European research projects.

Why joined the project?

Key intention of ARN was to expand its network in the European automotive sector, beyond the recycling thematic. The main field of competence of S_LIFE directly relates to ARN's expertise

Role within the project

ARN developed the Joint Action Plan, a Strategic Research Agenda and Vision Document for the S_LIFE project itself, but even more entrepreneurs, scientists and authorities which operate along the automotive value chain.

The Joint Action Plan (JAP) describes prioritised actions, which are to be taken in a short, medium, or long term by the S_LIFE project and its stakeholders. The actions support both network and competence development as well fundamental and applied research areas.

De Entree 258, 1101 EE Amsterdam
Phone: +31 (0)20 56 50 687, Fax: +31 (0)20 66 13 191
Mail: gert.vanderhave@arn.nl
www.arn.nl

Pôle Véhicule du Futur (Project coordinator)

Foundation: 2005



Key issues:

- Transfer of Knowledges
- Cluster and Network Management
- Promote best practise industrial excellence and competitiveness to local stakeholders

The Pôle Véhicule du Futur Alsace Franche-Comté is a French competitiveness cluster that organises the particular competencies of its geographical remit and missions around solutions for future vehicles and mobility. It was established in 2005 and has been awarded „competitiveness cluster“ status by the French State.



Contact

Pôle Véhicule du Futur
Hélène Pansard-Grynspan
European Project Manager

Why joined the project?

Pôle Véhicule du Futur originated the S_LIFE project to get an overview of the issues raised by resource efficiency and be able bring to support the French stakeholders' development.

Role within the project

PVF was the Project coordinator, supporting the consortium with a conductive line and an ambition to see concrete results arise from this CSA project.

PVF also participated in all other activities of the project such as SWOT, JAP etc. in the same manner as all other partners.

Finally PVF was responsible for the mentoring activities in close collaboration with the mentee partner ACS.

15 rue Armand JAPY, 25461 ETUPES Cedex
Phone : +33 (0)38 19 47 285, Fax: +33(0)38 93 27 645
Mail: hp@vehiculedufutur.com
www.vehiculedufutur.com

Ceipiemonte

Foundation: 2006



Key issues:

- One-stop-shop reference organization for development of internationalization and innovation potential of the region
- Customized approach through sector (cluster) and market specializations and extensive network reaching more than 50 countries in the world
- Broad representation and triple helix approach being the first Italian organization with broad membership including policy decision makers, business community, academia & R&D communities

CEIPIEMONTE is an organization with public partners and members created by Piemonte Regional Government and the Union of the Chambers of commerce of Piemonte in order to promote and strengthen internationalisation and innovation. Internationalisation and innovation are developed through 5 intervention lines: business promotion, investment attraction, agrifood and tourism development, management training, fundraising and international projects. Customised services are provided to companies through a twin approach combining specific sectors and markets specialisations. An extensive network of Liaison Offices and Co-operation relationships with BROs, innovation and development agencies, local authorities based in more than 50 countries in the.



Contact

Centro Estero per l'Internazionalizzazione
Annalisa Gamba
International Projects & Fundraising
Manager, Centro Estero per
l'Internazionalizzazione s.c.p.a.

An important link is established with EEN having among its main shareholders both Unioncamere Piemonte and Torino Chamber of Commerce which are active members of the network

Why joined the project?

Ceipiemonte joined the project to share Piemonte industrial, scientific and academia experiences and best practices on end-of-life Vehicle (ELV) in the recycling and remanufacturing project and process with all European Expert. In addition as a second purpose is to contribute to the enlargement of international networking of Piemonte stakeholders.

Role within the project

Ceipiemonte elaborated a feasible, effective and adjustable industrial and scientific road map for monitoring and impact assessment of the activities defined in the Joint Regional Action Plans covering the development of the integrated value chain for the life cycle of sustainable vehicles.

Also, Ceipiemonte set-up a financial business plan to enable the implementation of the S-Life Joint Action Plan and in particular developed partnership to answer to call for proposal and launch collaborative project. Moreover Ceipiemonte contributed and supported other project partners in the regional SWOT analysis, JAP, communication plan as well as the mentoring by organising staff exchanges and study visits.

Corso Regio Parco 27 ,10152 Torino
Phone: +39 (0)11 67 00 511, Fax: +39 (0)11 69 65 456
Mail: annalisa.gamba@centroestero.org
www.centroestero.org



Impressions



Kick-off-meeting in Belfort 2012



2nd Public Conference S_LIFE "Electric and Hybrid Mobility - Composites" 2013 in Munich



Meeting with scientific advisory board, associated regions groups and industrial expert in Nuremberg 2013



Matchmaking event Slovenia – Italy – Bavaria durch eCarTec and MATERIALICA trade fair 2013 in Munich



Staff Exchange Bavaria 2014



General assembly meeting in Stuttgart 2012



Advisory board meeting 2012 in Stuttgart



1st Conference S_LIFE Greening Vehicle Life Cycle in Mulhouse 2012



Matchmaking event Slovenia – Italy – Bavaria at eCarTec and MATERIALICA trade fair 2013 in Munich



General assembly meeting in Ljubljana 2014



2nd S_LIFE Conference Electric and Hybrid Mobility - Composites in 2013.



Matchmaking event Slovenia – Italy – Bavaria at eCarTec and MATERIALICA trade fair 2013 in Munich



Staff exchange at Porsche Museum 2014 in Stuttgart



Study visit Torino 2014



Study visit Netherlands 2014



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Gesellschaft für Innovation
und Wissenstransfer GmbH
Gewerbemuseumsplatz 2
90403 Nürnberg
Tel.: +49 911-20671-0
Fax: +49 911-20671-792
www.bayern-innovativ.de
info@bayern-innovativ.de

Editor

Tanja Flügel
Cluster Automotive and
New Materials
Bayern Innovativ GmbH
fluegel@bayern-innovativ.de

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www.wildner-designer.de

www.s-life-project.eu



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