

Deliverable 9.4
Executive Summary

*The co-modality
implementation in user-
friendly mobility*

Executive summary

Co-modality in user-friendly mobility environment

Rail based mobility is the objective, but rail cannot give an answer for the “last mile”, neither for logistics, nor for passengers. Co-modality between sustainable/low emission transport modes is the answer, and can be a great solution for users if unnecessary discontinuities are kept to a minimum.

Transfers between modes, or between lines of the same mode constrain travel flows, introducing different levels of waiting time and discomfort for passengers. Freight also suffers from these breaks, and their cost. Transition areas require specific solution. Passengers need to “read place and time” and the alternatives to identify how to make their trips at a low expense.

Co-modality can be seen as an organic element, and a tentative definition is the following:

“Co-modality in user friendly mobility environment” is the state in which the transport network and related services evolve in a cooptition¹ scenario to offer in any moment the lowest cost and the minimum entry barriers, according to present technological knowledge, to any potential user willing to make a trip or ship freight.

From this point of view co-modality is a flexible and changing concept. Accepting continuous technological evolution, the transport system should always progress towards higher levels of co-modality.

SPIDER PLUS identifies existing elements and technological solutions that have neither reached their optimum functionality nor sufficient expansion through Europe, and determines the development direction and rhythm to arrive successfully in a “rail based mobility 2050 society”.

The benefits of the action items included in this report do not only touch one specific issue. They rather trigger several improvements and realise their full potential in combination. Some technological tools and solutions can also be depending on each other, leading to a complex structure of preconditions and dependencies.

Co-modal integration into metropolitan areas: passenger and freight

It is in metropolitan areas where co-modal integration acquires maximum importance.

On top of the 24 hour freight reception and shipping activities, capillary intra and inter-city distribution generates a tangle of logistic related movements. Freight distribution has to be optimized to reduce the overall number of commercial vehicles, by limiting vehicle empty trips, and optimizing vehicle occupation. Collaborative warehouses and distribution services can work towards concentrating organizational efforts and reducing overall cost for a significant number of logistic related stakeholders.

Passengers and specially commuters move back and forth and around the metropolitan cities in huge volumes, tending in many cases to clog transport networks initially imbued in places with important space restrictions. Sustainable transport networks have to evolve and adapt themselves to channel increasingly high passenger volumes. Passenger trips in urban areas tend to be characterized by a 1/3 private car, 1/3 public transport, 1/3 walking distribution. This means that a high percentage of present trips have to be redirected to non-motorized or public transport means. While restrictive policies as parking limitations, low emission zones and urban access regulations “push” cars out of

¹ *competition plus cooperation*

the network, expanding non-conflictive areas for citizens to take pleasure in them and to enjoy acquired sustainable mobility possibilities; co-modal integration “pulls” passengers towards public transport by easing travel, and enhancing attractiveness.

This report includes the perspective of freight and passenger transport. For both perspectives vision targets have been derived based on potential capabilities of existing technological solutions and transport models. The vision targets focus on the market segments of urban and metropolitan areas as well as the interfaces to medium and long distance transport.

Recap of co-modality gaps, actions in place and deducted actions

For freight transport the role of enabling a seamless connection of urban freight transport with long distance rail network and integrated city logistics is the key targets. Regarding city logistics and last mile distribution there is also in the future only limited potential for rail based transport. The target there is a CO₂-free urban freight logistics.

Urban passenger transport should be overwhelmingly served by efficient modes, excluding motorised personal transport; also enabling seamless integration into long and medium-distance passenger mobility. The focus in the urban areas is on substituting all individual car traffic (to below 10%) with efficient transport modes. For the suburban areas as well as for the long-distance transport interfacing with local transport a 50% market share of rail is the vision target.

Gaps

Gaps can be identified within the thematic areas of infrastructure and operation, technology and ICT, planning, regulation, market uptake, governance and rolling stock. This abstract of requirements allows highlighting of major gaps in rail passenger and freight services in the local area today. The identified aspects are mainly taken and adapted from task 7.3.

Table 1: Passenger and freight gap identification

GAP	Passenger	Freight
Infrastructure and operation	<p>Highly congested urban and local networks: the capacity in urban and regional rail is a limiting factor for the introduction of new services. The high density in cities does not allow expanding capacity to the desired degrees, not under the current financial constraints.</p> <p>The link to airports and an integration of air and rail is only partially realised and has a high potential. Station layouts do not fully support multimodal trips, integration of all nodes is rarely realised</p>	<p>Not enough by-passes, causing congestion because of rail freight in transit</p>
Technology and ICT	<p>ICT solutions for users: differing solutions are available for several products. A clear integration and linking of different services is missing.</p> <p>Multimodal seamless trips and convenience in services has to be supported through advanced integration of fares/prices, networks and timetables</p>	<p>Standardized shipping and container units benefitted rail freight; for urban distribution an adequate modular urban freight box could realise similar success</p> <p>Underground transportation and rail based surface transport systems are not exploited towards their freight capability</p>
Planning	<p>The plans for urban development do not fully consider multimodal integration, rail is not fully exploited as an competitive alternative</p> <p>Station accessibility: in order to appeal the transport networks need to be highly accessible. Very low walking distances are not realised outside of central areas.</p>	<p>Freight intensive facilities, rail stations, airports and shopping centres do often not consider rail connections for logistics in planning and operation.</p> <p>City logistics are based mainly on road modality, rail connections to central locations serving as distribution hubs are scarce but would integrate rail</p>
Regulation	<p>High entry barriers in a largely not liberalised market prevent new business ideas and innovative individual solutions fostering new local transport solutions</p> <p>Space competition on urban roads between private and public transportation could be solved with access restriction programs; more consequent prioritisation of public transport on roads is often missing</p>	<p>In highly congested local rail networks rail freight needs to adapt to operational requirements and traffic flows, the level of needed industrialisation cannot be reached</p>
Market uptake	<p>The network accessibility: the means of transport that can be reached should not be seen as an isolated transport but rather as entrance to a seamless network. Instead of offering point-to-point transfers, full mobility has to be enabled.</p> <p>The service cost competitiveness today does not allow capturing the full market: Segmentation and differentiation of users is important to enhance offerings. On the local scope individual transport captures this requirement. While costs and prices for mass transportation do not allow a levelled, unsubsidised playing field.</p>	<p>Limited market share of local rail freight</p> <p>Freight villages are providing a new concept for urban distribution through a co-modal integration of rail, new last mile solutions are needed to supplement the system</p> <p>Rail service to industrial areas is an important traffic segment, high volumes can be realised but mainly over longer distances, short distance potential is not yet exploited</p> <p>High and concentrated freight volumes are not needed for single delivery points in urban areas, the flow of goods is more disperse since storing and larger inventories are reduced in denser areas</p>
Governance	SUMPs are not legally binding.	SUMPs are not legally binding
Rolling stock	Not completely prepared for automation	Not completely prepared for automation

Actions in Place

Actions in place can be of various types, including case practices, European programmes, projects, studies, legislation and funding.

Regarding each of the elements constituting the 2050 VISION, many actions have already been trialled, are operative, or have been modelled. In some cases, pilot projects have been put in practice, and obstacles for development have been identified. In other cases, the technological solutions have not yet been fully designed or tested.

For each of the SPIDER PLUS categorized elements, differentiating freight and passengers, case studies and related examples have been selected, from deliverable 7.3, as means of describing up to what point possible solutions are coming.

Table 2: Case studies related to SPIDER PLUS elements: Freight and passengers

N	Category	Elements	Case studies
Freight			
1	INFR.& OPER.	Rail freight bypasses	Newcastle rail freight bypass (successful planning)
2	INFR.& OPER.	Main freight nodes with rail access and city logistics functions	Freight Village Bremen
3	INFR.& OPER.	Rail capacity management in favour of freight	"Train Monitor" used by Kombiverkehr in their operation control centre in combination with their "Capacity Management System"
4	INFR.& OPER.	New rail operational concepts based on automation of rail	-
5	INFR.& OPER.	Cargo tram and cargo metro	CarGo Tram (Dresden), Cargo tram (Zurich), CityCargo (Amsterdam 2007-2009), GüterBim (Viena 2004-2007)
6	INFR.& OPER.	Automated underground freight systems	Cargo Cap (Germany) and Cargo Sous Terrain (Switzerland) are developed ideas. Not in operation.
7	MARKET	Integrated multi- and intermodal rail/road last mile services	Pendular train with hybrid power operating as a liner train through Switzerland serving both production plants and intermodal terminals. IDIOMA project (1998-2001) lacked economical viability at the time.
8	COOP. & COORD.	Private cooperation for consolidation and joint deliveries (new business model)	DUSS terminal in Regensburg
9	COOP. & COORD.	Cooperation between logistics service providers and railway undertakings	Distripolis (France), not fully operative. In some European experiments, consolidation centres were not feasible without public subsidies.
10	REGUL.	Optimised land use regulations in favour of rail and efficient urban freight logistics	Logistic Infrastructure Masterplan (Madrid)
11	REGUL.	Optimises planning and building regulations	In Switzerland a national regulation is established which obliges the cantons to implement land use measures to support rail accesses for industrial zones if this is technically possible and commensurate (Schweizerische Eidgenossenschaft 2010).
12	REGUL.	Modal split requirements for freight intensive facilities	Modal split requirements have been implemented in Switzerland for the Zurich Airport, gravel stripping plants, excavated material and big sawmills.
13	PLAN.	Integration of Logistics/Freight in Transport/Land use planning	Freight Village Nuremberg
14	PLAN.	Regional and local Logistics Masterplans in favour of Rail	-
15	PLAN.	Securing land for logistics activities	In Basel a port logistics and freight logistics areas are defined in the cantonal land use plan to secure

N	Category	Elements	Case studies
			enough space for logistics activities. Other examples of securing land are freight villages established in Germany (GVZ), Italy (Interporto), and other European countries.
16	TECH.	Automated rail operations for delivery of private sidings/goods stations	CargoMover is a fully automated rail freight car. The system was successfully tested in 2005 but further development of the technology and area wide implementation is necessary. BLU System (Hamburg)- semiautomated transshipment, loading and unloading
17	TECH.	Small boxes for integration of intermodal/urban freight	IDIOMA project (Nuremberg and Zurich). Technically feasible but not economically due to small freight volumes.
18	TECH.	Dedicated rolling stock for urban rail distribution	Freight wagons for trams are used in Dresden and Zurich.
19	TECH.	Multimodal ICT and IT systems	-
Passengers			
1	INFR.& OPER	Fast track direct rail connections to city hubs	RER network in Paris, Cross-rail lines in London, etc.
2	INFR.& OPER	City transportation network	Paris development plan.
3	INFR.& OPER	Mobility hubs centred around rail	Berlin multi-level main station, Atocha (Madrid), etc.
4	INFR.& OPER	Prioritisation of public transport	CIVITAS II project gives examples: Malmö, Toulouse, Tallin, etc.
5	INFR.& OPER	Integration of air transport in urban mobility	Zurich, Oslo, Amsterdam, Copenhagen, Munich, Madrid, Paris, Stockholm, Geneva, etc.
6	MARKET	Service cooperation: integration for all local mobility services	-
7	MARKET	Station 's service offerings	Bicycle sharing systems and car pooling system in Razlog (Bulgaria)
8	COOP. & COORD.	Integration of services beyond the local scope/cooperation with HS operators	-
9	COOP. & COORD.	Full tariff integration for the local area/larger urban area	SPUTNIC project gives examples in Dresden, St. Gallen, Brno, etc. Integration and simplification of the fare and ticketing system in Rogaland (Norway)
10	REGUL.	Access to cities: restrictions and charging	London congestion charging zone Stockholm Congestion Charge (Transek) Local scale: Walking promotion policies "Better on foot" (Pontevedra, Spain) Local scale: Car-free living in Garden City Weißenburg (Münster, Germany)
11	REGUL.	Modal split requirements in urban transport	Modal split requirements have been implemented in the Zurich Airport.
12	REGUL.	Pricing – support of mobility costs: fund for urban mobility	In Madrid, public transport funding is sourced 44% from fare revenues and 56% from public authorities. In Paris, only 1% of funding comes from government sources to support unprofitable routes.
13	TECH.	Improved rolling stock/vehicles	Metro line 1 in Paris has implemented autonomous train operations.
14	TECH.	Flexible shuttle transportation	Autonomous Heathrow Airport shuttle. Simulation study on autonomous cars (Ann Arbor – U.S.A.) reduction from 200.000 to 18.000 autonomous cars.
15	TECH.	Ticketing: mobility bill with fair pricing	London Oyster Card, National Public transport chip card (Netherlands)
16	TECH.	Full and easy information access navigator – Travel companion	-

N	Category	Elements	Case studies
17	PLAN.	Local scale logistics planning Municipal scale transport planning Regional scale transport planning National scale cyclist planning	Ecological urban distribution centre (Málaga, Spain). Integration of transport and urban operations (Grenoble, France). Generated Mobility Law (Cataluña, Spain). National Cycling Plan 2002-2012 (Germany). Mobility planning within other sectoral laws (France)

With the aim of describing the European Unions involvement in Urban Mobility Improvement and consequently in co-modal solutions, deeply linked to real functionality, an identification of related European programmes, projects and studies is made.

- Roadmap to a Single European Transport Area.
- Eltis, the Urban Mobility Observatory
- The European URBACT programme
- The CIVITAS Initiative
- Current research, applied research and demonstration activities are implemented through the 7th Framework Programme for Research and Technological Development.
- European Innovation Partnership (EIP) Smart Cities and Communities
- Intelligent Energy Europe programme (STEER)
- The urban dimension in Community policies is covered by two guides that explain the regulatory and financial framework relevant to urban areas
- CLARS platform (Charging, Low Emission Zones, other Access Regulation Schemes)
- The European Commission's Sustainable Urban Mobility campaign
- The European Mobility Week

These programmes result in a wide number of specific projects promoting technological evolution:

- EUROPTIMA
- ENHANCED WISETRIP
- EU-SPIRIT
- SMARTFUSION
- STREETLIFE
- TEAM
- DOROTHY
- VIAJEO PLUS
- NODES
- TIDE
- SOLUTIONS
- CITYMOBIL2
- MOVESMART
- MOBINCITY
- MYWAY
- SUPERHUB
- i-SCOPE
- CAPITAL
- 2MOVE2
- OPTICITIES
- TURBLOG
- BESTFACT
- CITYHUB
- EDITS
- SUMPROJECT
- SMARTSET
- STRAIGHTSOL
- C4CHALLENGE
- KonSULT
- C-LIEGE
- EPTA
- Sugar Logistics
- LAMILO

Studies worthy of mention are the “Study on Public Transport Smart Cards (2011)” and “Towards a European Multimodal Journey Planner”, both of them introducing later developed projects.

Deducted actions

The evaluation of the actions in place described in former sections of this document, and their present results, give an idea of their potential as feasible and functional actions. The combination of these possibilities, the Vision and the existing gaps allow deducing a selection of actions. These actions cover infrastructure, technology, market, governance and rolling stock related items.

Table 3: Actions in place related to SPIDER PLUS deducted actions

N	ACTIONS IN PLACE	DEDUCTED ACTIONS
1	Liner train through Switzerland. DUSS terminal in Regensburg. Distripolis (France).	Freight urban last mile related network and DTD integration
2	Train Monitor (Kombiverkehr)	Wagons, new materials and technologies for freight
3	Metro line 1 in Paris has implemented autonomous train operations.	Rolling stock design and materials for passengers
4	CargoMover. BLU System.	Automation of handling of CT units
5	Local scale: Ecological urban distribution centre (Málaga, Spain)	Collaborative logistics/warehouses
6	Train Monitor (Kombiverkehr)	Freight ICT based management
7	Berlin multi-level main station, Atocha (Madrid), etc.	Holistic integration of all modes in new designed stations and multimodal terminals
8	RER network in Paris, Cross-rail lines in London, etc.	Connection between airports and city centers
9	RER network in Paris, Cross-rail lines in London, etc.	Connection between airports and HSR stations
10	Newcastle rail freight bypass. Schweizerische Eidgenossenschaft (Switzerland).	Regional and Local Logistics Master Plans in favour of Rail
11	-	European Model for Transport Authorities
12	Mobility planning within other sectoral laws (France); Generated Mobility Law (Cataluña, Spain)	Sustainable Urban Mobility Plans (SUMP)
13		2050 VISION Sustainable Mobility Plans for Cities and Metropolitan Areas
14	Stockholm Congestion Charge (Transek); walking promotion policies "Better on foot" (Pontevedra, Spain); car-free living in	Parking management and traffic reduction
15	Prioritisation of public transport (Malmö, Toulouse, Tallin, etc.	Passengers ICT based management
16	Towards a European Multimodal Journey Planner; Study on Public Transport Smart Cards	European Travel Card and Travel Planner

At the same time, each of the programmes, projects and studies has a relationship with these deducted actions being proposed in SPIDER PLUS.

Table 4: European programme/project/study and SPIDER PLUS deducted action

N	European programme-project-study	Deducted action
1	LaMiLo project STRAIGHTSOL SMARTFUSION / DOROTHY OPTICITIES / SMARTSET	Urban last mile rail related network
2		Rolling stock, design and materials for passengers /
3		Collaborative logistics/warehouses
4		Regional and Local Logistics Masterplans in favour of Rail
5		Wagons new materials and technologies for freight
6		Freight ICT based management
7	URBACT programme CIVITAS initiative / SOLUTIONS	2050 VISION Sustainable Mobility Plans for Cities and Metropolitan Areas
8	Do the Right Mix NODES	Holistic integration of all modes in new designed stations and multimodal terminals
9		Connection between airports and city centers
10		Connection between airports and HSR stations
11	EPTA Project / EMTA / Towards a European Multimodal Journey Planner ENHANCED WISETRIP / TIDE / CAPITAL	European Model for Transport Authorities
12	European Innovation Partnership (EIP) Smart Cities and Communities / EUROPTIMA / ENHANCED WISETRIP / TEAM / VIAJEO PLUS	European Travel Cqrd and Travel Planner
13	CLARS platform / European Mobility Week STREETLIFE / CITYMOBIL2	Parking management and traffic reduction
14	7th Framework Programme for Research and Technological Development MyWay / SUPERHUB / i-SCOPE / MOVESMART / MOBINCITY	Passengers ICT based management
15	ELTIS, the Urban Mobility Observatory / SHAPE-IT Guide The urban dimension in Community policies TIDE / CITYMOBIL2 / i-SCOPE / 2MOVE2	Strategic Sustainable Mobility Plans
16	-	Automation of handling of CT-units

As seen, the proposed actions have already their place within social and political dynamics, but major levers are required to contribute for roadmap implementation.

The Derived Co-Modality Roadmap

Aggregate Roadmap picture

The “Vision” elaborated in WP7 can be achieved by 2050 in a co modal mobility system based on electrified rail. For achieving such ambitious results a number of actions need to be put in place and a monitoring system is required. Significant delays in certain areas may imply delays also in other areas with potential risk for the entire plan fulfilment. The risk of not being on time with “mobility becoming a determinant of value-creation in Society” (source Transport for a Changing World - Thinking beyond the Trends – Shaping Responses – International Transport Forum 2014) may affect economic and social growth. So being late is not an option.

The comprehensive Roadmap is here below shortly summarized. Additional descriptions are included in the following pages with graphics. Actions are grouped in clusters:

- Investments for planning and bottlenecks, interconnections and interoperability
- Governance and territory planning
- Technology
- Market uptake



Figure 1: Roadmap summary – clustering of levers for Roadmap implementation – Source: SPIDER PLUS Project

These groupings represent the pillars on which to build up in continuity with the previous parts of the study, the needed interventions.

Actions are controlled in their progressive evolution to the expected results through “Milestones” listed in the reference years:

- **2015**: the check is to verify the process status in filling the gaps and accelerating transformation speed while coordinating “hard” and “soft components.
- **2020**: the check is to verify the status the process of empowering drivers of change for maximizing impacts while implementing the next decade actions.

- **2030**: the milestones look at the achievement of intermediate results in building offer towards the demand growth and at the process aligning mobility with societal evolutions.
- **2050**: Looks at the objectives fulfilment assuming that the back casting process contributed to eliminate over the preceding decades the constraints generated by the conflict between the restraining and the favourable forces.

WHITE PAPER CO-MODALITY RELATED TARGETS

	INVESTMENTS	GOVERNANCE	PLAN/RTD/TECHNOLOGY	MARKET UPTAKE
2050	Comprehensive network implemented according to co-modality principles Extension of urban networks to surrounding areas	Role of European organizations, both in coordinating a consistent and compelling guidelines to lower levels (national, industry, etc) and executing European strategies and programmes	Dynamic control model in place for capacity optimizations and fast recovery of inconveniences Cascade information communication model to interested parties Modular design and automation fully exploited	Environmental features and KPIs fully established and driving co-modal policies and industry
2030	Connection of all core airports	EU single mobility rail area implemented for core network EU single mobility area planned for the comprehensive network Costing integrated with full externalities Mobility authority in each metropolitan area 50% cut in road deaths enabled by co-modality	ICT tools for time tabling and operational traffic management Central "crisis" management able to minimize disruption Comprehensive ICT development plan for the 2030-2050 period	Traffic planning and performance drivers (pollution, congestion, cost)
2020	New urban line fully financed	EU single mobility rail area planned Land use and spatial planning around sustainable efficiencies of public transport Mobility driving urban/territory planning	Integrated information systems handling the whole journey across modes and different mobility providers	Ticketless journeys compatible with local transport fare management systems Standardization of ticketing procedure and information Incentive plan supporting environmental friendly solutions
2015	Comprehensive planning of actions to be implemented within 2030 with focus on co-modal nodes both for passenger and freight Integration of "corridor" and "node" focus Integration of Metropolitan areas and TEN-T planning	Co-modality driving infrastructure and space planning decision process New authorities in place managing co-modal integrated operations	Intelligent System planned for optimizing use of existing infrastructure	Integrated handling the whole journey across mode and different mobility providers Horizontal collaboration in place within territories (mainly passengers) and logistic chains

Figure 2: Roadmap summary to 2050 targets

For every action, resource, time, milestone and responsibility **the need is to monitor** their execution.

Intermediate milestones at 2015, 2020, 2030 and 2050

All actions contribute with a concurrent role in realizing 2050 targets. Individual actions are listed in the following tables. The Milestones are also defined. The Milestones are so constructed for providing the reference points along the road. Their role is key for understanding deviations and suggesting corrective actions.

Infrastructure

Regarding infrastructure, the following decided and to be decided actions have been identified:

Table 5: Road map summary – Infrastructure

	ACTION ITEMS	Today Decided Actions	2015 2030	To Be Decided Actions	2015 2050
INFRASTRUCTURE	Holistic integration of all modes in new designed stations and multimodal terminals. Connection between airports and city centers. Connection between airports and HSR stations.	<p>NODES, CITYHUB. Comprehensive planning/implementation of actions to be implemented within 2030 (co-modal nodes and lines).</p> <p>Integration of metropolitan areas and TEN-T planning Extension of urban networks to surrounding areas. Connection of core airports.</p>	 	<p>Re-design (existing) or design (new) stations and multimodal terminals under holistic integration criteria. Connection of all metropolitan airports with city centres. Connection of all main metropolitan HSR stations with linked airports.</p>	   

Milestones actions already decided

With regards to actions already decided the following milestones have been identified:

Table 6: Road map milestones summary of actions already decided – Infrastructure

	ACTION ITEMS	Today Decided Actions	2015 2030	back casting milestones			
				2015	2020	2030	2050
INFRASTRUCTURE	Holistic integration of all modes in new designed stations and multimodal terminals. Connection between airports and city centers. Connection between airports and HSR stations.	<p>NODES, CITYHUB. Comprehensive planning/implementation of actions to be implemented within 2030 (co-modal nodes and lines).</p> <p>Integration of metropolitan areas and TEN-T planning Extension of urban networks to surrounding areas. Connection of core airports.</p>	 	<p>Comprehensive planning of actions to be implemented within 2030 with focus on co-modal nodes both for passenger and freight.</p> <p>Comprehensive planning of new urban lines to be implemented within 2030.</p> <p>Integration of Metropolitan areas and TEN-T planning.</p>	New urban line fully financed	Connection of all core airports	<p>Comprehensive network implemented according to co-modality principles.</p> <p>Extension of urban networks to surrounding areas</p>

Milestones actions to be decided

With regards to actions to be decided the following milestones have been identified:

Table 7: Road map milestones summary of actions to be decided – Infrastructure

	ACTION ITEMS	To Be Decided Actions	2015 2050	back casting milestones	
				within 2030	after 2030
INFRASTRUCTURE	Holistic integration of all modes in new designed stations and multimodal terminals. Connection between airports and city centers. Connection between airports and HSR stations.	<p>Re-design (existing) or design (new) stations and multimodal terminals under holistic integration criteria.</p> <p>Connection of all metropolitan airports with city centres.</p> <p>Connection of all main metropolitan HSR stations with linked airports.</p>	   	<p>Development of Construction Projects for the design/re-design of stations and multimodal terminal under holistic criteria.</p> <p>Planned connections and existing construction projects.</p>	<p>Stations and multimodal terminals are constructed.</p> <p>Rail connected Airport and city centres.</p> <p>Rail connected HSR stations and airports.</p> <p>Co-existence when feasible/functional.</p>

Governance and territory planning

Regarding governance and territory planning, the following decided and to be decided actions have been identified:

Table 8: Road map summary – Governance and territory planning

	ACTION ITEMS	Today Decided Actions	2015 2030	To Be Decided Actions	2015 2050
GOVERNANCE	Regional and Local Logistics Masterplans in favour of Rail. 2050 VISION Sustainable Mobility Plans for Cities and Metropolitan Areas. European Transport Authority Parking management and traffic reduction. Strategic Sustainable Mobility Plans.	Co-modality and mobility driving urban territory, infrastructure and space planning. Horizontal collaboration within territories (freight and passenger). EU single rail/mobility area. New transport (co-modality) authorities in metropolitan areas. EPTA CLARS platform, SUMPROJECT. Costing integrated with full externalities. KonSULT, TIDE, SOLUTION, CAPITAL, 2MOVE2, C4CHALLENGE, C-LIEGE	  	Develop regional and local logistic masterplans in favour of rail in all metropolitan areas. Develop 2050 VISION Sustainable Mobility Plans (Passengers and Freight) for Cities and Metropolitan Areas in all metropolitan areas. Create a European Co-modal Public Transport Authority. Reduce traffic (Max. 10% private vehicle transport in 2050 in urban areas). Continuously improve and complete the CLAS platform. Develop SUMP in urban areas. KonSULT to be used.	   

Milestones actions already decided

With regards to actions already decided the following milestones have been identified:

Table 9: Road map milestones summary of actions already decided – Governance and territory planning

	ACTION ITEMS	Today Decided Actions	2015 2030	back casting milestones			
				2015	2020	2030	2050
GOVERNANCE	Regional and Local Logistics Masterplans in favour of Rail. 2050 VISION Sustainable Mobility Plans for Cities and Metropolitan Areas. European Model for Transport Authorities Parking management and traffic reduction. Strategic Sustainable Mobility Plans.	Co-modality and mobility driving urban territory, infrastructure and space planning. Horizontal collaboration within territories (freight and passenger). EU single rail/mobility area. New transport (co-modality) authorities in metropolitan areas. EPTA CLARS platform, SUMPROJECT. Costing integrated with full externalities. KonSULT, TIDE, SOLUTION, CAPITAL, 2MOVE2, C4CHALLENGE, C-LIEGE	  	Co-modality driving infrastructure and space planning decision process. Horizontal collaboration in place within territories (mainly passengers) and logistic chains New authorities in place managing co-modal integrated operations	EU single mobility rail area planned. EU single mobility area planned for the comprehensive network. Mobility driving urban/territory planning. Land use and spatial planning around sustainable efficiencies of public transport	EU single mobility rail area implemented for core network. Mobility authority in each metropolitan area. Costing integrated with full externalities. 50% cut in road deaths enabled by co-modality.	Role of European organizations, both in coordinating a consistent and compelling guidelines to lower levels (national, industry, etc) and executing European strategies and programmes

Milestones actions already decided

With regards to actions already decided the following milestones have been identified:

Table 10: Road map milestones summary of actions to be decided – Governance and territory planning

	ACTION ITEMS	To Be Decided Actions	2015 2050	back casting milestones	
				within 2030	after 2030
GOVERNANCE	<p>Regional and Local Logistics Masterplans in favour of Rail. 2050 VISION Sustainable Mobility Plans for Cities and Metropolitan Areas. European Transport Authority Parking management and traffic reduction. Strategic Sustainable Mobility Plans.</p>	<p>Develop regional and local logistic masterplans in favour of rail in all metropolitan areas. Develop 2050 VISION Sustainable Mobility Plans (Passengers and Freight) for Cities and Metropolitan Areas in all metropolitan areas. Create a European Co-modal Public Transport Authority. Reduce traffic (Max. 10% private vehicle transport in 2050 in urban areas). Continuously improve and complete the CLAS platform. Develop SUMP in urban areas. KonSULT to be used.</p>	   	<p>Existing Regional and Logistics Masterplans. Urban Planning development coherent with Masterplans. 2050 VISION Sustainable Mobility Plans development, addressing Urban Development Strategies/Plans (Passengers, Freight and Urban Planning). European Co-Modal Public Transport Authority creation. SUMP in place. Continuous upgrading. Centred in achieving the 2050 VISION. Continuous traffic reduction within cities and metropolitan areas.</p>	<p>Construction of Rail infrastructure planned in the Masterplans. 2050 VISION Mobility Plans upgraded according to existing conditions. Private vehicle transport within cities reserved for specific groups (emergencies, special needs, garbage, freight, etc) Automated vehicles in operation. SUMP in place. Continuous upgrading. Centred in achieving the 2050 VISION.</p>

Plan/RTD/Technology

Regarding Plan/RTD/Technology, the following decided and to be decided actions have been identified:

Table 11: Road map summary – PLAN/RTD/Technology

	ACTION ITEMS	Today Decided Actions	2015 2030	To Be Decided Actions	2015 2050
PLAN/RTD/TECHNOLOGY	<p>Automation of handling of CT-units. Freight ICT based management European travel card and travel planner. Passengers ICT based management.</p>	<p>Modular design and automation fully exploited. OPTICITIES, BESTFACT. ICT tools for time tabling and operational traffic management. Cascade information communication model for interested parties. EUROPTIMA, EU-SPIRIT, ENHANCED WISETRIP, MOVESMART, EDITS Intelligent system planned for optimizing use of existing infrastructure. Integrated information systems. Ticketless journeys and standardized ticketing procedures. STREETLIFE, TEAM, CITYMOBIL2, MYWAY, SUPERHUB, i-SCOPE.</p>	 	<p>Development of a European Standard for freight data/route optimization. European Standard (Travel planner/card) selection. Continuous improvement and upgrading. Massive deployment throughout transport authorities/companies. Develop EU-SPIRIT area. Promote Tickego (EUROPTIMA SMART Cities / EV deployment promotion. Scrapping schemes of Conventional Vehicles (CV) in favour of Electric Vehicles (EV). Scrapping schemes on the basis of 1 EV per 2 CV. "Cars as a Service" (CAAS) concept development/implementation. Fully Electric Public Service Fleets (Cleaning, garbage, etc.) Privileges for EV (reserved lanes, reserved parking spaces). Eco-driving universal deployment. Eco-driving tests and professional driver license certificate. European level Charging Points deployment. Driving Educational Recycling Programmes. Massive implementation of eco-driving realtime assessment/training apps in public service vehicles. Realtime optimization of route software implementation. Private Vehicle Taxing Strategies/Schemes depending on elected route/time/alternative mode existence.</p>	  

Milestones actions already decided

With regards to actions already decided the following milestones have been identified:

Table 12: Road map milestones summary of actions already decided – PLAN/RTD/Technology

	ACTION ITEMS	Today Decided Actions	2015 2030	back casting milestones			
				2015	2020	2030	2050
PLAN/RTD/TECHNOLOGY	Automation of handling of CT-units. Freight ICT based management European travel card and travel planner. Passengers ICT based management.	Modular design and automation fully exploited. OPTICITIES, BESTFACT. ICT tools for time tabling and operational traffic management. Cascade information communication model for interested parties. EUROPTIMA, EU-SPIRIT, ENHANCED WISETRIP, MOVESMART, EDITS. Intelligent system planned for optimizing use of existing infrastructure. Integrated information systems. Ticketless journeys and standardized ticketing procedures. STREETLIFE, TEAM, CITYMOBIL2, MYWAY, SUPERHUB, i-SCOPE.	Intelligent System planned for optimizing use of existing infrastructure	Integrated information systems handling the whole journey across modes and different mobility providers. Ticketless journeys compatible with local transport fare management systems. Standardization of ticketing procedure and information.	ICT tools for time tabling and operational traffic management. Comprehensive ICT development plan for the 2030-2050 period.	Modular design and automation fully exploited. Cascade information communication model to interested parties. Dynamic control model in place for capacity optimizations and fast recovery of inconveniences.	

Milestones actions already decided

With regards to actions already decided the following milestones have been identified:

Table 13: Road map milestones summary of actions to be decided – PLAN/RTD/Technology

	ACTION ITEMS	To Be Decided Actions	2015 2050	back casting milestones	
				within 2030	after 2030
PLAN/RTD/TECHNOLOGY	Automation of handling of CT-units. Freight ICT based management European travel card and travel planner. Passengers ICT based management.	Development of a European Standard for freight data/route optimization. European Standard (Travel planner/card) selection. Continuous improvement and upgrading. Massive deployment throughout transport authorities/companies. Develop EU-SPIRIT area. Promote Tickego (EUROPTIMA) SMART Cities / EV deployment promotion. Scrapping schemes of Conventional Vehicles (CV) in favour of Electric Vehicles (EV). Scrapping schemes on the basis of 1 EV per 2 CV. "Cars as a Service" (CAAS) concept development/implementation. Fully Electric Public Service Fleets (Cleaning, garbage, etc.) Privileges for EV (reserved lanes, reserved parking spaces). Eco-driving universal deployment. Eco-driving tests and professional driver license certificate. European level Charging Points deployment. Driving Educational Recycling Programmes. Massive implementation of eco-driving realtime assessment/training apps in public service vehicles. Realtime optimization of route software implementation. Private Vehicle Taxing Strategies/Schemes depending on elected route/time/alternative mode existence.	Massive deployment of the standard throughout freight transport companies. European Standard for Multimodal Travel Planner and European Travel Card operative. Existent (2015) Travel Planners have been upgraded/adapted or been made compatible with the standard for providing the European Travel Planner/Card service. Traffic reduction schemes and EV promoting policies operative. Mandatory professional eco-driver licences. Reserved/assigned urban space for public transport, cooperative freight services, and non-mechanized mobility (walk/bike). Car-sharing proven to be a less expensive and fully functional alternative private car ownership. (-38%) traffic reduction achieved. Urban access restriction schemes and low emission zones in development according to the 2050 VISION/SUMP Plans strategies.	European Travel Planner/Card implemented throughout Europe. Evolving upgradings in functionality. (-52%) traffic reduction in promotion. Universal eco-driving training mandatory. Parking reservation prior to trips. Car-sharing services as standard.	

Market Uptake

Regarding market uptake, the following decided and to be decided actions have been identified:

Table 14: Road map summary – Market Uptake

	ACTION ITEMS	Today Decided Actions	2015 2030	To Be Decided Actions	2015 2050
MARKET UPTAKE	Urban last mile rail related network. Collaborative logistics/warehouses.	SMARTFUSION, LAMILO, VIAJEO PLUS, TURBLOG. <i>Traffic planning and performance drivers. Environmental features and KPIs fully established and co-modal policies and industry.</i> DOROTHY, SMARTSET, STRAIGHTSOL. <i>Integrated handling the whole journey across modes and mobility providers.</i>	  	Urban Logistics optimization. Collaborative logistics promotion.	  

Milestones actions already decided

With regards to actions already decided the following milestones have been identified:

Table 15: Road map milestones summary of actions already decided – Market Uptake

	ACTION ITEMS	Today Decided Actions	2015 2030	back casting milestones			
				2015	2020	2030	2050
MARKET UPTAKE	Urban last mile rail related network. Collaborative logistics/warehouses.	SMARTFUSION, LAMILO, VIAJEO PLUS, TURBLOG. <i>Traffic planning and performance drivers. Environmental features and KPIs fully established and co-modal policies and industry.</i> DOROTHY, SMARTSET, STRAIGHTSOL. <i>Integrated handling the whole journey across modes and mobility providers.</i>	  	Integrated handling the whole journey across mode and different mobility providers.	Incentive plan supporting environmental friendly solutions. Freight transport pricing linked to efficiency in using resources with profit sharing between supply chain partners.	Traffic planning and performance drivers (pollution, congestion, cost)	Environmental features and KPIs fully established and driving co-modal policies and industry

Milestones actions already decided

With regards to actions already decided the following milestones have been identified:

Table 16: Road map milestones summary of actions to be decided – Market Uptake

	ACTION ITEMS	To Be Decided Actions	2015 2050	back casting milestones	
				within 2030	after 2030
MARKET UPTAKE	Urban last mile rail related network. Collaborative logistics/warehouses.	Urban Logistics optimization. Collaborative logistics promotion.	  	Urban access restriction schemes and low emission zones in development according to the 2050 VISION/SUMP Plans strategies. Linked freight distribution schemes operative.	Freight vehicle parking guarantee prior to trip. Unique service providers serve "freight areas" minimizing freight vehicle traffic. High volume retailers entitled to special licenses. Urban Freight axes in place.

Rolling stock

Regarding rolling stock, the following decided and to be decided actions have been identified:

Table 17: Road map summary - Rolling stock

	ACTION ITEMS	Today Decided Actions	2015 2030	To Be Decided Actions	2015 2050
ROLLING STOCK	Rolling stock, design and materials for passengers Wagons, new materials and technologies for freight	Modular design and automation fully exploited.	 	Guaranteeing the decided actions commissioning	  

Milestones actions already decided

With regards to actions already decided the following milestones have been identified:

Table 18: Road map milestones summary of actions already decided – Rolling stock

	ACTION ITEMS	Today Decided Actions	2015 2030	back casting milestones			
				2015	2020	2030	2050
ROLLING STOCK	Rolling stock, design and materials for passengers Wagons, new materials and technologies for freight	Modular design and automation fully exploited.	 	Requirement of new features.	Requirement of new features. Partial implementation.	Partial implementation.	Modular design and automation fully exploited

Milestones actions to be decided

With regards to actions to be decided the following milestones have been identified:

Table 19: Road map milestones summary of actions to be decided – Rolling stock

	ACTION ITEMS	To Be Decided Actions	2015 2050	back casting milestones	
				within 2030	after 2030
ROLLING STOCK	Rolling stock, design and materials for passengers Wagons, new materials and technologies for freight	Guaranteeing the decided actions commissioning	  	Public authorities to demand upgraded rolling stock. New rolling stock to incorporate new features.	Public authorities to demand upgraded rolling stock. New rolling stock to incorporate new features.

Recap of major levers contributing to roadmap implementation

Working towards the 2050 VISION requires a well-grounded belief in the benefits of its outcome. As has been noted, many diverse interests and strongly rooted ways of living imply a huge resistance to the implementation of an idea meant to improve urban living in many ways. Summarizing, for the successful action of levers:

- There is a need for lever interaction
- There is a need for coherence
- There is a need for long term urban and mobility planning
- There is a need for convergence

The need for interaction and induction

The levers categories “Investments, Governance, Technology, Market Uptake and Rolling Stock” operate simultaneously and only their combination can fulfill the White Paper objectives.

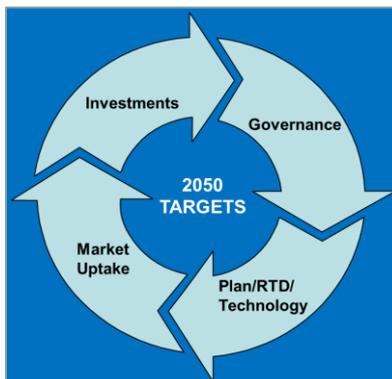


Figure 3: Levers interaction for Roadmap implementation - Source: SPIDER PLUS Project

From the infrastructure point of view, cities – and their politicians – are highly aware of the convenience of executing important transport projects as new stations, multimodal terminals and rail connections between airports, city centres and HSR stations. Nevertheless the present crisis situation slows down the inversion in high cost infrastructure. European funding is crucial for this type of developments, and although no continuity is guaranteed in terms of financial support, infrastructural investments push the economy growth. The existing funding tools – until 2020 – should be exploited to their fullest potential.

Governance, in regards to mobility, has Sustainable Urban Mobility Plans (SUMP) as a functional tool; but has to give a further step – already given in some European areas – consisting in assigning legal status to the developed documents, and therefore giving the SUMP practical regulatory power. The other governance related actions, as parking management and traffic reduction policies, regional and local logistics Masterplans in favour of rail or even the 2050 VISION Sustainable Mobility Plans for Cities and Metropolitan areas could be integrated in a flexible manner in the SUMP considered as an organic integrator.

The existent network of European Metropolitan Transport Authorities (EMTA) plus the guidelines included in the EPTA project for creating new transport authorities should encourage other areas to implement them.

Deciding on which territorial units the measures should be applied can constitute a major concern. Nevertheless, mobility problems solvable by means of high capacity/low emission public transport modes are concentrated in areas with high population densities, and mainly in metropolitan regions. Attending to Eurostat classification “Tipology of Metro Regions”, the selection criteria can be determined.

Technological development and market uptake go hand in hand. Businesses, including transport operators and transport authorities, concentrate efforts in creating a supply of sellable articles and customers rapidly accept any solution making life easier. The increasing access to data, including real time data, gives developers the chance to assess mobility patterns and design or adapt new and existing technologies to identified necessities.

The need to provide sufficiently homogeneous data, in a not discriminating manner, and guaranteeing the quality of it, derives in an increasing interest from many stakeholders for the existence of a European Co-Modal Transport Authority with responsibilities to be augmented step by step. In the same way it could be important to study an organizational model integrating existing entities such as ERA – European Railway Agency, EACI-Executive Agency for Competitiveness & Innovation, INEA-Innovation & Networks Executive Agency; the creation of a Co-Modal/Multi-Modal Transport Authority could improve the coordination, provision and performance of mobility related strategies. This could include the responsibility for mobility data standardisation, management of European travel card related aspects (including financial ones) and Sustainable Urban Mobility Plan validation, as well as a wider activity spectrum.

From the above recap, an important conclusion arises, and that is that **Shift to rail and sustainable modes will not take place automatically, having to be induced**. The major lever is therefore European level implication in promoting, by push and pull measures, the desired modal shifts; by generating a new balance between the five pillars.

INFRASTRUCTURE	GOVERNANCE	PLAN/RTD/ TECHNOLOGY	MARKET UPTAKE	ROLLING STOCK
Holistic integration of all modes in new designed stations and multimodal terminals	Regional and Local Logistics Masterplans in favour of Rail	Automation of handling of CT-units	Urban last mile rail related network	Rolling stock design and materials for passengers
Connection between airports and city centers	2050 VISION Sustainable Mobility Plans for Cities and Metropolitan Areas	Freight ICT based management	Collaborative logistics/warehouses	Wagons, new materials and technologies for freight
Connection between airports and HSR stations	European Model for Transport Authorities	European travel card and travel planner		
	Parking management and traffic reduction	Passengers ICT based management		
	Strategic Sustainable Mobility Plans			



Impacting on co-modality

Figure 4: SPIDER PLUS Road map in Extreme Synthesis

The roadmap is ambitious, and fulfilling the 2050 VISION lies mainly on successfully reducing private car presence within cities. Many are the cultural, legislative, governance, national, territorial and protectionist barriers against this needed evolution.

The crucial bonding tool are the concatenated Strategic Sustainable Mobility Plans, as neatly arranged steps of the journey towards the future, specifically and individually designed for each city and metropolitan area in their 2050 VISION Sustainable Mobility Plans.

Strengthening public transport networks, maximizing rail functionality within co-modal structures, increasing urban space fully dedicated for non-motorised modes, organizing urban logistics and their interfaces with long and medium distance rail freight transport are the main strategic axes. All of these require for optimum results continuous monitoring, milestones and deadlines; and consequently a European Co-Modal Transport Authority focusing entirely on sustainability. Dependence on car inside our cities has to be overcome.

The need for coherence

The European Union is actively promoting social and environmental policies while at the same time supporting technological evolution.

Making the most of any policy requires respecting coherence as a fundamental criterion. There has to be an underlying direction towards which efforts are oriented.

An example of alleged inconsistency could relate to Electric Vehicles (EV), which are being promoted by the European Union by means of different policies, and ongoing projects as MOLECULES, ICT 4 EVEU, MOBIEUROPE AND SMARTCEM. Although electric vehicles are a good alternative to conventionally fuelled cars², a simple substitution on a "one on one" basis is a less than warm approximation to the real objective. In this line, the European Metropolitan Transport Authorities association (EMTA) in its Position Paper on the 2011 Transport White paper - 14 november 2011 stated that:

*"Acknowledge that **there is no such a thing as green congestion** and that notwithstanding the progress and investment in green vehicles, European cities need to embrace a transition towards sustainable urban mobility based on walking, cycling, and high quality passenger transport where this reduces traffic congestion and minimises carbon emissions."*

Considering that the SPIDER PLUS 2050 VISION aims to reduce the modal share of urban car traffic to a percentage of below 10; the deployment of the Electric Vehicle related networks and industrial production should be done with the expected long term (2050) city structures in mind, and not with the present ones.

Coherence optimizes the overall functionality of developed measures.

The need for long term urban and mobility planning

SPIDER PLUS aspires to transform cities into mainly car free areas.

It is necessary that each Metropolitan Area and City strives in imagining its 2050 VISION; by defining 2050 VISION Sustainable Mobility Plans for Cities and Metropolitan Areas.

² In the hypothesis of electricity generation not based on fossil fuel consumption

Traditional planning is necessary to formalize the steps towards these desired scenarios, but lacks the capacity to define and regulate in the long term. Once sufficiently defined, conventional planning, preferably in the form of Sustainable Urban Mobility Plans (SUMPs) or equivalent document with regulatory capacity, would give official recognition to each of the short and medium term 2050 VISION coherent policies.

The opportunity is here to stop and think, to define 2050 VISION Sustainable Mobility Plans for our cities and metropolitan areas, prior to 2020.

2020 should be the milestone for action, the moment in which the vision definition can be handled out to lead a process of concatenated actions in which each of them is defined in clearly 2050 oriented SUMPs.

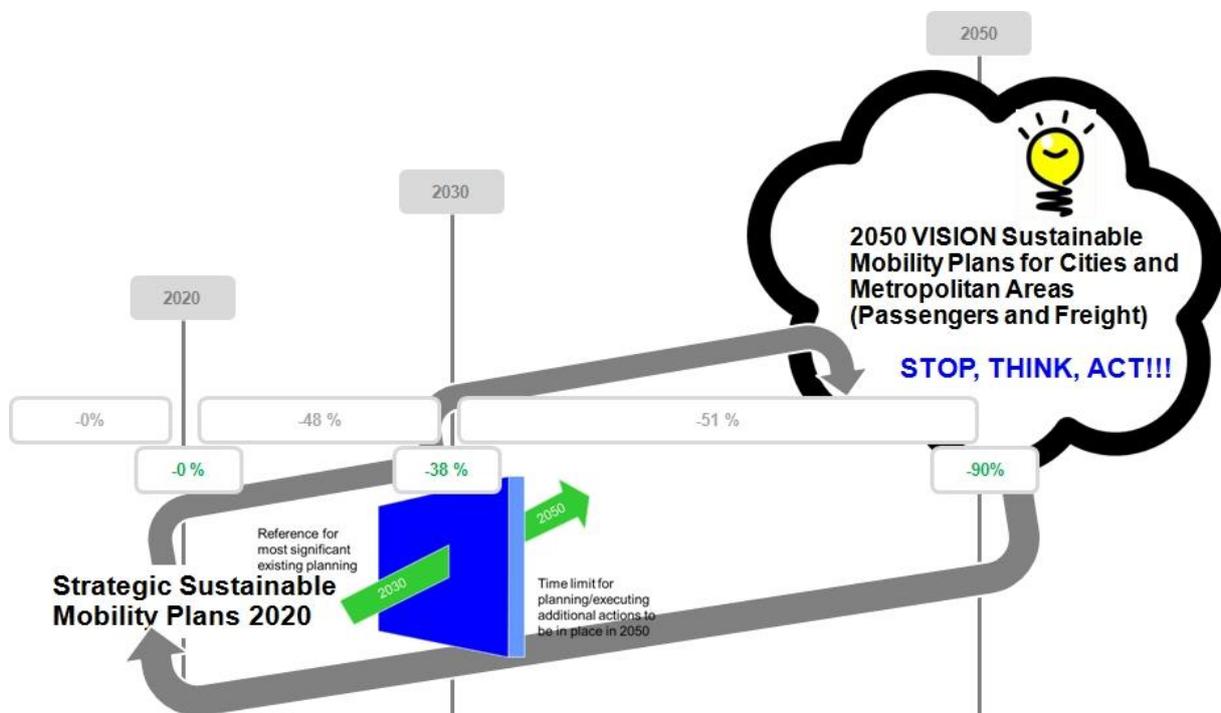


Figure 5: 2050 VISION Sustainable Mobility Plans for Cities and Metropolitan Areas and SUMP interaction. Traffic reduction required percentages – Source: SPIDER PLUS Project

The need for convergence

Sustainable transport is a must if urban life quality is to be improved. European Union actions and policies are deeply involved in providing tools and promoting technological development, while at the same time respecting citizen rights and market interests.

However, this search for equilibrium between stakeholders in a highly tensioned environment generates a dynamic in which problems are evaluated many times and from many perspectives, making it difficult to select solutions and develop them in practice.

Fully functional solutions could be implemented, while in parallel proceed with upgrading and improvement actions, including new approaches. As is, technological evolution and investigation has to be promoted, giving greater importance to the commissioning of selected projects.