POLITECNICO DI MILANO





Politecnico di Milano since 1863

WC2 University Network
September 1-3, 2010

The 16 Departments of the Politecnico di Milano

- Aerospace Engineering
- Architectural Projects
- Architecture and Planning
- Bioengineering
- Building and Environment Sciences and Technology
- Chemistry, Materials and Chemical Engineering “Giulio Natta”
- Electrical Engineering
- Electronics and Information
- Energy
- Hydraulic, Environmental and Surveying Engineering
- Industrial Design, Arts, Communication and Fashion
- Management, Economics and Industrial Engineering
- Mathematics “Francesco Brioschi”
- Mechanics
- Physics
- Structural Engineering

Biotechnology for Health


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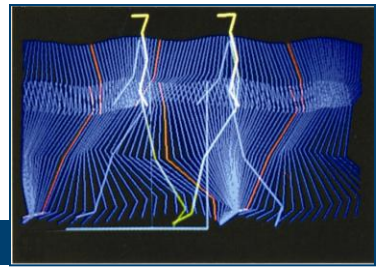
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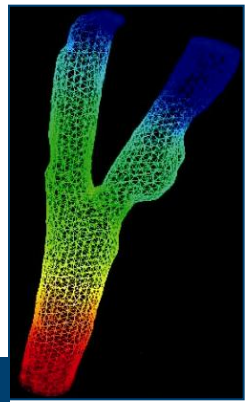
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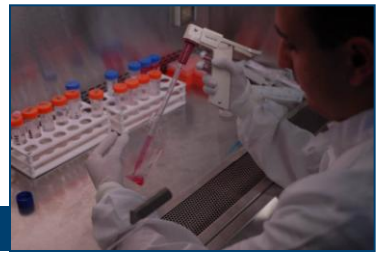
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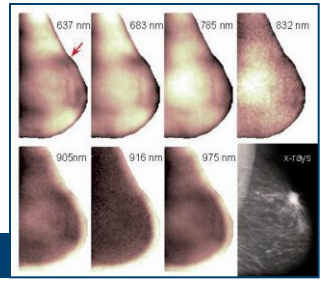

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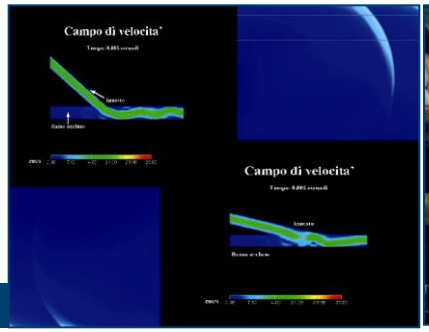

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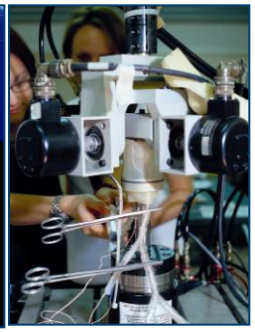

1. Diagnosis of movements at early ages
2. Intelligent prosthesis
3. Movement experimental analysis
4. Movement experimental analysis
5. Wheelchair driven by brain
6. Pressures and deformations in carotid artery
7. Bio cellular analysis
8. Optic Mammography: Cyst or Cancer?
9. Different velocity of blood in a human carotid artery depending on inclination of blood flow

Information Society Technologies


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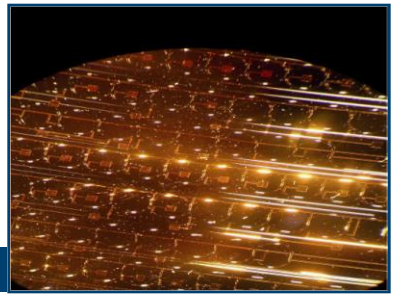
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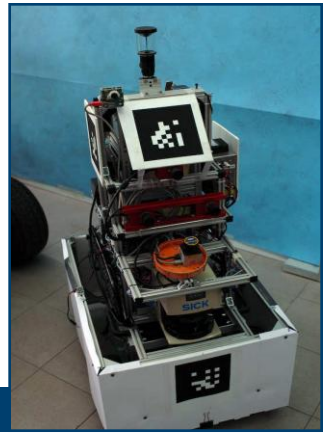
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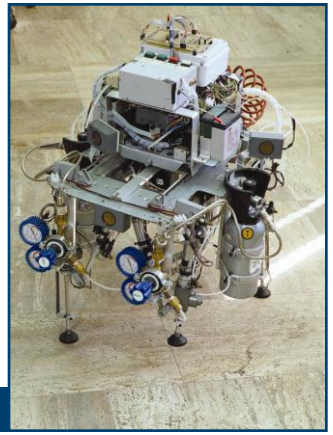
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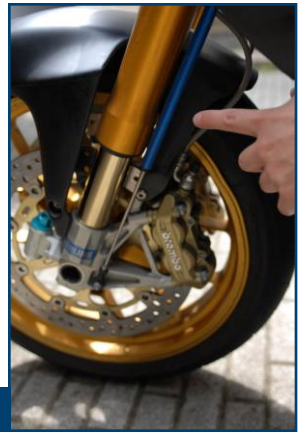
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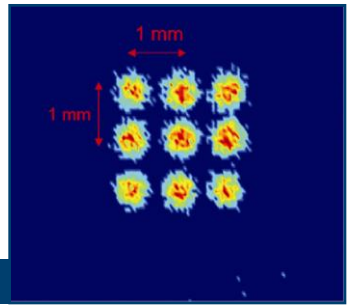

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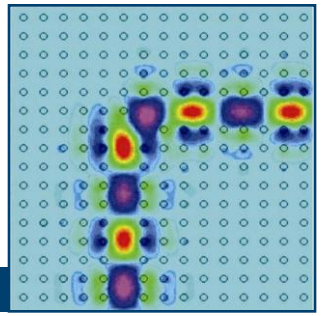
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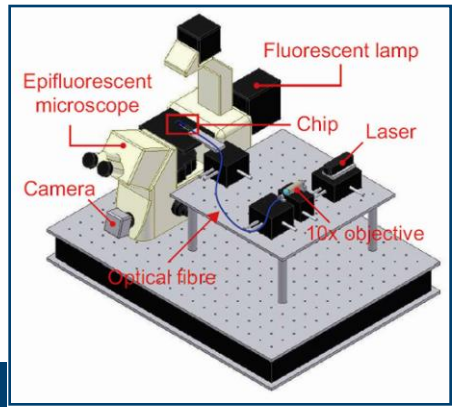
1. Telecommunications Lab in Spino d'Adda
2. Monitoring a off–shore platform
3. Integrated-optic tunable buffer
4. Intelligent Robots
5. *Ulisse* – 4-feet autonomous robot
6. Automation of motorcycles
7. X and Gamma ray detectors
8. Light bending in a photonic band-gap structure

Materials, Micro and Nano Technologies



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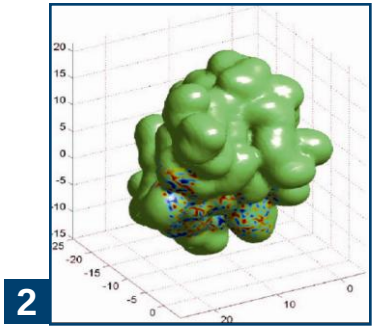

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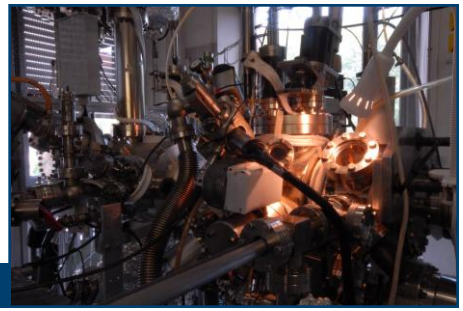

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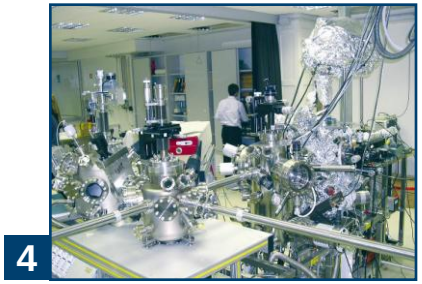

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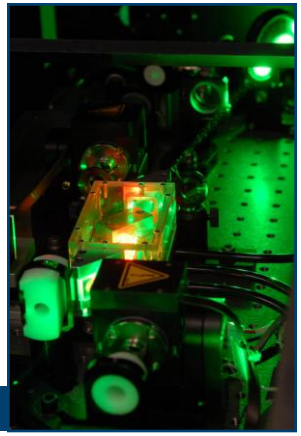

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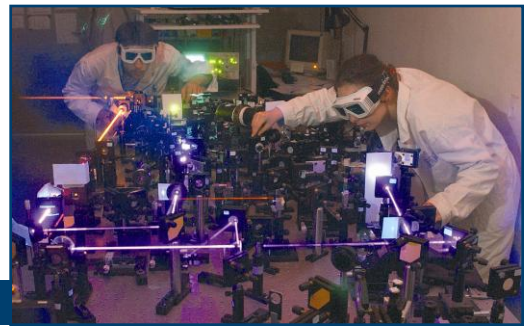

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1. Experimental setup to measure the cultured neuron activity
2. Analysis of protein sequences
3. Characterization and synthesis of nanostructured materials
4. Ultra vacuum machine for epitaxial nanostructures growing
5. Stress and deformations of composite materials
6. Laser equipments
7. Laser equipments

Aeronautical and Space

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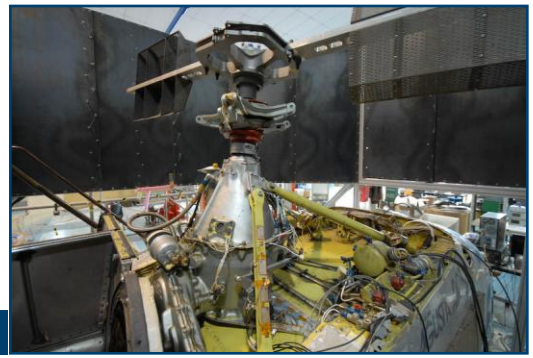

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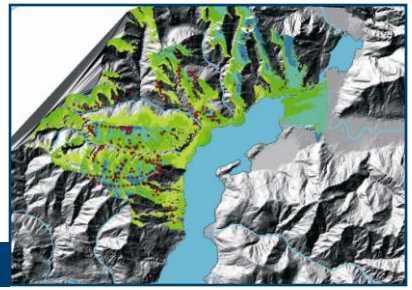
1. Robotic arm for Space exploration
2. Six-wheel rover for space exploration
3. Active control of vibrations
4. Active control of vibrations
5. Pressure loads and flow lines in a plane

Environment


1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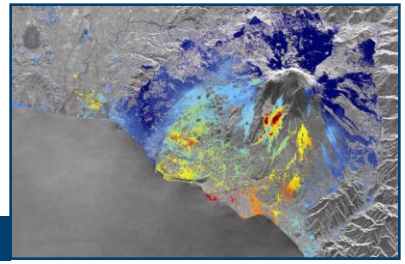
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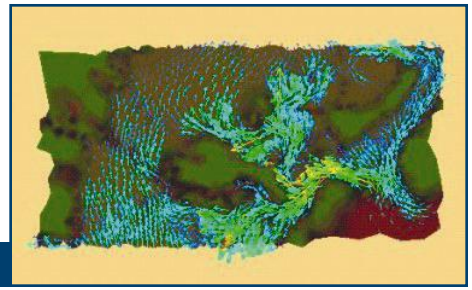
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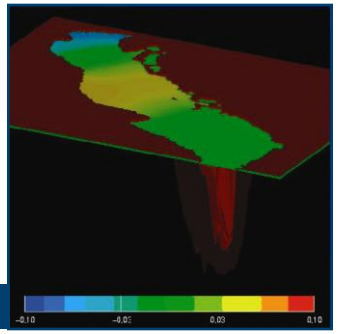
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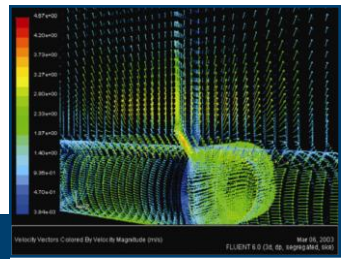
1. Solid urban wastes incineration system
2. Simulation for preventing forest fires
3. Crustal deformation of Etna
4. Virtual reality representation of air pollution
5. QuickBird image of Venice
6. Numerical models for studying Venice floods
7. Numerical models for studying Adriatic tides
8. Soil washing system

Energy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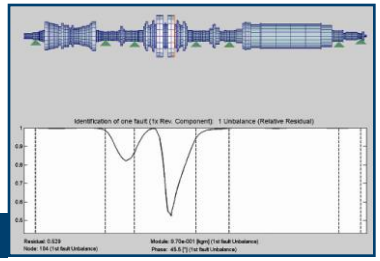
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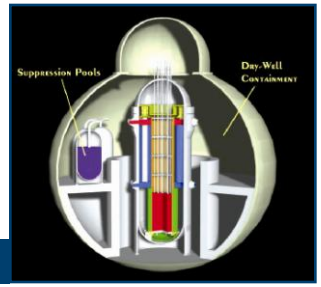

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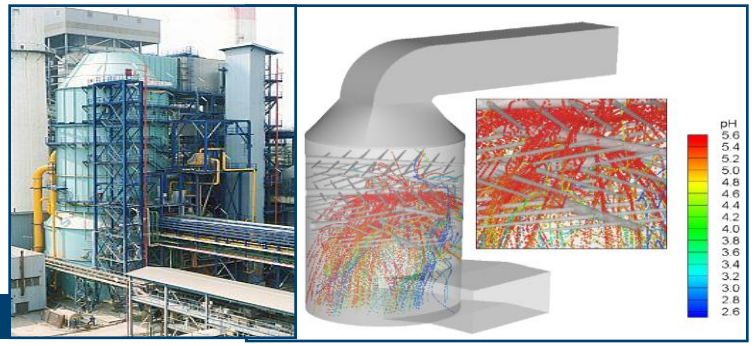

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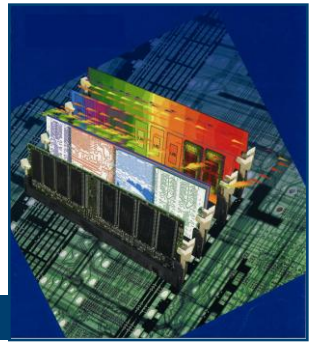
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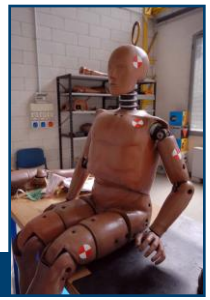
1. Fluid dynamical analysis of a ventilated facade
2. Model for unbalance vibrations of turbo generator rotor
3. IRIS nuclear reactor passive safety (Westinghouse)
4. Laboratory for fluid dynamic testing
5. Aero dynamical interactions in a Wind power generation Field
6. Velocity field in combustion flames
7. Simulation for eliminating SO” from a scrubber of power electric plant
8. Thermal analysis of a memory setup

Transport


1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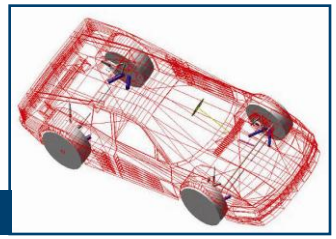
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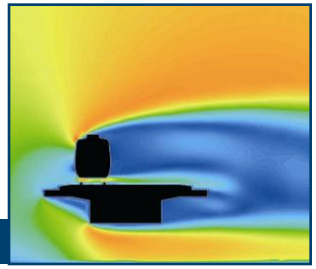
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1. Crash test: equipment
2. Crash test: the dummy specimen
3. Crash test: Numerical simulation of dummy specimen
4. Simulation of crash against a safety barrier
5. Car numerical model
6. Damper after the test
7. Equipment for the measure of centre of gravity and inertia matrix of cars
8. Equipment for testing railways subsystems
9. Numerical simulation of aerodynamics effects on a railway vehicle
10. Test equipment for train pantographs

Built Environment, Infrastructures, Urban and Land Planning


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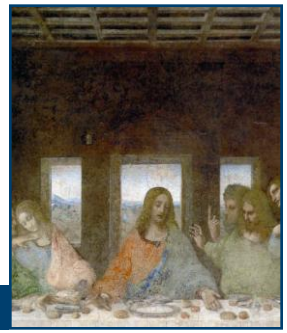
1. Ecobuilding Tsinghua University, Bejing
2. Wind analysis of tall buildings
3. Wind analysis of a stadium roofing
4. Modelling a landslide
5. Laboratory for urban planning models
6. Laboratory for construction modelling

Cultural Heritage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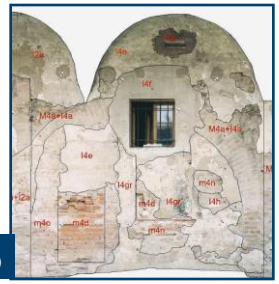
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1. Detecting organic and inorganic in the *Last Supper* by Leonardo da Vinci
2. Laser for restoring the *David* by Michelangelo
3. Mapping the *Certosa di Pavia*
4. Thermo graphic analysis of a fresco
5. Mapping the portico of the *Monastery of San Michele* in Lonate Pozzolo
6. Analysis of a bronze sculpture
7. Model of *Castello Sforzesco* in Milano
8. Program of maintenance of *Palazzo del Tè* in Mantova

Industrial Products and Processes


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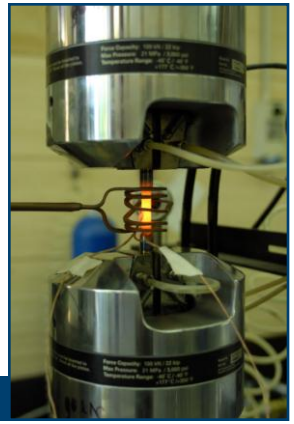
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1. Virtual prototype and reverse modelling
2. Laboratory of Fashion Design
3. Laboratory of Product Design
4. Design and construction of a boat model
5. Yacht Interior Design
6. Testing Materials at high temperature

Some examples in the thematic areas of WC2

TRANSPORT

POLITECNICO DI MILANO





Politecnico di Milano
Department of Mechanical Engineering
Railway Dynamics research group

Stefano Bruni – Department of Mechanical Engineering, Politecnico di Milano
tel. 0223998495, e-mail stefano.bruni@polimi.it

The Railway Dynamics research unit

Staff (January 2010) (total ~25 people)

- 3 full professors + 2 associate professor
- 5 permanent researchers
- 5 research assistants (non permanent staff)
- ~ 10 Ph.D. students

Competencies:

- Vehicle dynamics & train-track interaction (modelling, simulation, testing)
- Wheel-rail contact forces, damage and wear
- Suspension components
- Active control of rail vehicles
- Aerodynamics of rail vehicles (1.4MW – 14x4m^2 wind tunnel)
- Pantograph-catenary interaction
- Condition monitoring (rolling stock & infrastructure)

The Railway Dynamics research unit (2)

Main research partners from the industry:

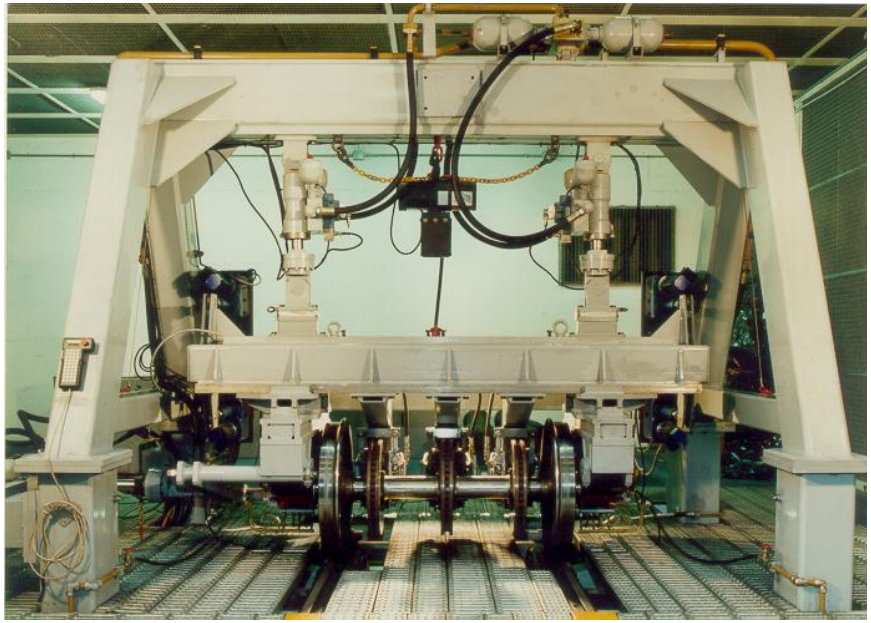
- Alstom Transport
- AnsaldoBreda
- Bombardier Transport
- Lucchini
- Balfour Beatty
- Furrer + Frey
- DB
- SNCF
- R.F.I. – Rete Ferroviaria Italiana
- Trenitalia
- ATM (Milano Transport Authority)

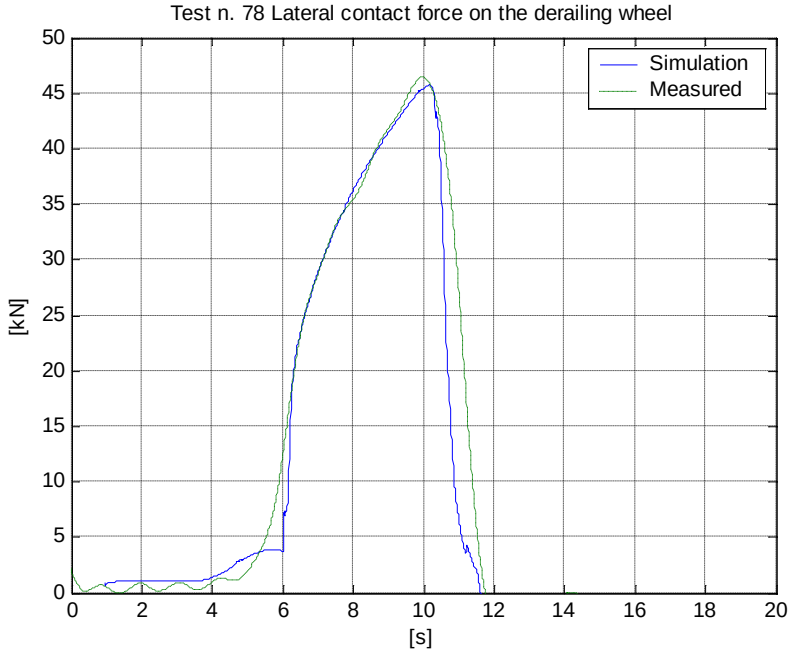
Member of the ITALCERTIFERR consortium, Italian centre for qualification of railway material and rolling stock

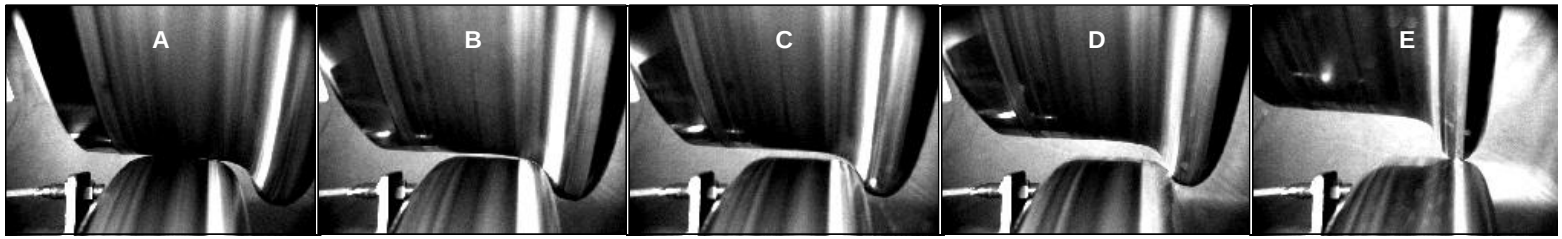
Full scale experiments on wheelset dynamics

Study of wheel-rail contact forces and their effect on derailment

One of the few worldwide known full scale experiments







Active secondary suspension for a new High Speed train

Active control of the secondary airspring suspension

- Active suspension concept
- Control strategies
- Design of the actuation system
- Full scale laboratory experiments
- Numerical simulation to predict behaviour in real service

Condition monitoring and diagnostics of railway vehicles and railway lines

Cooperation with Trenitalia and Rete Ferroviaria Italiana, including the development of a High-Speed test train and full scale test stands

ETR500 Y1 test train

Full-scale test stand for the condition based monitoring of the traction equiment

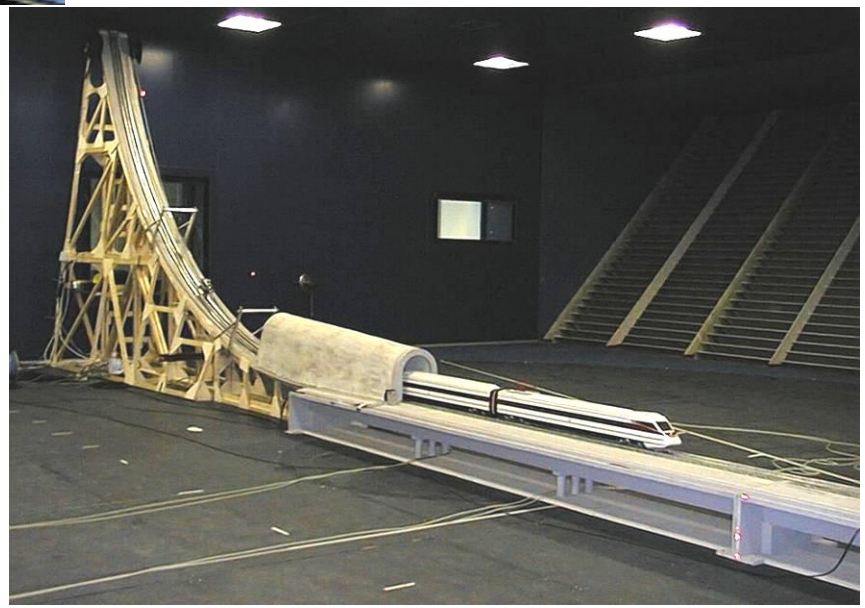
Rail vehicle aerodynamics
Cross wind on rail vehicles

Experiments in the POLIMI Wind Tunnel: installed power 1.4MW

Measurement section 14 m x 4 m

Results incorporated in the EU safety standards for HS trains

Experiments with a moving train model



Pantograph – Catenary interaction

Hardware in the loop testing and active pantograph control

Project MAGNUM (towards EXPO 2015)

OBJECTIVE

To define guidelines for the development of technologies for the integrated management of mobility in Milano

Comune di Milano – Direzione Centrale Mobilità Trasporti Ambiente

AMAT

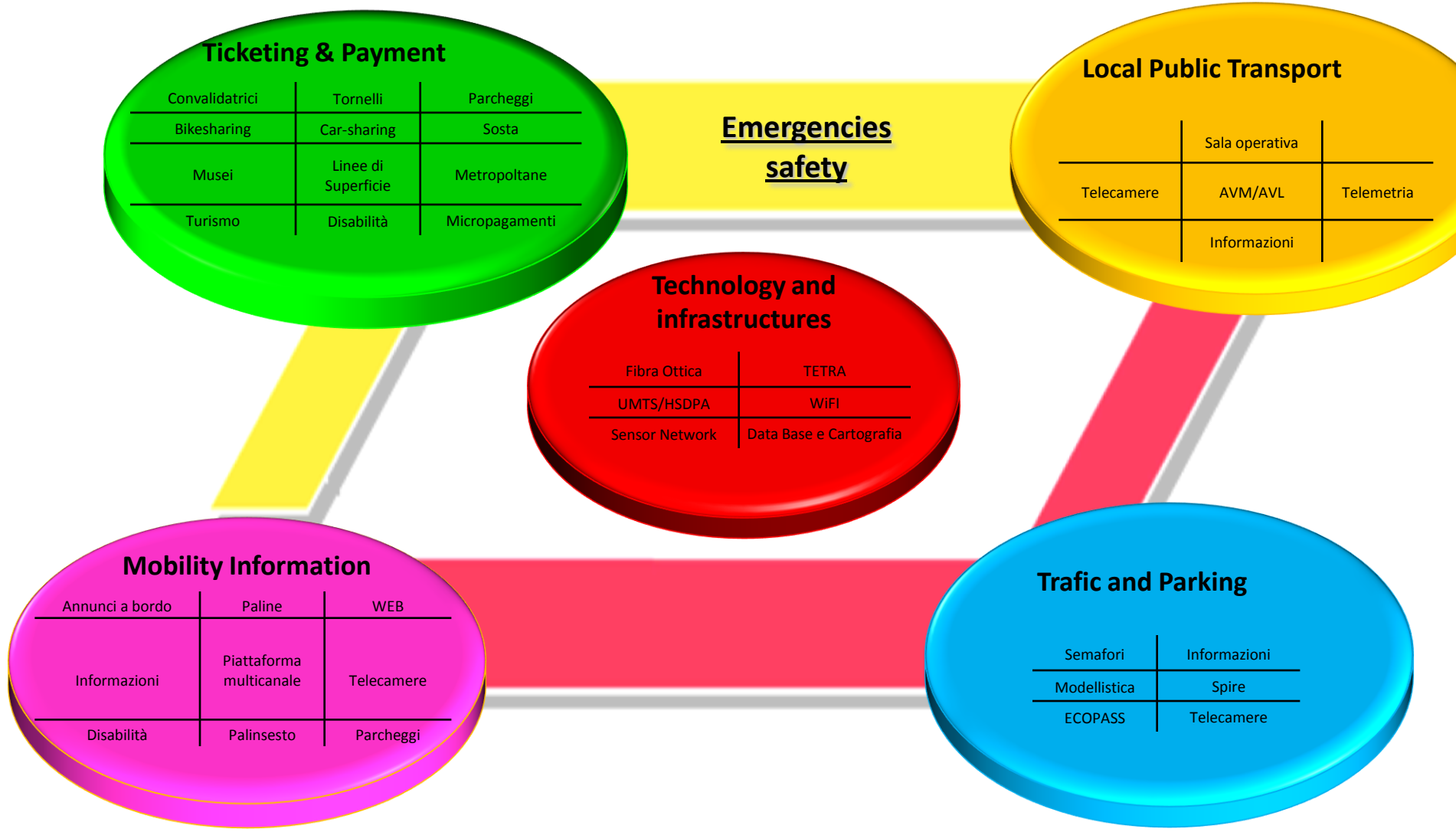
ATM

Fondazione Politecnico di Milano

DEI - Dipartimento di Elettronica e Informazione

Poliedra – Politecnico di Milano

Milano: tochnological model for ”clever mobility”



A web-based carpooling service for universities: a case study in Milan

Poli-Uni-Pool Project

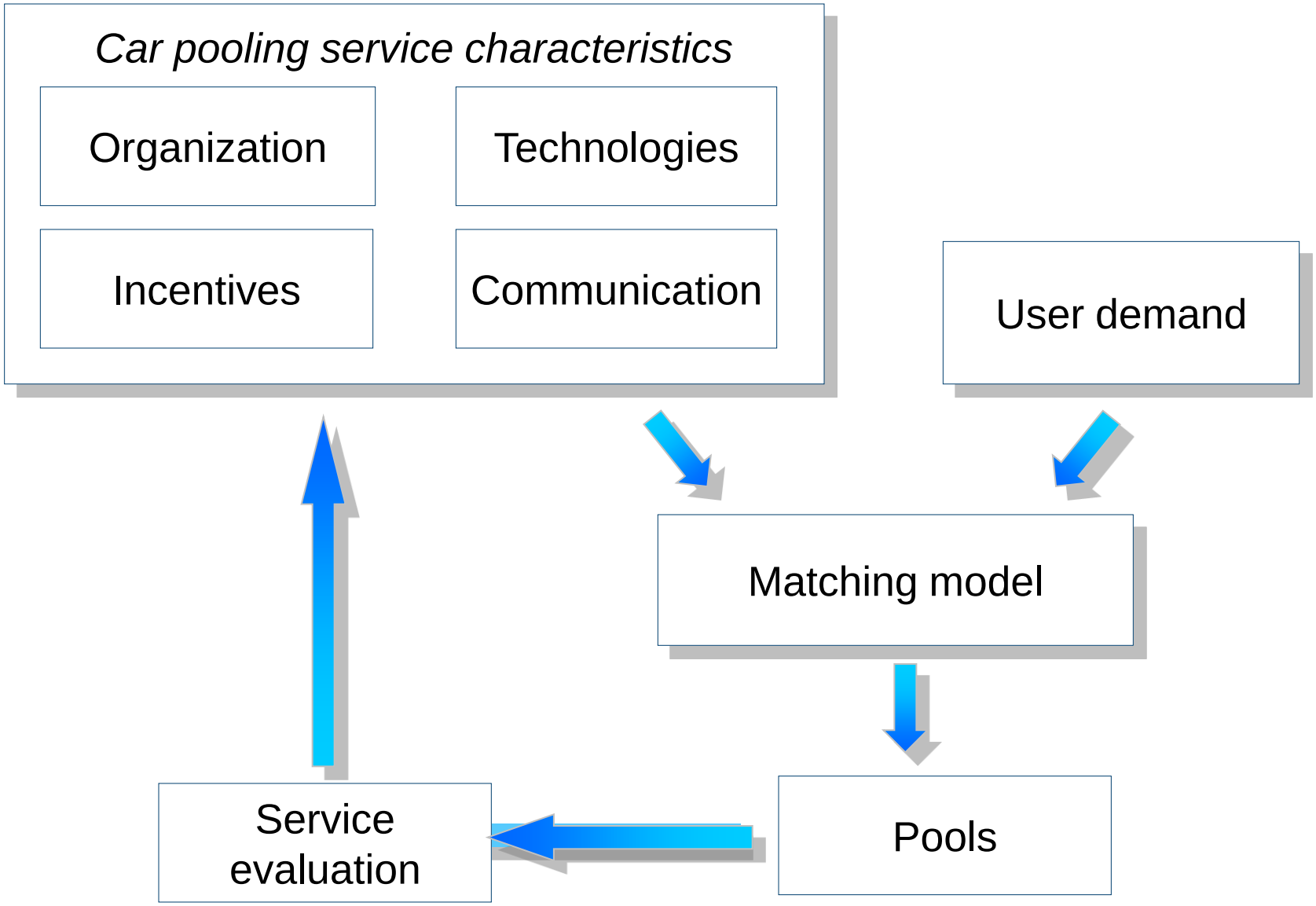
Implementation and experimentation of a car pooling system for Politecnico di Milano and Università Statale di Milano universities:

- founds by Fondazione Cariplo
- January 2010 – October 2011

Activities:

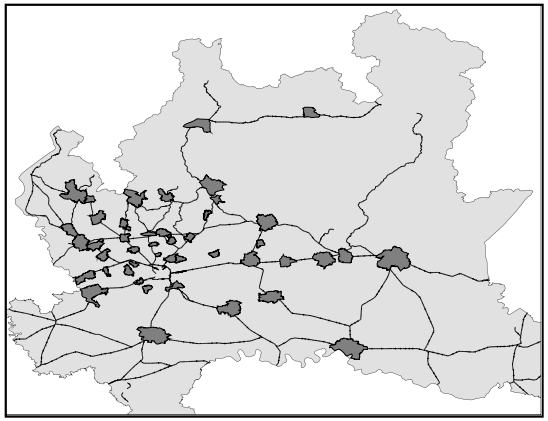
1. analysis of the potential demand
2. definition of the rules, incentives and access ways
3. platform implemetation for service delivery
4. testing (Politecnico & Un. Statale)
5. monitoring and evaluation of results

Car pooling service design



Characteristics of university car pooling

- **Checked** and **organized** system
- Management of a particular user category: the **students**
- Students can provide a list of **friends**
- They can provide **partial pools**
- They can have **very different timetables**
- They can express **multiple destinations** (to incentivate multimodality)



BUSINESS

Politecnico di Milano’s territorial marketing and territorial development projects

Projects

1. Territorial marketing plan for the city of Milan
2. Training course for the managers of Bureau of Shanghai World Expo Coordination

Milan's territorial marketing planning (1)

- Partners: Milan Municipality, Milan Chamber of Commerce, province of Milan, Politecnico di Milano (coordinator) and other 5 universities (Milan Catholic University, Bocconi, Milan University, Milan Bicocca University, IULM)
- Period: 2008 – today
- Objectives: introducing a thorough, shared territorial marketing planning process to support the city development policies by
  - making internal stakeholders (e.g., industry associations, policy-makers, companies, citizens, etc.) aware of the key performances influencing the attractiveness of the city and the decision-making of external targets (e.g., potential citizens, talents, external/international companies, external investors, potential tourists, etc.)
  - assessing and monitoring the attractiveness and the competitiveness at a national and international level of the city of Milan

Milan's territorial marketing planning (2)

- To do that, the group of universities is developing a complete and parsimonious methodology aimed at:
  - Defining and feeding in time a strategic dashboard to monitor the overall competitive positioning of the city of Milan, detecting distinctive traits, strengths and weaknesses
  - Defining and feeding in time thematic dashboard to assess the city performances with reference to the key-themes lying at the core of the city's Territorial Development Plan (e.g., talent development, innovation, entrepreneurship, environmental friendliness, etc.), also in comparison with a set of best-in-class international cities
  - Monitoring the evolution of the external targets' perception of the city through *ad hoc* investigations
  - Providing the policy makers with data, information and consultancy for the promotion of the city and the development of policies for nurturing next generation talents.

Training course for the managers of Bureau of Shanghai World Expo Coordination - Context

- Objectives of Shanghai World Expo:
  - showing to the world the extraordinary growth of Chinese economy (together with 2008 Olympic Games) and of Shanghai
  - affirming a leadership of the city of Shanghai in the debate on sustainable development in the urban areas
  - developing internal and international tourism in the whole Yangtzai River Delta (YRD) area (megalopolis in Eastern China Coast centered in Shanghai consisting of 15 big cities and some 80 million inhabitants, representing the 40% of national purchase parity GDP)
- Trainees' needs:
  - Developing skills for managing the facilities and the visitor flow
  - Designing a marketing strategy for attracting international visitors
  - Knowing the international best practices in mega-event and World Expo management to understand the world standards
  - Understanding how to lever on the World Expo heritage to accomplish the city and YRD area development policy in the future

Training course for the managers of Bureau of Shanghai World Expo Coordination - Details

- Period: 2008
- Description: training course for 40 World Expo managers in event management, event marketing, experience design and management, facility management and project management
- Objectives:
  - Presenting world-class standards and benchmarks for the organization and the representation of mega-events
  - Discussing and highlighting the role of the World Expo as a territorial marketing lever
  - Sensitizing to the need of developing a tourism culture to manage the visitor flow (70 million people) and to accomplish the city potential after the event
  - Designing the legacy of the event and the ways through which the organizing committee and the municipality could convert facilities to pursue a continuous improvement of the city and of the area
- Outcomes: Letter of Commendation by the Bureau of Shanghai World Expo Coordination indicating the course among the best training courses delivered for its managers at all the levels.

SUSTAINABILITY

Long term strategy and the Third Millennium

The Third Millennium and the role of Universities

New Social challenges

The 8 Millennium Goals

are the frontiers of global development

The interdependency principles

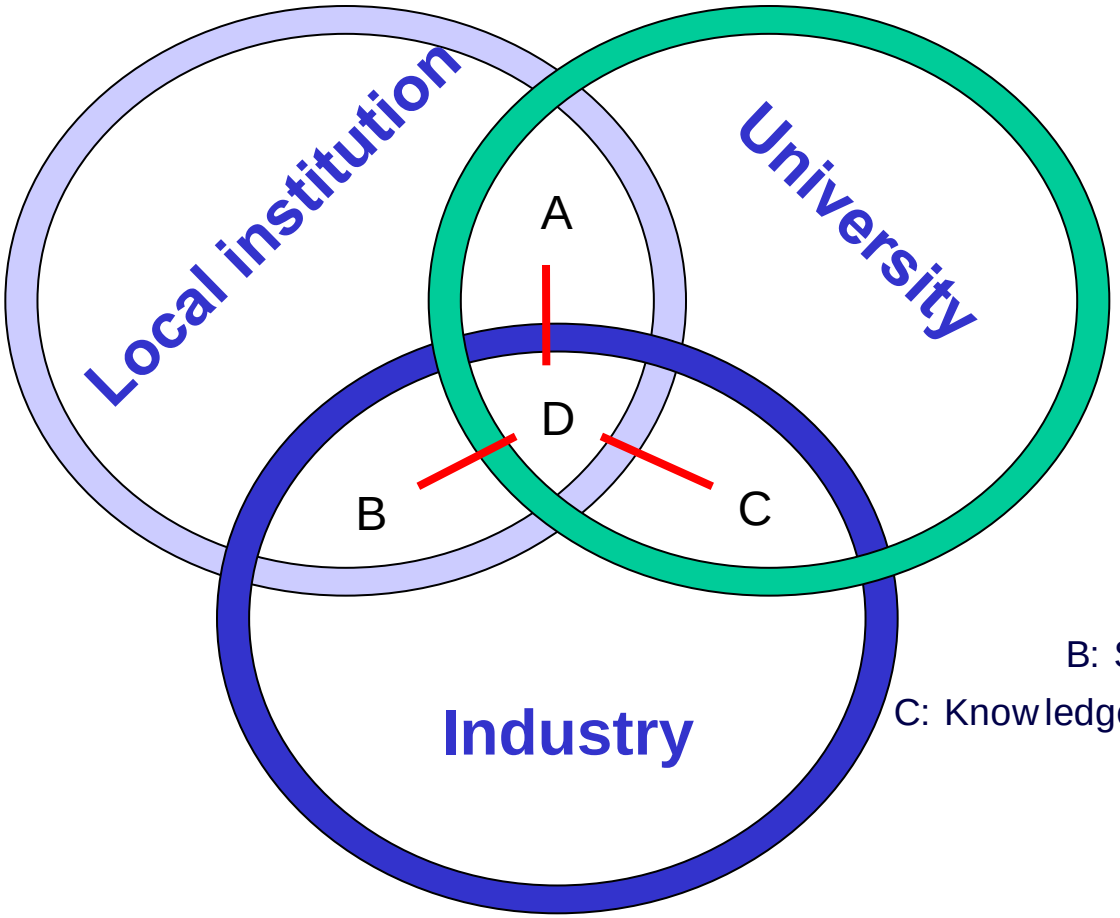
Lead to the need of managing a global society (economic, environmental and social aspect)

The aim at Sustainable development

Identify the need of new paradigm for economic and social development

Universities have a role to play for global development

Transversal Partnerships are essentials



A: Human development

B: Socio-Economic development

C: Knowledge & Technology development

D: Glocal development

Cooperation Projects and joint activities: some examples

Local Project on sustainability:

Cresco Project: "CREscita COmpatibile", a synergy among Politecnico di Milano and local enterprises, social players and institutions

- **Thematic Area:**
The project aim to promote the dissemination of a culture of sustainability within our cities, by promoting behaviours, technology and policies involving citizens, young students and professionals, institutional officers and enterprises.
- **Objectives:**
The main goal of the project is realizing the passage from a theoretical sustainability to practices of sustainability fully integrated in the daily life. With special attention to 4 dimension: resources (energy and water), waste and recycling, and sustainable mobility.

- **Involved Partners: Regione Lombardia**
- **Beneficiaries :** Local Citizen and municipalities
- **Partners:** Fondazione Sodalitas, Politecnico di Milano, Engineering Without Border, Enterprises within Lombardia region (ABB, ENEL, EDISON, ITALCEMENTI, COCA COLA, A2A, SIEMENS….)
- **Politecnico Role:** education and training to sustainability, cooperation with industries for promoting low impact technologies and best practise dissemination
- **Financings:** Regione Lombardia Funding for cooperation with Universties

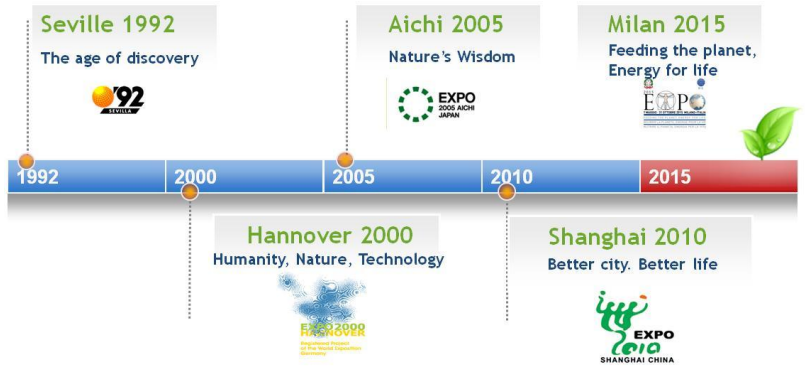
National Cooperation Projects and joint activities: some examples

The Expo' opportunity for Milano and Italy

Feeding the Planet , Energy for Life

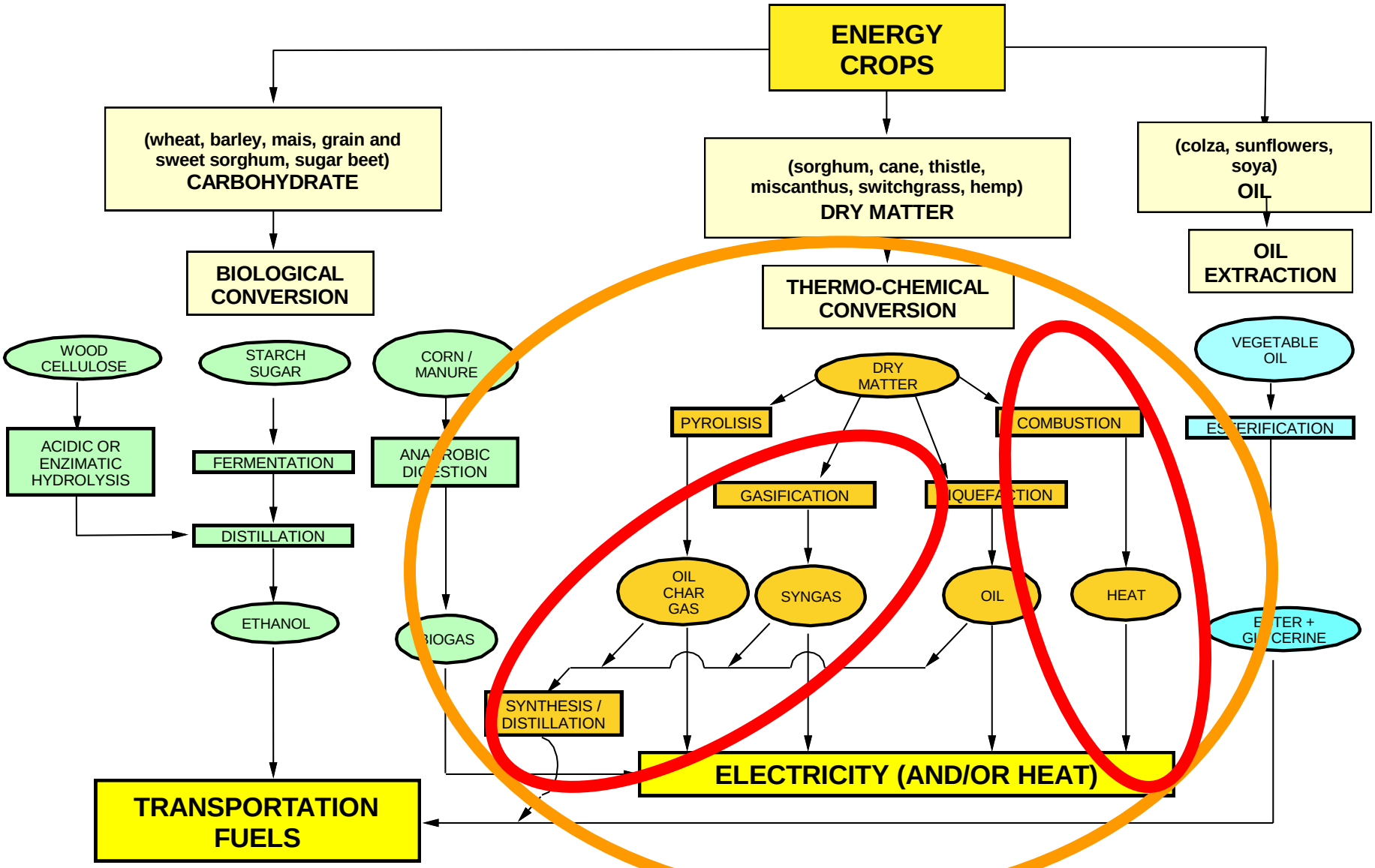
- **Thematic Area:**
A global cultural and educative event for raising the attention to science and technology for food quality and biodiversity, food culture, lifestyle and education and promoting international cooperation on the subject

•Objectives:
The main goal of EXPO is promoting education, cooperation and innovation on food and energy related aspect.

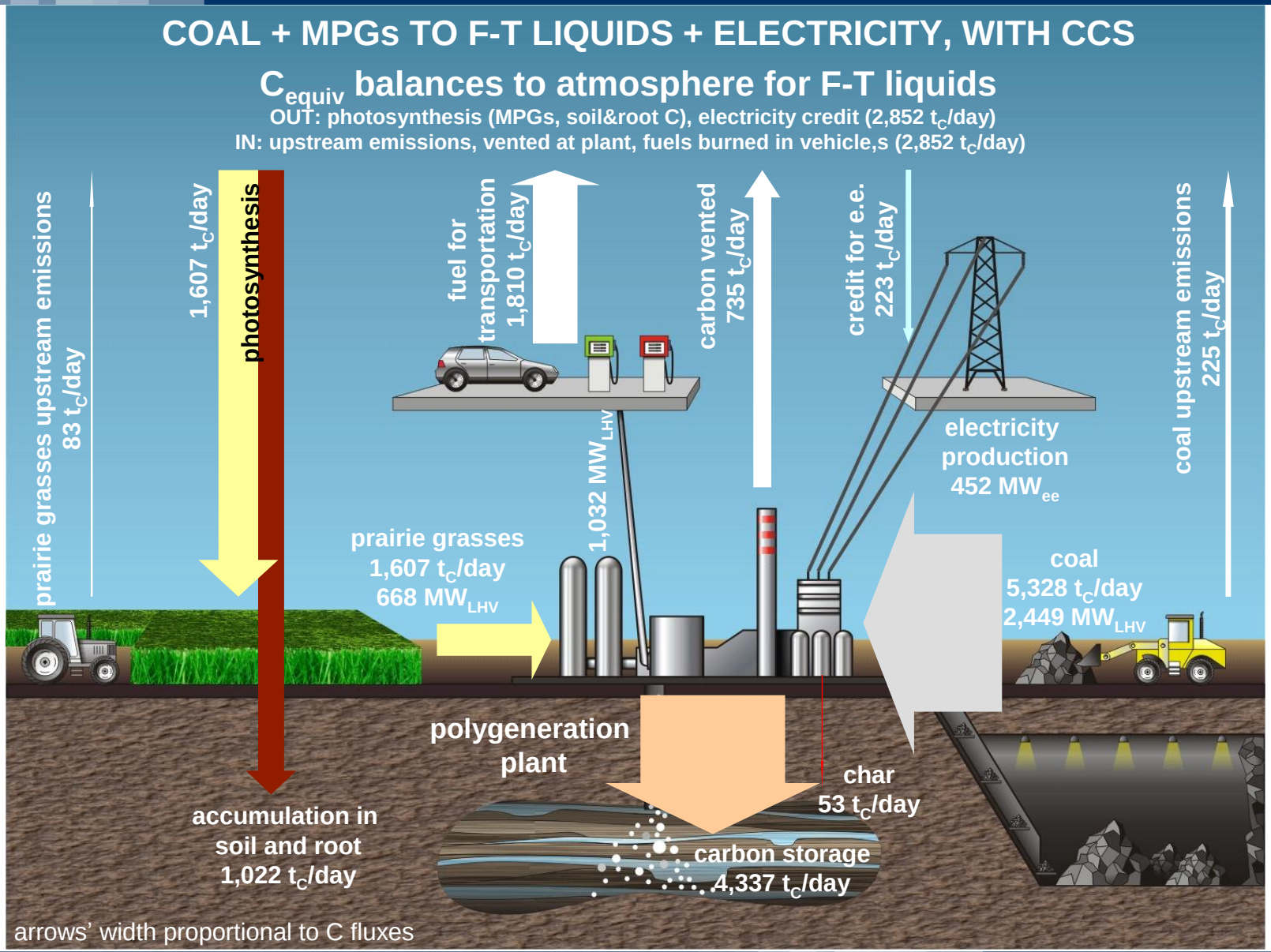


- **The role of Politecnico di Milano is dual.**
  - **•PLANNING and DESING** Supporting the design and planning of the site, the building and all the infrastructures needed for EXPO' 2015 in the local area of Milan
  - **•RESEARCH and COOPERATION** Promoting research project on the specific subject of the EXPO' (Politecnico di Milano is mainly involved in the energy aspect rather than in food or agriculture)
  - **•COOPERATION** Promoting international project for cooperating with the developing countries for supporting equity and sustainability in the problem of the access to food and energy.

Sustainable electricity and fuels from biomass


ENERGY CROPS
(wheat, barley, mais, grain and sweet sorghum, sugar beet) CARBOHYDRATE
(sorghum, cane, thistle, miscanthus, switchgrass, hemp) DRY MATTER
(colza, sunflowers, soya) OIL
BIOLOGICAL CONVERSION
THERMO-CHEMICAL CONVERSION
OIL EXTRACTION
WOOD CELLULOSE
STARCH SUGAR
CORN / MANURE
DRY MATTER
VEGETABLE OIL
ACIDIC OR ENZIMATIC HYDROLYSIS
FERMENTATION
ANAEROBIC DIGESTION
PYROLISIS
COMBUSTION
ESTERIFICATION
GASIFICATION
LIQUEFACTION
DISTILLATION
OIL CHAR GAS
SYNGAS
OIL
HEAT
ETHANOL
BIOGAS
BIODIESEL + GLICERINE
SYNTHESIS / DISTILLATION
ELECTRICITY (AND/OR HEAT)
TRANSPORTATION FUELS

Sustainable polygeneration from biomass+coal (with carbon capture)



Sustainable Waste Management practices: the four Rs

ADVANTAGES:

- reduction of materials consumption
- reductionof energy consumption

Reduction

Re-use

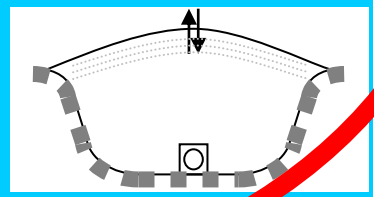
Recycling

Recovery of energy

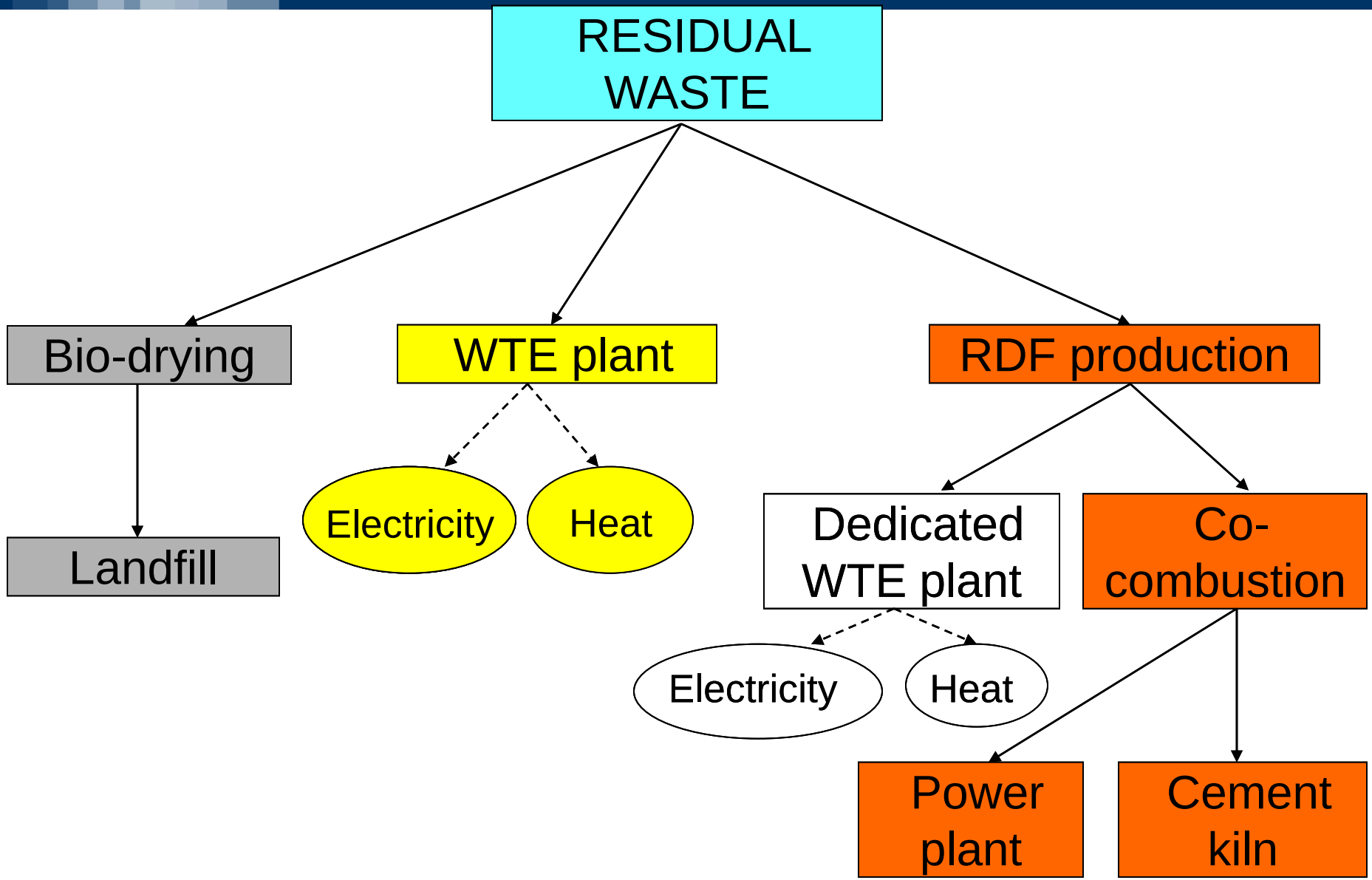
PROBLEMS/DIFFICULTIES:

- coordinating different actors
- complex management
- costs

auxiliary landfill (INERT residues)



Sustainable energy recovery from residual waste



Two joint laboratories already exist in the thematic areas of WC2

Examples of Joint Labs

- **Joint Research Center on Energy**

  Industrial partners: A2A, ABB, ANSALDO ENERGIA, EDISON/EDF, ENEL, ENI, SIEMENS, SIRAM, WESTINGHOUSE.

- **Joint Research Center on Railways Transports**

  Industrial partners: ABB, ANSALDO BREDA, BOMBARDIER, FS (Trenitalia and RFI).

Cultural Industries and Districts

The projects

Politecnico di Milano is actively pursuing the revitalization of cities and economy via the valorization of culture and cultural industries

Two projects have been recently developed:

- Cultural District
- Cultural Industry Mapping

Cultural Industries projects

Politecnico di Milano is actively pursuing the revitalization of cities and economy via the valorization of culture and cultural industries

Two projects have been recently developed:

- Cultural District
- Cultural Industry Mapping

Cultural Industry Mapping

A second project has been developed to map the Cultural industry active in the Lombardy Region

With the financial support of Lombardy Region a survey was carried out in 2009

The results have been used to set a database for:

- Mapping the evolution of the industries
- Guiding Lombardy Region financing and bid to enterprises
- Highlighting and stimulating networking among cultural industries, between universities and enterprises

Cultural District (1)

Cultural districts are geographically clustered networks of interdependent entities, defined by the production of idiosyncratic goods based on creativity and intellectual property

Politecnico di Milano with the financing of a Bank Foundation (Fondazione Cariplo) developed a feasibility study to create a Cultural District in a mountain area: Valsassina

The actors involved are:

- Chamber of Commerce
- Lombardy Region
- Local authorities
- Industrial Enterprises
- Touristic industry

Cultural District (2)

The study defined cultural themes, around which tangible and intangible actions have been developed

Theme	***Tangible actions***	***Information technology***	***Intangible Actions***	***Research***	***Teaching laboratories***
Iron making museum	Safety interventions; Harmonisation of ancient sites	Multimedia and virtual experiences	Itineraries and activities illustrating ancient and modern production	Bid for creative product design	Educational workshops on iron production
Traditional cheese-making	Ancient cheese production site		Living experience of a shepherd	Cheese traceability and innovative product packaging	Educational workshops on biological productions
Visitor centre	Restoration of an ancient brickyard				
Ancient fortification	Safety interventions for visiting the ruins		Events and experiences of the First World War	Restoration techniques	Educational workshops on history and war devices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