Sustainable Energy and Spatial Planning

BALANCE

Daniele Vettorato
Italy
Karl Bursa
USA
Khan Rubay Rahaman
Bangladesh
Melissa Castello
Brasil
Nuin-Tara Key
USA
Sheng Ying
China
Shiri Bass Specktor
Israel
Sofia Fernandes
Portugal

Coordinators
Pauline van den Broeke and Yigall Schilp
the Netherlands

The main questions adressed to Group 1 were:

- How to allocate (wind) energy sources, initiatives in renewable energy and find solutions for reducing the demand of energy without compromising the (spatial) qualities and interests of the Douro region?
- What general strategies, top-down as well as bottom-up, can be defined for the planning and the use of renewable energy that is also considering the vulnerable landscape and the environment?

The requested results were:
One or two dominating strategies (about concentration and combination of windmills and other renewable sources) including spatial consequences with choices stakeholders on 'decision makers level' in the Douro region have to make.

1. Background and introduction to the study area

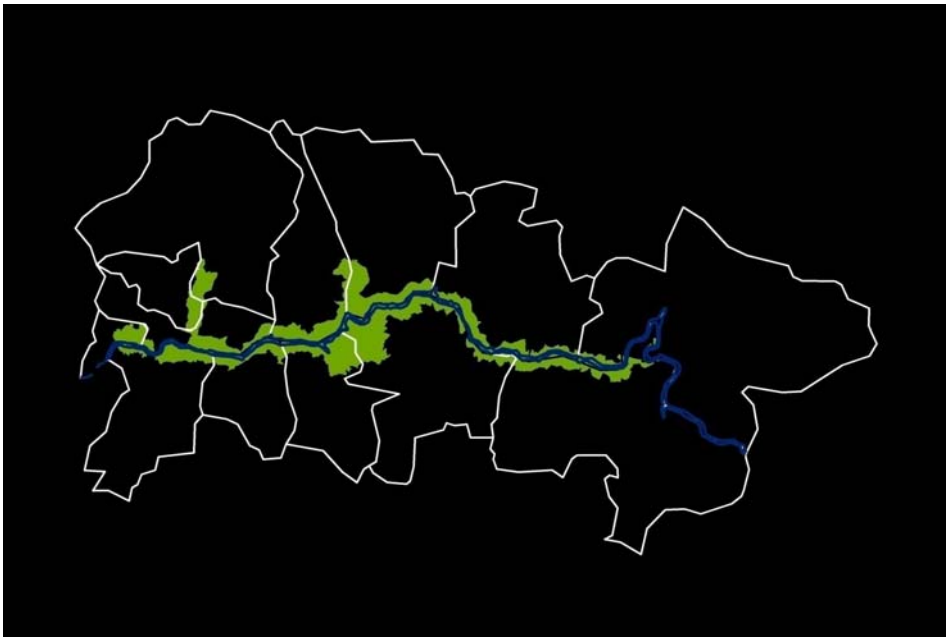
The "Alto Douro Wine Region", composed by parts of Douro Region, Trás-os-Montes and Alto Douro, is internationally renowned for the production of Porto wine and is located along the Douro River, 100km away from the city of Porto in the northern region of Portugal. Whole the region is characterized by its unique cultural and natural landscapes. The central part of this region, mainly composed by the lands that face to the river Douro's' course, have been recognized by the UNESCO as World Heritage Site.

Alto Douro Wine Region location: northern Portugal

Since the municipalities are the main stakeholders that have the power of management of the lands and according to the geographical definition of the World Heritage Site Group 1 defined the Area of Interest of the work including the territories of that municipality that overlap with the UNESCO world heritage site.
This area is characterized by a local scale system that is globally connected through the gateway of Porto (the city and the Brand). Douro river that flows across the region is the backbone that naturally connects its polycentric settlement morphology.
According to the definition of this area given by Unesco the wine has been produced by traditional landholders in the Alto Douro region for some 2,000 years. This long tradition of viticulture has produced a cultural landscape of outstanding beauty that reflects its technological, social and economic evolution. Thanks to this secular activity its landscape has been modeled by human activities. The components of the landscape are representative of the full range of activities association with winemaking – terraces, quintas (wine-producing farm complexes), villages, chapels, and

roads. The cultural landscape of the Alto Douro is an outstanding example of a traditional European wine-producing region, reflecting the evolution of this human activity over time.

The spatial temporal dimension of this area is characterized by a “slow speed”: from the time needed to produce the famous wine, several years, to the transport system based mainly on slow speed train and boat that runs along the rivers. This slow speed dimension is part of its cultural landscape and gives the opportunity to the visitors, to perceive correctly the interaction between local human activities and nature that is the essence of this area.



In green: Unesco World Heritage Site; in blue: the Douro river; in white: administative borders of municipalities

The area, classified as depressed from the point of view of economy and demography balance, is recently receiving attention from the central government of Portugal due to the region’s high wind and hydro energy potentials.

2. The “balance” concept

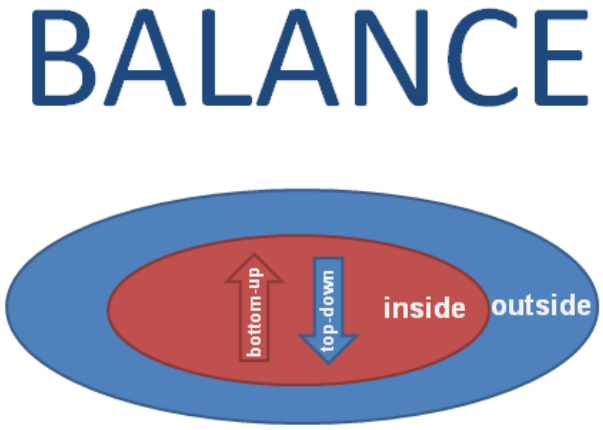
The slow embedded interaction between human activities and nature modelled the cultural wine landscape of this region over history. The global challenge and the local socio-economic condition of recession call for solutions utilizing the principles of sustainable development. Finally the immediate opportunity of renewable energy can be captured to re-launch the economy in an environmentally sound way.

Our analysis/design approach to the region started from the concept of BALANCE between the 3 factors that characterize this place: the cultural landscape, the development needs and the potential in production of renewable energy.

In this way we cconsidered a variety of aspects in a single stream of decision making in an effort to address the many challenges and opportunities of sustainable energy use, conservation and productions within the Douro region.

3. Vision and objectives of the work

To balance those characteristics that in our opinion describe the contemporary identity of this place we developed two approaches with different focus and directions, inside / bottom-up and outside / top-down. The objective is to understand if it is possible to increase the energy production and the energy efficiency of this area without compromising the (landscape) character of the region. The expected result is a set of guidelines for the sustainable development of this region following the spatial balanced relationship between its characters.



4. Methodology and procedure

To achieve this, Group 1 followed a methodology that aims to spatially compare the character of the area in order to identify their relations:

The main steps of methodology are:

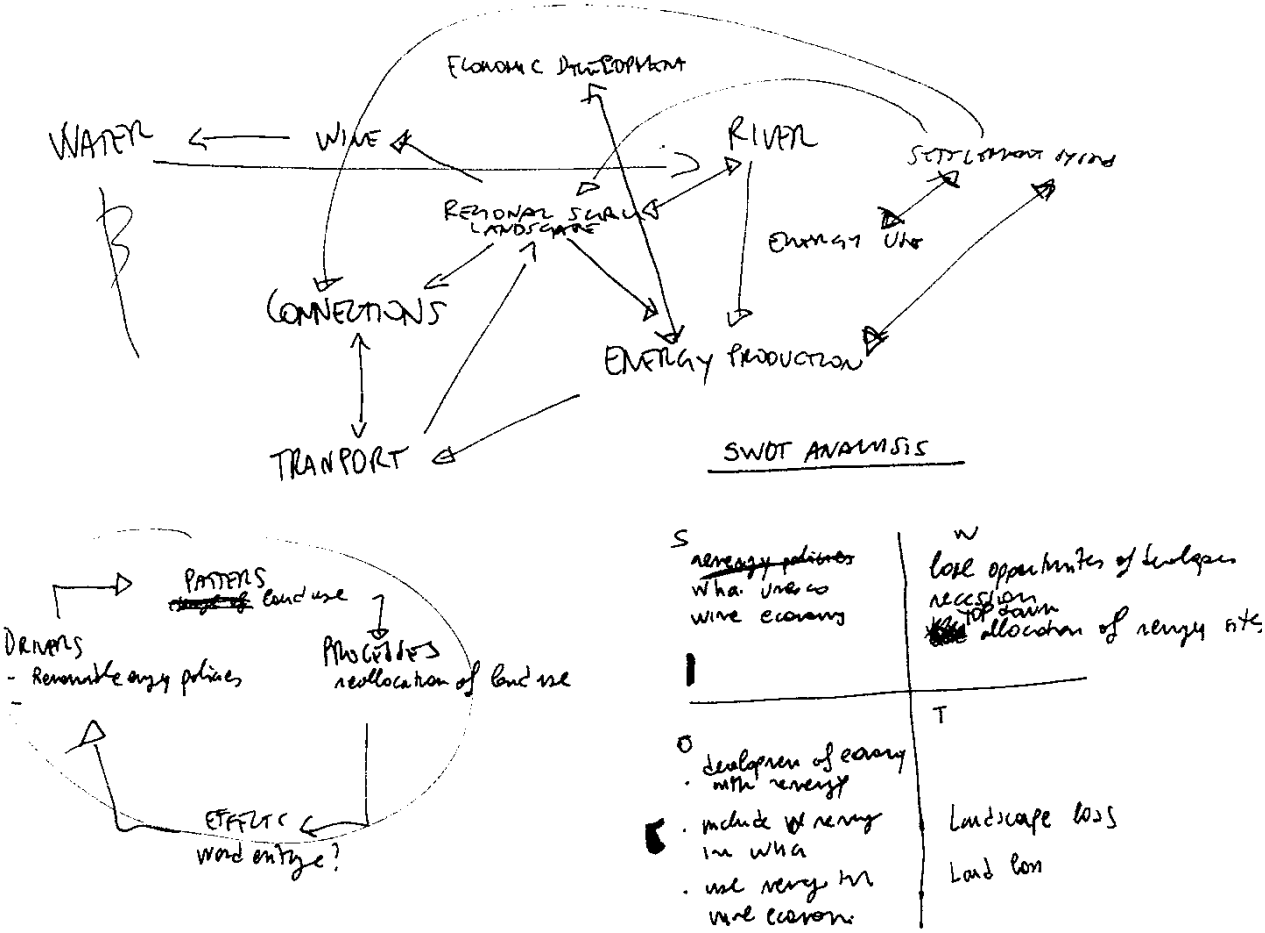
a) The analysis of the context using both top-down and bottom-up approaches to address energy use, conservation and production from renewable;
b) The construction of a framework to elaborate the dataset and to develop different scenarios;
c) The elaboration of scenarios and the identification of the options for balancing the cultural landscape, the environmental impact and the use, conservation and production of energy from renewable sources (mainly wind).

According to the limited amount of time available to finalize the job and to the developed methodology we decide to structure the procedure in this way:

a) Characterize and describe the Douro Area from the spatial, social, economical, and environmental points of view using the DPSIR conceptual model.
b) Identify the main stakeholders;
c) Conduct extensive field visits and conduct short interviews with the main stake holders (identified as local residents, local wine producers and sustainable energy professionals).
d) Integrate all the collected information in a Geographic Information System in order to compare maps considering wind energy possibilities and spatial cultural landscape.
e) Consider some alternative to improve the energy efficiency and conservation of the area.
f) Develop a guideline set based on the strategy-scenario approach.

5. Results of the Analysis

The description of the Douro Area from the spatial, social, economical, and environmental points of view: a conceptual model:

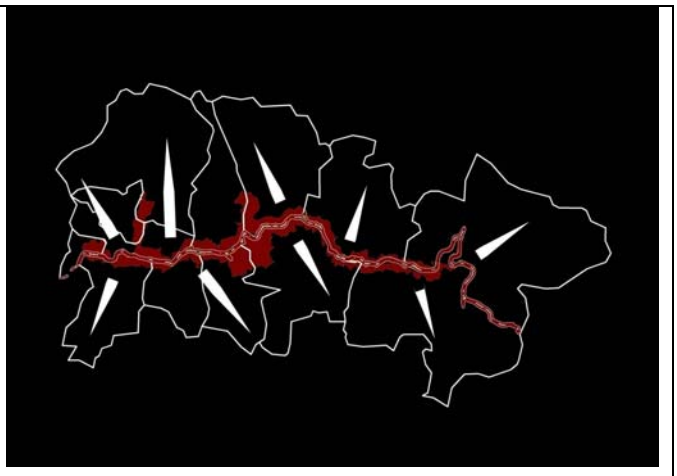


We found that a strong relation exists between the River and the area from the point of view of function, resources and material flows. Just to cite some of them: 2/3 of the energy production of the area comes from hydroelectric dams on the Douro River, the wine industry uses the river water to irrigate the vineyards, and one of the most important touristic attractions is the cruise on the river form Porto.

We identify also some criticisms in the area: the loss of soil caused by the intensive land cover transformation of mechanized wineyard that leave an high percentage of the soil uncovered by the vegetation and then mainly exposed to rain off; the environmental impact of the hydroelectric dams that modified the natural flux of the river forms the ecological point of view; the difficulties in maintaining untouched the beautiful cultural landscape from the point of view of the needs of the market and the energy production from wind power; the lack of an efficient and sustainable transport system to connect the polycentric structure of the area; the inefficient use of the biomass waste that comes from the wine production.

Generalizing we identified two main directions of function, resources and materials in the area between the WHS and the rest of the area: from outside to inside, and from inside to outside. The drivers of outside to inside are mainly top-down while the drivers of inside to outside are mainly bottom-up.

Outside-inside

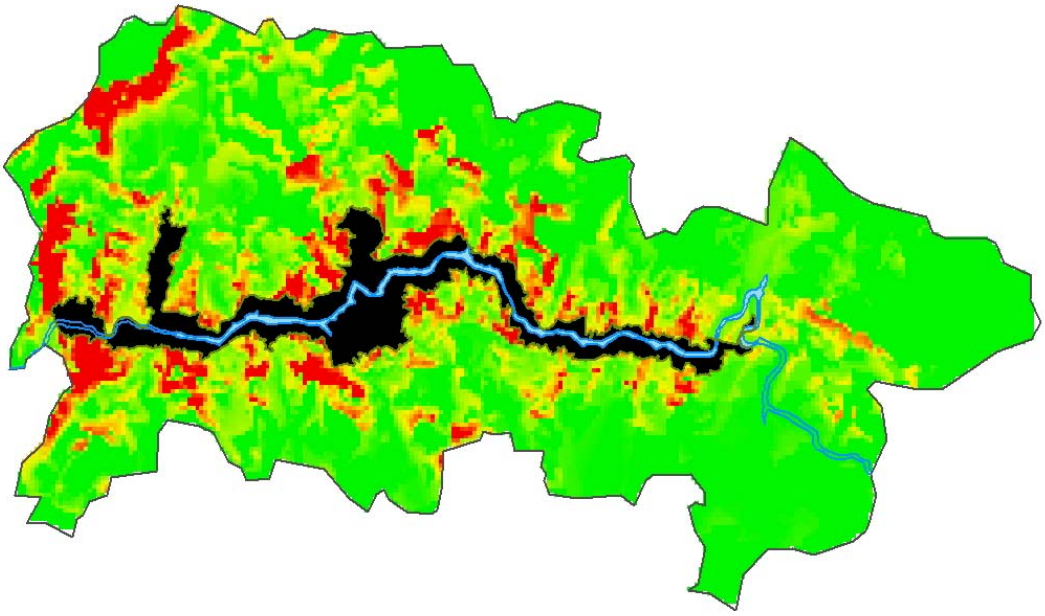


Inside-outside

Analyzing the potentiality of production of energy from wind we identify the areas with high potential wind energy (in red):

We developed a method to select suitable sites for energy production from wind taking into account different criteria and theresolds: high wind potential, low landscape and environmental impact, existing infrastracture.

For the landscape impact we used the view shied tool to estimate the invisible location from the WHS. In red the area with high visibility from the WHS (in black).

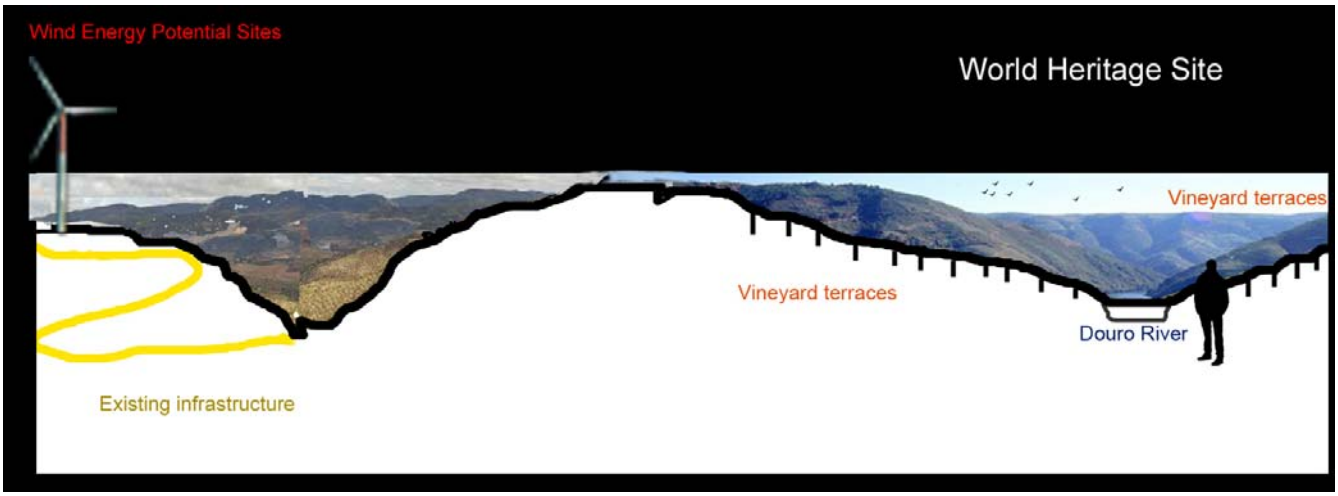


6. Output strategies and guidelines for a "balanced" development

Due to the lack of time the definition of strategies and guidelines can be considered as "work in progress". Anyway some output and ideas that come from our analysis and that we want to share and publish are:

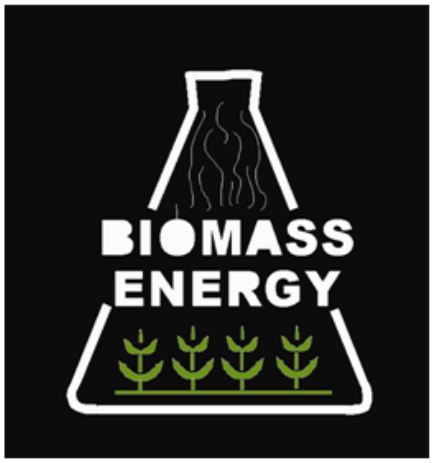
Top-Down

The production of energy from wind is possible and compatible with the WHS and is preferable to the hydroelectrict power production due to its high environmental impact that affects the ecological function of the river. We proposed some criteria to allocate wind farms in this area considering wind potentiality, environmental and landscape impact and existing infrastracture. However this attempt is work in progress and has to be improved.



Bottom-Up

The use of biomass waste from wine production could be improved to better fit the environmental integration. Today it is manily burnt releasing CO2. New technologies available let to transform biomass-waste in energy preventing the CO2 emissions and producing heat and electicity. We suggest a study in order to understand if a biomass energy production is economically sustainable in this area.



The transport system of the area can be improved to better fit the polycentric structure of the settlement system and to better connect the area to its "global gateway" Porto. In particular we propose the upgrading of the railway system. The Douro region has an ever growing tourism economy which is supported in part by the existing rail line that runs along the Douro River. In addition, the rail line has served a critical role throughout the region's history as the main link between Porto and other international trade ports. Currently, however, the rail line is outdated and inefficient when considering environmental and energy factors. By updating the train line the region could achieve two goals. First, by updating the line to an electric train system, the region could actively reduce their CO2 emissions and demonstrate their support of cleaner transportation options. Second, a more modern train system could better serve the tourism industry by providing a more comfortable opportunity for visitors to experience the Douro Region. In addition, an updated transit system could provide a less energy intensive travel option than the tourist ships that are currently in operation.

Other suggestions that we would give just in form of ideas are:

- The construction of walk pathways to connect the settlements of the area and to promote a slow speed tourism
- The use of solar panels for producing the solar energy to move the boats.

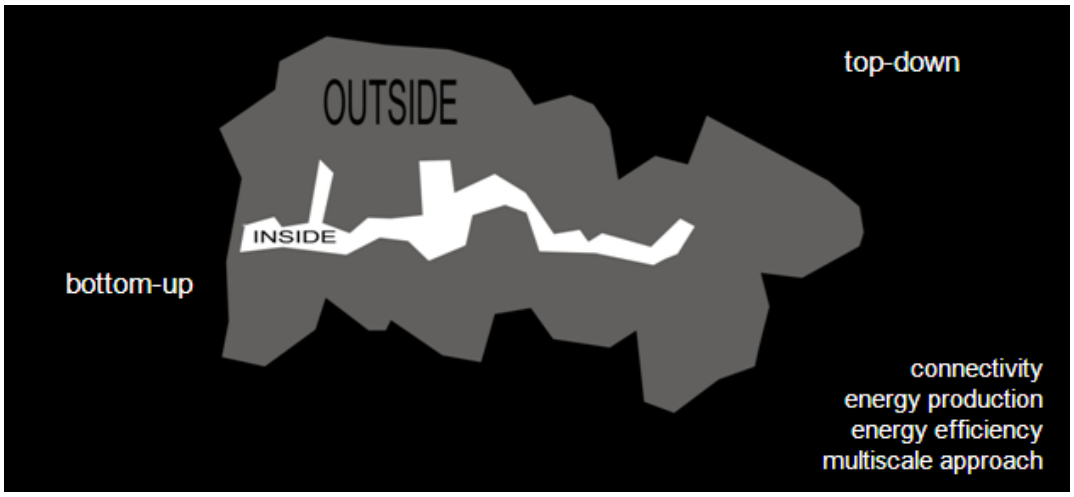
7. Final recommendations and conclusions

Even if we don't support the production of energy from wind at all costs we conclude that the production of wind power using wind farms is possible and compatible with the Unesco WHS if the criteria listed above are used and that this kind of energy production is preferable to the traditional hydropower that has an higher environmental impact.

However, some other improvements are critical for the area from the energy point of view: the transport system and the use of biomass.

This report describes the results of an attempt that must be improved to be used in the development of plans, programmes and policies. Anyway, we suggest a methodology that starts from the relation between inside and outside

and from top-down to bottom-up approaches to identify the problems and to develop solutions and that show to work very well in this case.



Sustainable Energy and Spatial Planning

ECO-LOGIC

Sebastian Witte
Germany
Ana Estevens
Portugal
Joana Pinho
Portugal
Mohammad Maeiyat
Iran
Silke Rendigs
Switzerland
Stephanie Rüsch
Austria
Tatiana Badmaeva
Russia
Vojtech Novotny
Czech Republic

Coordinator
David Prosperi
USA

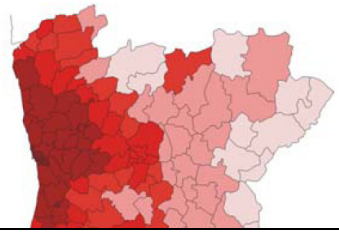
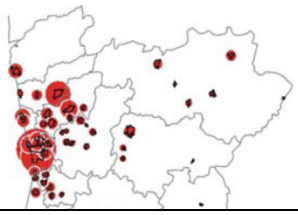
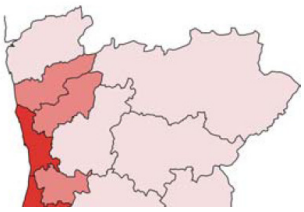
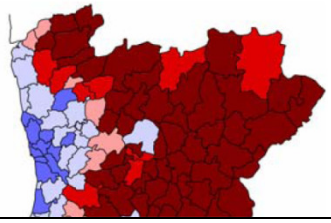
1. Introduction

The main objective of the project was to find a way to allocate energy sources, initiatives in renewable energy and find solutions for reducing the demand of energy without compromising the spatial qualities and interests of the Douro region. The idea of Working Group 2 was to find a concept to strengthen the local and regional employment sector, by using renewable energies as main driving force to the economic sector.

In order to achieve these goals, at first a description and analysis of the research region was needed, e.g. demographic and economic data sets.

North Region

The Douro Region is part of the North Region of Portugal. The table below summerizes the main demographic characteristics this area.

Demography	
	**Population density** • Coastal densely populated (represented with the darker red) • Contrary, the interior is considered a sparsely populated area (represented with the pink color)
	**Resident population** • Porto is the city with the largest concentration of population (represented with larger circles) • Polycentric system how to put in evidence the importance and the power of coastal area
Economics	
	**GDP** • The GDP in the interior area has seen a continued loss in weight of the country, which raises the question of the capacity of this territory to attract people (represented with the pink color) • Low economic growth of the interior with emigration and high levels of unemployment
	**Third sector** • Strong dependence of the third sector (55-65%) (trade and public services) although with patches of agriculture potentially competitive (wine and olive oil) • The recent dynamism of tourism deserves attention and investment, valuing natural and cultural resources
Education	
	**Illiterate population** • Low-skill of human resources in the interior of the Region (represented with the darker red)- obstacle to economical and social development

Douro Region

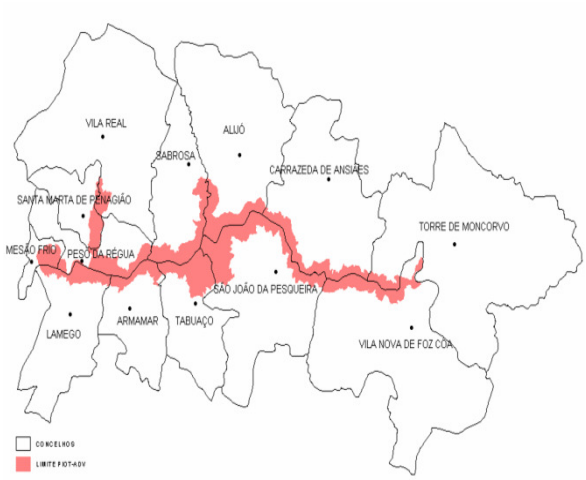
Douro is the region with the greatest depopulation of the country: Between 1991 and 2001, the region lost about 7% of its population (INE, 2001). Due to lack of employment, mostly young people are leaving the Douro region towards the Metropolitan Areas, like Porto and Lisboa.

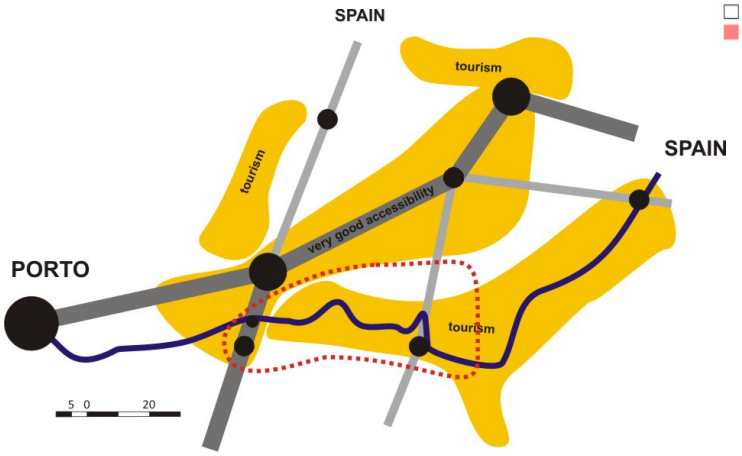
- The main urban centers of the region are Vila Real, Mesão Frio, Régua e Lamego, thus there is the concentration of first and third economic sectors. Although the region is a culture region with some economic potentials (viniculture, tourism), the GDP per capita is the lowest of the North Region, as shown in the table above.
- The overall energy consumption of the region is only 27% of the production of energy within the region, which is mostly hydroelectric generated power. Considering its sun exposure and quantity and quality of wind the region is a potential site for wind and sun power plants.

To sum up, the Douro Region is characterized by depopulation and unemployment on the one hand and by having a potential in energy and agriculture and tourism on the other hand.

2. Strategy and Objectives

Porto and its agglomeration is the economic centre of the Northern Region of Portugal. As shown in the graphic below Porto is well connected by transport corridors to the Northeast part of Spain. This main transport connection runs along the North of the study area of Douro Region, including the wine producing zone of the River Douro and the UNESCO World Heritage Site (Graphic on the right).





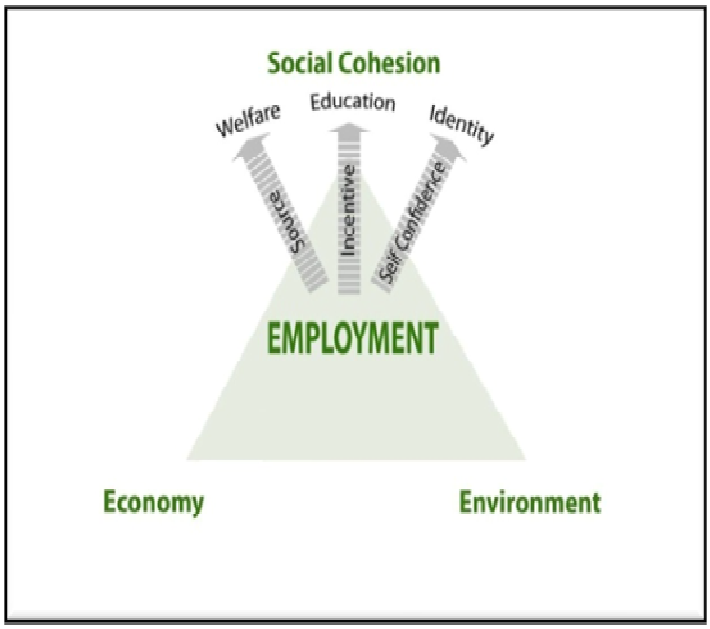
Graphic 1: Potential Development Areas in the catchment area of the Douro River

Until now the Douro Region has only a low level of access to this infrastructure and is therefore mostly isolated from the economic dynamics in the agglomeration of Porto. Additional to the road system, a railway line connects the Douro Region with Porto, but the frequency of the operation has been greatly reduced in recent times. As this link is very crucial for the welfare of the region it is recommended, that this link will be reactivated to operate more frequently.

The Douro Region is strongly marked by the river Douro and its structure of valleys, villages and small towns. The landscape along the river is especially characterized by the artificially made terraces that highlight the historical wine production area. This cultural landscape with its strong heritage content is nowadays a tourist attraction with cruising along the Douro River that brings tourists from Spain into the Douro Region.

The social cohesion has been identified as the important aspect of sustainable development in the region. As explained above the main reason for the declining population of the municipalities in the Douro Region is the lack of employment opportunities for the younger working group in the area. Therefore employment was identified as the core point to increase social cohesion, economic welfare and environmental quality for the region. Employment is the basic source of welfare, incentive for education and which increases self confidence and therefore the identity of the region.

In order to achieve sustainable development, including the improvement of the economical function and the boost of renewable energies as part of the way to economic growth in the region against the background of a low carbon future, the need of an *Eco - logic Planning for the Douro Region* was formulated.



Graphic 2: Concept of sustainable development in the Douro Region

Eco-logic Planning as a driving force for development. The focus is on the installation of renewable energies in the region.

In order to find the strategy which will help to achieve the goals best, two scenarios are proofed.

3. Scenarios

Analysis of the potentials of renewable energy in the Douro Region

For the quality of life and a prospering economy of the region renewable energies can be a key issue. Renewable energy is generated from natural resources such as sunlight, wind, rain, tides, and geothermal heat. They do not produce greenhouse gases during operation, such as carbon dioxide and methane.

Due to special geographic and climatic conditions the Douro region offers great potential to install renewable energies at the local level such as:

Wind power: Airflows can be used to run wind turbines. Modern wind turbines range from around 600 kW to 5 MW of rated power. The power output of a turbine is a function of the cube of the wind speed. If the wind speed increases, also the power output increases dramatically. Areas with stronger and more constant winds such as in offshore and high altitude sites are preferred locations for wind farms.

The spatial effects on wind energy depend on how the wind energy converters are installed: Single installations (punctual) or agglomerated (extensive land use). According to the connection between size of the construction and efficiency, the spatial impact is to be rated as high.

The geographic conditions of the Douro region favour wind power to be installed because on the top of the hills dominating the region there are strong and constant winds.

Hydro Power: Hydroelectric energy is a term usually reserved for large-scale hydroelectric dams and storage power plants. In contrast, micro hydro systems are hydroelectric power installations that typically produce up to 100 kW of power. The spatial effects of the usage of water power depend on the aim of the particular construction: Hydro power plants placed in river catchment areas have more intense effects on water households, water infrastructures and the eco-system. On the other hand storage powerplant´s mainly effects on space resume out of the needed large storage areas (e.g. barrages). So the spatial impacts are to be rated medium. There is an operative dam ("Bagausto") next to Regua.

Solar Energy: Refers to energy that is produced out of sunlight. It can be applied in different ways either to generate electricity (photovoltaic) or thermal energy, both heating and cooling (solar-thermal panels). It has a high potential in the region because of the high amount of sunshine during the year. Solar energy can be installed on the hills in the region for greater output and/or for individual production on walls and roofs of nearly all kind of buildings. Furthermore the thermal energy of infrastructures (roads, bridges, sewage systems) can be used for energy production, maybe by implementing heat pump technologies. Therefore the spatial impact can vary from medium to nearly none.

Biomass In Douro: Can be mainly derived from wood waste, as the region is a wine producing region. There is a big amount of waste or grapes. This waste can be used as biomass to generate electricity and thermal energy. Normally the spatial effect of biomass is quite huge, since the biomass has to be produced in industrial forms. According to the fact biomass is a result of the viniculture and can be processed in punctual plants, the spatial impact is mostly low.

Geothermal energy: Energy is obtained by tapping the heat from the earth itself. Although geothermal plants are not zero emission (because of setting inner earth gases free), they are still one the best alternatives to fossil fuels. The project could finally not gather information about the availability of geothermal energy; the potentials for the Douro region were stated low.

	Potentials	Level of Concentration		Spatial Impact		Purpose
Wind Energy	↑			High	High	Electricity
Solar Energy	↑			High	Medium	Electricity Thermal Energy
Bio-Energy	↔			Low		Electricity Thermal Energy
Hydro Power (River)	↑			Medium		Electricity
Hydro Power (Reservoir)	↔			Medium		Electricity Storage
Geothermal	↓			Low		Electricity Thermal Energy
Infrastructure Thermal Energy	↑	None		None		Electricity Thermal Energy

If further examinations show a possible applicability, it might be used for generating electricity and thermal energy by using geothermal heat. Although it is expensive to build a power station, depending on the depth of usable geological structures with enough heat energy, operating costs are low and therefore result in low

energy costs for suitable sites.

Description of the two scenarios

The scenarios are based on the leading question: "How to allocate (wind) energy sources, initiatives in renewable energy and find solutions for reducing the demand of energy without compromising the (spatial) qualities and interests of the Douro region?"

Considering the Multilevel-Planning approach the task was to find solutions how the economic functioning of the Douro region can contribute to a more sustainable spatial environment, including the possibility of top-down and bottom-up strategies. For finding solutions it was also important to keep the following questions in mind:

- What are the energy requirements of the economy?
- How and when are energy inputs required?
- Can they be reduced?

This thought lead to two different scenarios, both with the implementation of renewable energy sources to gain a sustainable regional development and urban development. The measures are designed for three different time frames – short, middle and long term.

small is beautiful

The **key words** to describe the scenario "small is beautiful" are bottom – up / "prosumer" approach and local investment.

Objective

This scenario leads to a sustainable development on local and urban level. The total added value remains in the region.

Investments shall be made at local level and make the village independent in terms of energy. Small wind turbines and/or solar panels can be installed on private houses to supply the households with energy.

The concept of being energy independent has a positive impact on the employment sector: Research and development will secure more jobs.

Also the local economy wins from the new concept because given the fact that Pinhão will be the first village with energy independency.

BIG IS GREAT

The **key words** to describe the scenario "big is great" are "top-down", spatial concentration of and large-scale investments in renewable energies.

Objective

The scenario describes the trend of a maximum profit policy, forced by large-scale investments into renewable energies on regional level.

The main driving force in this scenario is the large-scale investments done by regional investors, which lead to a massive improvement of the extent of renewable energies. The investments are done mainly into types of renewable energies, which promise to be most effective. Thus, the scenario focuses on fostering wind energy, solar energy, biomass energy and, where applicable, water energy to generate electricity (in contrast to the scenario "small is beautiful").

Significant for this scenario is the "proseller"-approach: The investor responsible for the the power plant is to distribute the energy to the market. This can be seen as a raise of market dependency. The result of these massive investments

would be spatially concentrated, high potential areas and according to this an increasing area consumption. On the other hand, the region will benefit from the renewable energies as a pull-factor to the employment sector.
By building slightly visible energy plants, area consumption and a changing landscape of the world heritage site "Douro Valley" might be an outcome of this. Concentrating the renewable energies outside the site would be a possibility to avoid conflicts with the environmental objectives.

Comparison of results

After the evaluation of the characteristics and potentialities of different energy sources that could be used in both scenarios, a list of potential impacts was considered. This list included aspects such as Population, Land Consumption, Local Economy, Regional Economy, Employment, Tourism, and World Heritage Region.
It must be highlighted that this evaluation was based on the potential impact that could be predicted. Therefore, some choices might be discussable. The table below lists the potential impacts considered.

Impact on:	*small is beautiful*	BIG IS GREAT
area consumption	+	++
local economy	++	+
regional economy	+	++
Employment	++	+
Tourism	++	+/-
world heritage site	+	+/-
Population	+	+/-
world heritage site (visual impact)	+	+/-

The implementation of the scenario ***small is beautiful*** will probably have a deeper impact on the local economy when compared to **BIG IS GREAT**, since the main actors of the first scenario are individual local investors. In other words, the stimulation of the local economy is expected to be lead from within the region itself. On the other hand, and logically, it can be inferred that the strong external investment necessary for the implementation of the **BIG IS GREAT** would mean the direction of the return benefits both to the investor and through taxes either to the municipality government or the regional region. This doesn´t mean that this couldn´t have a positive consequence at local scale but indeed the biggest direct beneficiary would not be the agents of local economy. From these considerations the potential impact on employment can be easily estimated, especially concerning the origin of the newly employed people. This can be predicted since local social capacity is fragile and technical experts would probably come from outside the region. ***Small is beautiful*** offers the possibility of stopping the negative migrant movements from the region, providing a solid option for local people to have another source of income by developing an economical activity. This scenario was considered to have a positive impact on tourism, namely on the economical niche of Eco Tourism, still on its first steps

in Douro Region. Discussing Land Consumption, the impact due to the implementation of the scenario **BIG IS GREAT**, and consequently the construction of large dimension structures, such as wind farms, is clearly more significant than the impact caused by the energy appliances of small scale investments typical from the scenario ***small is beautiful***. It has to be stated that these last energy appliances due the sprawl urbanization that characterizes the area of intervention would not have a localized visual impact but a spread visual impact. This might increase the risk of negative impact on the World Heritage demarked region that should be considered carefully.
The table below highlights the differences between both scenarios in terms of financial flows.

	small is beautiful	**BIG IS GREAT**
investments	from individuals	from institutions
financial benefits	for individuals	for municipalities

An important aspect of the implementation of each scenario, particularly taking the concept of the approach into account, is the origin of the investments and the direction of the financial benefits of these investments. It should be clear that the main effort to execute the ***small is beautiful*** is made by local individual investors, to whom technical and financial support might have to be provide. In this sense, the municipality also plays an import role in the success of this strategy. Transparency mechanisms of the financial support given should be applied so that the distribution of the financial benefits is understandable and individually directed. On the other hand **BIG IS GREAT** will not demand a financial effort from the municipality but the financial benefits will neither be largely directed to the municipality, except for the taxes related to land use. This means that the capital flows due to renewable energy sources exploitation in the region will not be kept significantly in the same area.

4. Conclusions

Renewable Energies do have a strong potential in the development of the Douro Region, and we see this potential as a main driver and essential incentive for boosting the economic situation.
But the implementation of Renewable Energies cannot be taken at all costs. Therefore, it is a long term project which has to be based on a strategy, involving both stakeholders and investors. Thus the strategies and policies should be based on a combination of the two scenarios, so then the benefits will be mutual.
The working group states a major chance for the region to foster cultural identity, social cohesion and the idea of a low carbon region in the implementation of these strategies.

Sustainable Energy and Spatial Planning

LINKS

Abdelkhalek Ibrahim
United Kingdom
João Granadeiro Cortesão
Portugal
Júlia Pinto
Portugal
Kiduk Moon
Germany
Niels Kropman
The Netherlands
Priya Sasidharan
India
Thomas Buhler
France
Wolfgang Aichinger
Austria

Coordinator
Javier de Mesones
Spain

1. Objective

The ultimate goal of this contribution to the 2009 YPP workshop in Douro Valley is to enhance sustainable, local development in the community of Pinhão, with respect to urban design, in order to turn it into a Low Carbon Village. Sustainability is understood in its broadest sense, comprising social, cultural, economic and environmental aspects.

2. Pinhão and Douro Valley

Pinhão is located on the Douro river bank, in northern Portugal and belongs to Alijó municipality. It is situated in the heart of the oldest demarked wine producing region of the world, the Douro Port Wine region. The area is classified by UNESCO as world heritage of culture, as it represents a unique landscape characterized by an impressive topography and man-made terraces used for wine production.
The village was founded on a strategic location, at the junction of the rivers Douro and Pinhão with several roads connecting Alijó, Vila Real, Sabrosa and Régua and the railroad station of the Douro Valley Rail line.

Pinhão has become a focus of the region's tourism industry, with several boats per week landing at the shores of the river and a major hotel opening at the riverside.

Figure 1: Aerial view of Pinhão

3. Process of Group Work

After some first impressions about Pinhão, a list of problems and challenges was compiled during a brief brainstorming. Grouping the major tasks into four fields led to the structure of further analysis to be undertaken. The result was a set of major goals, combined in the general concept of "Links for a Low Carbon Village".

Exemplary urban design projects were developed for the whole urban area of the village of Pinhão, always aiming at the integration of the concepts and action fields. Finally, each of the areas was given an easily memorable name, in order to improve the impact in the audience.

During the whole process, the group work could benefit from the enormous diversity in cultural backgrounds, skills and experiences.

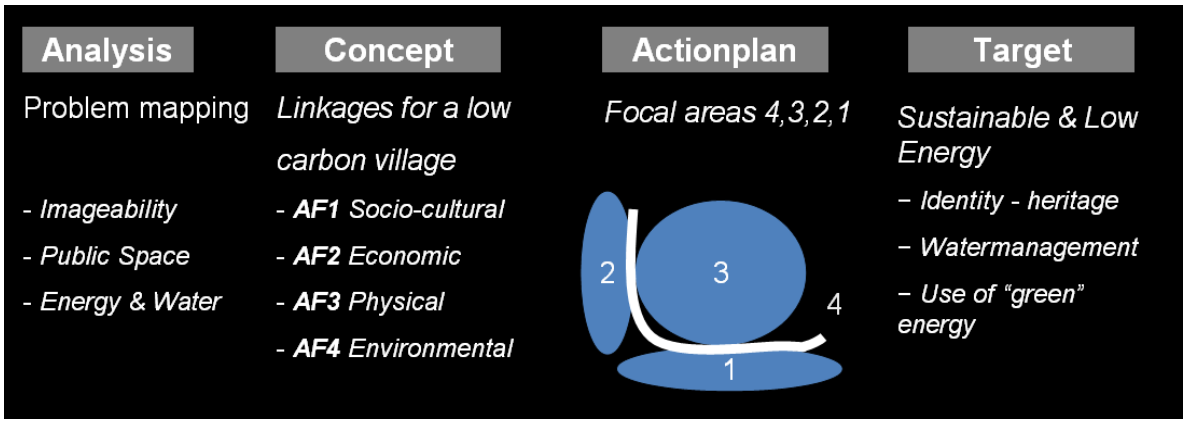


Figure 2: Work plan

4. Analysis

In order to gain insight and understand the problems challenging the village, analysis was conducted paying special attention to three questions, which require intervention and improvement: Imageability, Public Space and Energy/Water.

The data was collected by utilising the information presented during the workshop, informal talks with local residents and problem-focused walks through the village.

Figure 3: Problem Mapping

The main challenges for the village are…

Imageability

Weak usage and physical condition of parts of the heritage
Limited exploration of economic potentials

Public Space

Distribution and organisation of public spaces
Poor accesses within the village
Missing connection between the village and the river

Energy/Water

Cooling/heating demands (lack of thermal insulation)
Dependency on fossil energy sources
Brown waters & Water treatment
Erosion
Concept
Links for a Low Carbon Village means: bring things together !

By establishing important links, it should be possible to turn Pinhão into a Low Carbon Village. By implementing a set of integrated measures that will result in sustainable solutions concerning lifestyle, heritage, energy and water management. Thus, Pinhão can make use of inter-dependencies and reinforcing loops.

According to the analysis conducted, links can be understood in terms of the following links

- socio-cultural
- economical
- physical
- environmental

Each of this Action Fields (AF) can be characterised as follows:

AF1 socio-cultural
Further and denser interaction between local residents and tourists
Strong community and local identity
Enhance the populations commitment to local development through participation
Adaptive uses of heritage

AF2 economic
Economic interaction between local commerce and tourists
Use economic potential in energy efficiency/local energy production

AF3 physical
Provide connections between different parts of the village
Strengthen the mainroad - the “spine”
Enhance orientation
Improve access to waterfront
Make better use of the topography (views, …)
Improve accessibility, especially for people with reduced mobility

AF4 environmental
Improve water treatment and rain water harvesting
Prevent erosion
Positively influence Micro-climate
Enhance energy efficiency
Enhance local energy production

5. Action

In an exemplary mode, four projects in special focal areas shall be displayed with more detail. All following interventions are aimed at joining various elements, in order to create a greater benefit and value.

Focal Area 1 "Heart"

The Douro is the lifeline of the village. Formerly used for shipping wine, the banks of the river currently present the main entrance for tourism. With high quality public spaces, this area allows pleasure at contemplating the landscape and connects to the village's history. It is where both locals and tourists meet, go for a walk or have a drink at the bar. Even though usual central functions are missing, it offers to some degree a sense of centrality in a rather linear settlement, as it is the area with the strongest sense of place. Thus, it can be seen as the heart of Pinhão.

With the exemplary interventions in Focal Area 1, activities should be pumped into the village, helping the heart to "sustain" the vital functions of the "organism". The interventions focus on establishing access to the storage tanks for Port by opening a boulevard/wine route. Between the railway station and the river, a new connection will be opened. Heritage such as the Yellow Buildings of the Farmers Association will find adaptive reuse. Water housing or floating hotels deal with the problem of limited space for expansion and give new attraction to the riverfront. The promenade will be equipped with solar panels or small wind turbines for local decentralised energy production.

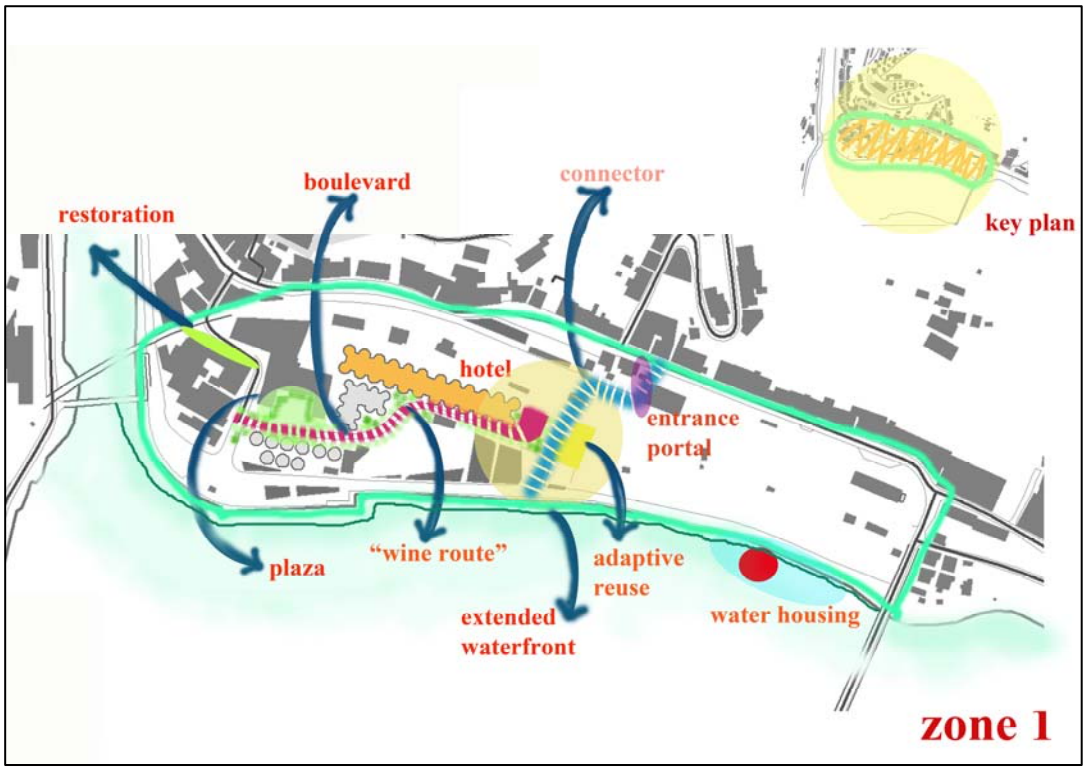


Figure 4: Action plan for Zone 1

Figure 5: Wine route opening access to the Storage Tanks and Yellow Houses

Figure 6: Waterfront with Water Housing or Hotel, Wind turbines and Solar panels

Focal Area 2 "Brain"

The banks of the river Pinhão are a place of memory, heritage and identity. It was the river that gave its name to the village, wine cellars, the traditional landscape at the slopes running down to the river and the impressive rail bridge connect to the past and store the memory of a village, similar to a brain.

The exemplary interventions in Focal Area 2 are thus focused on establishing links to the villages history, by opening new perspectives and accesses, and using local energy potentials. Therefore, the walk alongside river Pinhão should be cleaned-up, connected with the upper street levels, and equipped with some basic infrastructures such as lightning, solar panels or small wind turbines for decentralised energy generation and leisure facilities like a café or diving decks for swimmers and sun-bathers.

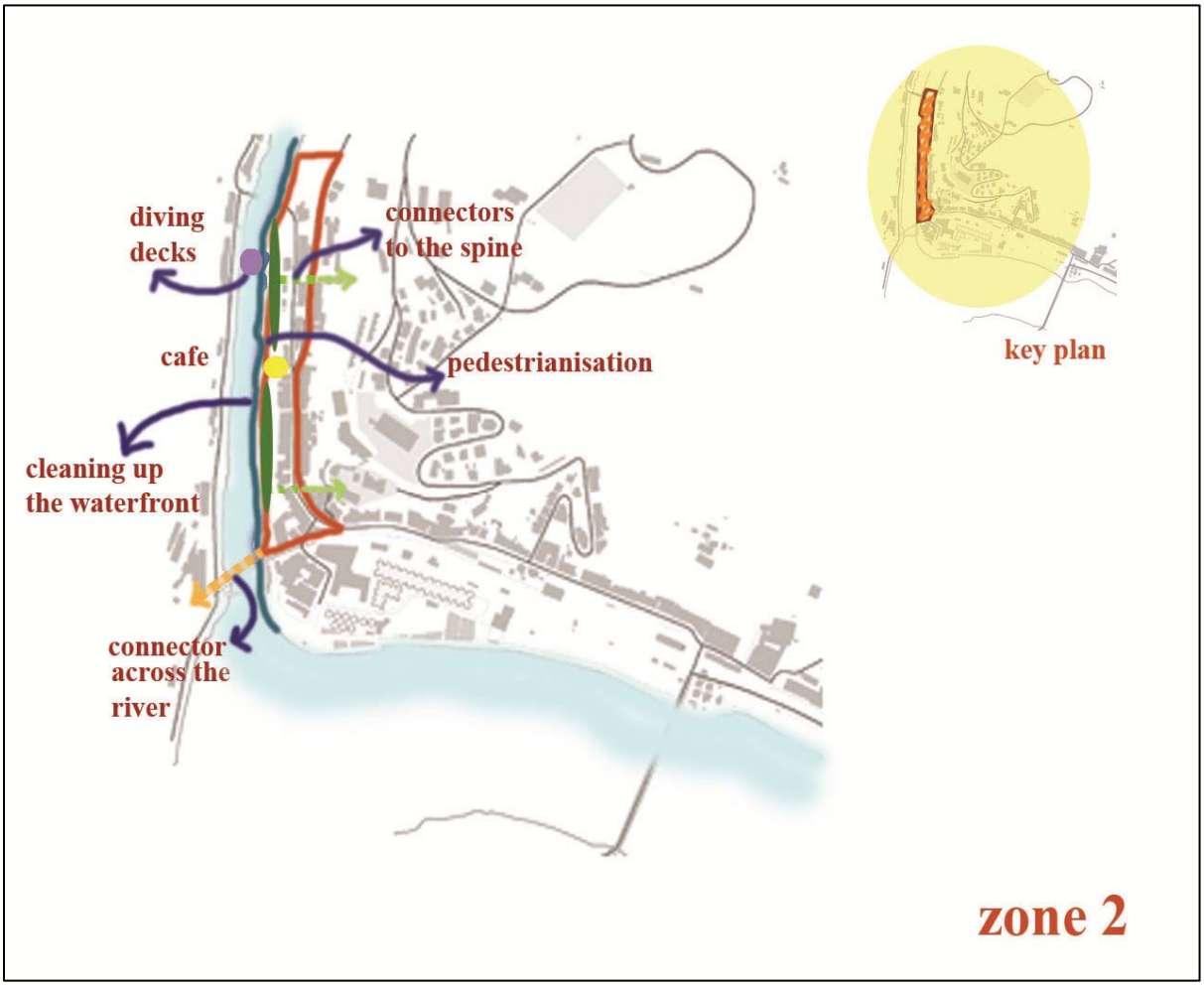


Figure 7: Action plan for Zone 2

Figure 8: A new walk along the river Pinhão,
with decentralised energy production and leisure activities

Focal Area 3 "Lung"

The area is situated on the steep slopes of the valley, overlooking both the river and the village. This is where local people live, work, study, eat and sleep - in short, where they breathe. Focal Area 3 can thus be designated as the lung of the village, the true Pinhão of the local population. Exemplary interventions in Focal Area 3 focus on changes to the water system, preventing erosion and improving penetration, ecological roofs (better thermal insulation) and opening and improving accesses and linking the different zones to each other.

Draining staircases will be a combination between the use of half open surface material and small wadis. By installing these staircases, changes to the water system occur. First of all, the water system needs to be separated in a brown- and grey water system, which will decrease the pressure on the local sewage system. Secondly, changes to the surface material - such as the use of old stones, such as on the surfaces at the waterfront or the main road - will also relate to the local heritage and make public space more attractive, and ultimately enhance the visual connectivity between the parts of the village. Thus, these draining staircases can be used to link the higher parts of the village to the waterfront by creating an attractive pedestrian connection for the "flaneur".

Besides the already mentioned reasons, the half-open surface material will improve the penetration of water during heavy rainfall and therefore reduce the risk of flooding. The use of vegetation is an extra measure to prevent erosion. It will also positively influence the local climate. As a side note special attention needs to be paid to the accessibility for people with reduced mobility.

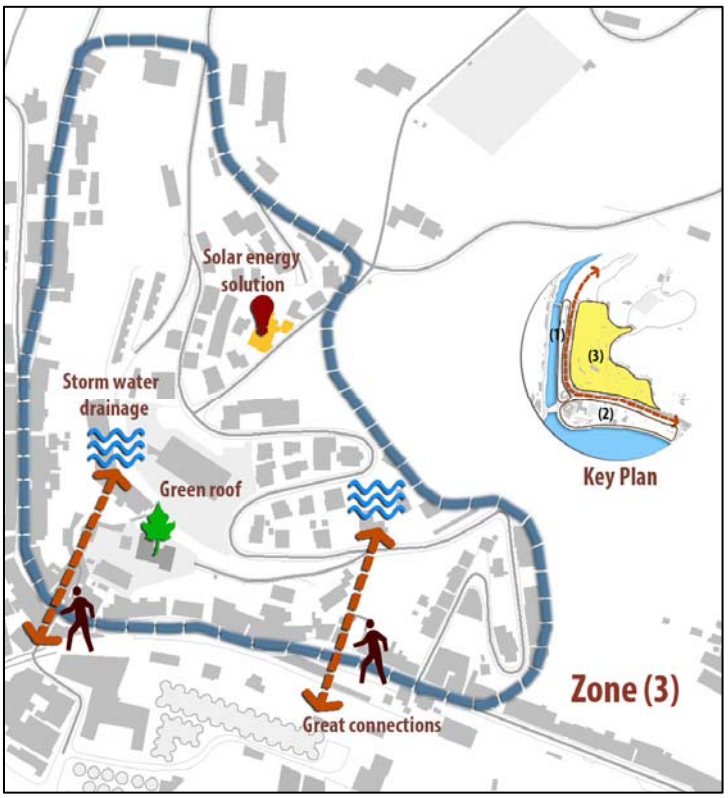


Figure 9: Action plan for Zone 3

Figure 10 and Figure 11: A draining staircase in Pinhão - before and after intervention

Green roofs are about saving energy through better insulation, combined with improvements in water draining. Furthermore, on the ecological roofs, wind turbines can be placed in order to also generate energy.

Pinhão can take advantage of its enormous potential in generating carbon free energy. Energy generation should occur at a local, decentralized level. Roofs can be utilised for the production of energy, depending on their shape: Steep roofs can be used for solar panels, flat roofs are good for ecological roofs and small wind turbines. By doing so, the diversity among roof styles can be seen as an advantage.
Green roofs need community support, since the implementation of this measure is highly dependant on the local residents. The municipality of Alijó can go first and realize an exemplary green roof on top of a public building, such as the local kindergarten.

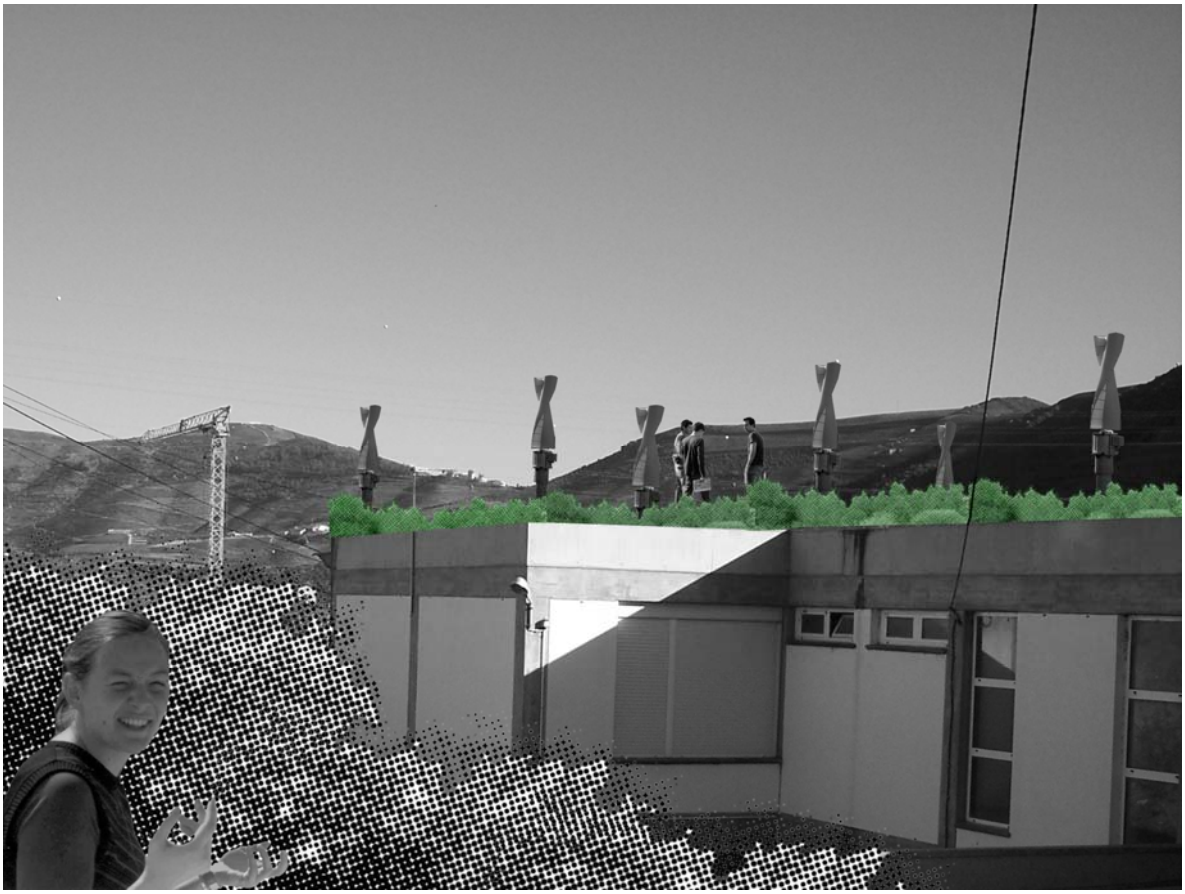


Figure 12: Green roof at the kindergarten

Focal Area 4 "Spine"

The main road - in other words the Spine - is the interface between all the before mentioned areas. Besides the rivers, which are the structuring element of Pinhão, the "Spine" brings both division and connection between the other parts of the village. Alongside the spine, most of traffic, commerce and other uses are taking place - it is the most vibrant part of Pinhão and essential for both locals and tourists.

Unfortunately, the spine concentrates most of the negative impact on public space due to an extensive usage of car. High car dependency is typical for remote, rural areas such as the Douro Valley. Action on public transport would be required on regional level to reduce car usage. Though, on the level of the village's main road - the spine - car usage has to be tackled in a different manner: by redistributing public space or pedestrianisation. The attractiveness of public space relates to social-cultural matters (as for encounters or hang-outs), economics (shopping on the main street) and environment (enhanced non-motorized mobility).

Concerning car traffic, focus should go on:

- car driving

Street design should enhance slower speed, and a fair distribution of public space amongst all kind of users, including pedestrians and cyclists.

- car parking

Due to the lack of off-street parking lots, the parking problem and its negative impact are transferred to the public space. Problems detected alongside the spine comprise illegal, double row parking or wreck car dumping. By enlarging the width of sidewalks, this intervention leads to improved security on the street for pedestrians and cyclists.

Figure 13: The Spine - new sidewalks, a "Kiosque" and reduced speed for motorised traffic

6. Conclusion

Identifying the lack of links as the most important aspect that needs improving we developed a comprehensive master plan which tries to improve the connectivity between the different zones in the village and at the same time tries to prepare the village for the future by using sustainable and durable urban-, energy- and water management solutions.

The disconnectivity of the village is best seen when walking on the main road. This is clearly visible boundary between the central village and the waterfront. Secondly the main road itself is not optimal for pedestrian use. By using and improving existing alleys and also develop them as water alleys, realising connections through the redeveloped (heritage) waterfronts and creating extra space for pedestrians the master plan improves the connectivity between the different parts of the village and at the same time improves the possibilities for pedestrians. Besides this the improved connections will also draw the tourists into the village and therefore it will support the needed social-economical development. The connectivity of the village will be under scribed by the use of the characteristic stones used on the main road. Besides, these stones are considered to be a half open surface and thus, to improve the quality of the water management greatly. By further improving the water management of the village by means of separating the brown and grey water system, creating the water alleys, using the wastewater plant, the village will be able to cope with the results of climate change. Furthermore, the implementation of several sustainable energy measures, such as ecological roofs, solar cells and wind turbines, the village of Pinhão will actively reduces its CO2 emissions and will prepare itself for the future.

The master plan *"Links - an urban design for a sustainable and low-carbon Pinhão"* is a design for a sustainable and low-carbon Pinhão while keeping in mind the collective memory of the past, dealing with the present and preparing for the future.