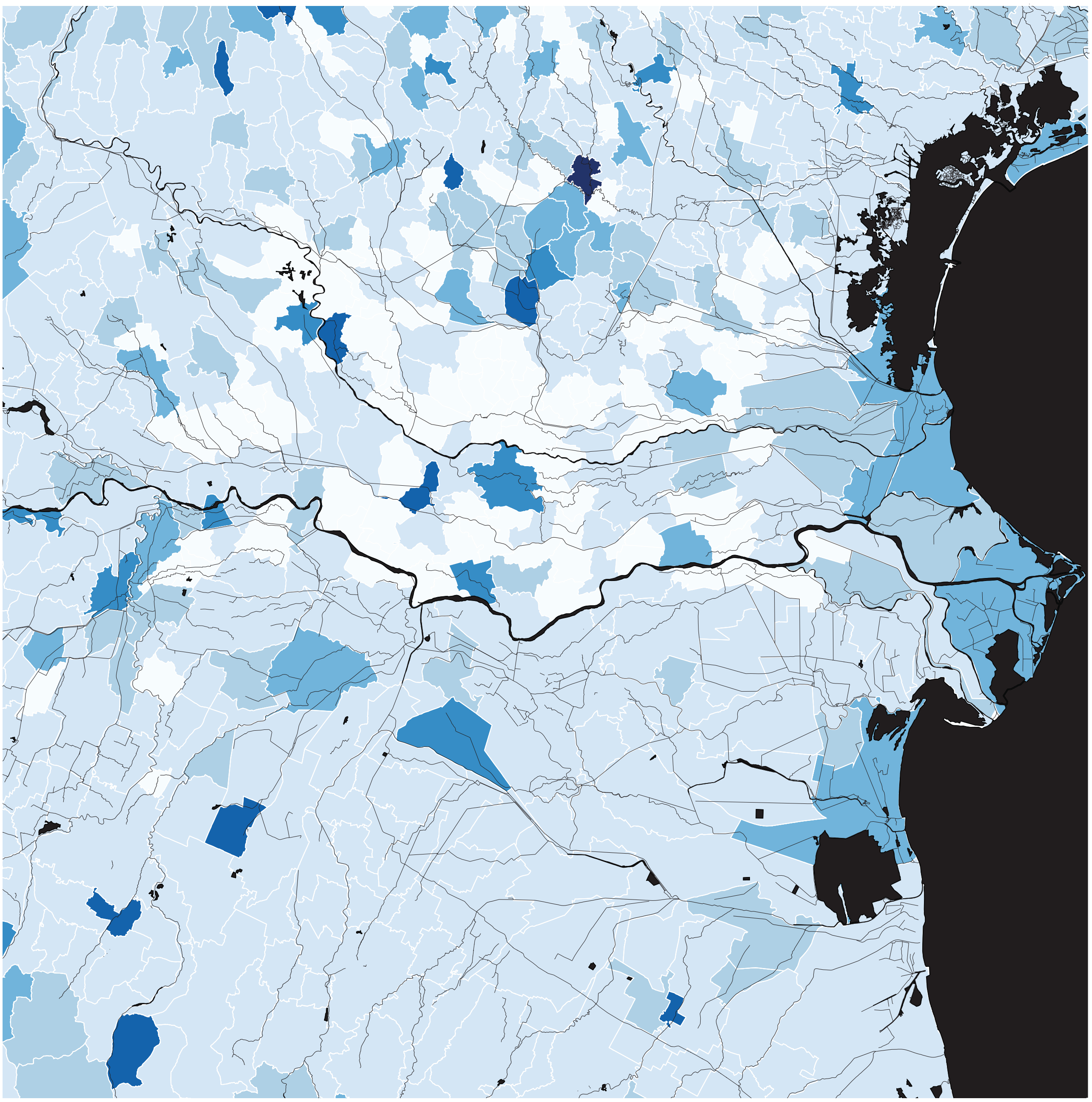
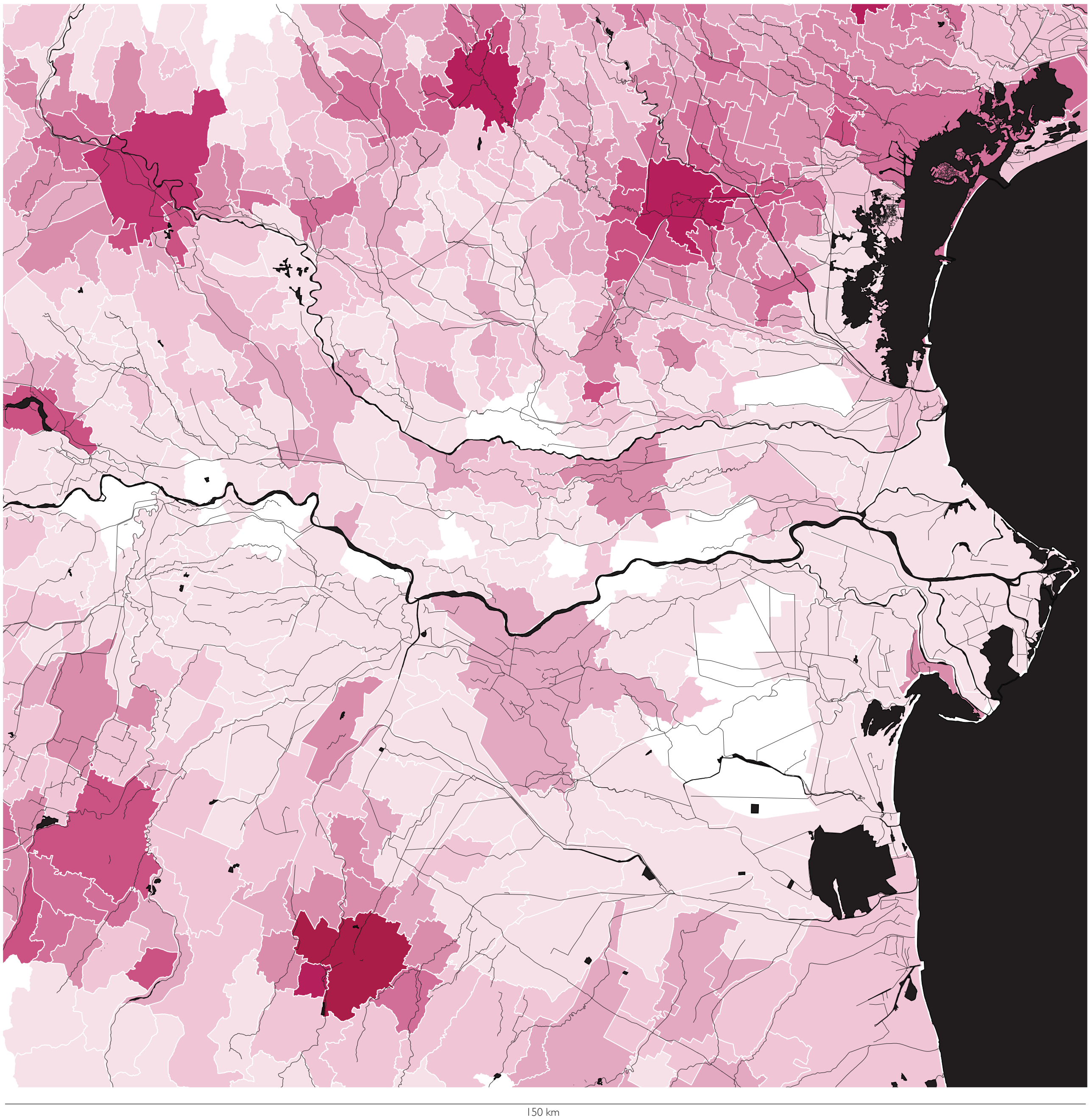


150 km

AVERAGE TOURISTIC OVERNIGHT STAY (number of nights - 2014)

0 1 3 6 10 20 33 +50

Fig. 192 Economic indicator: Tourism (source: Corine Land Cover, Diva-GIS, ISTAT, annex 3; elaborated by the author)



ENTREPRENEURIAL DENSITY (companies/km²)

0 4 11 20 33 49 71 108 144 257 384

Fig. 193 Economic indicator: Entrepreneurial density (source: Corine Land Cover, Diva-GIS, ISTAT, annex 3; elaborated by the author)

the adriatic coastal arc regional district

The indicators considered show how the municipalities lying along the Natura 2000 ecological axes (Adriatic coastal arc and Po river) show comparable trends in each of them. Some variations begin to occur at the extremities, as we approach more important urban poles like Porto Marghera and Ravenna.
By distinguishing between coastal and river territories due to a structural diversity of local characters, problems and strategies, we can affirm that the *Adriatic coastal arc* can be considered as a *regional district*, because it presents some similar socio-economic trends, strengths and weaknesses which could constitute the framework on which we can try to speculate on a plausible local development strategic vision which places the role of *green infrastructure* at the centre of reflection and which integrates the search for a new narrative for oil meshes within it.

It is difficult to define the scope of the regional district without relying on administrative boundaries, bearing in mind that statistical data are organized on this criterion. For this reason, we thought that, in order to reduce the inside/outside effect, our regional district could be constituted of different nuances of involvement and influence, thus identifying those municipalities that are fully interested in the local development strategy, an extended range of influence that presents some similar conditions and that can benefit from it and some consolidated economic poles to which the regional district could link to trigger further development processes.

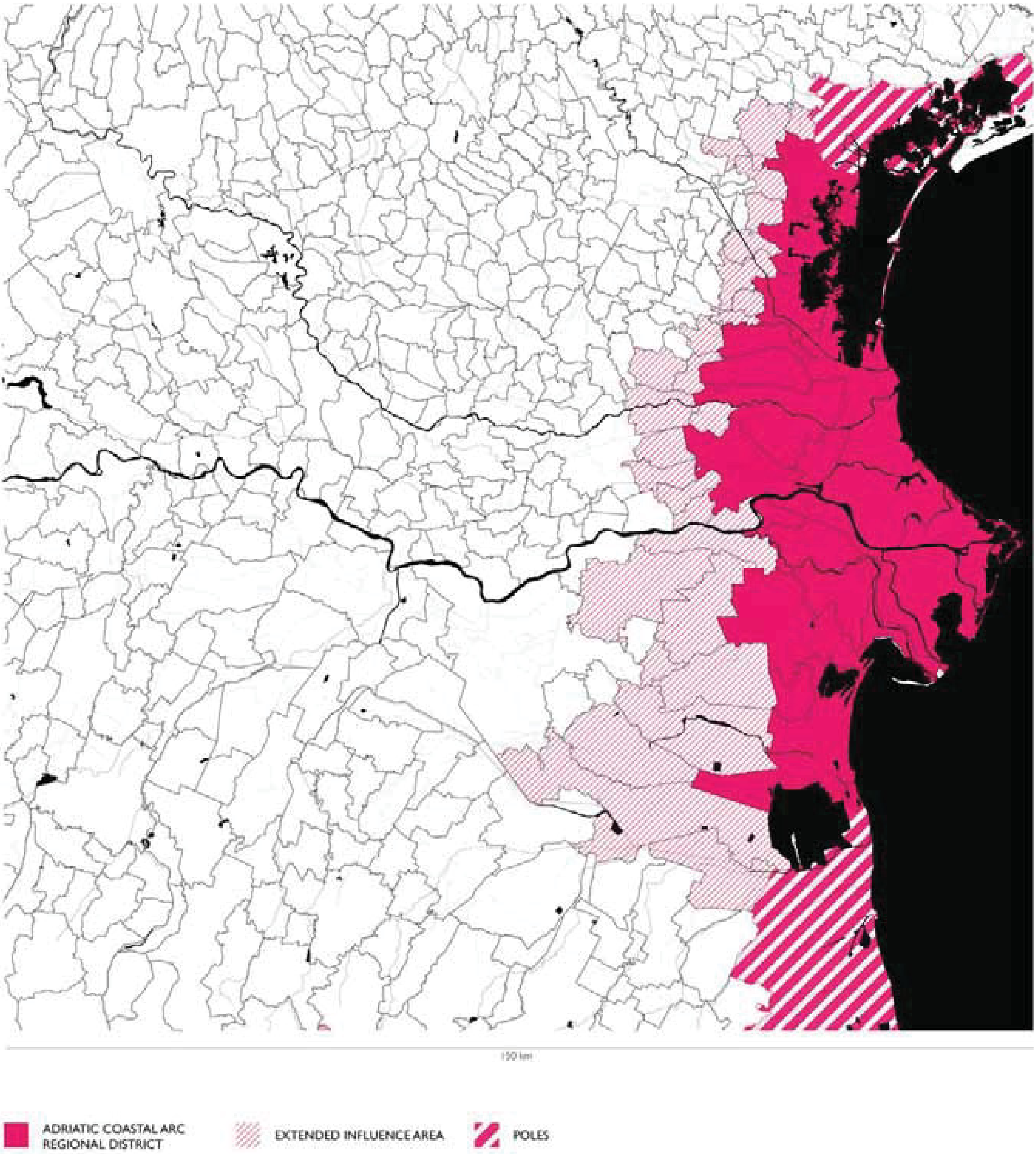


Fig. 194 Adriatic coastal arc regional district (source: Corine Land Cover, Diva-GIS, ISTAT; elaborated by the author)

INDUSTRIAL AREAS
URBAN AREAS
NATURA 2000 AREAS
NOT PRODUCTIVE AGRICULTURAL AREAS
WOODY AREAS
INTENSIVE AGRICULTURAL AREAS
IRRIGATION CHANNELS
RAILWAY INFRASTRUCTURE
RAILWAY STATION

sources: **Geographical metadata**
- Corine Land Cover 2012 metadata: www.eea.europa.eu
- DIVA-GIS metadata: www.diva-gis.org

Fig. 195 Type of landscapes in the north-easter Po Valley (source: Corine Land Cover, Diva-GIS; elaborated by the author)

Seeking a new narrative for oil meshes

A local development programme for the Adriatic coastal arc regional district cannot avoid relying on a new oil mesh narrative, which, as taught by Samona, would enable the regional district to be integrated into the enlarged territorial situation of the north-eastern Po Valley.

The following paragraphs will therefore attempt to set the conditions for framing how the renewed narrative of fossil fuel infrastructure can reintegrate the energy field for which they were originally and technically conceived, but incorporating that socio-ecological dimension that architecture and landscape disciplines can bring in their process of “de-engineering” (Bélanger, 2012).

As already seen in the previous parts of this research, the energy transition towards distributed and no longer centralized models of energy production opens up new scenarios, including those of exploiting the energy potential that comes from the process of metropolization of the territories, thus transforming the landscape not just in a support for energy infrastructure, but in the infrastructure itself.

Thus, the widespread network of fossil fuel infrastructure, given its pervasive diffusion on the territory, could become the *energy backbone* for a territorial distributed energetic production and storage.

Let’s start analyzing the types of landscapes of the metropolization of the north-eastern Po Valley territories in order to glimpse their energy potential.

types of landscapes

Our territorial case study extends over an area of 22’500 km^2 on both side of the river Po and it is delimited to the east by the Adriatic Sea coast.

Agriculture is the principal land use and it is characterized by a highly mechanized intensive production which drastically reduces the biodiversity of the environment. The most common types of cultivation in the area are wheat, corn, rice, fruit trees. The cultivation of sugar beets historically played an important role for the industrial development and for the well-being of local communities, because lots of sugar factories spread across the Po valley, until the application of EU Community Agricultural Policies and the introduction of “sugar quotas” allocated among Member States for its production. From that moment, most of the sugar factories have shut down and, at the moment, only two sugar factories are still producing in the territorial case study area: Minerbio (in Emilia-Romagna) and Pontelongo (in Veneto).

The functioning of the agricultural landscape lies on a balanced irrigation system across fields, mostly dating back to the Roman empire, consisting of a fine and dense network of water channels, which, towards the Eastern areas of the Po delta and of the Comacchio lagoons, also works as a massive drainage system to

permit cultivation in otherwise wetland areas.
Protected areas belonging to Natura 2000 network for the preservation of fragile habitats and natural environments have a remarkable importance and extension in our territorial case study and, actually, they mostly cover the whole Adriatic sea coasts, from the Venetian lagoon to Cervia salt pans, passing through the Po Delta natural Park and the Comacchio valleys.
Going inland, the banks of the river Po are also part of the Natura 2000 network as reserves of great biodiversity to be protected, as well as the Euganean hills and others pre-Apennine and pre-Alpine areas are.
Some important industrial polarizations are situated in the outskirts of the major urban centres, mostly organized around highly specialized industrial districts consisting of several small-medium enterprises rather than few international corporates. Without mentioning again the important industrial sites previously explored in Porto Marghera (Venice), Padua and Ravenna, other internationally renowned industrial excellences are distributed throughout the territory and can be described as follows:

- in the province of Modena, automotive, biomedical and ceramics industries have been for decades the driving forces supporting the economy in the secondary local sector;
- industrial districts in Bologna area are specialized in mechanical engineering and electromechanical industry;
- near Verona, marble processing, agro-food and footwear industries are certainly the most important sectors.

Othes decentralized and diffuses industrial platforms, principally constituted by small-medium enterprises, scatter the agricultural landscape and play an important role in the economic development of the north-eastern Italian territories, specially in the central Veneto region where, as seen in part III of this research, they have generated a very specific extensive use of a low-dense and polycentric city-territory.

Thanks to a holistic vision which promote the exponential effects of creating a synergic diffused energy network, each of the above mentioned territorial features could participate in making economically bearable the transition towards the planning of our *energy landscapes*.
It is noteworthy to point out that this research does not want to invent new methods for energy production, as it is not an engineering research. It wants to reflect on the role of architects in the field of energy transition and how they can integrate their competences in the process of imagining, describing and designing the programme and the morphology of energy landscapes.

up-sourcing: fossil fuel meshes as green energy backbones for energy landscapes

The potential of fossil fuel meshes lies in their physical and functional connections among upstream, midstream and downstream infrastructure, which crosses far and different territories. In this sense, their new narrative could see their traditional centralizing role of the energy industry completely overturned and they could rediscover themselves as a support for a process of democratization of energy production and distribution that could also have significant environmental benefits.

Fossil fuel infrastructure must now compensate for the imbalances generated by the indiscriminate exploitation of non-renewable natural resources during the second industrial revolution and return to territories and communities what they have taken, not in material terms, since it is not possible, but in terms of a sustainable local development based on socio-ecological values.

This is the reason why we would like to propose the narrative of **up-sourcing** as a plausible scenario for reinventing their territorial role in the light of the third industrial revolution.

As seen in part I, **up-sourcing** is a neologism that refers to some theoretical inspirations of the recent sector literature that can be summarized as follows:

- *upcycling* notion;
- *re-wiring* scale;
- rejects as *new sources*;
- re-cycle's inversion between *figure and background*.

In the framework of an economy that is still heavily dependent on fossil fuels, we must try to interpret its main environmental problem, namely CO_2 emissions, as a condition to valorize by making it a new source for innovative production processes or services, whether related to energy or not.

Thus, fossil fuel meshes could be thought as territorial energetic backbones for the CO_2 recovery and H_2 storage to which the other distributed territorial energetic networks could hook up.

In the light of the excursus conducted in part III among EU-funded research and projects in the field of technical innovation in energy production, we can think that CO_2 recovery network should rely on the existing oil mesh, whilst H_2 storage network would mainly work on natural gas infrastructure.

CO_2 feeders and CO_2 eaters

Carbon dioxide recovery must be fed by activities producing CO_2 emissions, as downstream oil activities are (refineries and petrochemical sites). The extremely diverse situation of the state of use of downstream sites in the area of the north-eastern Po Valley suggests a further step in the reflection: those refineries and petrochemical plants still in operation could play the role of *CO_2 feeders*, while the dismissed ones could be considered as *CO_2 eaters*. The main technological improvement neede to make the synergic functioning between *feeders* and *eaters*

effective should be the use of *Carbon Capture and Use (CCU)* technology.
Carbon dioxide can be intercepted by exhaust industrial fumes, purified and stabilized in a supercritical stage and then conveyed to the "digester" site through the use of the former oil pipeline. In this way, it will be necessary to set up activities capable of absorbing large quantities of CO_2 on the receiving site and thus contributing to emissions reduction through a process of valorization of industrial rejects as new sources, precisely, through an **up-sourcing** process.
It is well known that plants devour large amounts of carbon dioxide during the photosynthesis process. In particular, in algae the absorption of large amounts of carbon dioxide speeds up the process of biomass growth.

Algae for energy purposes is a fairly recent field of research, but their cultivation in closed phobioreactors pumped with carbon dioxide seems to be a promising technology. In addition, the cultivation of algae in photobioreactors made of translucent tubes can also have a vertical development and therefore be conceived as an architectural distinctive element for the treatment of facades, without competing with agricultural cultivation for the food industry.
Hydroponics cultivations in greenhouses, even though they are less efficient in terms of carbon dioxide absorption, can also be considered as CO_2 eaters activities that could also integrate a R&D programme in the field of agriculture for energy or food purposes.

In our specific territorial case study, the still operational refineries, petrochemical sites and thermal power plants situated in Ravenna, Porto Marghera, Sermide and Ostiglia could play the role, in the medium term, of CO_2 feeders for those algae and hydroponic cultivation sites which could reconvert the shut down sites of Polesine Camerini power plant, Mantua refinery and the partially dismissed petrochemical site in Ferrara.
It is clear that the energy transition wonders to substitute every fossil fuels' industrial use in the long term, thus a conversion of still operational downstream sites towards a *bio-based industry* is absolutely desirable. Bio-refineries and bio-chemical sites are slowly appearing in the industrial scene and they could take advantage of a circular industrial production.
We can also imagine that other residual territories could be suitable to set up algae intensive cultivations in photobioreactors, even if they don't lie in ancient oil infrastructure sites. The possibility to feed these additional sites with carbon dioxide would be foreseeable if they were connected to our energy backbones, probably requiring the construction of additional CO_2 pipeline branches.

hydrogen landscapes

Hydrogen storage technology is considered a necessary step to implement a massive renewable energetic transition (Rifkin, 2011). It could solve the renewable energy intermittent storage because, through hydrolysis process, it can be transformed in oxygen and hydrogen. As already explored in part III, *NaturalHY* EU-funded project (FP6-2002-SUSTDEV-ENERGY) focused on the possibility to transfer hydrogen through the existing gas pipelines network. The results of the research confirm the feasibility of the proposed solution, thus a hydrogen quota can be mixed with the natural gas flowing in the national gas grid. The separation of hydrogen from natural gas will be realized in apposite processing units, which will transform the separated hydrogen into electricity. Other research demonstrates that exhausted gas fields are suitable natural containers where to stock hydrogen. Thus, the depleted gas fields in Emilia-Romagna are suitable as natural storage sites of that renewable intermittent electricity under the form of hydrogen. When needed, processing units will demand for hydrogen through natural gas pipelines and they will reconvert it in electric energy to be distributed through the national grid.

hidden electricity landscapes

The territory hides other sources of electricity production that have not yet been used. Let us now consider which are the other territorial opportunities due to the metropolization phenomenon to produce renewable electric energy and feed the storage hydrogen network.

The most commonly known are solar, wind and hydroelectric energies.

As regards to wind energy, the Po Valley is not the suitable location to set up wind turbines due tolack of strong and constant winds.

At the same time, the Adriatic coast, where stronger winds could be found, is not an appropriate site because, as seen, it is almost entirely considered a protected natural area due to its very fragile and unique eco-systems.

Solar energy from photovoltaic panels has long been deepened and improved in recent decades, making it competitive on the energy scene.

The applications are known and do not deserve further study. The only consideration we can make is that, in addition to widespread applications on the residential property stock of private individuals, solar energy could find important applications in industrial areas, thus trying to optimize waterproof surfaces for energy purposes. Nothing new if we think about the solar energy potential of industrial facades, roofs, parking areas and street guard rails.

Although hydropower production is regarded as a form of renewable energy, it is often associated with large centralized power generation sites that require major infrastructure investments and that disrupt entire ecosystems and landscapes by altering the course of rivers and flooding entire portions of land.

Recently, micro-hydroelectric power technology is trying to make electricity production more democratic and less invasive. The wide diffusion of a dense network of water channels for irrigation and drainage for agricultural purposes is a peculiar characteristic of our territorial case study from the time of the Romans and could represent a source of distributed energy production if conceived as a support for the integration of a large amount of micro-hydroelectric turbines (Tavola, 2013) that could hook up to the hydrogen grid and store the large amount of energy produced in the form of innumerable small contributions.

There is another electric energy potential source we want to talk about which results to be hidden in our territorial case study. The diffusion of a wide and isotropic mesh of railway infrastructure make territories quite well connected at the local, regional and national scale, except for the eastern Po delta area. The quite homogeneous accessibility to railway services is made explicit by the presence of a remarkable number of railway stations on the territory, to which a considerable number of train transitions is also associated (according to the importance and connection frequency of the railway station). Trains are carriers of a big amount of kinetic energy and during their braking phase, especially when they enter in railway stations, they dissipate a lot of energy in the form of heat generated by the friction of the brakes on the rails. Some condensers could collect the heat and transform it into electric energy. This amount of electricity could first be reused for the energy demand of railway operations and the residual part could be stored as hydrogen. Experiments are already taking place in some London Metro stations, such as Victoria Station one[1], and demonstrate that it is possible to recover 1MWh per day[2].

heat recovery landscapes

There is another spatial and energetic synergy which deserves to be mentioned across our analysis among hidden territorial energetic potential.

A distinctive feature of all industrial areas, beyond their type of production, is the treatment of external surfaces with impermeable materials, such as asphalt, over huge surfaces. Heat islands and sewage floods are common problems of a modernist single-use zoning model. Rainwaters and residual heat released from impermeable surfaces could be thought in order to be combined in a unique integrated system for heat production. A good management of rainwaters recovery, which could be part of a larger industrial landscape design, could collect large quantities of water and convey them in a closed fluid circulation system immersed in the bituminous surfaces of industrial streets, so as to absorb the accumulated heat through flowing water. The beneficial effects would be cooling down road surfaces, so making less aggressive heat islands, and collecting hot water to be used for industrial, agricultural or civic purposes.

1 http://www.alstom.com/press-centre/2013/5/alstom-to-supply-ground-braking-energy-recovery-system-for-london-underground/

2 https://www.sciencealert.com/london-is-now-recycling-energy-from-train-brakes-to-power-their-stations

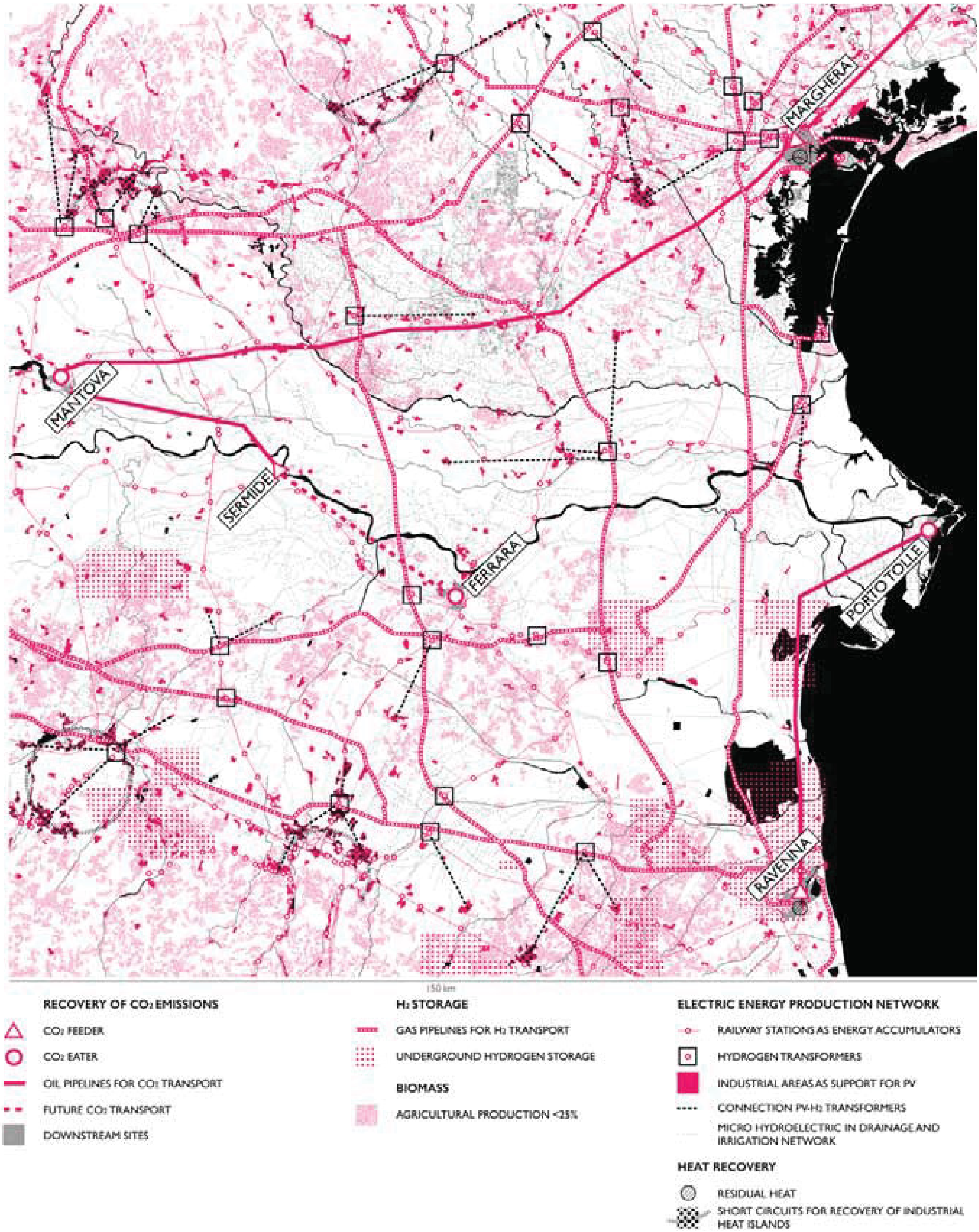


Fig. 196 Energy landscapes (source: Corine Land Cover, Diva-GIS; elaborated by the author)

PART V

OILAND**SCAPES**

Not only energy landscapes

coupling socio-ecological dimensions to a mesh case study

The new narrative of our fossil fuel infrastructure as *green energy backbones* capable of "up-sourcing" the industrial emissions for a high environemntal value added cannot stop at a supporting responsibility for the supply of territorial distributed renewable energies. As mentioned in the previous parts, new urban and architectural scenarios of reconversion of the "cathedrals of the modernity" (Branzi, 2006) are tightly related to the socio-ecological re-signification of existing fossil fuel meshes, thus making our *green energy backbones* as the articulators among different design scales (territorial, urban and architectural one).

New synergies with social inclusive activities, resulting from existing territorial vocations based on established local historical and cultural values, must be sought in order to enhance the creation of new green job opportunities in an economic depressed area.
In order to test a research methodology that can lead to the above-mentioned objective, the research is forced to restrict the perimeter of the analysis to the *mesh case study* between the oil downstream and storage site of the port of Ravenna and the Polesine Camerini thermal power plant.
If the Ravenna site, being still operational, will be considered the CO_2 feeder of the system, it is for the dismissed site of Polesine Camerini that it will be necessary to conduct an in-depth analysis of its surrounding territorial context in order to understand strengths, weaknesses and territorial vocations on which to set up a programme of activities with marked socio-ecological values that can be integrated into the *green energy backbones* narrative.

Fig. 197 The territorial context of the Polesine Camerini thermal power plant (source: Google Earth; elaborated by the author)

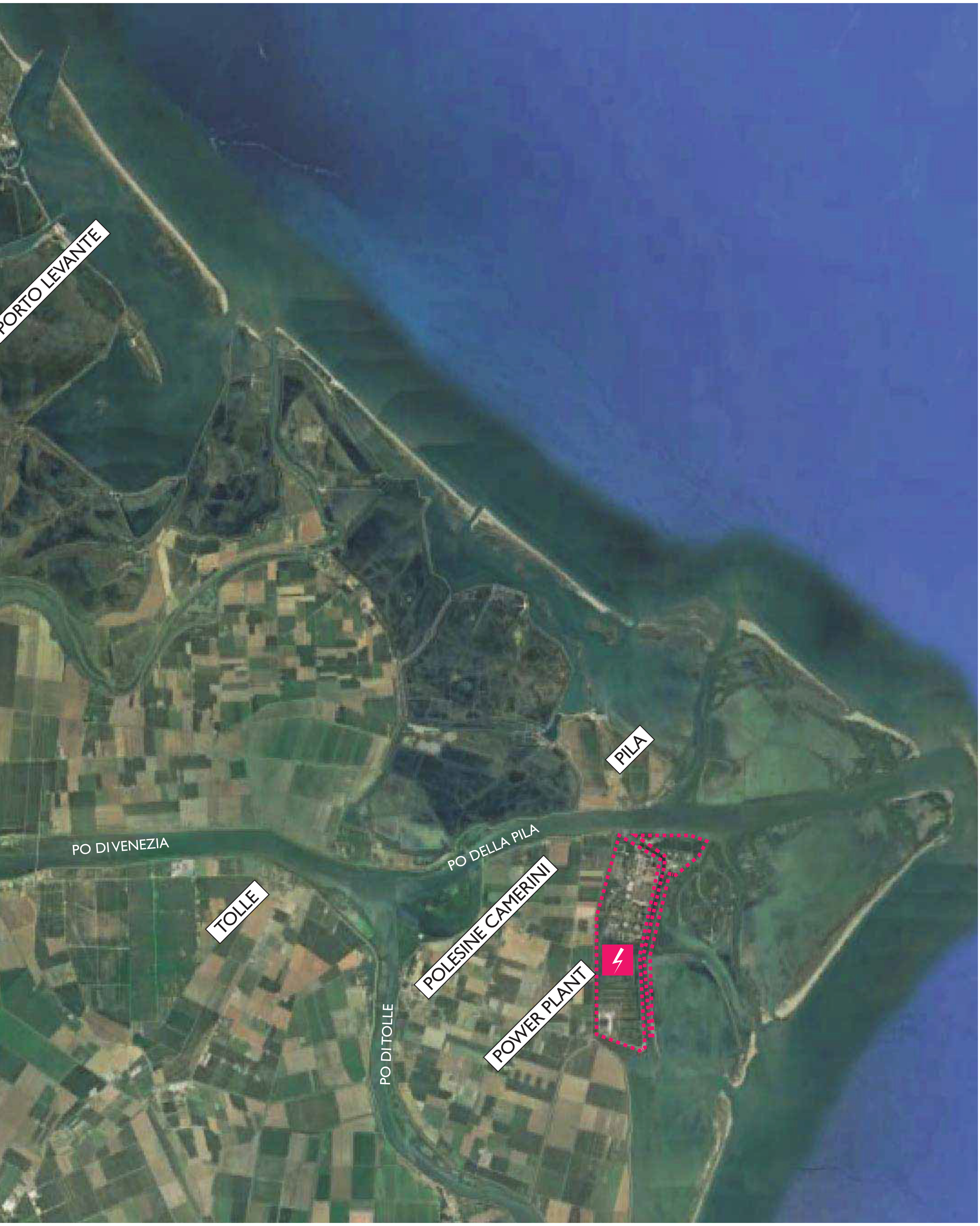

PORTO LEVANTE
PILA
PO DI VENEZIA
PO DELLA PILA
TOLLE
POLESINE CAMERINI
POWER PLANT
PO DI TOLLE

Fig. 198 Polesine Camerini thermal power plant site (source: Google Earth; elaborated by the author)

Polesine Camerini power plant site

general information about Polesine Camerini and the thermal power plant

The selected *site case study* is situated in the municipality of Porto Tolle (in the province of Rovigo - Veneto region), specifically in the locality of Polesine Camerini. The power plant site occupies 380 hectares and lies on the Po delta river, a territory characterized by a high degree of biodiversity.
The thermal power plant rises on the right side of the Pila Po river, 14 km far from the centre of Porto Tolle and quite distant from the main regional and national roads (approximately 25 km).
The site is composed of:

- an area covered with the power plant and oil tanks in the northern part;
- a natural area in the southern part with also a portion affected as nursery plants in commodatum;
- some entirely or partially submerged areas on the eastern coast of the river delta. This portion consists of particularly fragile areas environmentally speaking, which are submitted to rigorous protections and restrictions by urban planning instruments;
- three woody relevant portions are also reckoned within the site.

Polesine Camerini power plant site is surrounded by cultivated fields, Natura 2000 areas (some of which are reckoned inside our case study area), the Pila Po and the Tolle Po rivers together with the sea which completes the whole scenery. As far as cultural heritage is concerned, on Polesine Camerini island it is possible to appreciate Palazzo Camerini, the residence of Camerini family (at that time owner of the most of the island) built during the second half of the XIX century and some typical valley houses. Near the area, an offshore LNG terminal stands in front of Porto Levante, in Porto Viro municipality (in the province of Rovigo).
The project to settle a thermal power plant in the very middle of the Po delta river dates back to the end of the 1960s (Caldiron, 2013). In 1969, Enel proposed to realize one of the biggest thermal power plant in Europe in that poor and sparsely populated territory, but very rich in water, normally called Polesine[1]. Enel pledged to support a civil, economic and social local development of Polesine region in exchange for a substantial variation in the ecological and landscape structure of the Po delta river. Due to the economic depression and the underdevelopment of the area, local authorities could not refuse that opportunity which would have created several jobs, but they completely neglected the subsequent environmental and health risks.

1 *Polesine* is an historical and geographical region of north-eastern Italy whose identification has undergone variations over the centuries. From a geographic point of view, Polesine is the territory situated between the lower course of the Adige and Po rivers up to the Adriatic sea which defines the eastern border. The Valli Grandi Veronesi close the Polesine to the West. Polesine territory appears as a narrow and long tongue of land ending with the Po Delta river which is characterized by a huge presence of watercourses and of historic roads slightly raised compared to the surrounding countryside.

The thermal power plant started to produce electric power in 1980 from four steam-thermoelectric units (2'640 MW), the last one of which was activated in January 1984.
Oil coming from Enel oil deposit, situated in Ravenna harbour, by a 90 km underground pipeline fueled power plant's boilers.
Until the end of the 1990s this thermal power plant significantly contributed to the national energy power production (10-15 billion of kWh per year, equal to 10% of the yearly total). In the 2000s the production of energy slowed down until it was stopped in 2009. The plant, first, was declared in standby, looking forward to a possible coal reconversion in 2003. Then, lacking the finalization of the administrative procedure and changing the energetic scenario, at the beginning of 2015 Polesine Camerini power plant definitely ceased its activities. The dismantling of the principal components of the generators is still carried out, and some of those components have been transferred to other power plants. The four thermoelectric unit stand on an artificial relief (3 m above sea level), and insisting on foundation piles. All around the area of the power plant, banks (4,5 m above sea level) were built to protect the area from the Adriatic Sea storms and from the potential flooding of the Po river.

territorial infrastructure and accessibility to the site

The area of the power plant can be reached thanks to some local roads connected to the Provincial Road SP38. The principal road axis, the SS309 Romea, is situated 25 km far from the site. It is the only primary road in proximity of Po delta river and it crosses from north to south the Adriatic coastal arc, connecting Mestre to Ravenna (127 km). SS309 Romea runs through some of the most fragile protected areas of the Po delta valley, so generating a clear cut in the delicate ecosystem. Romea is also unfortunately known as the most dangerous road in Italy, with 8% of fatal accidents, a percentage that turns out to be double than the national average (Istat, 2013)[2]. For decades the project of connecting Mestre to Orte (Viterbo) by a new motorway passing through Ravenna, by realizing the E55-New Romea more to the west, has been debated, and it could result a very interesting factor for the Polesine Camerini site because it would improve the accessibility of the region. The New Romea axis would be connected to an another east-west future motorway branch, the Nogara – Mare Adriatico, a route that is expected to go from Nogara (Verona) to Adria (Rovigo). At the moment, the nearest national motorway axis is the A13 Bologna-Padova whose closest motorway entry is about 70 km tomthe west west, a few kilometers from Rovigo. The easternmost part of Polesine sub-region is very poor in rail infrastructure and beyond the Romea there is absolutely no trace of railways. The principal national railway axis towards Venice stops at Rovigo railway station, and from

2 ISTAT (2013). *L'incidentalità nelle regioni d'Italia. Anno 2013.* Roma: Istat.

here a non-electrified double-track railway axis begins, crossing the SS309 Romea in Adria, from where it will follow in parallel its path until Chioggia.
In the province of Ferrara in Emilia-Romagna, the Romea intersects another secondary railway in Pomposa, the easternmost arrival of the Ferrara-Codigoro rail track located just on the edge of the Natural Reserve of the Po delta valley. A project to connect the two railway branches through a north-south branch from Adria to Comacchio, passing through Codigoro and parallel to the New Romea, is foreseen by Rovigo and Ferrara provincial planning tools (PTCP of Ferrara in force since 1997 and PTCP of Rovigo in force since 2012).

Waterways represent an important access mode to the area. Some improvements to the navigability of the Po river are planned to make Piacenza-Chioggia fully navigable by class V-boats according to the European standard[3]. Moreover, Tartaro-Fissero-Canal Bianco waterway allows to connect the Mincio River in Mantua to Po river in Porto Viro, where the waterway connects to the system of a secondary Po navigable waters (Brondolo Po in the direction of Chioggia and Levante Po towards Porto Levante). As far as logistics, the area is not equipped with a sufficient infrastructure, being present only two logistic poles: a commercial port in Chioggia and a multimodal interport in Rovigo, lying on Canal Bianco. On the contrary, the Po delta is full of small touristic and fishing harbours towards the Adriatic coasts (Albarella, Porto Levante, Pila, Scardovari, Porto Barricata, Goro, Gorino), but only an inland river harbour in Porto Viro is situated in proximity of the junction between Po and Canal Bianco waterway.

Fig. 199 The navigability network of the Po valley (source: Il giornale del Po)

3 Visentini, I. (2017). Il Po diventa navigabile da Piacenza a Chioggia, ma la logistica latita. *Il sole 24 ore*. [online] 4th February. Available from: http://www.ilsole24ore.com/art/impresa-e-territori/2017-02-03/il-po-diventa-navigabile-piacenza-chioggia-ma-logistica-latita-164900.shtml?uuid=AEMT2kN.. [Accessed: 19th August 2017]

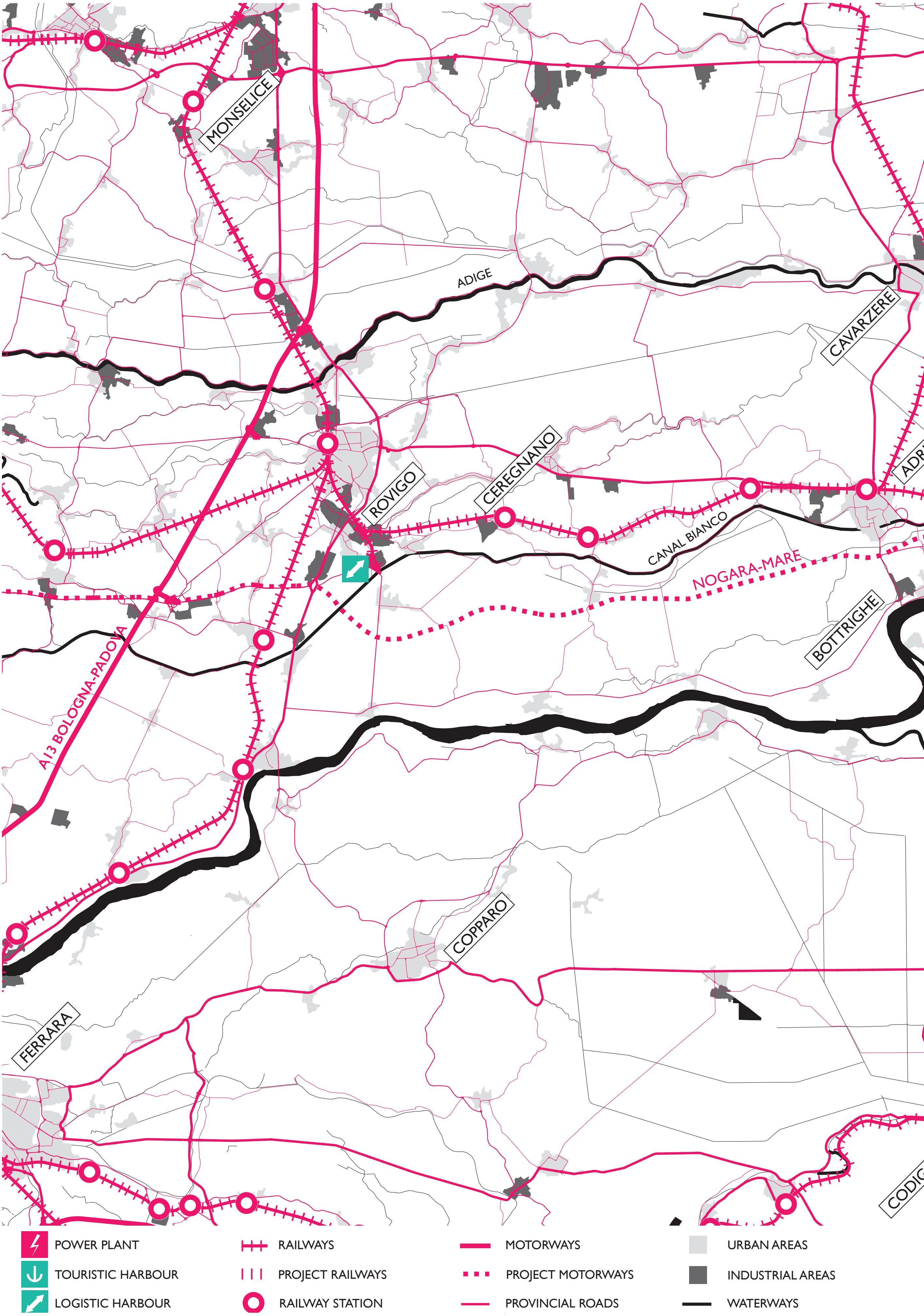

MONSELICE
ADIGE
CAVARZERE
CEREGNANO
ROVIGO
CANAL BIANCO
NOGARA-MARE
A13 BOLOGNA-PADOVA
BOTTRIGHE
COPPARO
FERRARA
POWER PLANT
TOURISTIC HARBOUR
LOGISTIC HARBOUR
RAILWAYS
PROJECT RAILWAYS
RAILWAY STATION
MOTORWAYS
PROJECT MOTORWAYS
PROVINCIAL ROADS
URBAN AREAS
INDUSTRIAL AREAS
WATERWAYS

Fig. 200 Accessibility to Polesine Camerini thermal power plant site (source: Corine Land Cover; Diva-GIS, PTCP of Rovigo-2012, PTCP of Ferrara-1997; elaborated by the author)

naturalistic and cultural heritage

The territory of the Po delta covers an area of about 700 km^2 and spreads in Veneto and Emilia Romagna regions, in three different provinces (Rovigo, Ferrara and Ravenna). It is worldwide recognized as an area of great interest from a naturalistic and environmental point of view. As to protect the Delta natural landscape, two Park Institutions have been created, both influencing the territories of several municipalities. At present, it doesn't exist a coordinated planning system of the parks between the two regions, nevertheless UNESCO in 2015 has recognized the whole area of the Po Delta river as *Biosphere Reserve*, in the framework of the *Man and Biosphere Programme* (Quaglia et al., 2011).
The evolution of the Po delta was shaped both by men's intervention and by climate and alluvial factors. Among natural principal events, we can reckon:

- the *rotta di Ficarolo* (1152), when the course of the Po river was deviated towards north-east, moving the principal delta from Ravenna to Rovigo province;
- the appearance of the Venice Po and its subdivision into two branches (Quaglia et al., 2011).

Along the centuries, those two branches have given birth to two further deltas, that is to say the *Sacca di Goro* and *Sacca di Scardovari* inlets.
What is known as the *Taglio di Porto Viro* was carried out in XVII century by Venetian people and stands as the most important hydraulic intervention for the anthropic development of the Po delta. Afterwards, in 1882, after the *Baccarin law*, which gave way to large public land reclamation works, some deltaic territories were drained thanks to the use of water pumping stations. At present the Regional Museum of Land Reclamation is lodged in Ca' Vendramin (an important water pumping station dismissed at the end of the 1960s).
Now the Po delta territories consists of a *historical Delta* (principally set in Ferrara and Ravenna provinces) and a *modern Delta*, principally lying in Rovigo province. One of the main characteristics of those deltaic territories is that topographic quotes are lower or very proximal to the sea level, and higher reliefs are some dunes which reach 4 m high and represent a natural defense from the sea floods.

The landscape of the Po Delta is characterized by a great changeability and evolutivity, due to the constant interaction among the sea, the river and the land. The Po delta mainly consists of reclaimed plains devoted to agricultural activities, apart from a complex system of humid zones, intermingled with small woods and minor settlements (Quaglia et al., 2011).
The last part of the Po riverbed, because of the reduced depth, gives birth to a marshy landscape with numerous environmental systems such as reed canes, brackish valleys, coastal dunes, lagoons, etc. All those different eco-systems host lots of different flora and fauna species, so making the areas part of Nature 2000

areas as *SIC (Sites of Community Interest)* and *ZPS (Zones of Special Protection)*, in accordance with the indications provided on the matter at European Community level within the Birds Directives (09/147/CE) and Habitat Directives (92/43/CE).

Fig. 201 The Po delta river and the power plant in Polesine Camerini (source: Quaglia)

Fig. 202 Ca' Vendramin water pumping station (source: Quaderni Ca' Vendramin n.0)

Fig. 203 The avifauna of Po delta river (source: Quaglia et al. 2011)

Fig. 204 The natural and anthropic landscapes of Po delta river (source: Quaderni Ca' Vendramin n.2)

gastronomic excellences

Polesine region, rich in water and fertile countryside, is renowned both for agricultural and fish production. In order to give an idea of the abundance of typical local products, we would like to mention the *white garlic* from Polesine (DOP), the *melon* and the *rice* from the Po delta (IGP), the *green salad* from Lusia (IGP), the *chicory* from Chioggia (IGP) and the *pumpkin* from Melara, together with sugar beets, which, in the past, have been a key resource for sugar industry. Among fishy products, it worths to be mentioned the *mussels* from Scardovari (DOP), the *mullets* and *clams farms* and the *eels* from Comacchio valleys.

industrial and productive districts

Major and internationally renowned industrial districts are mainly situated in the provinces of Modena and Ferrara (biomedical, textile and agro-mechanical districts), in the areas of Padua and Verona (thermal baths, furniture, fashion, paper, marbles districts) and in the province of Venice (naval shipyard district).
Nevertheless, the fishing and shellfish farming is renowned to be a peculiarity of Polesine territory and Veneto Region has recognized the *District of Fish Sector of Rovigo Province* within the L.R. 8/2003 as evidence of the organizational capacity of the industry and of the local operators.
The *Bonello fish experimental centre*, located at Porto Tolle, consists of a small fishy valley where some research on new fish species for national aquaculture are conducted, in particular focusing on shrimp production. At Porto Tolle, four fishy valleys have been recognized by PPRA (*Piano Paesaggistico Regionale d'Ambito*): *Valle Ca' Zuliani, Valle San Carlo (or Valle Nova), Valle Ripiego, Valle Chiusa.*

A rare example of excellence in the manufacturing sector in the Polesine area can be described by the the presence of the naval shipyard Visentini, located along the Levante Po branch in Porto Viro and engaged in the construction of large boats for cars and passengers transport.

Fig. 205 Mussel farming in the Sacca di Scardovari (source: Quaderni Ca' Vendramin n.2)

Fig. 206 A typical fishing technique in the Po delta river (source: Quaglia et al. 2011)

Fig. 207 Mussel farming and fishing huts in the Sacca di Scardovari (source: Quaderni Ca' Vendramin n.2)

tourist sector

Tourism is the driving force of the tertiary sector in Polesine area. *Mass* and *slow* tourism are both experienced throughout the territory.

Along the coastline, *mass tourism* represents an important economic factor for those locations that witness exponential population increases during summer months, when territorial mobility and service infrastructure are under pressure due to the congestion phenomena generated by the tourist inflow. In particular, the municipalities that are most interested by these dynamics are Rosolina in the Veneto part of the Po Delta and Comacchio, Ravenna and Cervia in the Emilia-Romagna part. Nevertheless, seaside resorts and art cities of Polesine area have suffered a tourist inflow contraction, due to a growing competition with more remote seaside destinations and to an aggressive building speculation over the last twenty years that has greatly damaged the original natural environment.

The rest of the territory of the Po delta is rather interested by *slow tourism*, which is distributed more regularly throughout the year, but which represents a much smaller phenomenon in terms of tourist attendance quantity, but even of tourist offer on the territory. For *slow tourism,* with the Dgr n. 1033 of August 4th, 2015, Veneto Region means that type of tourism that is capable to valorize and interpret the territory, to appreciate its most specific characteristics, to grasp its environmental peculiarities, to discover its local traditions and habits, so representing a firm point and a clear objective of the regional tourist strategy.

In order to give a structure to this new form of tourism, Veneto and Emilia-Romagna Regions proceeded to identify some routes of landscape and naturalistic interest within the two Po delta parks that can contribute to the spread and improvement of cyclotourism.

The insertion of a qualitative *slow tourism offer* in the tourist proposals of Italian and foreign operators becomes a primary action to pursue in order to look for a sustainable development of the territory based on the promotion, preservation and valorization of the local natural environment.

criticalities and environmental risks

Several are the territorial criticalities which affect Polesine territory, all of them contributing in the worsening of water condition, and they can be listed as below:

- fishing and aquacolture activities, if on the one hand they represent an important economic opportunity for local population, on the other one they constitute an interference in the environmental equilibrium, impoverishing the eco-system;
- the spread of intensive agriculture needs more and more quantities of pesticides and fertilizers, which then go down to main waterways;
- the alteration of watercourses to carry out works for water capture and regulation;
- the phenomenon of subsidence due to water and natural gas extraction

and the consequent erosion of the coasts, which risks to enhance the disappearance of sand dunes and to salinize the whole coastline;

• the rise of the saltwater edge, which has already reached 20 km from the sea and could make unproductive significant agricultural surfaces;

• the realization of an energetic infrastructure of national strategic importance, such as the LNG terminal in the middle of the Adriatic sea, just in front of Porto Viro municipality;

• the pressure of mass tourism settlements on the environmental equilibrium of water;

• the rise of the average level of the Adriatic sea due to climate change, an increase that the most cautious estimates foresee of 15 centimeters by 2100 (Quaglia et al., 2011).

Fig. 208 The evolutivity of the coastal line of Sacca di Scardovari (source: Quaderni Ca' Vendramin n.2)

Multiscalar legal framework

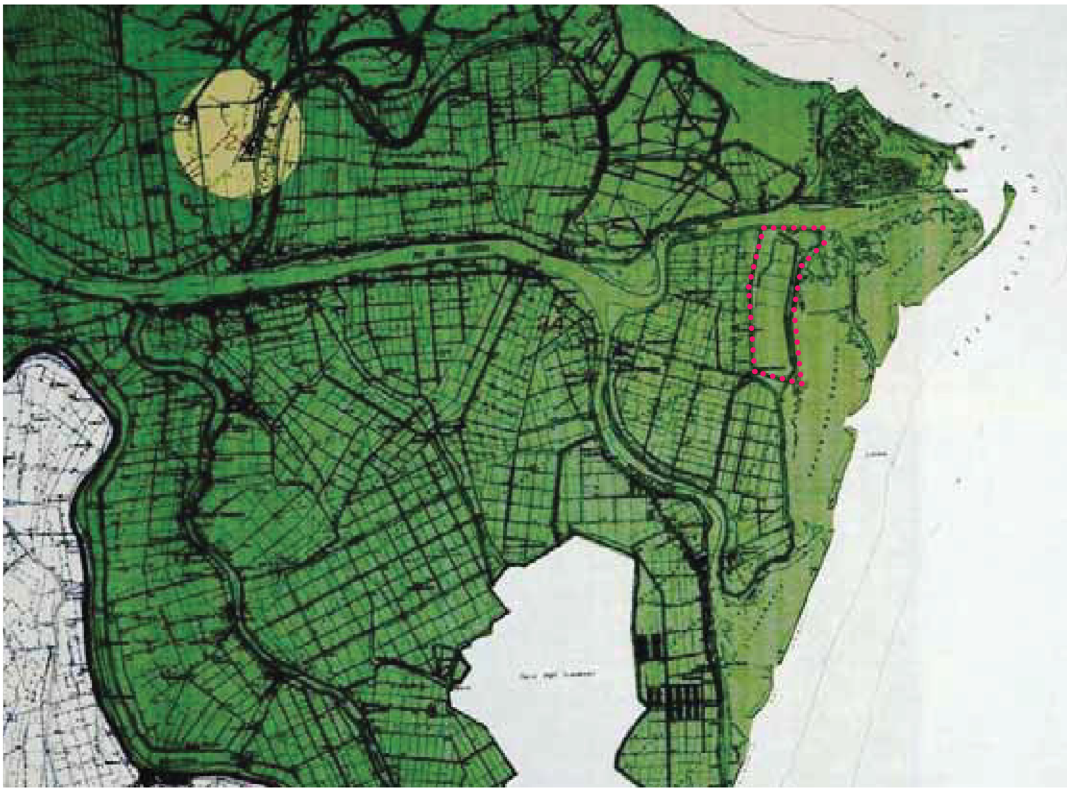
Territorial and environmental technical planning tools result to be different in Veneto and in Emilia-Romagna, and this complicates the division of the responsibilities among the different planning levels (regional, provincial, municipal) for the management of the protected areas of the Po delta and their interregional correlation.
Considering that lots of sites in the Po delta are included among the *Sites of Community Importance (SICs)* and *Special Protection Areas (SPAs)*, which together constitute the European ecologic network *Natura 2000,* it worths to be mentioned that EU Member States undertake to transpose *Habitat Directive (92/43/EEC for the SICs)* and *Birds Directive (79/4096/CEE - 09/147/CE for SPAs)* into *Management Plans* (*Piani di Gestione*), which are meant to be operational tools for the protection of the biodiversity of the site, but also for the whole network, since they regulate land uses in order to make them compatible with the presence of habitats and species in the optimum conditions.
Management plans do not overlap with other planning tools but they principally have the role of *strategic plans*, aiming at coordinating and synergizing the interaction of various institutional actors involved.
Below we will discuss the contents of the main plans of the different levels of territorial planning in the Veneto region.

Regional Territorial Coordination Plan of Veneto Region (1992)

The Regional Territorial Coordination Plan (PTRC) in force was approved in 1992. A new PTRC and a variant were respectively adopted in 2009 and in 2013, but not yet approved.
The PTRC 1992 classifies the entire Po delta, within which Polesine Camerini area, as *Area of Landscape Protection under regional competence* regulated by article 33 of the Technical Standards of the PTRC, which highlights:

- how the main feature of the Park must be constituted by areas of naturalistic-environmental interest, also through the aggregation of interclosed or adjacent agricultural areas. For the latter, agricultural activity must be maintained and properly supported, in a compatible form with Park's objectives;
- that the naturalistic-environmental system is linked to the historical-cultural asset of inner or adjacent areas (historical centres, rural buildings, local know-how, etc.), with the aim of enhancing the use of the Park.

In addition, most of the area is classified as a *coastal zone subject to subsidence,* regulated by art. 11 of the Technical Standards, where Provincial Territorial Plans must consider current and future safety conditions in relation to infrastructure, residential, productive and tourist settlements.



art. 33
Regional Landscape Protection Area of regional competence

Fig. 209 Extract from PTRC, Chart 9.24 - Areas for the establishment of parks, natural, archaeological reserves and landscaping protection areas (source: PTRC, 1992)

art. 11
Coastal zones subject to subsidence

Fig. 210 Excerpt from PTRC, Chart 10 - Historical-cultural values, environmental landscape and landscape conservation areas (source: PTRC, 1992)

Delta Po Area Plan (1994)

The *Delta Po Area Plan (PdA - Piano d'Area del Delta del Po)* is an in-depth tool of the Veneto Regional Coordination Plan (approved in 1994) for those specific areas which require multidisciplinary planning approaches. The *Delta Po Area Plan* consists of a planning tool that oversees local municipalities included within its perimeter (Rosolina, Donada, Taglio di Po, Porto Tolle, Corsola, Ariano del Polesine and part ot the municipalities of Loreo and Papozze). These municipalities will have to adapt their urban planning instruments to the directives, prescriptions and constraints highlighted in the *Piano d'Area*.
Those areas which are included in the *Delta Po Area Plan* are automatically subject to prescriptions foreseen by *Galasso Law n.431/85*[4].
The objective of the *Delta Po Area Plan* is to build the quality of a sustainable development on environmental resources, thus giving a new image of the Po delta that rediscovers the real and historical values of the area:

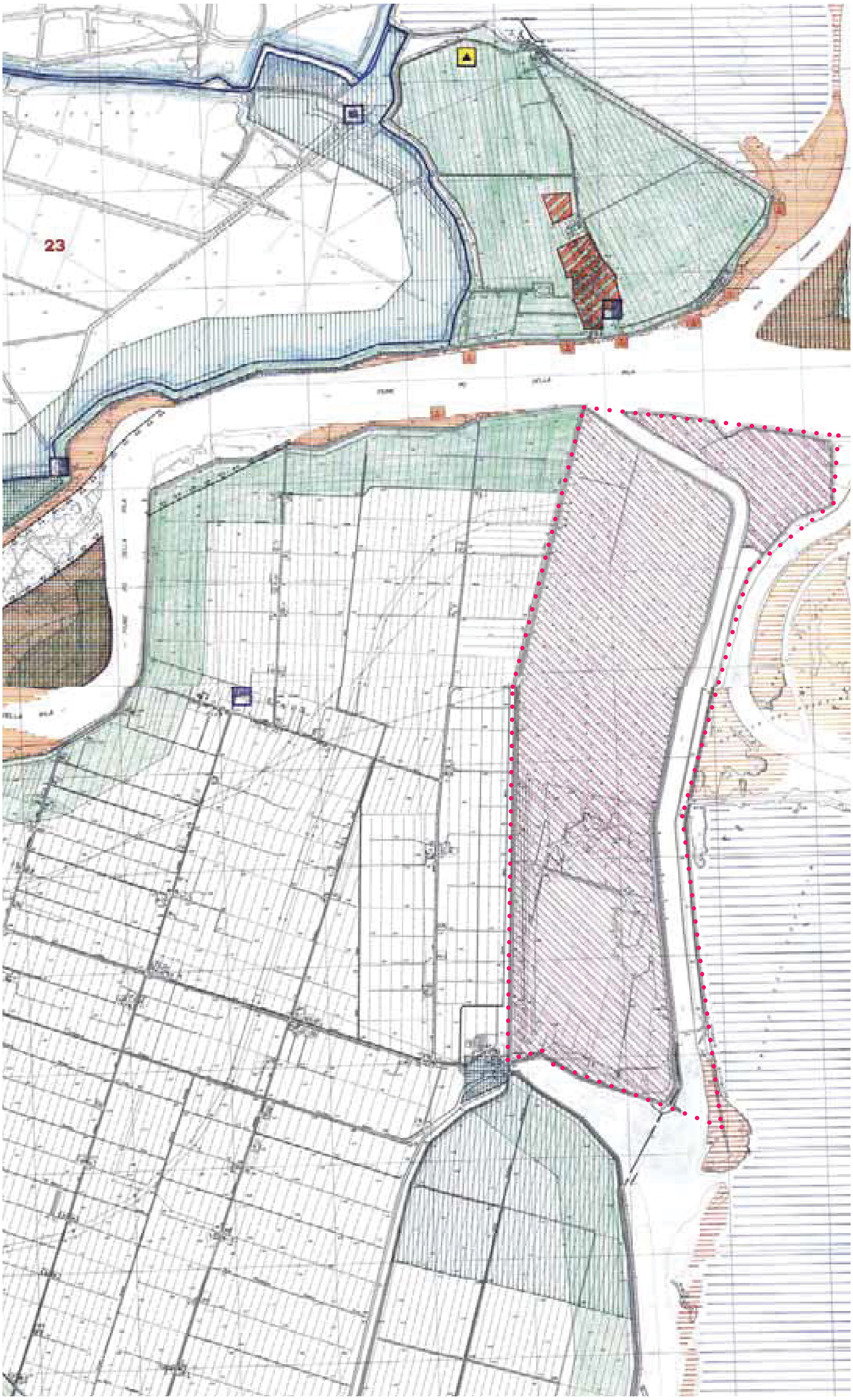
- the lagoon and coastal system;
- the landscape and environmental system;
- the historical heritage system;
- the tourism valorization system;
- the corridor of the SS309 Romea system;
- the settlement and production system;
- the agrarian landscape system.

Most of the power plant area is classified as *Thermal Power Plant Area*, as regulated by article 53 of the Technical Standards, and the following directives must be complied with:

- all the operations necessary to reduce pollution must be planned, even the conversion of fuel, recognizing the importance of the technological value of the plant as an element of land use differentiation;
- agricultural and livestock farming activities that fit into the context are allowed, using resources deriving from the thermoelectric power plant's production processes;
- in order to ensure environmental improvement, production capacity extensions are permitted only if they lead to a reduction in the environmental impact and promote innovative technological solutions.

Other portions of the area are regulated by art. 13 *Delta branches* and art. 15 *Old river bed of the Po river* and it deserves to be remembered that it is possible to create cycling and equestrian routes along the riverbanks.

4 Galasso Law n. 431 of August, 8th 1985 is an Italian law, which introduced some preservation norms on landscape and environmental heritage. It was incorporated, with some amendments, in the Legislative Decree n. 42, on *Code for Cultural and Landscape Heritage, according to the article n.10 of Law n. 137 of July 6th, 2002.*



art. 13
Delta branches

art. 15
Old river bed of the Po river

art. 53
Thermoelectric power plant area

Fig. 211 Excerpt from Delta Po Area Plan, Project Systems and Areas - Chart 2.18 and Chart 2.24 (source: PdA, 1994)

Provincial Territorial Coordination Plan of Rovigo province (2012)

The *Provincial Territorial Coordination Plan of the province of Rovigo* consists of a general programmation which, in coherence with the regional socio-economic finalities, identifies the objectives, the fundamental elements and prevalent vocations of the territorial structure of the province.
The Provincial Territorial Coordination Plan of the Province of Rovigo has been approved in 2012.
It focuses on the improvement of life quality, keeping in balance natural and economic growth's needs as the driving force around which constructing the socio-economic development of Polesine region.
In this perspective, it becomes important to define Polesine's role in national and European dynamics, trying to get out of localisms and to connect Polesine's productive systems to major European axis. For this reason, the PTCP asserts the necessity to hook the Polesine territory to some of the principal infrastructural European corridors (see Corridor I Berlin-Palermo, Corridor V Lisbon-Kiev). Moreover, the Polesine could represent an outlet to the sea of the Po Valley, thanks to the Po and the Fissero-Tartaro-Canalbianco-Eastern Po navigability and thanks to the functionality of Rovigo and Legnago (Torretta) interports. In this way, the river transport would improve and become essential for a provincial logistic corridor integrated with regional hubs and south-eastern and northern Europe commercial exchanges.

Furthermore, the PTCP defines the strategies for the local economic growth, in respect of those environmental and landscape values that built up the identity of a liveable and dynamic Polesine. The PTCP has a coordination role for the definition of the specific objectives and actions to achieve the vision of the future territorial development of Polesine.
Six are the fields recognized by the PTCP of Rovigo as prior to reach the objectives of liveability, dynamicity and territorial integration stressed above:

- soil defense system;
- mobility and infrastructure system;
- biodiversity system;
- primary sector system;
- production system;
- housing development system.

The concept of liveability is principally connected with the preservation and the development of the environmental excellences, of the local history and culture, together with a widespread and accessible welfare system, while the concept of dynamicity is directly linked with the necessity to build an efficient and productive Polesine region.
The PTCP particularly stresses the importance of the role of agriculture and

tourism, particularly concerned with environmental excellences.
The valorization of those territorial agricultural excellences and of a unique slow tourism offer represent the real potential on which defining the territorial development.

Some thematic cartographies accompany the aims of the PTCP to highlight the territorial systems of the province (i.e environmental, infrastructure, production). We will use these cartographies in order to extrapolate the territorial legal framework to which Polesine region and, more specifically, the adjacent areas to the power station must respond.

Chart 1-3/3 - Constraints and Territorial Planning
The plan classifies the whole area as a *landscape heritage* (subject to restrictions of the Legislative Decree 42/2004[5]) and a large part of the site as an area subject to the protection of the Hydrogeological Plan. Parts of the area are also subject to forest hydrogeological restrictions and are included in the Natura 2000 network as Sites of Community Interest (SIC) and as Zones of Special Protection (ZPS).

Chart 2-3/3 - Territorial fragility
The thematic plan explores the principal environmental risks of the Rovigo province, which include the power plant in Polesine Camerini and some areas which are subject to subsidence phenomenon.

5 DL 42/2004 is the Italian Cultural and Landscape Heritage Code which has the task of protecting, preserving and enhancing Italy's cultural heritage. The Cultural and Landscape Heritage Code invites Public Administrations to draw up territorial urban planning plans with specific attention to landscape values.

R.D. 3267/1923
Forest hydrogeological boundary

Legislative Decree 42/2004
Landscape heritage

Natura 2000
SIC - Sites of Community Interest

Natura 2000
ZPS - Zones of Special Protection

Superior planning
Area subject to protection of the Hydrogeological Structure Plan

Superior planning
Area for the establishment of parks, natural and archaeological reserves to protect landscapes

Fig. 212 Excerpt from PTCP - Chart 1-3/3 - Constraints and Territorial Planning (source: PTCP, 2012)

Power plant

Relevant subsidence area

Electroduct (132 kV)

Electroduct (380 kV)

Sea defence

Hydrovora

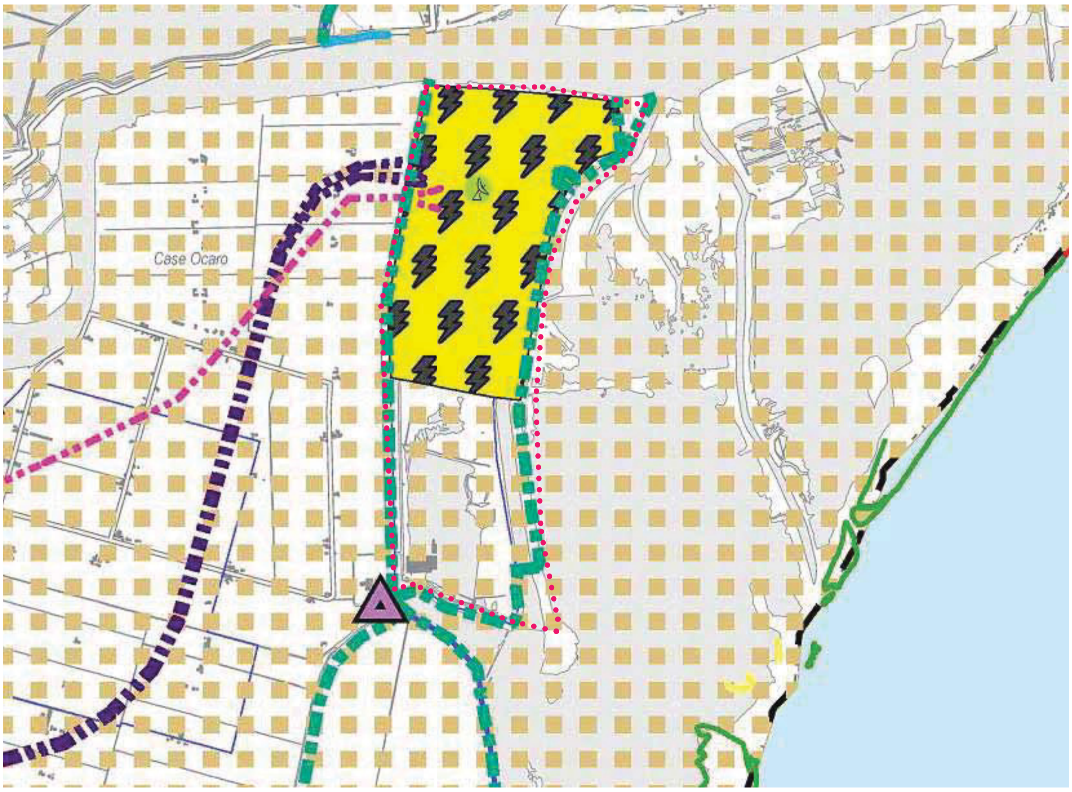


Fig. 213 Excerpt from PTCP - Chart 2-3/3 - Territorial fragility (source: PTCP, 2012)

Chart 2-3/3a - Hydraulic and hydrogeological safety

It identifies the presence of a hydrogeological constraint on part of the area (R. D. 3267/1923) and classifies a large part of the area as an area subject to flooding or water stagnation.

Chart 3-3/3 - Environmental and natural systems

The cartography subdivides natural areas in:

• *core areas*, which are those with the highest biodiversity degree and are recognized at European, national and regional levels. They include Protected Areas, Parks, Reserves, Special Protection Areas, Sites of Community Interest, Special Conservation Areas and Geosites. In the PTCP, core areas are regulated by Article 25 of the Technical Standards, according to which municipalities must regulate core areas through management plans (for Natura 2000 sites), in compliance with higher-level legislation;

• *wooded areas of particular environmental and naturalistic value*, which include those spontaneous wooded areas which grow in the territory, with the exception of Natura 2000 sites. They are regulated by article 27 of the Technical Standards of the PTCP, which states that municipalities have to pursue the protection of these areas and foresee the prohibition to modify their consistency.

• *other wooded areas*.

Flooded or waterlogging areas

Sea defence works

R.D. 3267/1923
hydrogeological restriction

Hydrogeological Structure Plan
A-band / Outflow band of flood

Hydrogeological Structure Plan
B-band / Flooding strip

Hydrogeological Structure Plan
C-band / Flooding area for catastrophic flood

Fig. 214 Excerpt from PTCP - Chart 2-3/3a - Hydraulic and hydrogeological safety (source: PTCP, 2012)

Regional ecological network
Core areas

Wooded areas of particular environmental and naturalistic value

Other wooded areas

Fig. 215 Excerpt from PTCP - Chart 3-3/3 - Environmental and natural system (source: PTCP, 2012)

Chart 4-3/3 - Settlement and infrastructure systems

With regard to the productive pattern, the PTCP classifies the northern part of the area as *power plant* and the southern part as *controlled increase area*. The guidelines for controlled increase areas are indicated in art. 88 of the PTCP: in these areas, only artisanal and small-scale businesses with a low environmental impact are permitted. A cycle path for tourist purposes that surrounds and crosses the site of the power plant is envisaged by the plan.

Chart 5-3/3 - Landscape system

The area is classified as an *area of landscape interest to be protected and enhanced*. A large part of the area also belongs to thosee areas which present *recurrent local architectural typologies*.

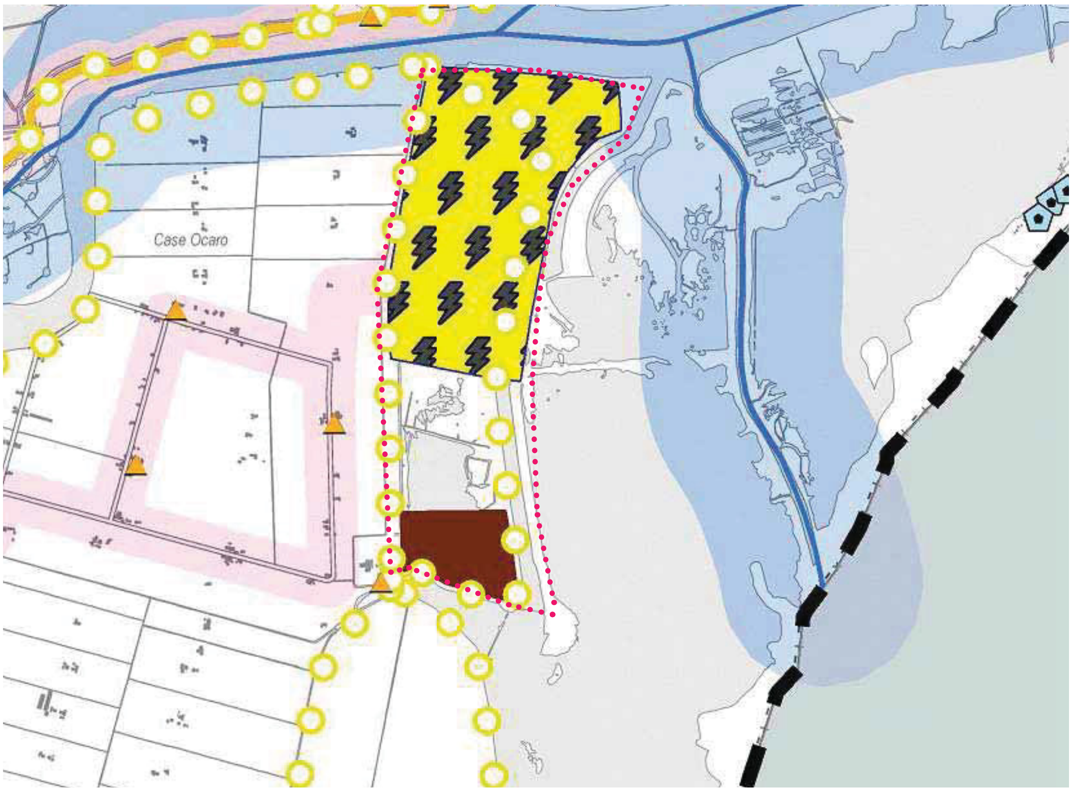


Fig. 216 Excerpt from PTCP - Chart 4-3/3 - Settlement and infrastructure system (source: PTCP, 2012)

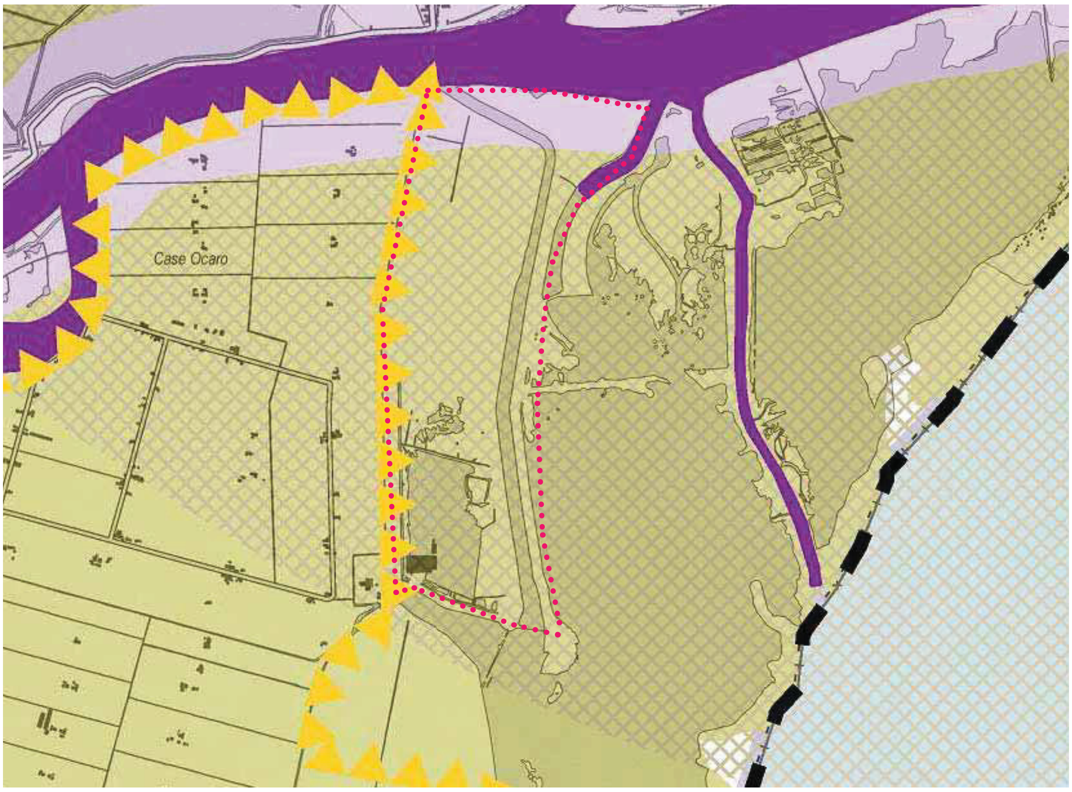


Fig. 217 Excerpt from PTCP - Chart 5-3/3 - Landscape sysem (source: PTCP, 2012)

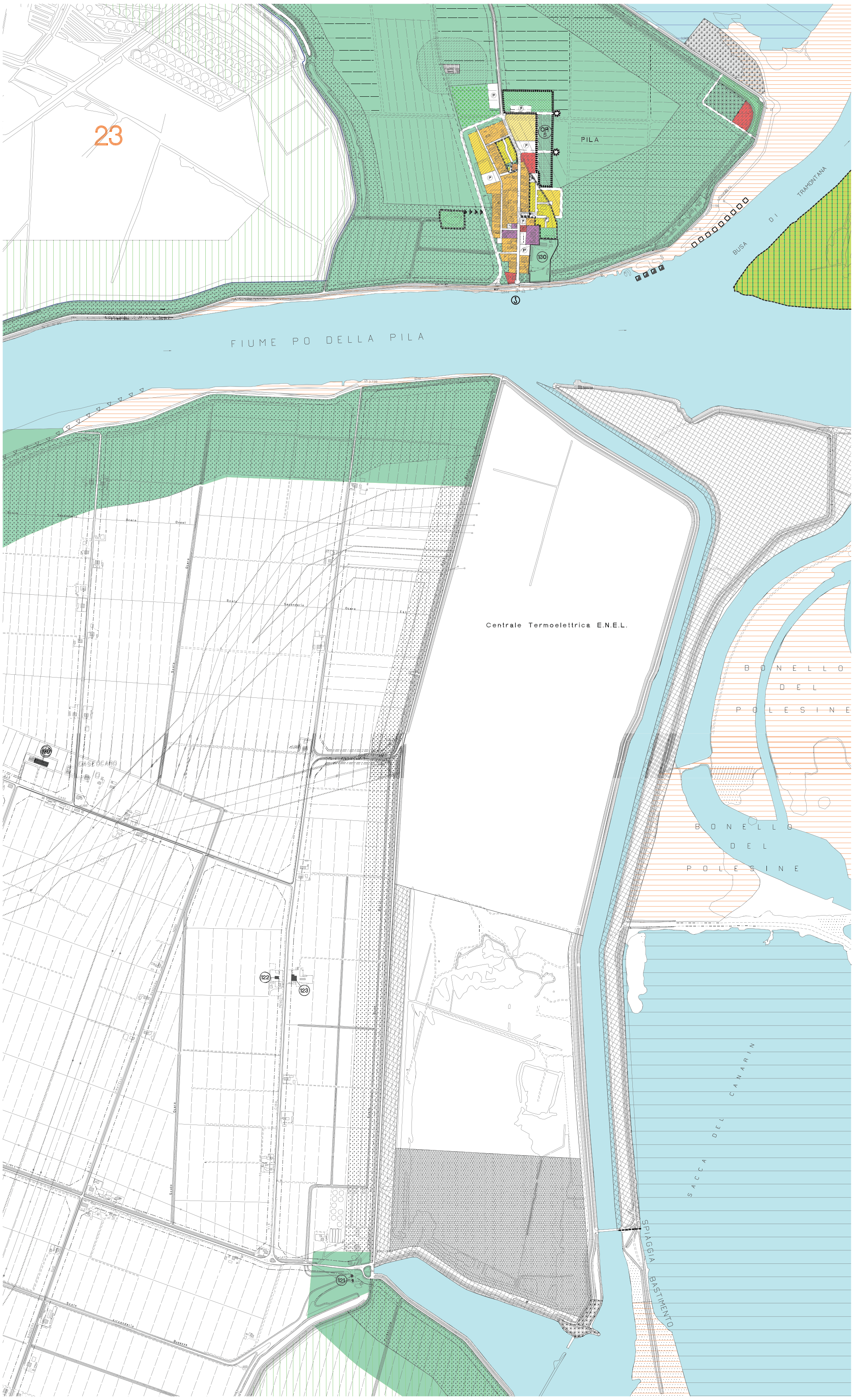
General Regulatory Plan (PRG) of Porto Tolle municipality (2003)

The part of the area in which the power plant is located is currently classified by the PRG as *Zone F4/2 - Equipment for the production of energy*. This classification concerns both the area of the Enel Thermal Power Plant and the area immediately to the east, beyond the water supply channel, where the northern oil storage tanks are located, and are regulated by art. 43 of PRG. This article allows the settlement of agricultural and livestock farming activities within these areas, which have to be compatible with the surrounding environment, including through the use of resources deriving from the production of the power plant. The article envisages the possibility of expanding the plant's production capacity (if required by the National Energy Plan), under the condition that its environmental impact is reduced or innovative technological solutions are implemented. The norm states that the municipality and the competent authorities are required to define the most appropriate operations to reduce the negative impact created by various environmental factors.

The areas within the *Zone RDZ1 - Delta branches* are of particular environmental value and fragility and are regulated by art. 67, according to which the restoration of existing woodland formations and the restoration of riparian vegetation must be encouraged. In addition, along the embankments, the formation of cycle-pedestrian and equestrian paths is allowed, as well as the construction of small services for tourist use and for sport and professional fishing.

The southern part of the area is identified by the PRG (2003) as *Zone D6/1 - Agro-industrial activities*. This area is regulated by art. 32 point a), in which it is stated that this area is intended for the implementation of Enel's programmes for the development of aquaculture and agrithermic activities.

In addition, there is a further area classified as an *agricultural area* which lies between the power plants' area are (zone F4/2) and the agro-industrial one (zone D6/1) and, more specifically, it is identified as *Sub-area E1*.
The regulatory dispositions relating to agricultural areas (zones E) are contained in the specific *Technical Implementation Standards for the protection of agricultural areas*. Sub-areas E1 are dealt with in Article 2, defining them as *valuable areas not because of their productive characteristics but mainly because of their environmental characteristics*. These areas have a particularly well-preserved agricultural landscape, in which we can often observe farms and aquaculture activities. They have to be protected in order to preserve their agricultural-productive features, in particular by prohibiting the construction of new buildings for both residential and agricultural use.



Zone D6/1
Agro-industrial activities

Zone F4/2
Equipment for the production of energy

Zone RDZ1
Delta branches

Zone RDZ2
Old Po riverbed

Zone L2
Bonelli

Fig. 218 Excerpt from PRG - Chart 13.1.16 - 13.1.23 - Zoning (source: PRG, 2003)

Territorial Management Plan (PAT) of Porto Tolle municipality (2012)

The *Territorial Management Plan* (*Piano di Assetto del Territorio*) outlines a complex image of the area where the power plant is located.
The *Chart A.1 - Constraints and Territorial Planning* classifies the entire territory owned by Enel as an *area of considerable public interest*, on which there are some *landscape constraints* (Art. 8 of PAT). Immediately to the south of the power plant area, a zone with a *forest constraint* is located (Art. 10 of PAT). There are additional constraints related to the oil pipelines buffer strips which is regulated by art. 20 of PAT, stating that the protection range corresponds to 8.00 m measured from the pipeline axis on each side. Some areas are classified as Zones of Special Protection and as Sites of Community Interest. Both are subject to the regulations of art. 11 of PAT: for these areas, a specific Management Plan will be prepared as a tool to define the constraints of the different sites.
It can be seen from the *Chart A.3 - Territorial Fragility* that part of the area is subject to hydro-geological instability (*flooded or water stagnation areas*, art. 30), *protection for watercourses* (art. 32) and *river buffer strips* (art. 25), which prohibit the construction of new constructions, as well as any transformation of the existing one that is not compatible with the protection purposes of the PAT.
For Enel properties classified as *flooded or water stagnation areas*, art. 30 specifies that interventions in these areas always require in-depth investigations from a hydro-geological point of view. The article also indicates which interventions are preferable: the construction of underground and basement floors is not recommended, as well as the creation of waterproof external flooring surfaces. On the contrary, the preservation of green areas, the adequate maintenance of water drainage channels, the creation of bicycle or pedestrian paths are recommended.
The *Chart A.4 - Transformability* distinguishes between strategic actions, values and protections. The area in which the power plant is located is classified by the PAT as a *consolidated urbanization area* (art. 34), which stands for substantially completed or planned areas by PRG for residential/productive destination.
The regulation allows the possibility of extending existing buildings or constructing new ones. For *core areas*, art. 46 envisages some constraints aimed at preserving their functionality and environmental qualities. These areas are defined as natural areas from which biological diversity can spread. The *stepping stones*, described in art. 50, are smaller portions of territory than the core areas, which share with them a fundamental function for the local eco-system.
Finally, ATOs are portions of territory with similar geographical, historical, landscape and settlement characteristics. Complex issues can be tackled in these areas with a systemic logic.

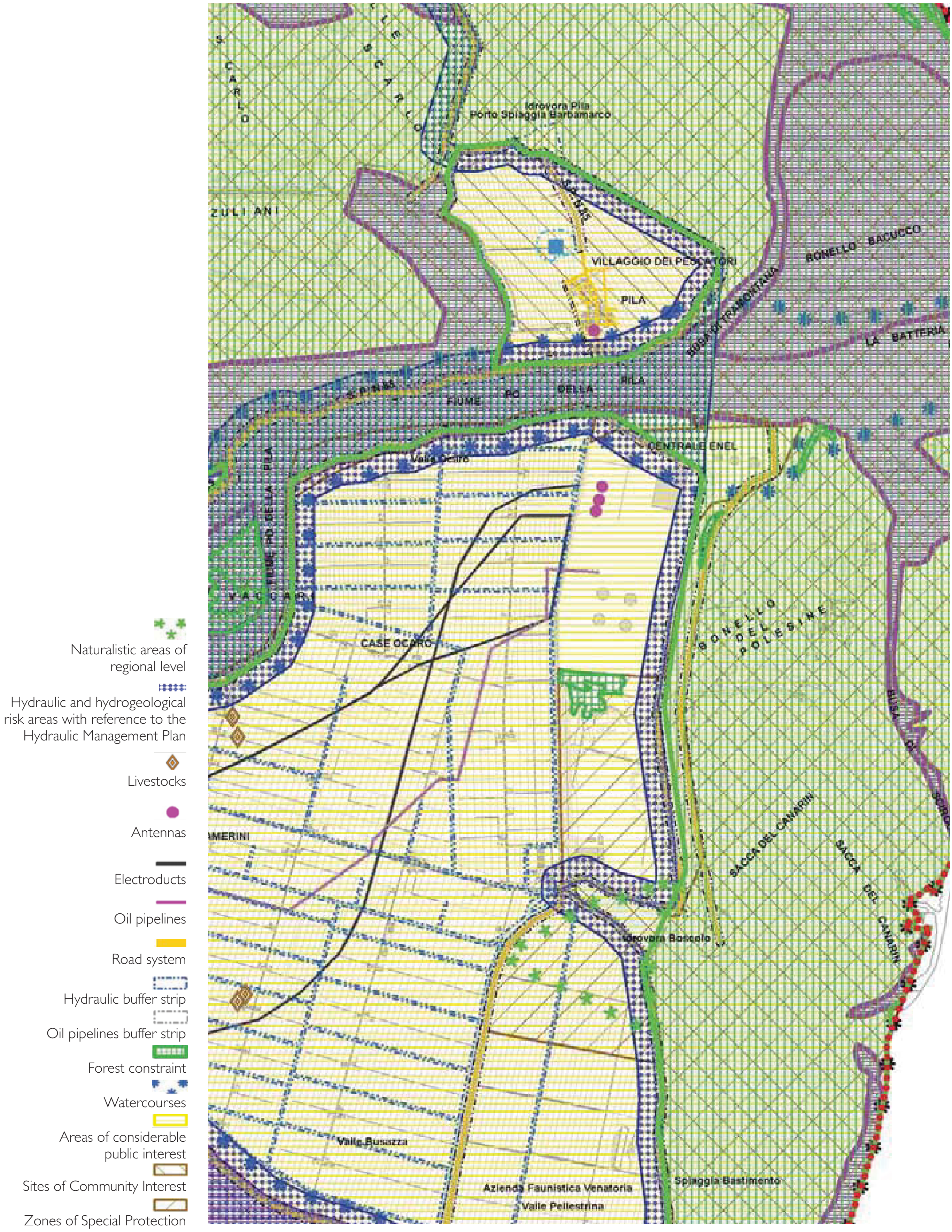
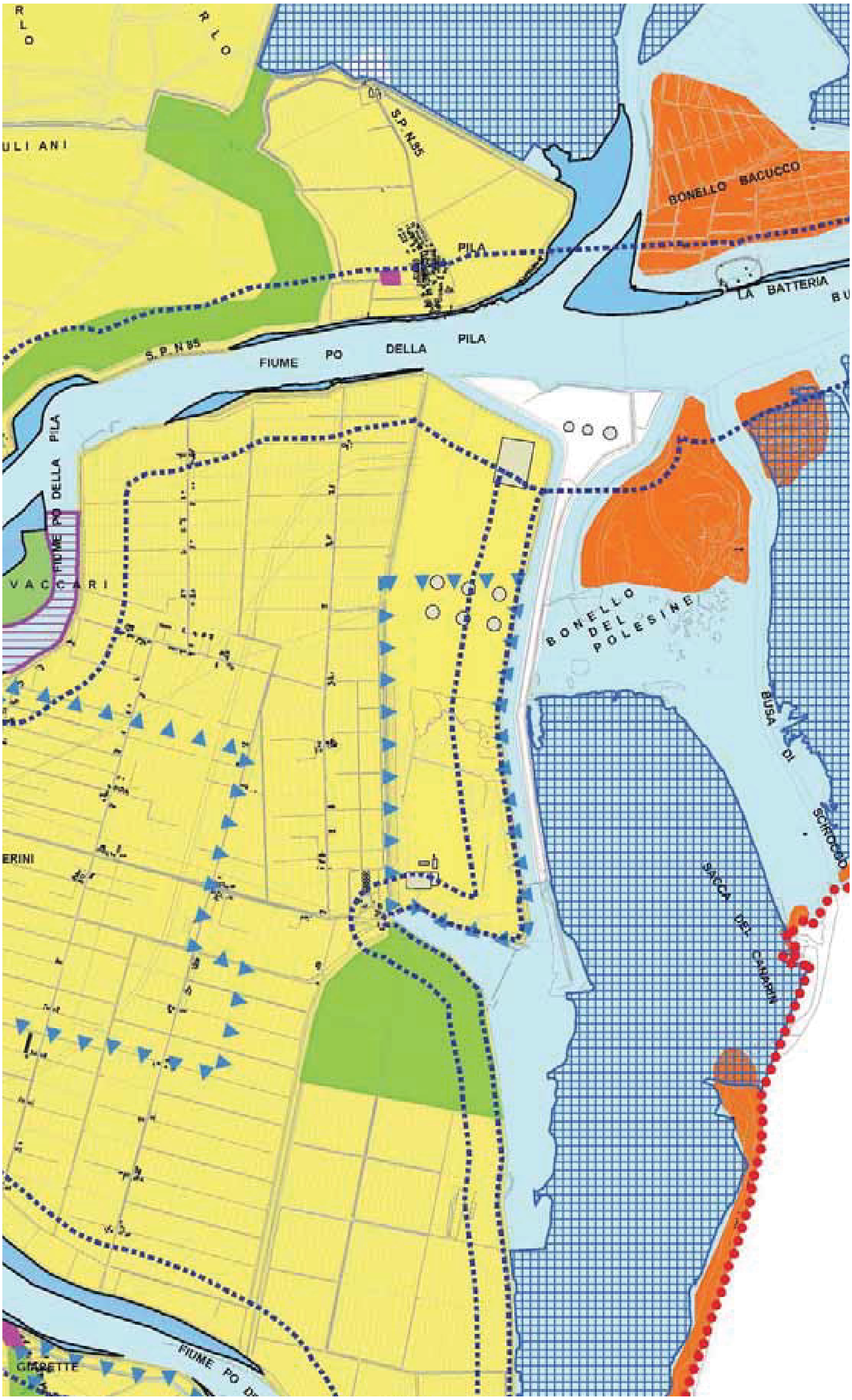


Fig. 219 Excerpt from PAT - Chart A.1 - Constraints and Territorial planning (source: PAT, 2012)



Flooded or water stagnant areas

Watercourses

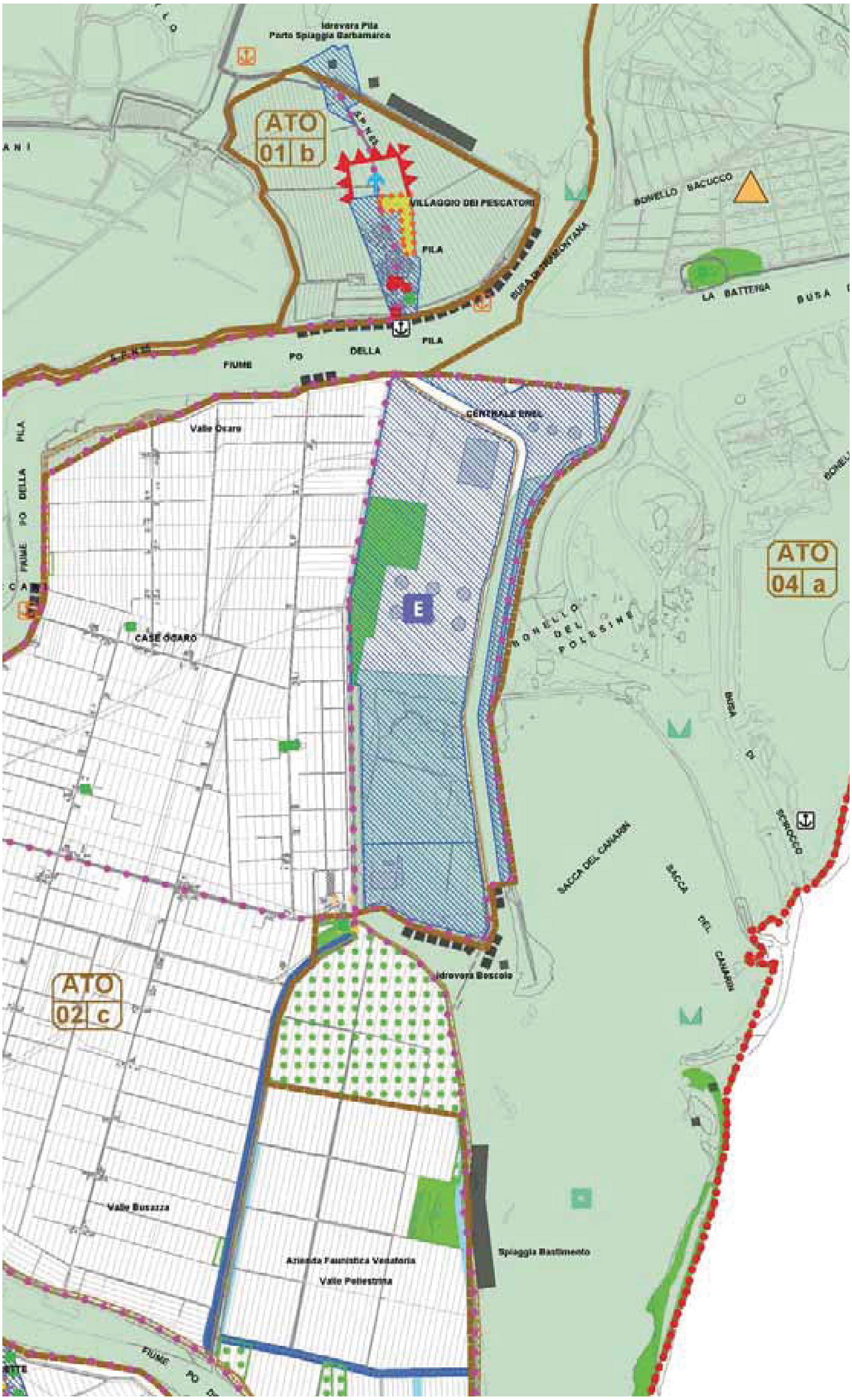
Lagoons and valleys

River buffer strips

Suitable geological compatibility

Not suitable geological compatibility

Fig. 220 Excerpt from PAT - Chart A.3 - Territorial fragility (source: PAT, 2012)



ATO - Homogeneous Territorial Area

ATO 02 x
ATO Agricultural-residential settlement

ATO 04 x
ATO Landscape and environmental area

Consolidated urbanization area

E
Power plant

Natural protection: core areas

Natural protection: stepping stones

Project tourist itineraries

Fig. 221 Excerpt from PAT - Chart A.4 - Transformability (source: PAT, 2012)

The oil-based functioning of Polesine Camerini power plant

Polesine Camerini power plant consisted of four thermoelectric steam sections, each of which had a gross efficient power output of 660 MW and was composed by a steam generator fueled by oil, a steam turbine and an alternator with a 20 kV voltage.
Each steam generator was contained within an open 100'000 m^3 metal structure. The turbines and alternators were located inside a unique building with a volume of 490'000 m^3, characterized by a steel structure, clad in metal panels and glazed surfaces. The exhausted fumes produced by the oil thermal combustion process of in boilers, after having undergone a process of ash abatement, were then released into the atmosphere through four metal rods inside a chimney of 250 m high.

The pricipal peculiarity of the Polesine Camerini power station was a particular system of water utilization: the condensers' cooling water was preferably taken from the river through the adduction channel from the Po di Pila, but during periods of scarce availability of river water it could also be taken from the sea, through the adduction channel of the Sacca del Canarin. After having been used for cooling, fresh or saltwater were respectively returned to the river or to the sea through a system of locks.


Fig. 222 Lock system for water supply and return (source: Enel)

In order to feed the steam generators, two fuel oil storage parks have been realized, to the north and to the south of the plant, where nine tanks have been built, two of 50'000 m^3 (in the northern oil park) and seven of 100'000 m^3 (one located in the Northern Park, the remaining in the southern oil park). Subsequently, two 100'000 m^3 tanks in the southern oil park were dismantled. The floating roof tanks are located inside containment ponds with ground embankments.
In addition to the production groups, we can also find some plants for production support activities (demineralisation of process water, purification of waste water,

logistical infrastructure). The power station is connected to an electric station, from which two 380 kV double-twist lines start, connected to the stations of Dolo (Venice) and Forlì. Within the perimeter there is a Terna electricity station, a biomass plant of Enel Green Power and a parking lot owned by the Province of Rovigo.

Fig. 223 The integration of thePolesine Camerini power plant in the delta landscape (source: Enel)

Fig. 224 The chimney of 250 m high (source: Enel)

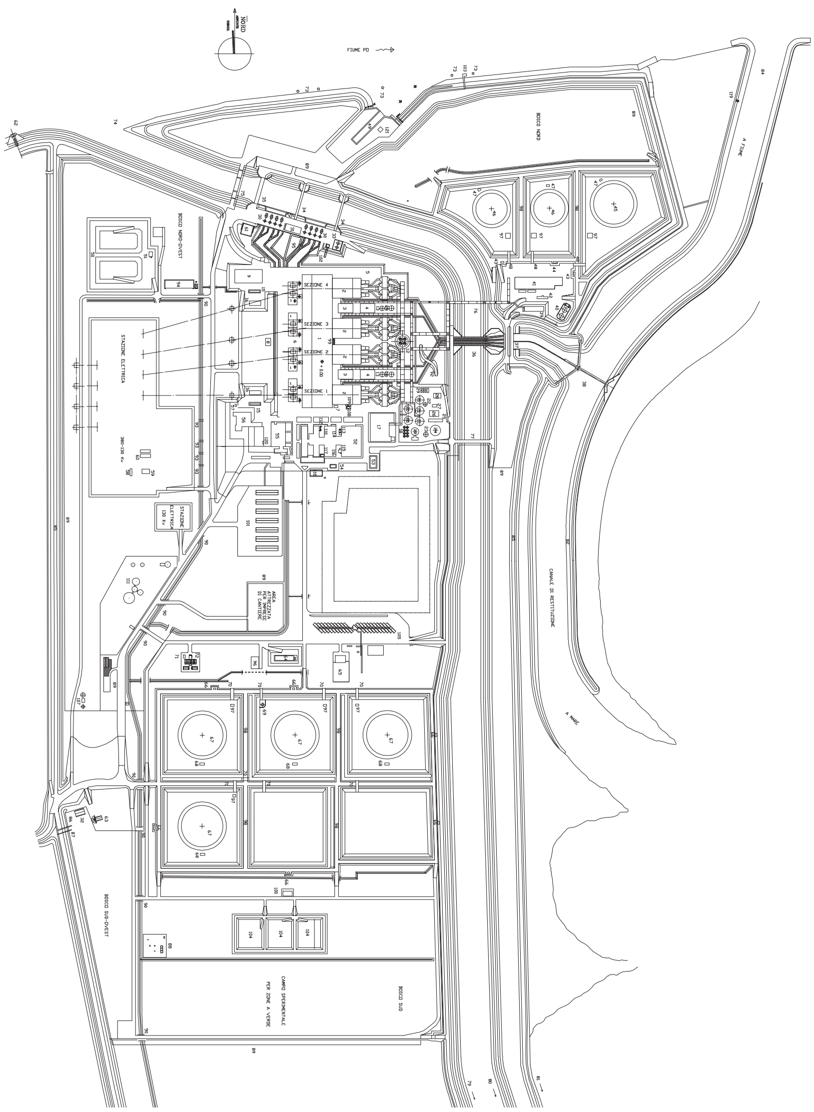


Fig. 225 Plan of Polesine Camerini thermal power plant (source: Enel)

Fig. 226 Elevation of Polesine Camerini thermal power plant (source: Enel)

Fig. 227 Polesine Camerini thermal power plant (source: Enel)

Fig. 228 The quayside for oil barges (source: Enel)

Fig. 229 Oil tanks and water adduction system (source: Enel)

Fig. 230 The agricultural landscape aroun the thermal power plant (source: Enel)

Fig. 221 Po delta wetlands (source: Enel)

Fig. 232 Po delta typical fishing huts (source: Enel)

Fig. 233 Polesine Camerini power plant water adduction system (source: Enel)

OILAND**SCAPES: the multi-scalar construction of scenarios**

research by design: scenarios construction

Research by design involves the use of the *scenarios construction* as a tool that, using reasoning and some simple design tools, allows to describe spatial futures (Viganò, 2012 and Sijmons, 2014). The definition of scenarios' field of action, limits and assumptions directly affects the *project of the programme* (Massarente, 2016) as well as the results in terms of spatial and territorial dynamics generated. The development of at least two scenarios will therefore make it possible to compare and assess the possible impacts of the developments foreseen by each scenario, thus having a scientific relevance because the process produces knowledge useful for decision-makers.

The objective of the scenarios is to define the development framework of our *energy landscapes*, fading the traditional boundaries between nature (intended as untouchable areas only suitable for recreational purposes and as biodiversity reservoirs) and industry (intended as impenetrable and polluting activities), aiming to experiment different type of **OIL**AND**SCAPES** as supportive backbones for a multi-scalar energetic and socio-ecological territorial restructuring.

mesh case study: Ravenna-Polesine Camerini

Moving directly to our *mesh case study*, our scenarios will focus on the close relationship that has always existed between Polesine Camerini thermal power plant and the industrial port area of Ravenna through the supply of crude oil by a 90 km underground pipeline.

In the light of the renewed role of oil meshes for the territorial restructuring of the third industrial revolution, the future development of the two intertwined sites cannot be considered separately, since their territorial potential precisely lies in considering them as a unique system.

Our challenge is therefore to propose a trans-regional designing scale, more similar to that of infrastructure domain than to urban planning one, which can allow to simultaneously assess the development scenarios of Ravenna and Polesine Camerini sites. In this way, the programme of the two areas has to be thought in synergic dependency.

The *up-sourcing* narrative described in previous parts in order to define the territorial role of *green energy backbones* will constitute the common condition for both scenarios. Whatever the program and physical expression of *CO_2 feeders* and *CO_2 eaters,* they will have to actively contribute to the achievement of a carbon neutral industrial economy. The trans-regional potential of our *mesh case study* makes the project for converting activities in Polesine Camerini dependent on the supply of CO_2 from downstream activities at the Ravenna industrial harbour.

Two scenarios will be developed and assessesd, describing two different types of *energy landscapes* for the former Polesine Camerini thermal power plant:

- the first scenario will propose a conversion of the area that complies with the current provincial and municipal planning framework;
- the second scenario, on the contrary, will respond to owner's intentions (Enel spa) as expressed on the occasion of the *Futur-E conversion programme*, which aims to strategically integrate a new sustainable environmental approach directly into the energetic business to facilitate the transition towards a *circular economy*.

phase 0: Ravenna site as CO_2 feeder

Four of the seven industrial sectors with the highest carbon dioxide emissions are located along the north side of the Ravenna dock: moving from the sea inland, we find the oil refinery belonging to Alma Petroli group, the production activities of a cement factory, Marcegaglia steelworks and Versalis petrochemical plant. On the southern side of the dock, on the contrary, we can find an industrial platform that accommodates small-medium enterprises, the logistical-commercial hub of the industrial port of Ravenna and the decommissioned oil deposits which fed the Polesine Camerini power plant.

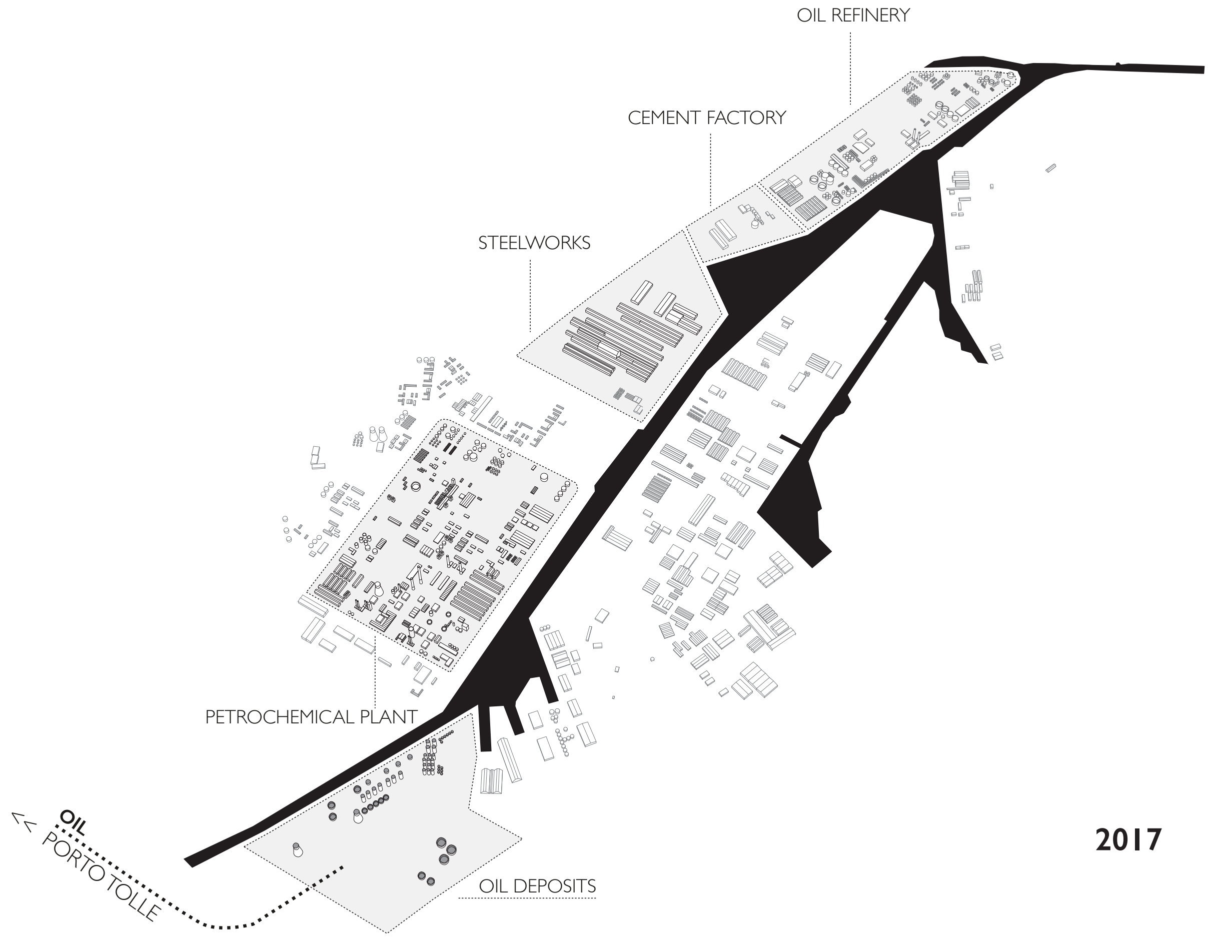


Fig. 234 Ravenna industrial harbour current situation (source: elaborated by the author)

phase 1: 2025
implementation of Carbon Capture and Use technology

A future technological improvement in the area which integrates carbon capture technology with heavy industrial activities on the northern shore of the dock would require the establishment of an *Eco-industrial Park*[1] which includes the four properties in order to overcome ownership fragmentation and pursue a collaborative synergy in the financing of the necessary infrastructure for the recovery, storage and transformation of carbon dioxide before being conveyed to Polesine Camerini site. The Eco-Industrial Park's partners would not only share infrastructure costs, but could also benefit from the revenue generated by the use of recovered carbon dioxide for other industrial purposes, actively contributing to a significant reduction in atmospheric emissions and enhancing a reversal of the trend that has seen multinational corporates so far among the main environmental polluters. A hypothetical scenario could also envisage them as active partners in the conversion of Polesine Camerini site as CO_2 eater, in order to diversify their market production and to develop high value added by-products from the waste fumes of their main industrial activity.

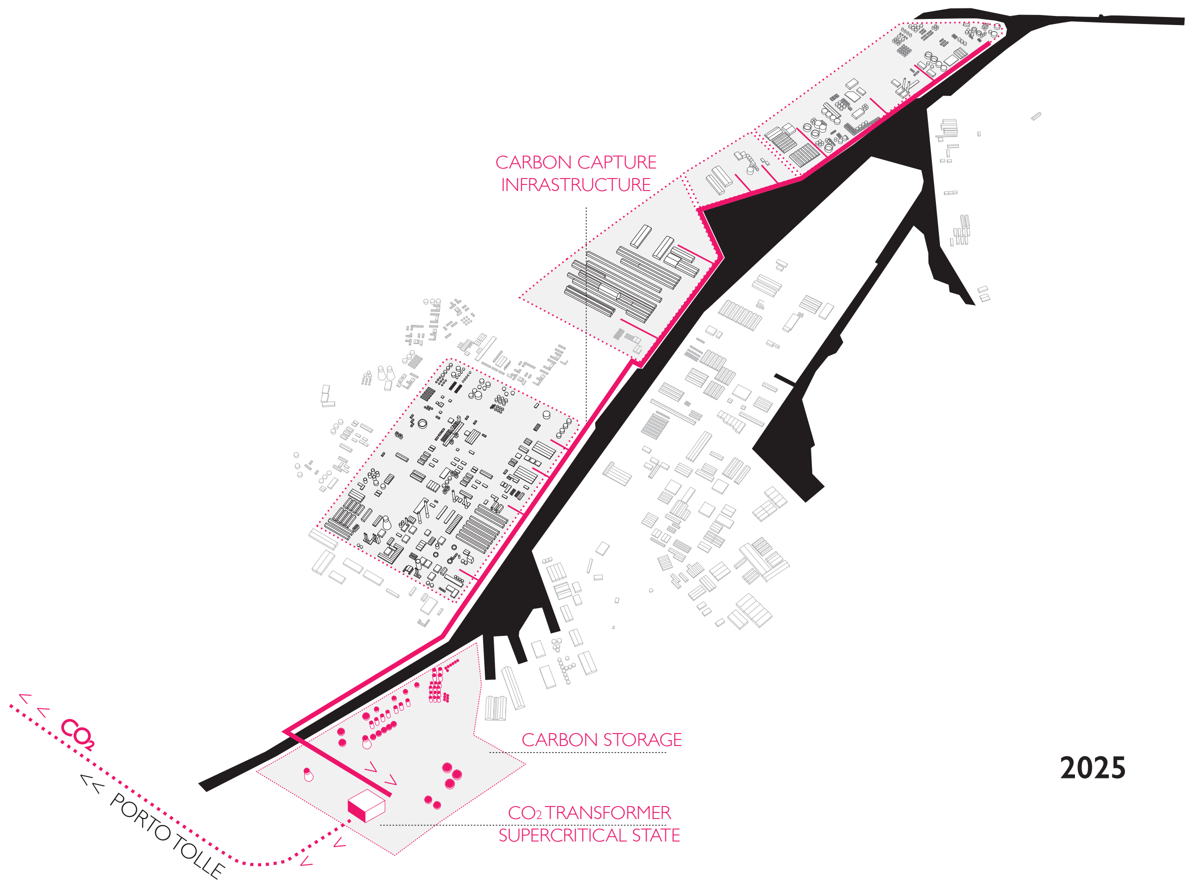


Fig. 235 Ravenna industrial harbour: implementation of CCU technology (source: elaborated by the author)

1 By *Industrial Eco-Park* we mean the innovative notion of planning industrial areas in which companies cooperate with each other and with the local community to reduce waste and pollution, to share resources (materials, water, energy, infrastructure) more efficiently, to achieve a more sustainable development, with the intention of increasing economic gains and improving environmental quality. (see Hein, A. M. and al. (2015). *A Conceptual Framework for Eco-Industrial Parks*. DOI: 10.1115/DETC2015-46322).

phase 2: 2040
bio-based industry and hydrogen technology

Subsequently, the transition to a more sustainable economic model will be completed by the shift of standard oil activities towards a bio-based industrial model. As seen in part III, oil refineries can be converted in algae biorefineries which process micro-algae to obtain bio-fuels very similar to fossil fuels. At the same time, petrochemical activities can also be adapted to the algae chain, thus producing plastics from glycerol synthesized from algae biomass and other products that can replace petroleum derivatives. Taking advantage of the large voids that are normally present in the downstream areas, it is possible to imagine to implement an algae cultivation in photobioreactors in order to encourage the self-sustaining activities of the bio-industry, thus reducing costs and emissions due to raw materials' transport. If algae biomass will be processed for by-products, during its growth phase it may be thought to collect the hydrogen produced during the photosynthesis process when the environment is sulphur-free. Hydrogen technology could be implemented in order to use it as a clean source for the electricity production.

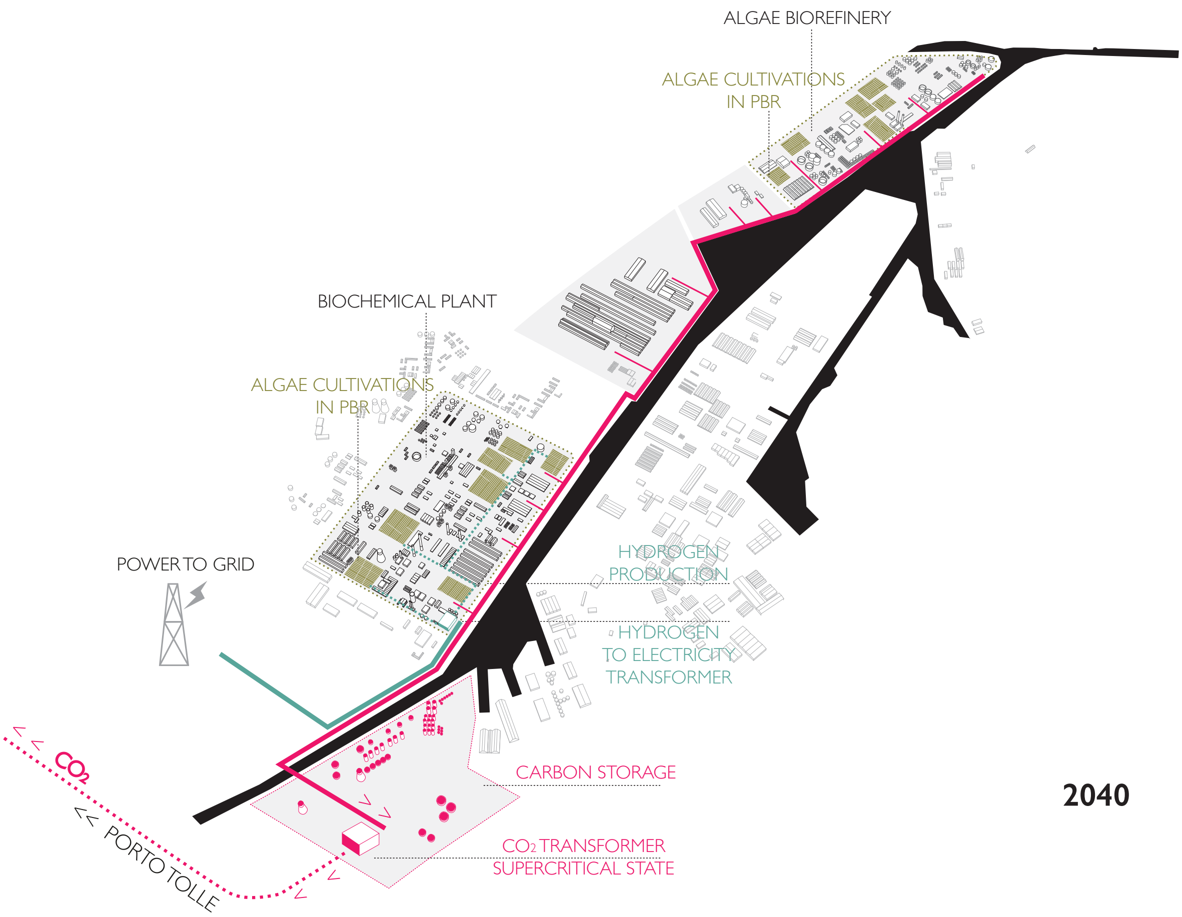


Fig. 236 Ravenna industrial harbour: bio-based industry and hydrogen technology (source: elaborated by the author)

Scenario 1: Legal Framework

Polesine Camerini site as an energy productive CO_2 eater

The current provincial and municipal regulatory framework does not provide for any development other than the energetic one for the Polesine Camerini power plant area. As already seen, the article 43 of the Technical Standards for the Implementation of the General Regulatory Plan - PRG 2003 (replaced by the Territorial Planning Plan - PAT 2012, which, through the article 88 of the Operational Technical Standards, confirms the provisions of the PRG) allows a possible expansion of the plant's production capacity under the condition of providing a considerable reduction of the environmental impact and of adopting innovative technological solutions. From our point of view, the challenge is to imagine an energetic production scenario which works in symbiosis with the supply of CO_2 coming from Ravenna.
If carbon dioxide is the raw material supplied by Ravenna site through the existing oil pipeline, it will be necessary to establish a high carbon dioxide consumption activity for energy production. Algae cultivations could be a plausible response, in particular because of their great potential for CO_2 absorption, which enhances biomass growth.

It could be interesting to give a general look at the potential of a circular economic and productive model for energetic purposes.
During a first phase, microalgae cultivations in raceway open ponds could be implemented and enriched by the collected carbon dioxide in order to make microalgae's growth faster and more efficient. After flocculation and dehydration processes, microalgae biomass can be harvested and treated via *pyrolysis*[2] in order to obtain *syngas*[3] and *bio-char*[4].
The two by-products are exploitable for different purposes:

- syngas is a renewable and locally produced combustible, which could represent an alternative to liquified natural gas and oil and temporarily be used as fuel for internal combustion of thermal power plants' boilers for electricity generation;
- bio-char is a selenium-rich natural fertilizer which is used in agriculture to improve soil quality and which seems to have remarkable properties in carbon sequestration.

2 Pyrolysis is a thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen (or any halogen). It involves the simultaneous change of chemical composition and physical phase, and is irreversible (see https://en.wikipedia.org/wiki/Pyrolysis).

3 Syngas, or synthesis gas, is a fuel gas mixture consisting primarily of hydrogen, carbon monoxide, and very often some carbon dioxide. The name comes from its use as intermediates in creating synthetic natural gas (SNG). Syngas is usually a product of gasification and the main application is electricity generation. Syngas is combustible and often used as a fuel of internal combustion engines. (see https://en.wikipedia.org/wiki/Syngas#Electricity)

4 Biochar is charcoal used as a soil amendment. and made from biomass via pyrolysis. Biochar improves the soil texture and ecology, increasing its ability to retain fertilizers and release them slowly. It naturally contains many of the micronutrients needed by plants, such as selenium. (see https://en.wikipedia.org/wiki/Biochar).

The electricity produced using the renewable syngas will be entered in the national power grid and CO_2 emissions will be captured again, stored and then used to feed micro-algae cultivations in raceway open ponds, thus closing the circular system and giving the start to another carbon neutral energy productive cycle.

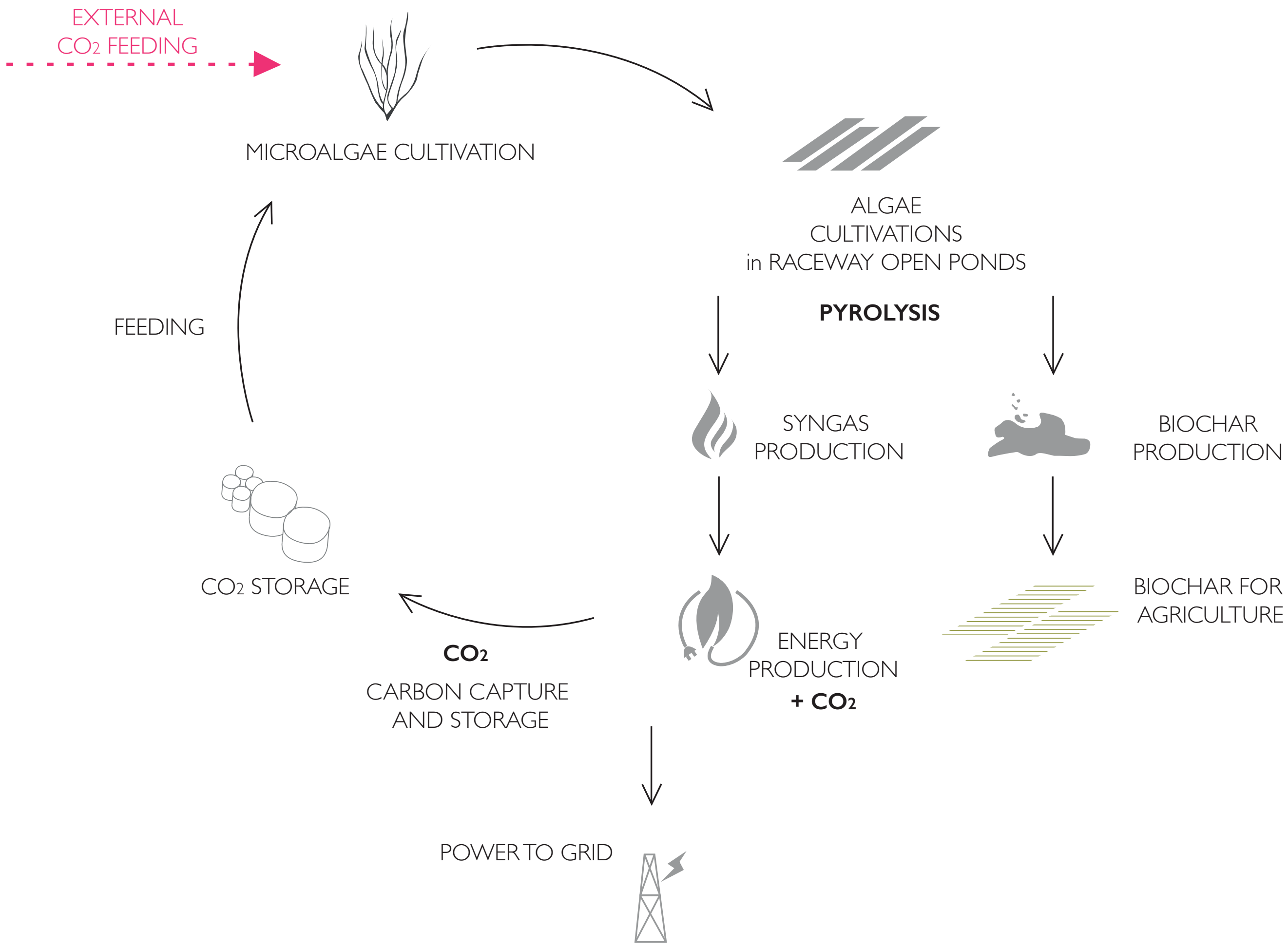


Fig. 237 Carbon neutral energy productive cycle during the first phase (source: elaborated by the author)

As for Ravenna industrial harbour, the second phase could be characterized by the implementation of the hydrogen technology for energy production.
Developments in research for the cultivation of algae in photobioreactors will make this technology more cost-effective, less energy-intensive and therefore scalable for a large industrial production. The recovered carbon dioxide will be conveyed inside the cultivation broth of photobioreactors in order to speed up the growth process of algal biomass. Hydrogen production during the photosynthesis process will be recovered from photobioreactors and stored as a clean renewable source of electricity. At the same time, algae biomass can be used for the implementation of biochemical processes for energy transformation, such as anaerobic digestion, which will allow to obtain biogas rich in methane, hydrogen and carbon dioxide (ENEA, 2013).
In this case, upgrading processes of biogas in biomethane involve the capture of hydrogen and CO_2, in order to use biomethane as a renewable fuel for the local energy production or even to inject it into the national natural gas pipeline for heating energy needs.
The implementation of hydrogen technology would contribute to the consolidation of a further step towards a circular economic and productive model, which allows the production of renewable fuels and biogas through local algae cultivations and disrupts the historical dependence on those geographical areas rich in hydrocarbons.

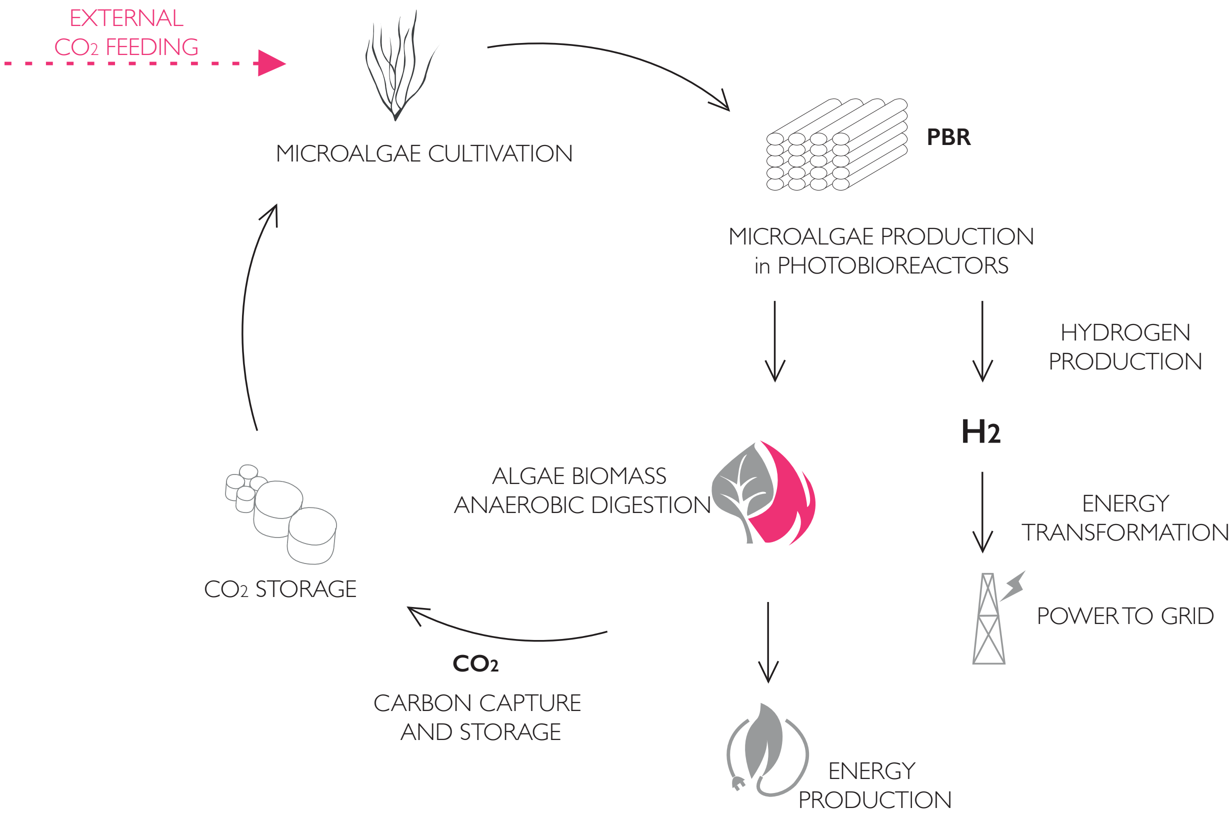


Fig. 238 Carbon neutral energy productive cycle during the second phase (source: elaborated by the author)

phase 0: 2017
current state of the decommissioned power plant

If we now take into consideration the spatial hierarchies established during the thirty years of operation of the Polesine Camerini thermal power plant, we can see a clear separation between northern and southern part of the site. In fact, in the northern part all the plants connected to energy production are concentrated, such as the large oil storage tanks, the chimney of 250m high, the four large volumes that house the boilers and the generators. A wooded area stands between the area for energy production and the area to the south for agro-industrial use which, as envisaged by the PRG, can also have agro-energy purposes.

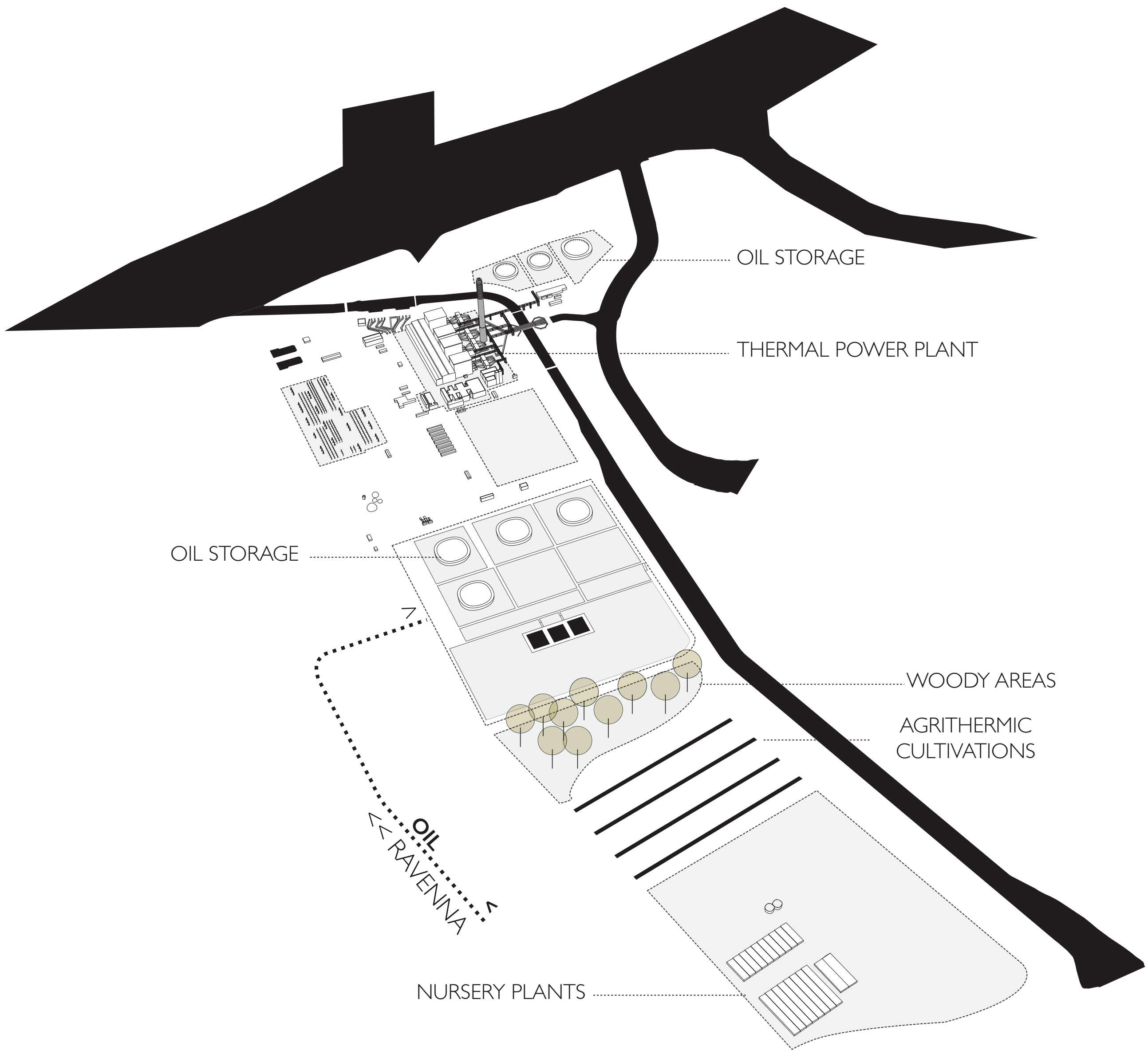


Fig. 239 Polesine Camerini power plant current situation (source: elaborated by the author)

phase 1: 2025
micro-algae cultivation in raceway open ponds

With the aim of reconverting the site's energy production to improve its environmental impact through the use of new technologies and new renewable energy sources, the first fundamental operation to be carried out is to convert the oil tanks for CO_2 storage. At the same time, in accordance with the agro-energetic vocation evoked by the PRG, it will be possible to implement microalgae cultivation in raceway open ponds in the southern part of the site whose water will be enriched with carbon dioxide to foster micro-algae biomass development. Facilities for treating algal biomass through pyrolysis could be installed on the north-eastern portionof the site, completing and upgrading the existing storage facilities. In addition, this area presents a quayside for barges which has been useful for the inland waterway transport of raw materials. The production of bio-char from pyrolysis process could allow to strengthen the role of waterways because of the necessity to transport this natural fertilizer to the multimodal interports of Polesine region.
The power plant will be upgraded in order to temporarily use the syngas produced by the pyrolysis process as an alternative fuel to oil for the electric generation.
The syngas combustion will produce lower carbon dioxide emissions than traditional fossil fuel emissions, thus improving the environmental impact of the energy production system. The Carbon Capture technology will minimize the emissions and reintroduce them into the circular system, thus feeding again algae cultivations in racey open ponds.
Before being returned into the delta, the huge water quantities taken from the river for energy production could be used as the broth for microalgae cultivation in raceway open ponds and, thanks to microalgae's phytoextractive properties, could be reclaimed before their release into the Po delta.

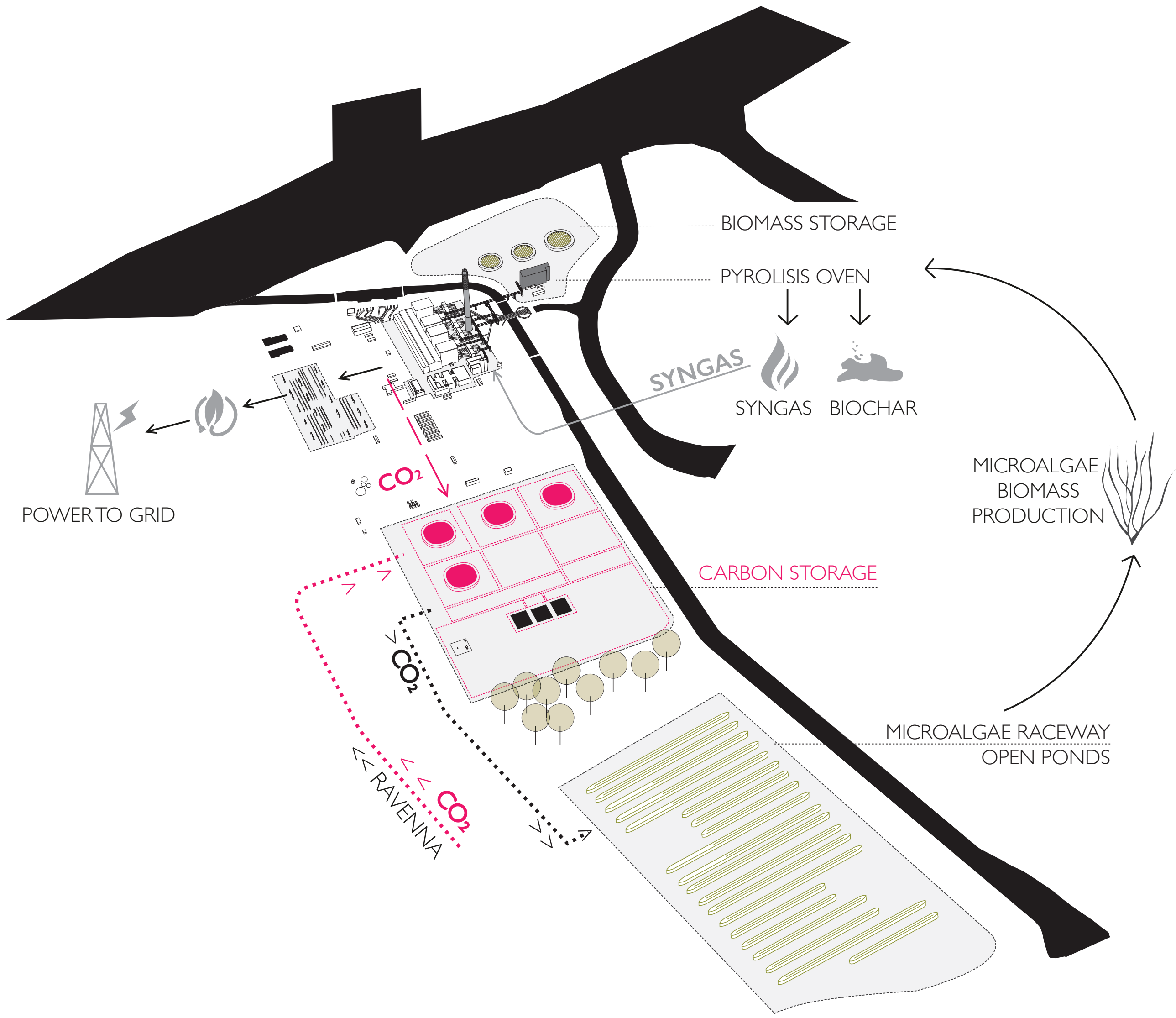


Fig. 240 Polesine Camerini power plant: microalgae cultivation in raceway open ponds (source: elaborated by the author)

Fig. 241 Polesine Camerini **OIL**AND**SCAPE***: scenario 1 (source: elaborated by the author)*

phase 2: 2040
micro-algae cultivation in photobioreactors for the implementation of hydrogen technology

The implementation of microalgae cultivation in photobioreactors could bring some structural advantages in terms of productive efficiency because of their higher quantity of biomass produced per unit area, considering that they can have a vertical development. Precisely for this reason, photobioreactors could be used for facade claddings.

The upgrading of the existing power plant's buildings could envisage the application of this type of facade solution in order to confer a renewed identity to energy infrastructure, and to take advantage of the huge available vertical facade surfaces. Only to give an order of magnitude, the four façade surfaces of a single boiler unit constitutes 1 hectare of intensive microalgae cultivation (40 m x 40 m x 60 m height). The total amount of the available façade surfaces reaches 7 ha where to implement a vertical microalgae cultivation in photobioreactors.

Further vertical photobioreactors' greenhouses could be settled in those empty spaces in the northern part of the area, around the existing power plant.

Advantages brought by photobioreactors' technology are many, as they allow an optimal control of the environment of the cultivation broth and a better dosage of carbon dioxide for the nourishment of microalgae. In addition. they facilitate the collection and separation of oxygen or hydrogen production from the broth, which is not possible in an open air system.

Biodigestors for anaerobic digestion could replace oil storage tanks in the north-eastern portion and, as seen before, contribute through a biochemical process to an energy diversification process since they provide biomethane and hydrogen.

In the southern part of the site, raceway open ponds can be kept working in a complementary way.

As a matter of fact, an alternative energy productive scenario resulting from the symbiotic relationship between Ravenna and Polesine Camerini activities allows to take advantage of the incremental benefits established between CO_2 feeders and CO_2 eaters, tending to make our **OIL**AND**SCAPES** carbon-neutral or even carbon-negative.

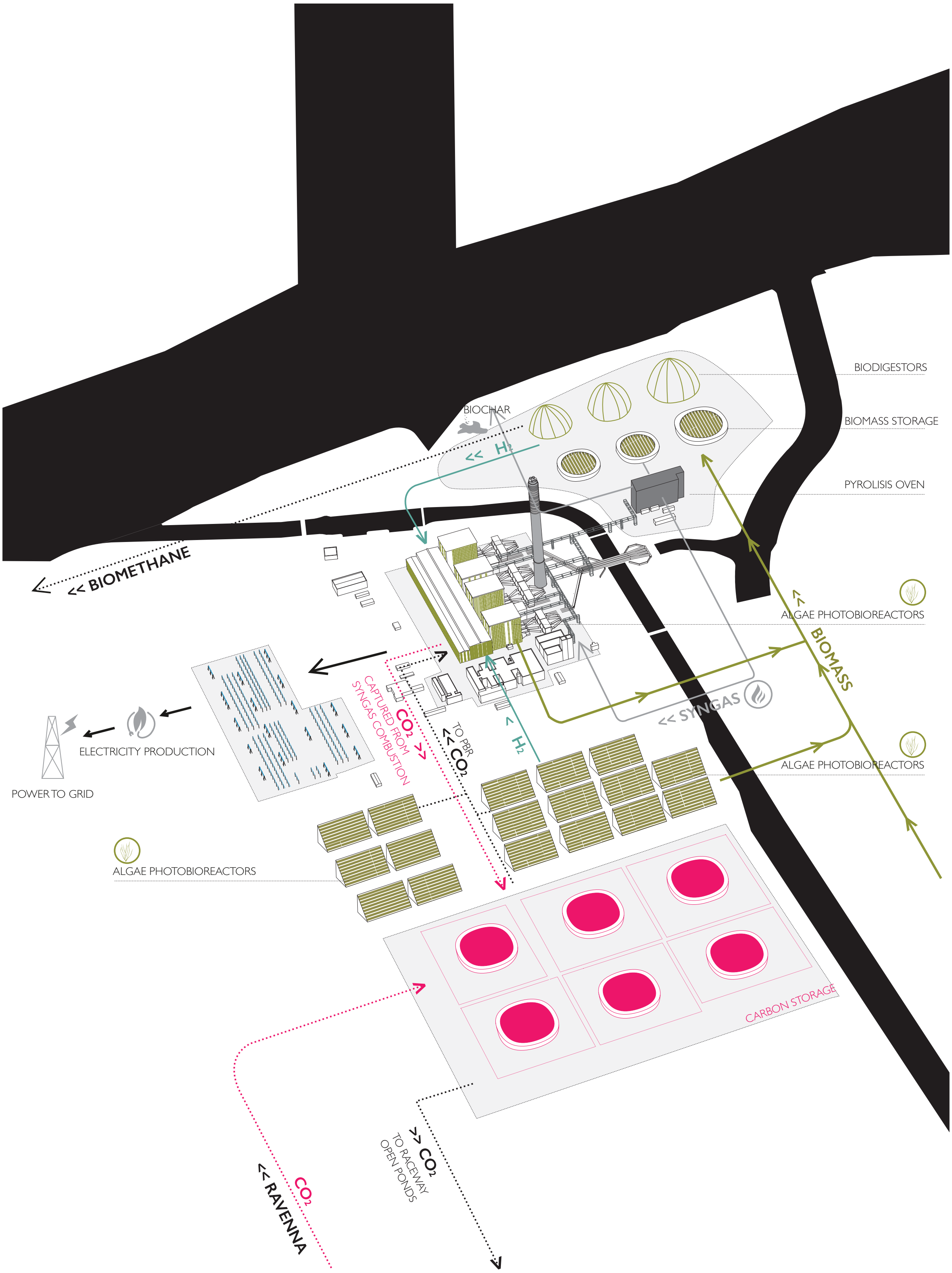


Fig. 242 Polesine Camerini power plant: microalgae cultivation in photobioreactors (source: elaborated by the author)

Fig. 243 Polesine Camerini ***OIL**AND**SCAPE**: scenario 1 (source: elaborated by the author)*

Scenario 2: Futur-E programme

Polesine Camerini site as a multifunctional CO_2 eater

The *Futur-e programme*[1] for the conversion of the 23 power plants, launched by Enel Produzione spa (the main electricity supplier in Italy), originates from the awareness that the energy production model is changing.

As seen in the previous parts, the reduction in consumption, the renewable energy transition and its increasing competitiveness, the technological evolution of distribution networks are leading to a real structural change in the energy industry. In fact, we are witnessing a progressive abandonment of the centralized model, which until a few years ago saw few large power plants producing energy for the entire national territory, in favour of a distributed and horizontal model based on small, widespread renewable plants that transform the final consumer into an energy producer.

The growing demands of environmental sustainability, energy efficiency and competitiveness that affect both the individual citizen and the energy companies are therefore calling into question the role of large power plants, especially thermoelectric ones.

The Futur-E conversion programme is therefore an opportunity to open up to disruptive development possibilities for the territories that have long host them. Enel has identified those plants that are less efficient or already in disuse and which could not play the role of *reserve energy capacity*. We are talking about plants that could not return to production with traditional technologies even if demand for electricity were to significantly increase, and, therefore, which have exhausted their life cycle.

The site of the Polesine Camerini power plant, due to its proximity to an extremely fragile environmental area, its historical importance in the European energy production scene and due to the extremely depressed socio-economic context in which it stands, has been identified among the 23 plants whose conversion would have the potential to start an innovative local territorial development.

In 2016, a call for tenders was launched for the acquisition of the site in order to create an innovative project proposal, together with a solid business plan for the economic feasibility, for the conversion and enhancement of the site in one or some of the following sectors: tourism, agri-food and aquaculture, sports, cultural, research and development, logistics, ICT and innovative industry.

It is interesting to notice that the call for tenders categorically excluded a re-use of the site for energy purposes, not even providing for innovative and environmentally friendly resources and technologies, as envisaged instead by the legal planning framework in force.

1 The 23 sites are: Trino, Alessandria, Genova, La Spezia, Carpi, Porto Marghera, Polesine Camerini, Camerata Picena, Livorno, Piombino, Pietrafitta, Bastardo - Gualdo Cattaneo, Montalto di Castro, Larino, Campomarino, Maddaloni, Giugliano, Bari, Rossano, Augusta, Termini Imerese, Assemini, Portoscuso.

After some extensions of the deadlines for the delivery of the proposals, we do not yet know anything about the result of the procedure and about which kind of programme has been chosen for the valorization of the area.

Although the intentions of the procedure seem interesting, we would like to integrate basic expectations testing a conversion model which enlarges the strategic reflection by dealing with three additional aspects:

- the first, already mentioned in the previous scenario, is the conviction that a scenario for the valorization of the Polesine Camerini site cannot be separated from the development scenario of the Ravenna site;
- the second is related to the symbiotic relationship between CO_2 feeders and CO_2 eaters' activities for non-energy purposes;
- the third is related to the necessity to enlarge the socio-economic analysis to the territory of Polesine in order to define a programme of activities that can actively contribute to the local territorial development.

If the first two aspects concern the potential enclosed in the physical connection between the two sites and the possibility to reconvert it in order to encourage a carbon-neutral or even carbon-negative circular economic model, we must deepen the objectives of the *National Strategy for Growth and Economic Development of Inner Areas* (Aree Interne), deliberated by the Council of Italian Ministers for the National Reform Programme on April, 8th 2014 and responding to a multilevel governance which originates from the EU objective of *territorial cohesion,* to better understand the third point.

Inner Areas

The necessity to define a specific territorial strategy for the develpment of Inner areas derives from the particular polycentric structure of the Italian territory, where a non-homogeneous network of accessibility to services such as education, mobility and health care is established between urban, rural and smaller centres. Currently, the territories that are less easily accessible and that have historically been characterized by a scarce offer in such services cover 60% of the Italian territory and accommodate 13.5 million inhabitants, a little more than a quarter of the total Italian population (Barca, Casavola, 2014).

The effects of the difficult accessibility to these kinds of services have resulted in a gradual process of depopulation, leading to social high costs which are related to hydrogeological, cultural and landscape degradation.

The demographic decline has also been accompanied by a process of weakening personal services and by the oblivion of a huge territorial, natural and human capital that, in this way, would remain unexploited.

Therefore, inner areas' difficulties can be described by distinguishing three main categories, as summarized in the following diagram:

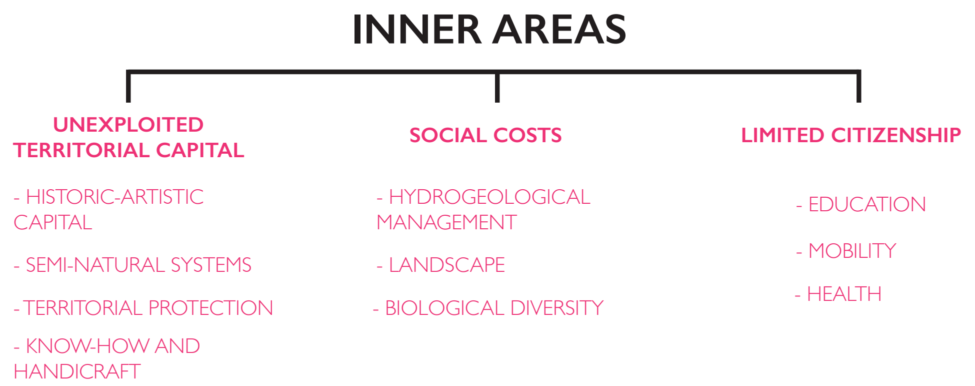


Fig. 244 The status of Inner Areas (source: Barca, Casavola, 2014; re-elaborated by the author)

Precisely on a more democratic accessibility to education, mobility and health services, the National Strategy for the Growth and Economic Development of Inner Areas wants to intervene in order to improve personal services and stimulate innovative local development processes.

The final objectives of the Strategy for Inner areas are the following ones (Barca, Casavola, 2014):

- *intensive/extensive local development*: with intensive development we refer to all those changes that increase the per capita well-being of inner areas' residents, respect to a given productive size and, on the contrary, with extensive development we relate to all those changes that, in addition to increasing the per capita well-being of residents of inner areas, also increase the scale of production processes;
- *reversing demographic trends.*

Five intermediate and interdependant objectives are necessary to be preliminary achieved in order to pursue the above mentioned changes:

- *increasing the well-being of the local population;*
- *increasing local demand for labour (and employment);*
- *increasing the degree of use of territorial capital;*
- *reducing the social costs of de-anthropization;*
- *strengthening local development factors.*

There are two instruments with which to implement actions in order to achieve the intermediate objectives:

- *adaptation of the quality/quantity of essential services' offer;*
- *local development projects.*

The revitalization of the inner areas necessarily consists in revitalizing local systems as productive areas, thus requiring the consolidation of a demand for local goods and services (Barca, Casavola, 2014).

The association of the statistical data for the classification of the Italian municipalities according to the definition of Inner Areas, elaborated by the Agency for the Territorial Cohesion[2], with the GIS geographical data has allowed us to extrapolate some thematic cartographies which identify the status of education, mobility and health services' offer at a municipal level in our territorial case study of the north-eastern Po Valley region.

Municipalities which appear coloured meet the following criteria:

- with regard to the *education sector*, they offer all types of secondary schools in their municipality;
- as regards the *health sector*, they present in their municipal territory at least one hospital with a first level First Aid department, which means guaranteeing the observation, short stay and reanimation functions, carrying out diagnostic-therapeutic interventions in general medicine, general surgery, orthopaedics and traumatology, intensive cardiology therapy specializations, as well as providing laboratory services for chemical-clinical and microbiological analyses, diagnostics for images and transfusions;
- concerning the *mobility sector*, they are equipped with a Silver type railway station according to RFI (Rete Ferroviaria Italiana) classification, which stands for a medium-small railway station with a medium frequency for metropolitan-regional transports and which is frequented for medium-long distance journeys.

Those municipalities which record the simultaneous presence of the three types of services as described above are considered *poles* or *inter-municipal poles*.

In order to identify inner areas, the methodology of the Agency for the Territorial Cohesion suggests to analyze even the journey time to the nearest pole and, thus, to classify the remaining municipalities into four categories: *peri-urban areas* (or *belt areas*), i*ntermediate areas*, *peripheral areas*, *ultra-peripheral areas*.

2 see http://www.agenziacoesione.gov.it/it/arint/Cosa_sono/

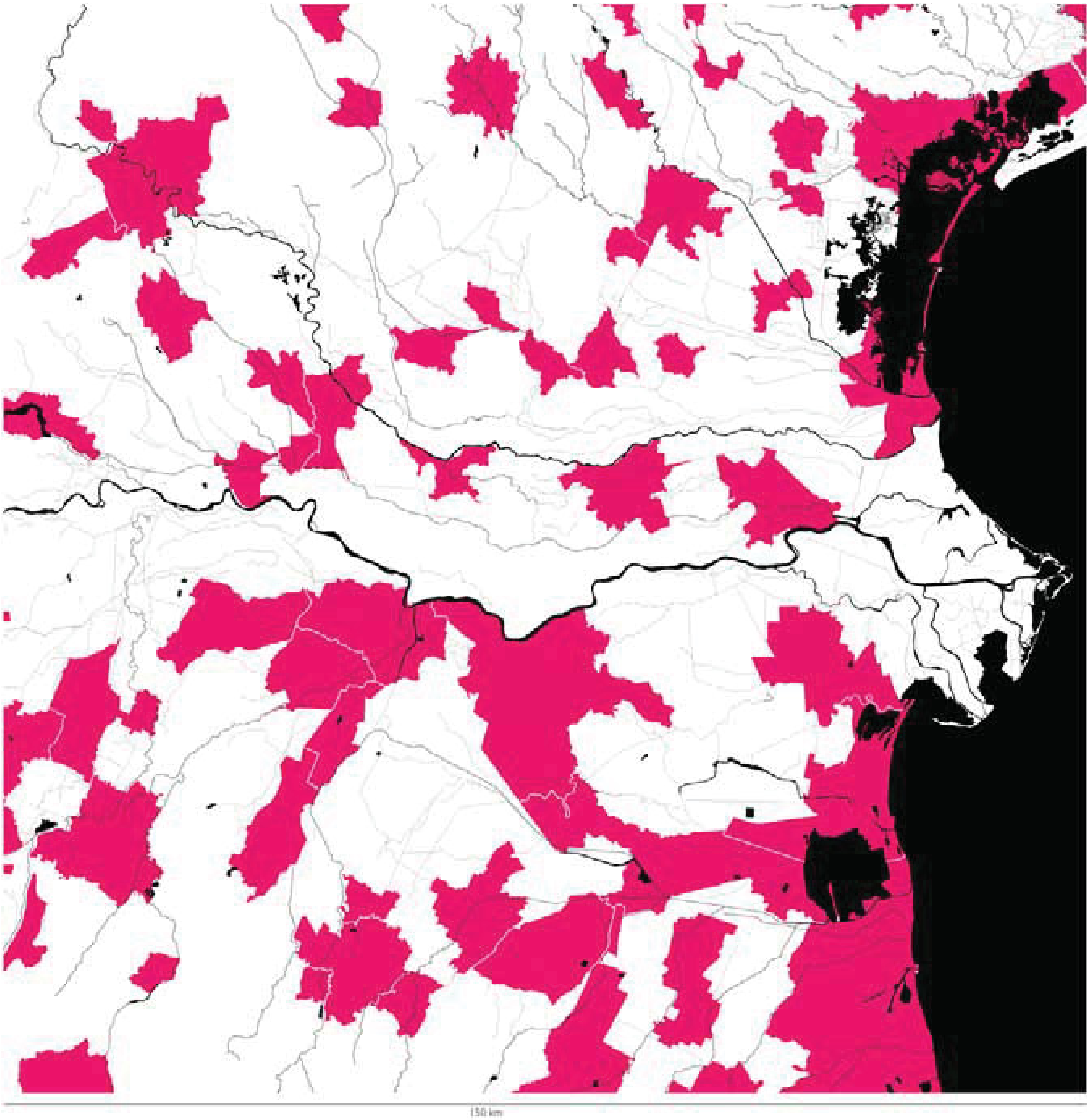


Fig. 245 Centres for the educational service (source: Agency for Territorial Cohesion, annex 3; elaborated by the author)

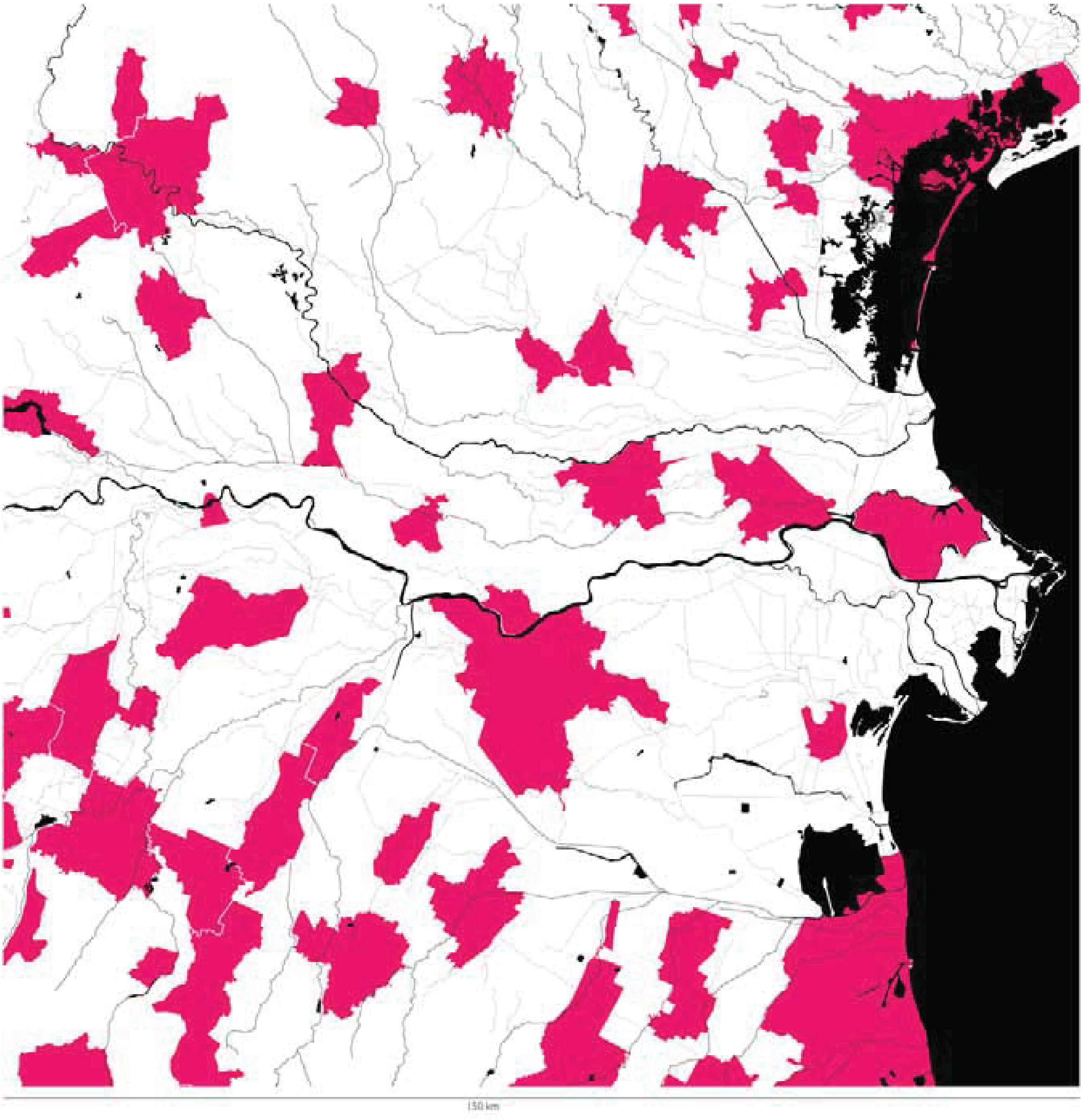


Fig. 246 Centres for the health service (source: Agency for Territorial Cohesion, annex 3; elaborated by the author)

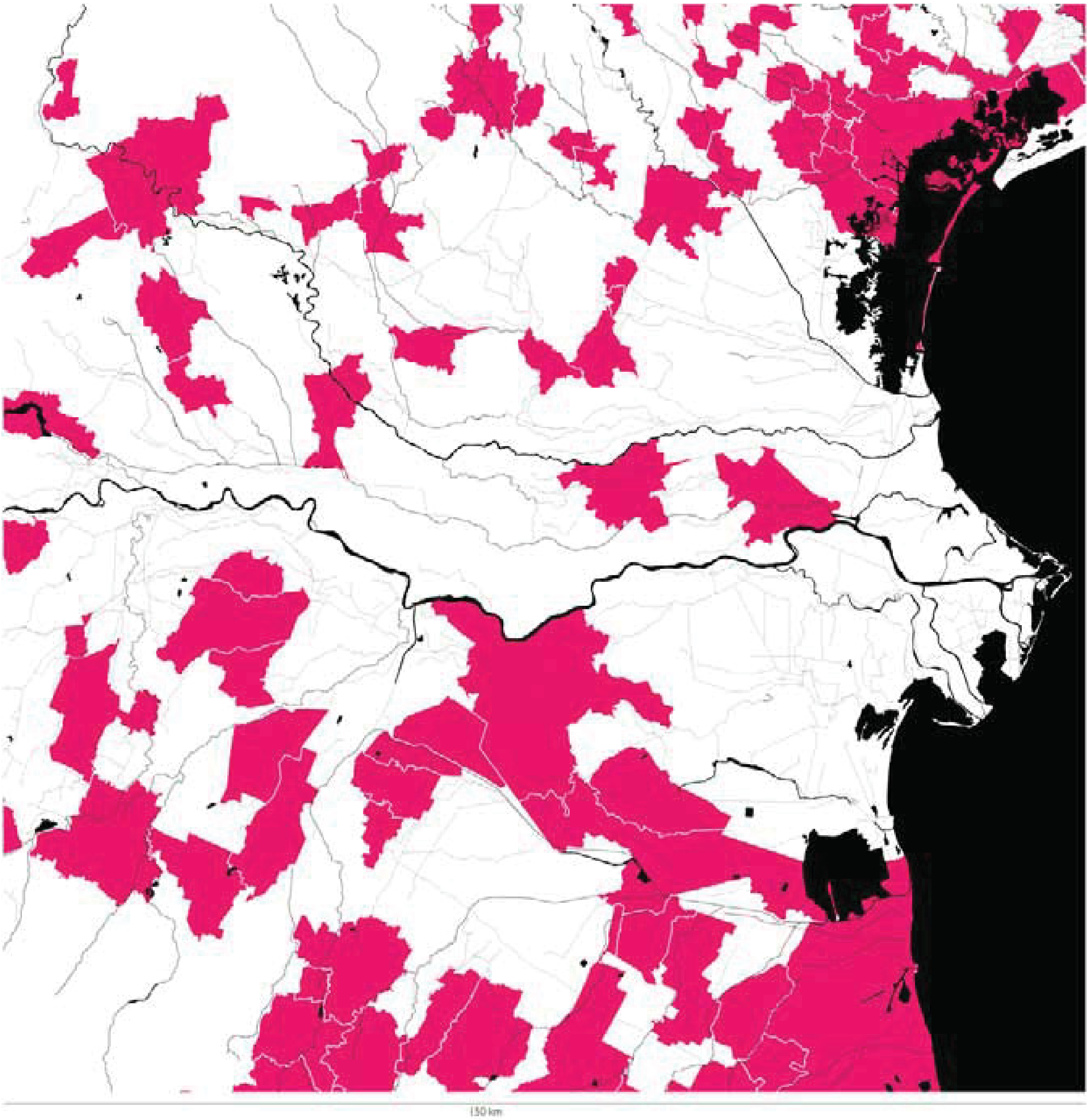


Fig. 247 Centres for mobility service (source: Agency for Territorial Cohesion, annex 3; elaborated by the author)

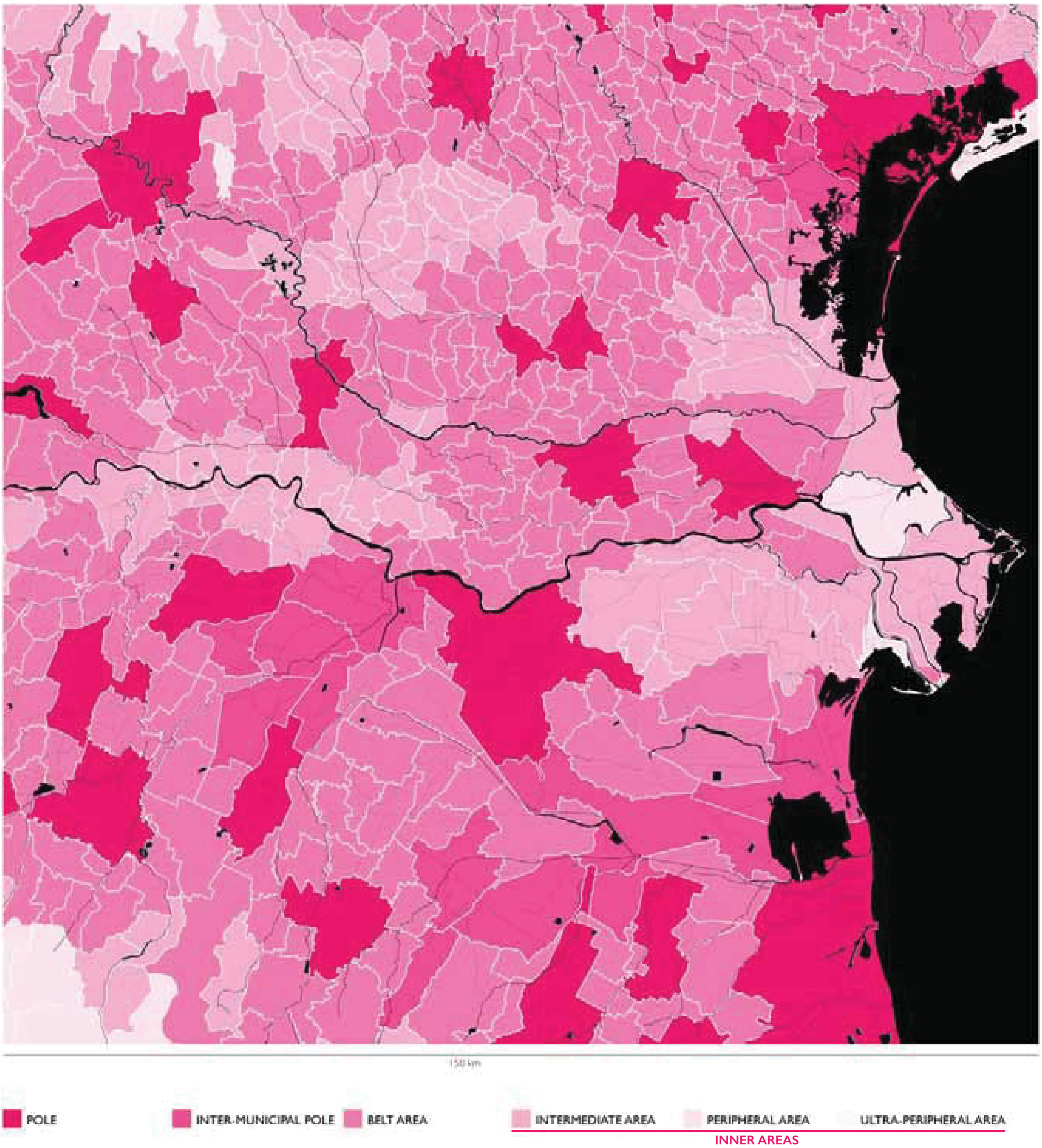


Fig. 248 Inner areas in north-eastern Po Valley region (source: Agency for Territorial Cohesion, annex 3; elaborated by the author)

The analysis of the thematic maps shows that, first of all, the entire Po delta area is classified as an *Inner Area*, and secondly that all municipalities belonging to this sub-region are lacking education, health and mobility services.

The nearest educational service centres to Polesine Camerini are the municipalities of Adria, Chioggia (Veneto) and Codigoro (Emilia-Romagna), respectively about 50 minutes (43 km), 65 minutes (50 km) and 45 minutes (39 km) far by car.

In terms of proximity to health service centres, Polesine Camerini is about 33 minutes (28 km) from Porto Viro Hospital, 50 minutes (43 km) from Adria Hospital and 50 minutes (44 km) away from Lagosanto Hospital.

As already mentioned above, the entire Po delta area lacks railway infrastructure. The nearest Silver type station is Adria, and nothing else up to the more important stations, such as Ferrara, about 100 minutes (80 km) and Rovigo, about 85 minutes (65 km) far by car.
The complete absence of railway infrastructure is replaced by a weak public transport service via intercommunal buses operated by Ferrovie dello Stato Italiane, but the situation remains inadequate and absolutely critical. If we consider public transport connections between the two nearest centres along the SS Romea and Polesine Camerini, namely Porto Viro (28 km) and Mesola (23 km), we are surprised by the lack of a regular bus service. If from Porto Viro the travel time remains acceptable, between 50 and 75 minutes, even if with a very low daily frequency (only 7 trips per day), the connection between Mesola and Polesine Camerini is almost non-existent, covering the 23 km in 5 hours, with two changes and only two trips per day.
Although on the one hand we understand that, up to now, there has not been an urgent need to intensify public transport service in an economically depressed and very poorly inhabited area, these data represent a picture of the current state of abandonment and neglect of the Polesine territories near the Po delta, but at the same time they show us a great potential for an improvement in the perspective of a local development strategy of Inner Areas as witnessed by the National Strategy mentioned before.

local development strategy: deficiencies and excellences

The identification of the services' deficiencies, together with the enhancement of local excellences, should contribute to the definition of a multifunctional programme for the reconversion of the Polesine Camerini power plant site, which can actively contribute in a long-term development of the vast area.

The scarcity of a complete offer in the secondary education services is confirmed by a more detailed analysis concerning the location and consistency of secondary higher education institutions specialized in *horeca (hotellerie-restaurant-catering)*, *agrarian* and *tourism services* fields in the provinces of Rovigo, Ferrara, Venice and Padua.
These fields have not been randomly chosen, but they probably represent some important sectors from which to start an long-term development process able to enhance the uniqueness of local agricultural and aquaculture products through a renewed model of slow and ecological tourism.

It is interesting to note that the percentage of students enrolled in these educational sectors is very diversified in the four considered provinces:

- agrarian sector attracts a higher percentage of students in the provinces of Veneto (between 3-5%) than in the province of Ferrara (1%);
- tourism services and horeca secondary education register a higher rate of students enrolled in the provinces of Veneto than in Ferrara, reaching peaks of 14.8% in horeca and 16% in tourism services sectors of the total student population attending secondary schools in Rovigo province;
- the total percentage of secondary school students enrolled in primary and tertiary education reaches 33.8% in the province of Rovigo, 26.3% in Venice and 13.2 in Padua, despite 6.5% in the province of Ferrara.

If we now consider the presence on the territory of University institutions in the agricultural sector, it is clear that the only one is located in Padua, and it is mainly composed of three separate divisions: the main *Campus Agripolis*, equipped with experimental agricultural farms, is situated in Legnaro (Padua), while the viticulture and oenology branch is located in Conegliano (Treviso), and the food safety one in Vicenza.
Looking at pursuing a local development that can complete the education and research cycle in the agricultural and tourism sectors and thanks to the local excellences in agricultural and aquaculture production already existing in the Po delta area, our case study could represent a favorable site where to think to settle another satellite University branch where to implement experimental cultivation techniques in marshy and aquatic environments.

The other fundamental local excellence is the uniqueness of the delta landscape, far from noisy urban systems and immersed in an anthropic nature, however rich in biodiversity and fragile eco-systems. The peripheral location of the area respect to important transport and urban axes can represent an ideal context for developing activities related to the body care and well-being.