POLITECNICO DI TORINO
SECOND SCHOOL OF ARCHITECTURE
Master of Science in Architecture
Honors theses

Recovery and innovation: new life for an old farm in Pertengo
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The subject of my dissertation is the recovery and the change of functions of an area in the town of Pertengo, a small village next to Vercelli in Piedmont. The main theme is the sustainability viewed at 360°, taking in con sideration subjects matter such as social and economic, as well as environmental.
The town of Pertengo has about 340 inhabitants and is completely surrounded by rice fields.
During these last years, the town saw a decline of its population: this brought a gradual disappearing of a lot of facilities like shops and places where people can meet and socialize as bars and so on.
The area of my project was a farming place and is located at the center of the village: it is approximately 7500 square meters.
There are two reasons why that justified the decision of not demolish the existing buildings:

- the first one is socio-cultural: leave unaffected places for the all the people who live there;
- the second is economic: the demolition would have led to have a smaller volume than the existing one.

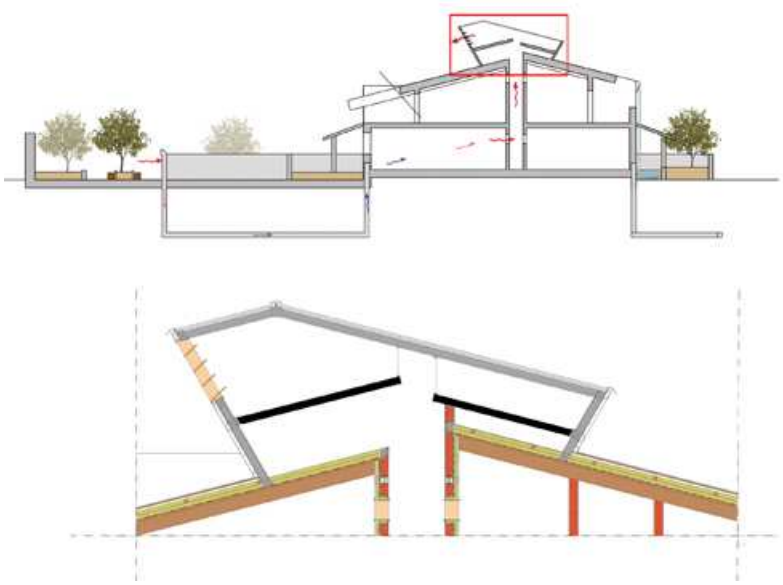
After this careful analysis, the design strategies were the following:

- reunite the existing fabric with the new outdoor places of socialization;
- rupture from the mono-functionality and the new different activities;
- inclusion of public green spaces;
- inclusion of private green spaces and of secondary accesses between housing units and public space.

Within the project area, there are residence, commercial, sport, education and outdoor meeting places. To give a higher priority to pedestrian and bicycle paths, the parking lots were placed to the exterior area, creating an underground car park on the west side.

Ground floor plan

The passive cooling system is based on the use of two different coupled techniques: the solar chimney and the heat exchange with the ground. This technology was developed in an experimental scientific way and it doesn’t have a practical correspondence in existing buildings especially if applied to an architectural salvage. The system is composed by two parts: the solar chimney and the underground pipes. The solar chimney have a glass surface which allows to the solar radiation to enter inside the chimney so that it could taken in by an element which works as an absorbing surface. The air inside the chimney is heated by solar energy and flows upward because of the chimney effect, which is a natural principle that brings air flows passing through the pipes to exit on the top of the chimney. The heat exchange system with the ground is made up by horizontal pipes buried at a specific depth and properly spaced.

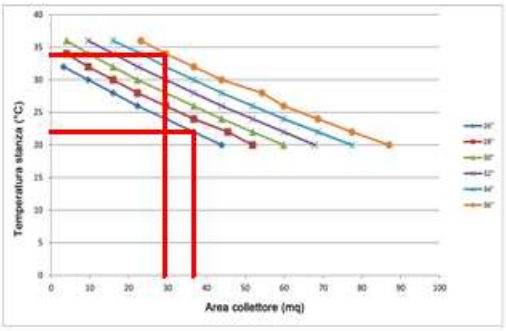


Schematic diagram of the passive cooling and building details of a solar chimney

The principle of operation during the summer is very simple: the outside air is taken from specific elements and lead into pipes which are in contact with the ground; the low temperature of the soil allow to refresh the air which will be sent in the rooms. The air input is naturally activated by the chimney effect, which starts with the opening of the cover grates of the solar chimney, from which the bad air goes out. In absence of a sufficient draft in the natural system, there are fans which are driven to capture the air; these fans are powered by energy produced by photovoltaic cells. Using a series of formulas, it was possible to determine the temperatures that could be achieved inside a room: this depends on the outside temperature, on the absorbing surface and on the power of cooling.

TEMPERATURA ESTERNA 26 °C G_3-G_4 16 °C					
Tr (°C)	Tcs (°C)	Area (mq)	ΔT (°C)	Potenza minima (W)	Potenza (W)
20	75	43,89	6	5300	2100
22	68	36,71	4	4410	3150
24	61	29,53	2	2629	4200
26	54	22.34	0	848	5250
28	48	15,96	-	-	-
30	42	9,56	-	-	-
32	36	3,19	-	-	-
34	31	-	-	-	-
36	27	-	-	-	-

TEMPERATURA ESTERNA 36 °C TEMPERATURA G_3-G_4 26 °C					
Tr (°C)	Tcs (°C)	Area (mq)	ΔT (°C)	Potenza minima (W)	Potenza (W)
20	129	86,98	16	5300	-
22	119	77,41	14	5300	-
24	110	68,63	12	5300	-
26	101	59,85	10	5300	0
28	96	54,26	8	5300	1050
30	85	43,89	6	5300	2100
32	78	36,71	4	4410	3150
34	71	29,53	2	2629	4200
36	65	23,14	0	848	5250



Tables and graphs of calculation

In relation to the shape of the chimney and to its surface accumulation, we could hypothesize a use even in winter, where the chimney becomes a kind of "solar greenhouse". For a proper working, small fans could be installed at the entrance of the vents so that they can allow to warm air to enter the room.

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