EuroSun 2010 – Antroposophical Solar Center

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Abstract

Below is presented a concept for a future Regional Solar Center, in the vicinity of Smolyan and the innitial work how on a proper place in Bulgaria to be demonstrated in Bulgaria existing Solar world technologies, shaping our future. The necessity of such Center is motivated with documents and questionnairs. The 'Solar' name includes mostly all renewables as it is in its physics' sense. With an medical function additional advantages are emphasized.

The presentation describes how a layout and a set of buildings (according to Bg Forest Law) could be used both for bioclimatic/energy demonstrations + educational purposes of the Renewable technologies1 and Medical Recreation.

1. Introduction - The beginning - Idea creation

The regional population is not aware of the advantage of solar energy technology. The lack of RE (Renewable Energies) awareness is resulting here in the newly born idea of a Solar Center (SC) designed, organized and completed in Bulgaria for educational and demonstrational purposes. Moreover such centers do not exist in most of the neighboring countries and a new one could be very attractive for the visitors of the Balkans. Most of the elements of the Center could demonstrate the energy gain that could be achieved in other buildings.
From the other side the regional population has not enough cultivated habits to explore the local nature, mineral water and climate conditions. Bulgaria's natural resources and climate are extremely favorable for convalescent and recreation procedures. This could be a good basis for the development of different Health Recreation Centers and even larger medical complexes.
A lot of sick people get health improvement in Bulgaria. The legend says that Justinian The Great (525-565) had been advised to bring his beloved daughter who was terminally ill to Serdica (one of the ancient names of the Bulgarian capital Sofia) where she fully recovered.
The experts suggest that both functions could be supplementary to one another and exist simultaneously in one and the same building. Both functions do not contradict each other: on the opposite, they could mutually benefit. That could refer to most of the buildings' parts like space and constructions, materials and elements, as well as to the external and internal walls, eaves, windows, roofs, parapets etc. All of them could gain energy from the Sun and contribute to the microclimate of the whole edifice.
Below are described the author's intentions, effort, work and results up to now for creating a project, where both functions are combined in one building.

The designer team:

Architects: Anna Dobrinova, Constantin Antonov, Rozina Chervenkova,
Metodiev, Iva Delova, etc.

Medical therapeutic Consultants;
Engineers: Heating, Cooling & Domestic Hot Water (DHW): Venelin Stojnov, Stanco Shtrakov, etc
Electrical: Dobrina Bicheva, eng;
Geodesy - Plamen Vaklinov, eng.
Water supply, Economists etc.
Constructors: "Comans 2000" AD.

2. The owner vision

The owner's purpose is the development, completion and construction of the project on a piece of land owned by him in the village Hvoina near Smolyan in the Rhodope mountains in South Bulgaria, and putting it in operation as a Health center. His wish is that the center should function according to the medical visions of Rudolf Steiner. They are called Antroposophical ideas everywhere across the world and are based on the correct and precise exchange of nature energies, including the subtle ones. The complex will be called Antroposophical Solar Center (ASC). It puts together the demonstration, education and dissemination of bioclimatic, solar, (renewable) technologies and antroposophical ideas of Health and architectural form as well. Its layout will be displayed in a multifunction and interdisciplinary use of those technologies and ideas. This sustainable project will reveal possibilities of combining the environment (mountains, mineral waters and agricultural land) and the unique RE technology for visiting, antroposophical work and recreation.

The owner has already handed to the designers his requirements for the functional organization and the different phases of design and construction. He will expect the Investor to develop a business plan evaluating the expenses and the incomes and a scheme of financial self support of the ASC plus a suitable proposal about his compensation.

3. The Therapeutic (medical) vision - still expected in completed form, as a base of a business plan.

4. The architectural approach
The architectural design method provides both the innovations in RE and in Rehabilitation scope and reveals and demonstrates the advantages of renewable energy use even in each and every construction phase (even in field conditions).
This will appear in three aspects: technological, economical and environmental. The design work will keep up to the Bulgarian regulations, Forest legislation and Building rules, size and margins for suiatable half-subterranean midle size hall with semi-underground facilities. A layout and a set of buildings/villas/bungalo (according to Bg Forest Law) could be used both for medical or for bioclimatic /energy demonstrations and also for educational purposes of the therapeutical and RE technologies. Visitors could experience all thechnologies and be part of an educational process inspite of their age or background.

The necessity of such ASC is well defined by numerous Bulgarian documents and questionnaires.

4.1. Reception building
Main volume – a hall (50 seats), used for meetings, lectures, educational purposes, demonstrations and workshops etc. with the respective service rooms – lobby, foyer, buffet, library, administration offices, stores, toilets,; (built area ~ 300m²).

4.2. Convalescent medical department - waiting room, spa center, laboratory, therapeutical and procedure surgery, offices for phisicians, staff and administration, toilets, stores, medical devices and garages ~ 320m².

4.3. Hostel Departement with canteen, 25 rooms for visitors/sick people with connection to the reception and access to the canteen and also to the spa center ~ 600m².
The canteen - 30 seats for guests and visitors, with terrace and kitchen according to standards ~ 118m². multiphases use

4.4. Park - gardian and agricultural area, swiming pool (10m/18m), water cascade, children and recreation squares with open amphtheatre for recitals, lectures and musical events. Parking ~ 35 conected both with the road and the complex

As innovations could be shown the rather spesific synthesis between demonstrations, education and site peculiarities and devices put together RE&medical innovations and construction parameters, allowed by the Law. The innovative function will provide new architectural image and silhouette of the ASC. It is important the ASC to become self-supported. ASC to be an attractive Center for the other Balkan countries, that has no such center.
ASC could involve as lecturers a lot of eminent European pedagogues.

5. Engineering aproach

The systems for air condition, ventilation and DHW are forseen to work together for the priority of reducing energy expenses.

5.1. **Reception building**

Hall for 50 seats, a half-subterrainean middle size hall with semi-underground facilities for projection, demonstration and educational purposes with annex: foyer, guards, buffet, guarderoubes, services and instalation rooms, toialets etc.
Data for technical installations :

- **air condition** system – heat capacity 15 kW and cooling capacity 12 kW.
Energy consumption for heating – 13000kWh/season; for climatisation ~ 4800 kWh/season;

- **ventilation**

Central ventilation system combined with heat exchanger. Technical characteristics: flow rate 2500 m³/h fresh air. The ventilation is combined with heating and cooling system with heat capacity 11kW and cooling capacity 4.6 kW. Energy consumption for heating 6600kWh/season and energy consumption for air conditioning - 4200kWh/season

- **Solar installation for hot water** – technical data:

Collector area – 36 m2.
Type of solar collectors –flat plate with high selective surface
Average daily production – 2500 l/d (average temperature in solar heat tank – 50º C).
Additional energy source – heat pump with heat capacity – 13,5 kW.

5.2. Convalescent medical department - 2 floors, 50 staff and visitors, waiting room, spa center, laboratory, therapeutical and procedure surgery, offices for phisicians, staff and administration, toilets, stores, medical devices and garages ~ 320m².

- **air condition** system – heat capacity 20 kW and cooling capacity 14 kW.
Energy consumption for heating – 15000kWh/season; for climatisation ~ 4000 kWh/season;

- **ventilation -**

Central ventilation system combined with heat exchanger. Technical characteristics: flow rate 2500 m³/h fresh air. The ventilation is combined with heating and cooling system with heat capacity 11kW and cooling capacity 4.6 kW. Energy consumption for heating 6600kWh/season and energy consumption for air conditioning - 4200kWh/season

- **Solar installation for hot water** – technical data:

Collector area (flat plate with high selective surface) – 36 m2.
Average daily production – 2500 l/d (average temperature in solar heat tank – 50º C).
Additional energy source – heat pump with heat capacity – 13,5 kW.

5.3. Hostel Departement - Data for technical installations **–**

- **air condition** system – heat capacity 40 kW and cooling capacity 27 kW.
  Energy consumption for heating – 30000kWh/season; for climatisation ~ 12000 kWh/season
- **ventilation**

Central ventilation system combined with heat exchanger. Technical characteristics: flow rate 2500 m³/h fresh air. The ventilation is combined with heating and cooling system with heat capacity 11kW and cooling capacity 4.6 kW. Energy consumption for heating 6600kWh/season and energy consumption for air conditioning - 4200kWh/season

- **Solar installation for hot water** – technical data:

Collector area – 36 m2.
Type of solar collectors –flat plate with high selective surface
Average daily production – 2500 l/d (average temperature in solar heat tank – 50º C).
Additional energy source – heat pump with heat capacity – 13,5 kW.

5.4. Canteen -

- **air condition** system – heat capacity 15 kW and cooling capacity 14 kW.
  Energy consumption for heating – 11000kWh/season; for climatisation ~ 4000 kWh/season;

- **ventilation**

Central ventilation system combined with heat exchanger. Technical characteristics: flow rate 2500 m³/h fresh air. The ventilation is combined with heating and cooling system with heat capacity 11kW and cooling capacity 4.6 kW. Energy consumption for heating 6600kWh/season and energy consumption for air conditioning - 4200kWh/season

For kitchen – flow rate 750 m³/h fresh air. The ventilation is combined with heating and cooling system with heat capacity 3kW and cooling capacity 4 kW. Energy consumption for heating 4400kWh/season and energy consumption for air conditioning - 1430kWh/season

- **Solar installation for hot water** – technical data:

Collector area – 36 m2.
Type of solar collectors –flat plate with high selective surface;
Average daily production – 2500 l/d (average temperature in solar heat tank – 50º C).
Additional energy source – heat pump with heat capacity – 13,5 kW.

5.5. **Park**

Additionally accepted data for: open swimming pool 280м²; covered swimming pool 20x15x, 150м²;
Data for the service device – The systems – for air condition, ventilation and hot water are forseen to work together to reduce energy expenses.

- **air condition**

Floor radiation heating for covered swimming pool. Heat pump capacity 22kW and annual electricity supply - about 7450kWh/год..

- **ventilation**

Central ventilation system combined with heat exchanger. Technical characteristics: flow rate 2500 m³/h fresh air. The ventilation is combined with heating and cooling system with heat capacity 11kW and cooling capacity 4.6 kW. Energy consumption for heating 6600kWh/season and energy consumption for air conditioning - 4200kWh/season

- **Solar installation for hot water** – technical data:

Collector (flat plate with high selective surface) area – 36 m2.
Average daily production – 2500 l/d (average temperature in solar heat tank – 50º C).
Additional energy source – heat pump with heat capacity – 13,5 kW.

5.6. Others

Some of the shown systems are with equal parameters in order to be compared obtained results and analyzed energy efficiency of different consumer.

- A geothermal plant- heat capacity 100 kW could be eventually realized (governmental permission), which to replace part of the above described heat sources and to be combined with a new SPA centre.
- Two wind turbines (with electrical power 5 kW each) could be mounted on suitable places and connected to building power installation;
- Solar PV collectors with capacity $2kW_{(p)}$ could be mounted on the roofs;
- The hall and nearly the whole edifices could be semi under ground to use earth energy or isolation and Solar energy by the roof or biomass heating, which technology could be also demonstrated and advertised.

6. Conclusion

Development of this project (preliminary design work and detail design work) as well its next phase will define more details of RES kinds, applied in it and mainly its self supporting energy conception. This is in support of the idea of multifunctional centre, as far some of the RE systems will be just for advertisement in the total energy balance of the ASC.

During development of preliminary design will be analyze and assess additional options for energy supply systems and energy efficiency measures incl. biomass boiler, special technologies for building insulation etc.

The main goal of this project is to demonstrate as well:

- multifunctional building which operate with maximum green energy and minimum carbon emissions.
- Selection of suitable renewable energies technologies.
- Effective combination on different renewable technologies guaranty low cost of energy.
- Demonstration of good practices and dissemination of results