ENERGY PLANNING ON THE ISLANDS - CASE: ISLAND OF BRAČ

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ABSTRACT

According to the modern perception local planning is one of the key prerequisite of well-balanced, quality and sustainable development, both in energy sector and other sectors. Energy planning at local level sets up a firm basis for decentralization and security of supply; helps achieve competitiveness, rational use of energy resources and environmental protection. Islands are particular natural resources in every country, so they require special attention and care even when defining future energy system development. The island of Brač present specific case where crucial conditions for establishing sustainable energy development were created. Authorities, energy suppliers and others recognize importance of their involvement in creation of energy development plan of the island and its implementation in order to achieve balanced and optimizing supply from old and new conventional and renewable energy sources. Application of various integrated measures results with sophisticated energy planning methodology applicable not only on islands level but in local communities in general. The procedure for sustainable energy planning on the island of Brač is developed in the frame of the IEE EASY project – energy actions and systems for the Mediterranean local communities.

1. INTRODUCTION

Island of Brač is selected for the proposed project for a number of conditions which have been created on the island lately. Given the fact that the consumers are mainly oriented on use of electricity from the national power system and fuel wood from the island, the potential projects like gasification, small district heating networks and others, create the new moments and certainly create the need for new development plans. Intensive gasification program which is underway in the coastal area of Croatia open the possibility to develop on the Brač LPG gas distribution system.

Also, on the basis of the terms of national and regional energy development strategies which provide support to use of renewable energy sources and energy efficiency measures sustainable energy planning necessary include overview of all possibilities and potentials of such energy supply.

1.1 Island of Brač

Island of Brač is one of the 50 permanently inhabited islands of the Croatian Adriatic. It belongs to Central Dalmatian group of islands. The town of Supetar and island's seven municipalities make (Bol, Milna, Nerežišća, Postira, Pučišća, Selca, Sutivan) form a part of Split Dalmatia County. Apart from Central Dalmatian group of islands this County includes local communities in coastal and overland areas, which makes it very heterogeneous in terms of demography, geography and economic development.

Population of island of Brač, according to the Census in 2001 is 14,034; the most developed economic activity is tourism and manufacturing (stone and stone products), followed by trade, other services and agriculture. Reconstruction and opening of new small industrial and handicraft facilities in the recent years caused the stop of the population immigration. In Nerezisca, candy and textile factory was founded; in Sutivan factory of plastics; in Selca drive for the construction of doors, and in Milna and Sumartin two small shipyards. Special possibilities of development of Brac is found in the tourist economy. Most famous tourist destination is certainly Bol with the world famous beach named Zlatni Rat.

As in case of other islands, energy supply on island of Brač is currently inadequate and unsustainable, and has no enough qualitative capacity to meet long-term planned and growing needs. In addition to higher demand, the Brač's energy system is permanently faced with high seasonal load oscillations, caused by great differences in number of dwellers on the island between the summer and winter period.

1.2 Methodological concept for energy planning on islands

The sustainable energy plan is to be based on various aspects of energy supply in order to study all the possibilities of sustainable energy development. An integrated approach is particularly useful for island areas as so called "closed systems" and can be modified separately from the influence of other areas.

In order to examine all the possibilities, it is necessary to develop an integrated approach of creating an energy plan that will examine and compare all the possible scenarios of the future energy system on the island. The methodological concept in particular assessed the economic, ecological and energy components of an individual scenario, whilst also have a built in Demand Side Management (DMS) procedure and Least Cost Planning (LCP) approach.

As previously mentioned, preparing at least two different scenarios is recommended to ascertain how energy demand and supply can change in the time. Island's own long-term plan should be used as a basis when describing the expected activity in the coming 10-20 years period. Expected residential construction and development plan in industry and business are determining factors for how both the population and energy consumption will developed.

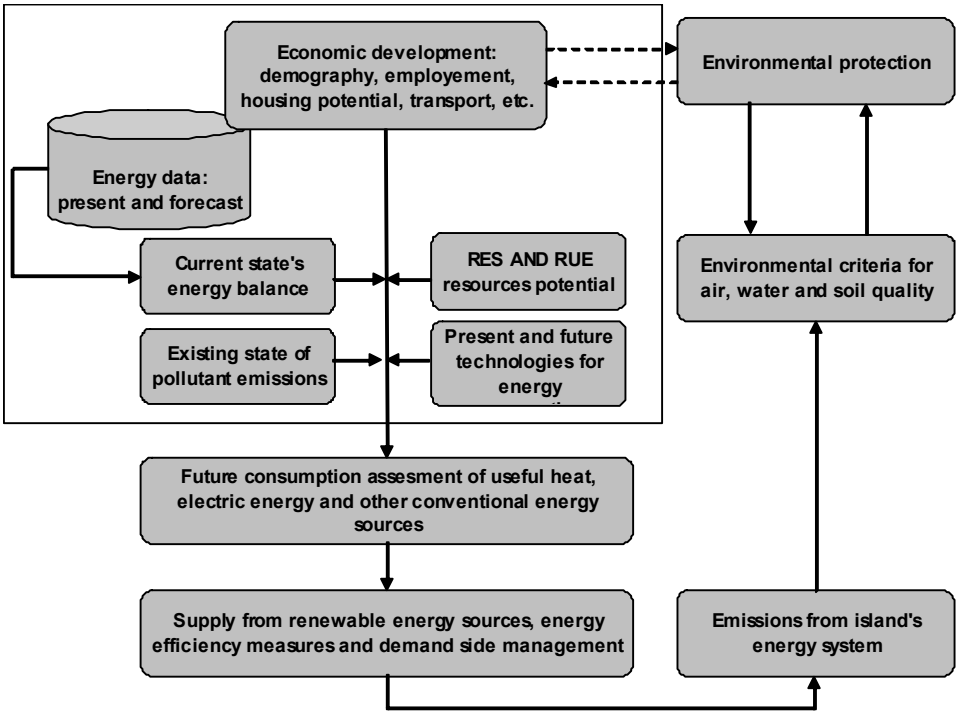


Figure 1. Integrated energy planning

2. ENERGY PLAN OF THE ISLAND OF BRAČ

On the base of the previous energy consumption analysis and survey results in Split Dalmatia County and on islands separately which were conducted in the frame of several energy development projects [1], [2], [3], energy balance for the island of Brač in 2008 is constructed as well as the forecast of the future needs. All analyses are performed for each consumption sector (households, services, industry), according to the final energy consumption and purpose of the consumption (thermal energy, non-thermal energy and cooling).

2.1 Present energy demand

Total final energy consumption for households, services and industry in 2008 amounts to 337 TJ. Electricity has the biggest share in the total consumption with about 56,7 GWh or 57 %. Fuel wood consumption has a share of about 23 %, fuel oil 15 % and LPG 5 %. As regards consumption sectors, households spend the highest amount of energy – 60 percent, followed by services with 31 percent and industry with 9 percent.

Table 1. . Total energy balance consumption on the island of Brač in 2008

	fuel oil	LPG	wood	elect.	total
	TJ				
households	30,2	15,3	82,5	85,8	213,7
services	8,0	2,2	0,2	102,0	112,4
industry	14,8	0,0	0,0	16,4	31,2
total	53,0	17,5	82,7	204,2	357,4

	fuel oil	LPG	wood	elect.
	t	t	tis. m3	MWh
households	30,2	15,3	82,5	85,8
services	8,0	2,2	0,2	102,0
industry	14,8	0,0	0,0	16,4
total	53,0	17,5	82,7	204,2

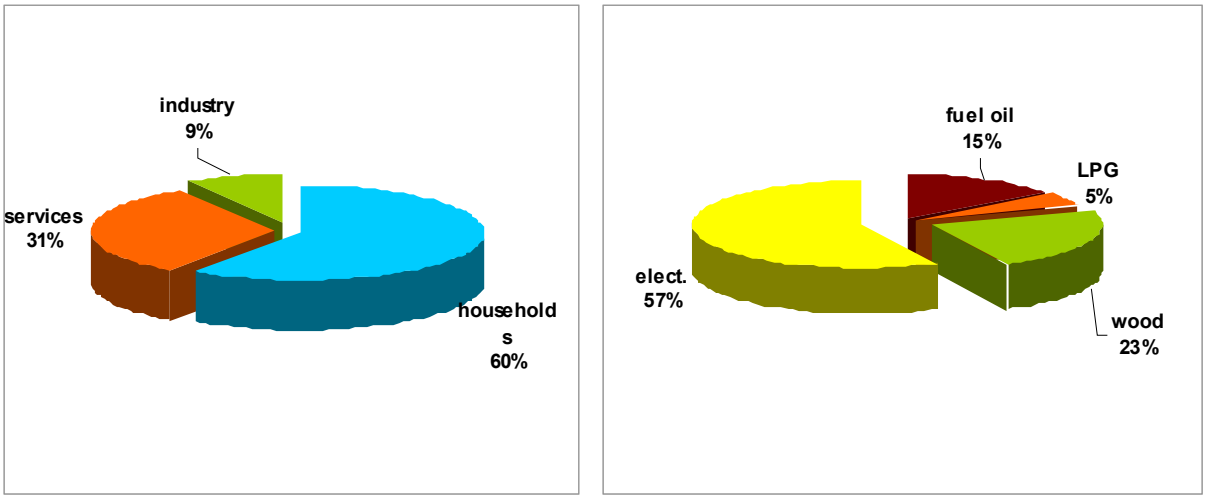
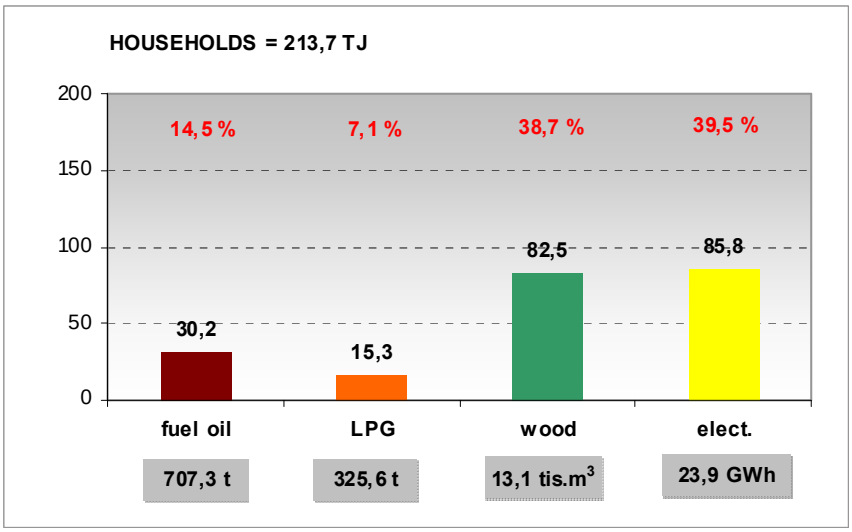
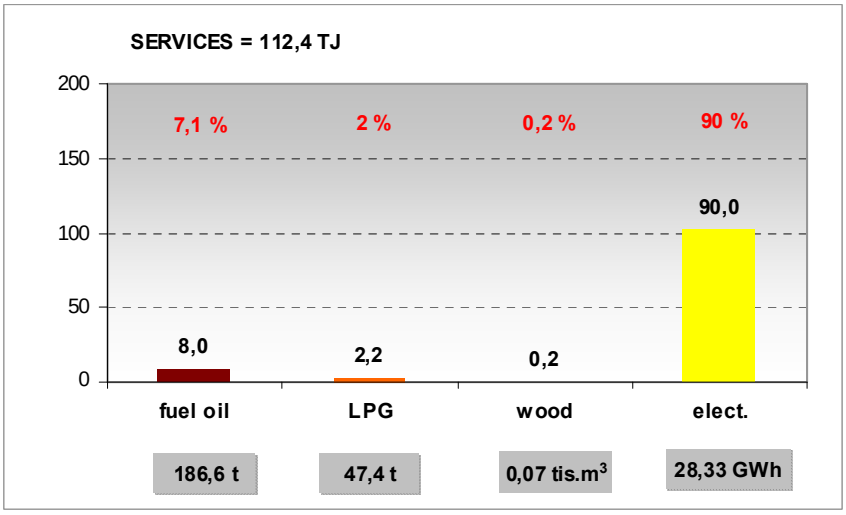


Figure 2. Balance of energy consumption by sectors and energy sources

Energy consumption by sectors in 2008 is presented on the figure above. Energy demand is calculated using bottom-up approach which allows distribution of the end-use consumption at the consumer level. Therefore calculation on the lower level, for municipalities, settlements and towns on the island is available as well as purpose of the consumption.
Example of the distribution of energy consumption in local communities in 2008 is presented on the following picture.





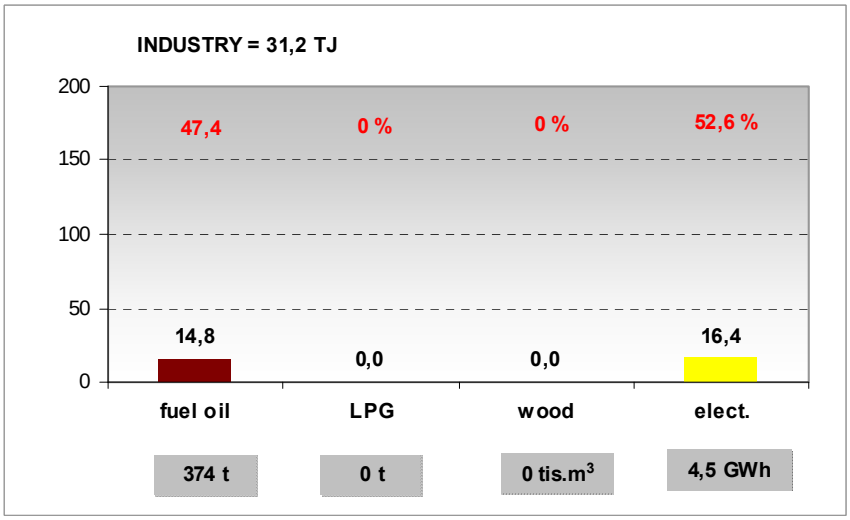


Figure 3. Energy consumption by sectors in 2008

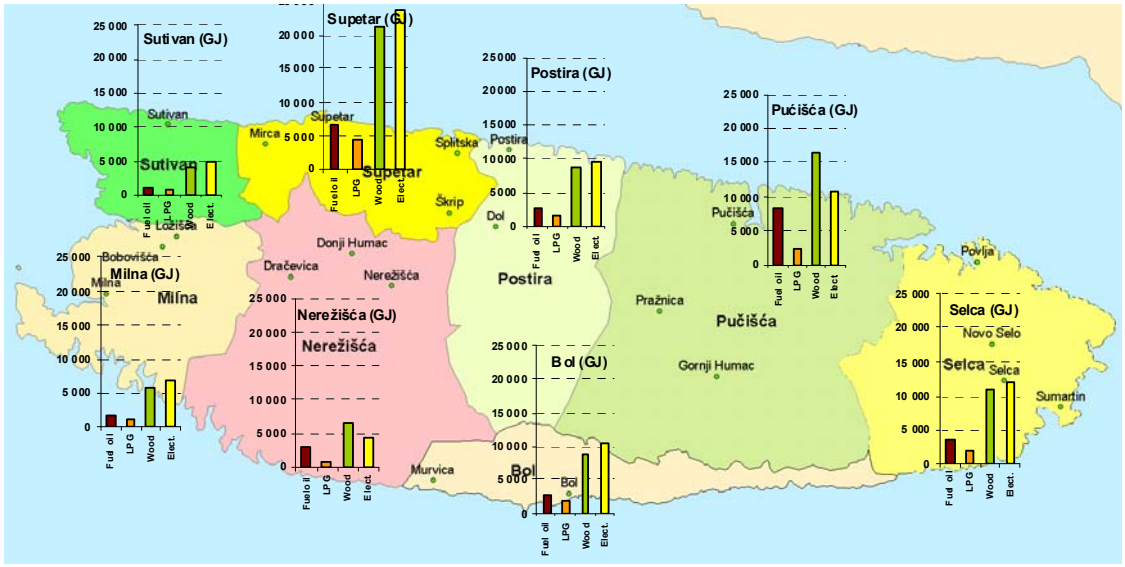


Figure 4. Distribution of energy consumption in households by municipalities

2.1.1 Future end-use energy demand

On the basis of detailed energy analysis in 2008 and expected changes of crucial parameters in energy planning process (number of inhabitants, households, dwellings, dwellings size, central/room heated dwellings, services surface areas, normative of energy consumption and others) end-use energy consumption for thermal purposes, non-thermal consumption and cooling is modelled and calculated. This structure is important in the later analysis when energy supply scenarios are developed. Thermal energy consumption is the ground for the modelling of conventional and biomass energy consumption. Total end-use energy demand in the period concerned is expected to increase from 335 TJ in 2008 to 736 TJ in 2030.

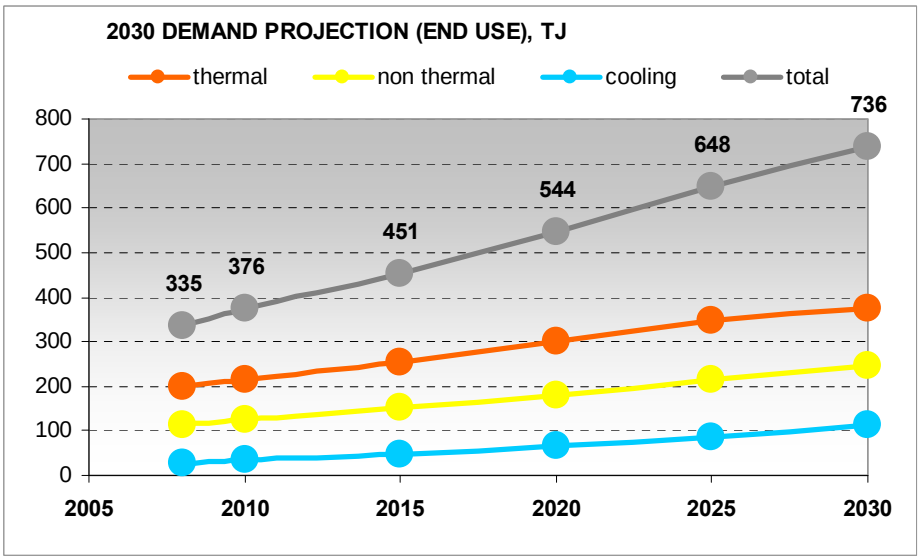


Figure 5. End-use energy consumption forecast

2.1.2 Future energy supply options – scenarios

Energy development of the island of Brač is defined in the framework of four energy scenarios. They are based on the simulations of possibility of gas distribution network development and introduction of the energy efficiency measures (EE) through isolation of buildings and renewable energy sources (RUE) into energy structure consumption: solar heaters, biomass, etc. All scenarios are evaluated technically and financially and describe not only the overall energy system development on the island of Brač but spatial development of particular areas, like municipalities or towns.

Four scenarios until 2030 are described in the following way:

- Scenario 1 provides for slow energy structure and technology changes without gas network development and without support and incentives for introducing EE measures and RUE
- Scenario 2 provides for significant intervention and supports for the EE and RUE introduction but not construction of the gas network
- Scenario 3 is opposite to Scenario 2: concerns construction of the gas network but not support for introduction of the EE and RUE
- Scenario 4 is an optimistic scenario with strong intervention and supports for the EE and RUE as well as construction of gas network.

Parallel to these activities possible development of electricity distribution system is analysed in interaction with the results of the above mentioned scenarios. Special activity was directed to the analysis of the potential of the fuel wood on the island as a very important energy source in households and to possibilities of introduction of individual LPG containers for consumers.

Some of the main results are:

- In 2030 consumption of liquefied petroleum gas (LPG) can reach, according to scenario 3 and scenario 4, 3,361 tons, or 2,556 tons respectively. This consumption is assumed only in the larger municipalities: Bol and Supetar.
- According to scenario 2 and scenario 4 the introduction of solar heaters is expected to be realised in 2,313 households or 1,850 households respectively, as well as result with about 6,900 m^2, or 6,250 m^2 respectively, of solar collectors in service sector.
- In order to achieve the goals of scenarios 2 and 4, 2,413, or 1,690, of the old households should be reconstructed in terms of improved thermal isolation.
- Fuel wood will still remain a very important and significant energy source. According to scenario 1 demand for fuel wood will remain at the level from the year 2008, but according to the optimistic scenario 4 demand for fuel wood will until 2030 decrease to 6 thousand m^3, or to about 48 percent of the initial 2008 level.

Realisation of all these measures will in different ways affect the electricity distribution network development plans. However, growing standard and overall development will result in a continual increase of electricity demand and the corresponding need for network development and reconstruction. According to scenario 1 electricity consumption will reach 110 GWh in 2030, while scenario 4 shows consumption of about 85 GWh.

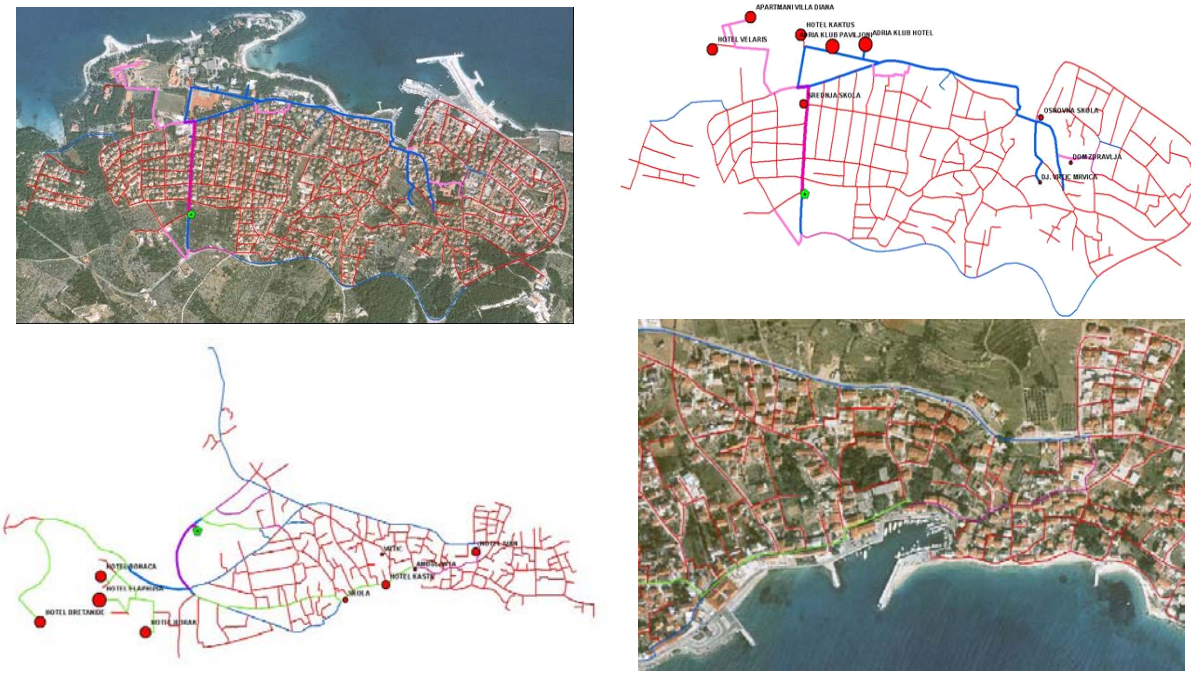


Figure 6 Gas network development in Supetar and Bol

Figure 7. Reconstruction and development of the main electricity distribution network until 2030

3. CONCLUSION

Developing the energy plan is first and crucial step in processes that are necessary for island of Brač to achieve its sustainable energy system targets. At the moment, investments in the gas distribution network, reconstruction and development of electricity network is analysed. Parallel to the technical development of the assumed networks construction, capacities and feasibility for introduction concrete energy efficiency measures and renewable energy sources is elaborated.

The results of the work on energy scenarios on island of Brač will provide the variety of development activity: energy potentials and resources, proposals for internal and external implementation organisation, management, sources for financing projects (Fond ZOEU, Budgets, Incentives, ets.) as well as measurement of the results. Such evaluation is focused on specific factors linked to sustainable development, and at the same time result in a number of concrete proposals for improvement of the energy supply of the island.

4. REFERENCES

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