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Possibilities to use renewable energies for land improvement arrangements and farms

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Abstract – The main objectives of this paper are the following: presentation of the already famous types of renewable energies, advantages brought by the use of this vs. the conventional types (based on hydrocarbons) and a review of the possibilities to use this energies efficiently for the land improvements arrangements and farms.
As a result, the paper has a general character, like an overview regarding a set of works with punctual technical applicability that we have proposed for the future.
Key words: renewable energies, wind energy, solar energy, thermal energy, etc.

I. INTRODUCTION

The energies called today renewable or alternative and until recently unconventional were available for humans since their early beginnings.
The hydraulic, wind energy for displacement and transport of merchandise on water or to be transformed into electric energy, hydromechanics or simple mechanical energy through watermills, hydropower plants, solar energy to obtain heat energy, bio energy or geothermal energy, were intensively used and exploited along humans history.
Reversing towards renewable energies was made beside the mentions above also due too the advantages they bring:

- are clean energy with very little or zero pollution for the environment components;
- most part of them are regenerative;
- they represent ideal solutions to obtain the energies required for small or isolated communities;
- they require low conversion costs into electric, heat or hydromechanics energy;
- have affordable prices for gear and constructions required for the arrangements.

Types of renewable energies.
The ever-living primary sources are made of water, solar, wind, geothermal, waves and biomass energy. They are considerate ever-living because they are found in high quantities or hey are permanently regenerated.
Water is found in nature at the earth surface, underground (phreatic waters) and in atmosphere. Terra's water resources are about 1,37 billions km³, from who 97,2% are water located in seas and oceans and 2,7% located in underground and surface waters. Surface waters represent only 0,002%. From fresh waters, only 1,44% are liquid, the rest are blocked in glaciers. The water availability is about only 4% from the fresh water ressources which represents 1: 700.000 from the planetary ocean. Thereby the water resources are limited and uneven dispersed around the globe, permanently suffering from pollutant actions.
Water is used as :

- drinking water for human and animals;
- in agriculture;
- in industry, as raw material, cooling agent, transport agent, to obtain steam or for gear action (turbine, mills, etc.);
- for transport;

Solar energy arrived as light flux represents only 0,04% from the solar radiation aimed to Earth. It is used for water evaporation, drying some products, heating and photosynthesis. To obtain hot water dark surface panels are used, that are passed by a coiled pipe with water or parabolic mirrors with the focus circulated by the water pipe.
With the aid of the semiconductors solar energy can be converted into electric energy, using the photovoltaic or thermionic effect. By example with semiconductors Si/Si unclear, GaAs/AlGaAs, or Cd/s type, through the created junction radiation is obtained potential difference. Applications are found in telecommunications, solar modules, signal lights, etc. Expansion projects for solar energy regard the African continent, where solar energy has an unusually intensity on large surfaces.
Wind energy can be converted into mechanical energy or electric energy using wind engines. A plant build in Spain has two runners with 40 m diameter each, fitted on a 45 m tall mast, generating electricity of 3 MW power. Smaller power installations are used in secluded areas with relatively constant wind speed.
Waves or tides energy can be converted into electric energy using turbine type installations, oscillating columns or panels. For waves higher then 20 m were achieved yields of 13% and 75W power. Main concerns regard the installations reliability, high material consumption, low conversion yields, applicability only in some areas on earth..
Geothermal energy is made from the energy stored in rocks or thermal waters. Thermal waters are efficiently used to obtain electricity only when temperature is

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higher then 60ºC. The use of heat accumulated in rocks and transformation into steam in low depth magmatic areas, must avoid causing major ecological changes (volcanic eruption, earthquakes).

Biomass is represented by vegetal mass and fermentable wastes, resulted from domestic consumption, agriculture, food industry. For example, from sugar cane is extracted sugar and then through alcohol fermentation is produced ethanol that can be used as fuel in adapted engines. Animal waste can be anaerobic fermented at 38ºC, to obtain biogas. Biogas can be also used for burning and it also reduces the animal wastes volume.

Energetic alternatives

Energetic alternative for fuels depletion is represented by hydrogen. This is found in hydrocarbons and water. The idea is based on water decomposition in oxygen and hydrogen and then hydrogen burning resulting electricity and water restoration.

$$2H_2O \rightarrow 2\,H_2 + O_2$$

$$2H_2 + O_2 \rightarrow 2\,H_2O + \text{electricity}$$

The principle called „combustion piles" was applied at space ships and in present is introduced in other fields.

II. LOCATIONS AND POTENTIAL IN THE V WEST REGION AND TIMIŞ COUNTY. CONCLUSIONS REGARDING THE UTILISATIONS POSSIBILITIES

To approach an investment in the renewable energies domain, location favourably for energetically application are selected depending some criteria, including conditions and technical, economical and environment restraining.

The main selection criteria are the followings:

- Energetic potential of renewable source in the interested area;
- Actual location conditions (terrain morphology, roughness, obstacle, terrain nature).
- Closeness to human settlements;
- Natural reservations, historical, touristic, archaeological areas;
- Special details: restricted areas, civil/military airports, special telecommunication objectives, etc.
- Existence and condition of access areas;
- Condition of degree in land usage: juridical regime, leasing/buying.
- Possibilities to connect at the electric network: distance, power level;
- Existence of a consumer in the area;
- Potential investors in the area;
- Potential self-producers in the area;
- Possibilities of public/private partnership;
- Technically-economical performance indicators favourable for investment approach in the selected area.

2.1.Biomass energy potential in Timiş County.

Table 1

Biomass type	Theoretic potential [GWh/a]	Technical potential [GWh/a]	Achievable potential (until 2020) [GWh/a]
Tail water slime	26	26	12
Tail water	58		
Municipally wastes	872	315	315
Domestically wastes	314	314	314
Paper, board, foils	59	59	59
Streets wastes	6	6	6
Total organically agriculture wastes	10004	5002	5002
Sugar beet	0,3	0,3	1,3
Tomatoes	173	173	173
Vegetables	61	61	61
Straw	7970	3985	1993
Pigs	≥1800	≥1800	≥1800
Waste biogas	250	25	25

Table 2

Biogas potential from agriculture wastes

Cultivated area in 2007 [ha]	Wastes [toTR/a]	Biogas production [Miom^3/a]	Biogas [Miom^3/a]	Energetic potential [Miom^3/a]
Sugar beet	20	100	0,475	0,048
Potatoes	12268	35986	0,8	28,8
Other vegetables	12926	14477	0,7	10,1

Dry Biomass.

Wood

It is used mainly for heating and cooking in households. The energy potential from forestry is very low in Timiş County.

Paper, board and foils

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Energetic potential can be estimated at around 59.000MWh/year.

Straw (hay)

From the cereal cultivated area in Timiş County, considering the efficiency of straw production at 5,5t and an inferior calorific power we can estimate energy potential at straw burning at around 7.970.074MWh/year.

Organically municipally wastes

Energetic plants

Uncultivated present terrains could be used in the future for energetic plants. Still this types of plants must be carefully chosen so they do not interfere with food plants.

Animal wastes

In Timiş county are raised currently about 2 millions pigs. From 2 millions of pigs farmyard manure can be produced a quantity of biogas around 240-300 million m^3/year, which corresponds to a energetic potential of 1,44-1,8 millions de MWh/year, with a medium caloric power of 6kWh/m^3 de biogas.

Domestically wastes rural and urban

Burning the 313.950 tons of trash produced in Timiş County in 2007 we could obtain an energy of 872.083MWh/year, considering a caloric power of 8-10 MJ/kg form domestically wastes.

Wastes from public sanitation

Annual are collected in Timişoara about 12.000 tones of wastes from de public streets cleaning and the public wastes tanks. From these it could be generated about 0,9 million m^3 of biogas/year and respectively a total generated of 5.600MWh /year.

Tail waters

In municipally tail waters are found various organically carbon compounds that can be converted into biogas through anaerobic degradation. For the 661.000 residents from Timiş County we could obtain if all tail waters are collected a potential of 9.650.000 m^3 of biogas per year, leading to a potential energy production of 57.900MWh/year, considering a caloric power of 6 MWh/m^3.

Biogas from slime and sediments from cleaning plant

Slimes and sediments came from decantation basins and installations from cleaning plants. The infiltrated water content into the sewage systems is very high, with a low concentration of tail water typical substances. Treatment stations and cleaning plants are in reconstruction and technological modernisation. When information regarding tail water generated per habitant in Timiş County will be available we can calculate exactly the biogas potential from slime and sediments.

2.2 Wind potential in Timiş County.

Timiş County has unfavourable conditions to use wind energy comparing with coastal areas in Romania. Average wind speed in Timiş County is lower then average wind speed in coastal areas.

The lowest potential is found in the north-eastern part and the centre north part of the County, the highest potential is in south, south-west.

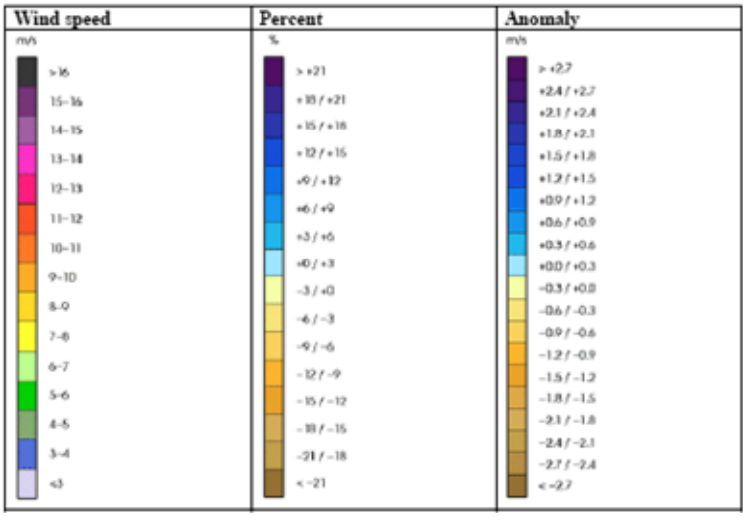

Figure 1
Legend for maps with wind speed, anomalies and percents

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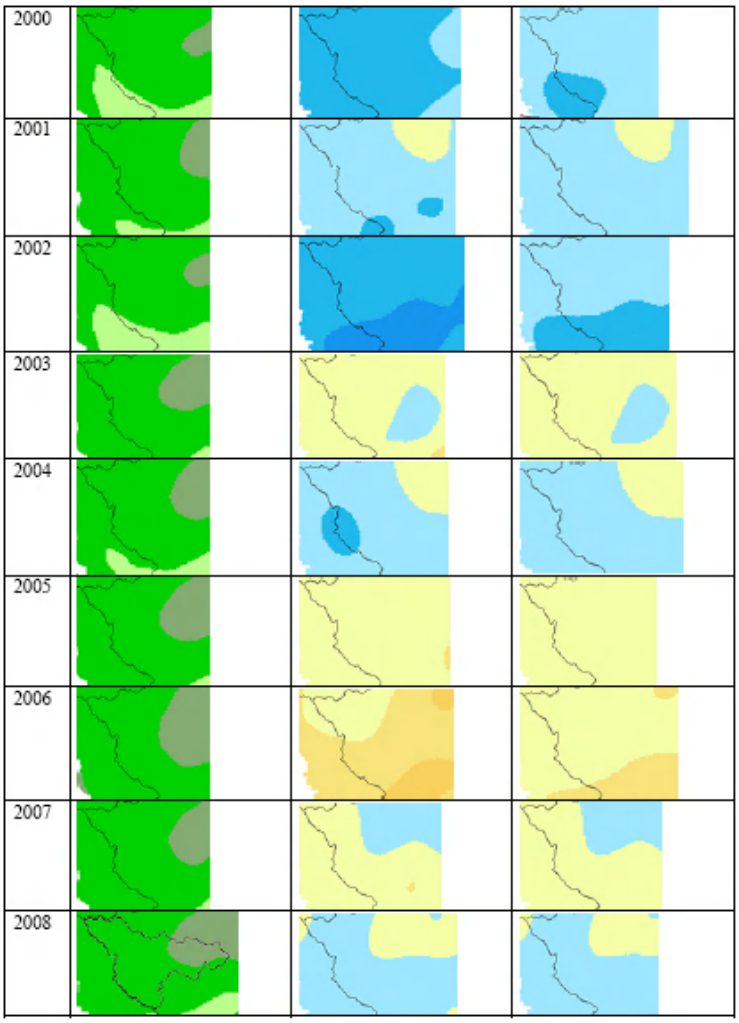

Figure 2
Map with an annual average potential focalised on Timiş County

2. 3 Photovoltaic potential in Timiş County

With the help of the METEONORM program were measured solar radiations for Timişoara region.

Photovoltaic potential from surfaces required on households & equivalent saved energy.

Based on required surfaces usage on „households" and considering the equivalent energy covered in solar photovoltaic energy consumption it results the solar photovoltaic potential of 960MW capacity installed until 2020, with about 190MW foreseen for installation per year.

Figure 3
Difused and direct horisontal radiations.

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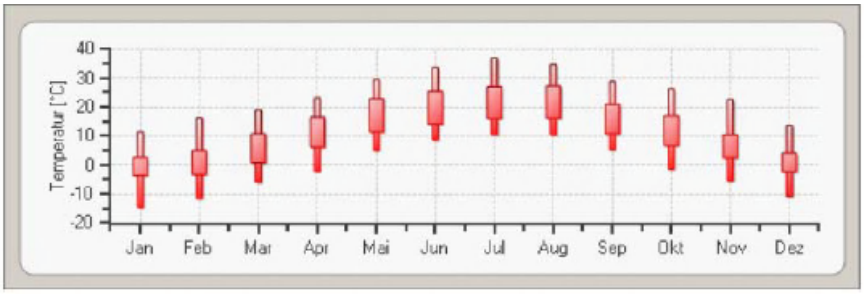

Figure 4
Minimum and maximum temperatures on every month for one year.

Table 3
Photovoltaic potential „achievable" in Timiş County for 2020

		Value	Unity
Number of habitants in Timiş County	Info	687377	Habitants
Number of habitants/households estimated	Estimated	2	Habitants /household
Number of households	(C=A/B)	343689	household
Energy consumption/habitant in Romania/2006	Info	2401	kWh/habitants
Energy Consumption /household	(F=B*E)	4802	kWh/(year*household)
Solar global radiation	METEONORM	1275	kWh/year
Photovoltaic performance rate	Info	0,75	
Achievable/installation/household	Estimated	2,5	kW
Energy production/household	Info	2391	kWh/ household
Solar coverage of energy consumption	(=I/E)	49,78	%

2. 4 Hydraulic potential in Timiş County

Hydraulic potential is too small for solid implementation projects in Timiş County, this is the reason why this types of projects or not financed currently or in the future.

III. POSSIBLE SOLUTIONS FOR RENEWABLE ENRGIES UTILISATIONS IN LAND IMPROVEMENTS ARRANGEMENTS AND FARMS

Most known applications of this area regarding hydroelectric/hydrodynamic energy with direct application in land improvement are:

1. The hydraulic transformer (Bărglăzan).
2. The hydraulic Pump („water ram").
3. The hydraulic wheel/paddle wheel.
4. Fertilisations irrigation installation.
5. Locks/regulators with hydraulic action.

All this mechanisms/mechanical systems or hydrotechnical constructions are energy generators using the hydraulic energy (pumping or obtaining the optimum hydraulic regime on the channels networks or water ways for various land improvements/hydrotechnical purposes. They are technical applications for functioning in permanent (classic) hydraulic regime, but especially the nonpermanent, and under pressure (unconventional/alternative) hydraulic regime.

Solar energy can be used in land improvements for:

Pumping**:**
- Pump stations for small arrangements;
- Water pump stations for farms;
- Pump stations for rural area;
- Solar wells and water mill.

Communications**:**
- Breakdown telephone;

Control**:**
- Water level measurement in reservoirs and in irrigations/drainage channels.

Illuminating**:**
- Illuminating systems for streets, private or public houses, yards or farms.

Transport**:**
- Charging accumulators for cars or agrarian equipments;
- Electric propulsion for lakes, rivers or channels displacement or the irrigation gears.

Heating**:**
- House or animal water, pre-heating for irrigation water.

Electric energy**:**
- Electrification of rural areas, islands or secluded areas.

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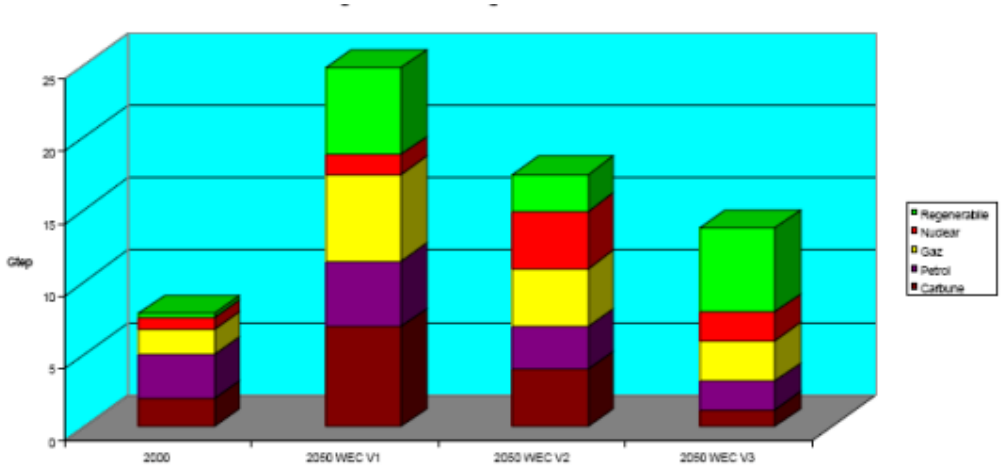

Fig. 1.2.2 Alternative energy scenarious 2050

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