VISNOVA
CLEAN ENERGY FROM RURAL REGIONS

SWOT Analysis for Renewable Energies and Energy Efficiency

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CENTRAL EUROPE
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1. The „Green" society

Motto: „The realization of the problem is the first step towards the solution!"

Let's ask ourselves! Are we late to save our natural environment?

A lot people give a lot different answers to this question.

According to the pessimistic perception: Yes! They think that humanity has caused too much damage with its activities, which results in irreversible consequences no matter how much effort the humanity is now willing to take.

Unfortunately, there is another group, who are not aware of the damage and its consequences that the humanity has caused so far. They can be characterized with a simple fable:

Jan Hus, who lived in the 14th century, was a Czech priest and a university professor, who turned the religious leaders against himself with his doctrines. According to the customs of that age, he was first excommunicated and then he was burned at the stake, because of his guilty thoughts. It is said that while Hus was burning at the stake, an elderly woman passed by, who gathered faggots and she put them at the stake for heresy. His last words were the following:" Oh, blessed simplicity."

I personally belong to the third group. I believe that the humanity is not late to take actions.

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On what do I base my optimism?

I believe that we can change the “ignorant” minds of majority with the help of proper communication

We can take advantages of the rapid technological development, which caused sudden deterioration in the last three centuries (e.g. to save our natural habitat and to maintain sustainable development)

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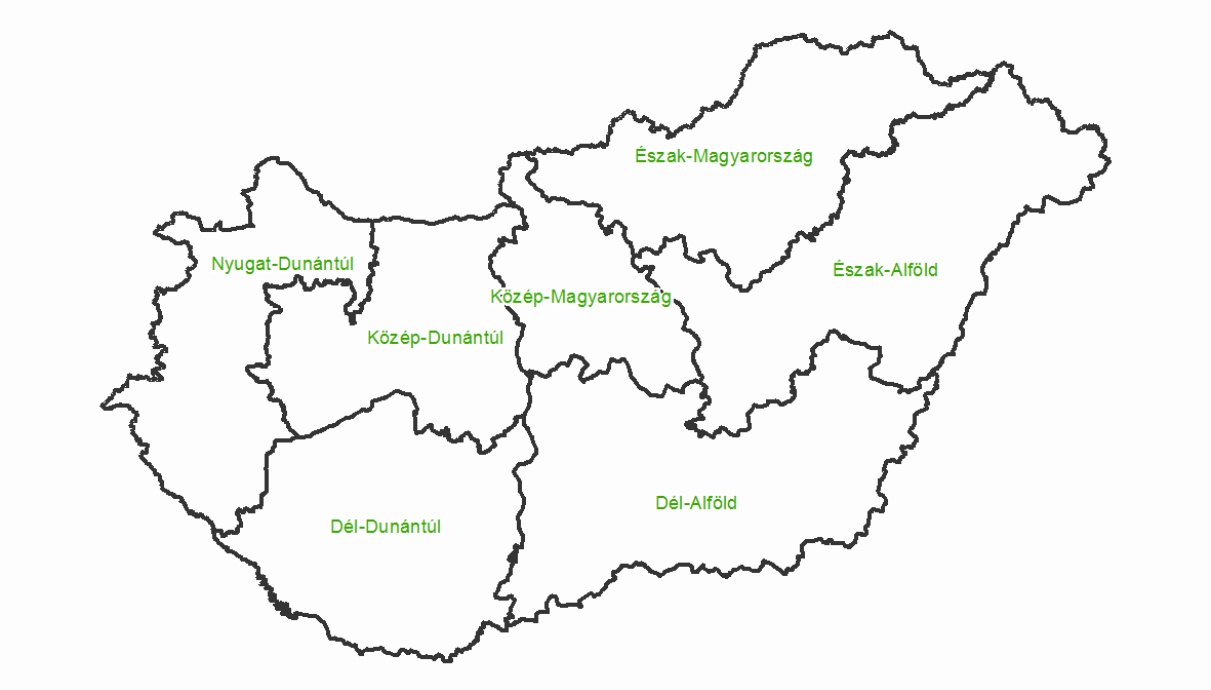
2. Introduction of the South-Transdanubian Region

2.1 Topological Layout

The Transdanubian-Region is one of Hungary's seven Strategic Planning Regions, and located in the south-western part of the country. It is bordered by Croatia to the South and South-West, the Southern Great Plain to the East, Central-Transdanubia to the North and the Western-Transdanubian Region to North-West. Its area is 14 168,61 km^2, its population is 940 585. It consists of 3 counties, Baranya, Somogy, Tolna, and the center of the region is Pécs.



1. ábra Topological layout of the South-Transdeanubian-Region
Source: VÁTI TeIR adatbázis
http://arcgis.vati.hu/teirgis_kozigazgatas/

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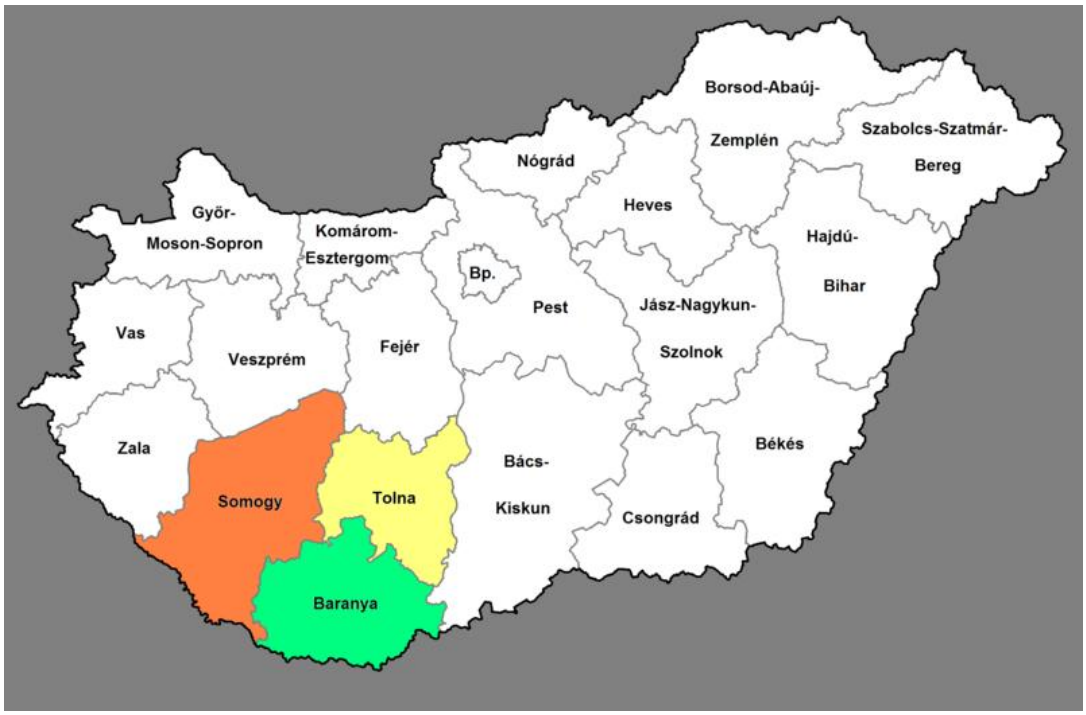

Its geography and hydrography is particularly diverse, with hills (Transdanubian and Somogy-hills, Tolna-ridge, Szekszárd-hills, Geresd-hills), mountains (Villányi and Mecsek), valleys (Völgység), plains (Pécs plains, Sárköz, Nagyberek) and rivers (Danube, Drava, Sio, Kapos). Its highest peak is the Zengő (680m), many of its higher peaks reach up to 100-300 metres above sea level. It is affected by the pool effect, and those parts located in the basin are mainly comprised of valley-scattered hills, even-surfaced smaller mountains torn into lumps, and large plains created by neighbouring rivers.

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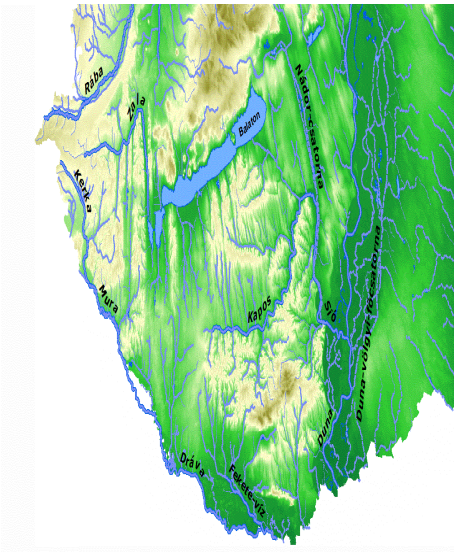

2. ábra Geography and hydrography of the South-Transdanubian Region
Source: VÁTI TeIR adatbázis
http://arcgis.vati.hu/teirgis_kozigazgatas/

The Mecsek and the Villány mountains are often referred to as the southern bastions of the Transdanubian hills. Among these the Mecsek can hardly be called a mid-mountain, as its height barely reaches 600 metres above sea level, while the Villány-mountains only reach above 400 metres. The title of the mountains (and sometimes their nature) is a result of the relative height compared to South-Transdanubia and the surrounding plains, or rather their observable geographic structure that gives away the local mountain forming forces. These two mainly West-East oriented mountains are surrounded by lower hills, from which the Zselic and the Völgység to the North, Szekszárd-hills to the East, Geresd-hills and Mórágy (or the so called „Fazekas-boda-Mórágy lump") to the South-East , and of course the Baranya-hills lying between Geresd and Mórágy, belong to the Mecsek Region. (4) On the northern border of the region lies the biggest body of water of Central Europe, Lake Balaton (net surface 595 km2, length 78km, greatest width 12km, average depth 3m), bordered by the Danube to the South,

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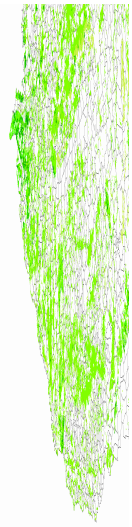
the Drava to the South-West. The Danube-Drava National Park is located in this region, along with 4 other landscape protection areas, and 23 natural reserves.



3. ábra Forest areas of the South-Transdanubian Region
Source: VÁTI TeIR adatbázis
http://arcgis.vati.hu/teirgis_corine/
CORINE 2006

2.2 History, population, settlement structure

Immigrant tribes appearing around 2000 B.C. brought the civilisation and knowledge of the Bronze Age with themselves, and thanks to their technological superiority, they soon prevailed over the aboriginal tribes. Instead of caves and holes dug in the ground, they erected huts in areas covered by water, wore fur clothing and created common tools, pots, jewellery and arms, all made of bronze. They even created dirt fortifications on higher grounds of importance.

During the establishment of the state, Stephen I of Hungary bestowed lands to earls and knights, to fight on his side against Koppány. After the Mongol invasion, Béla IV of

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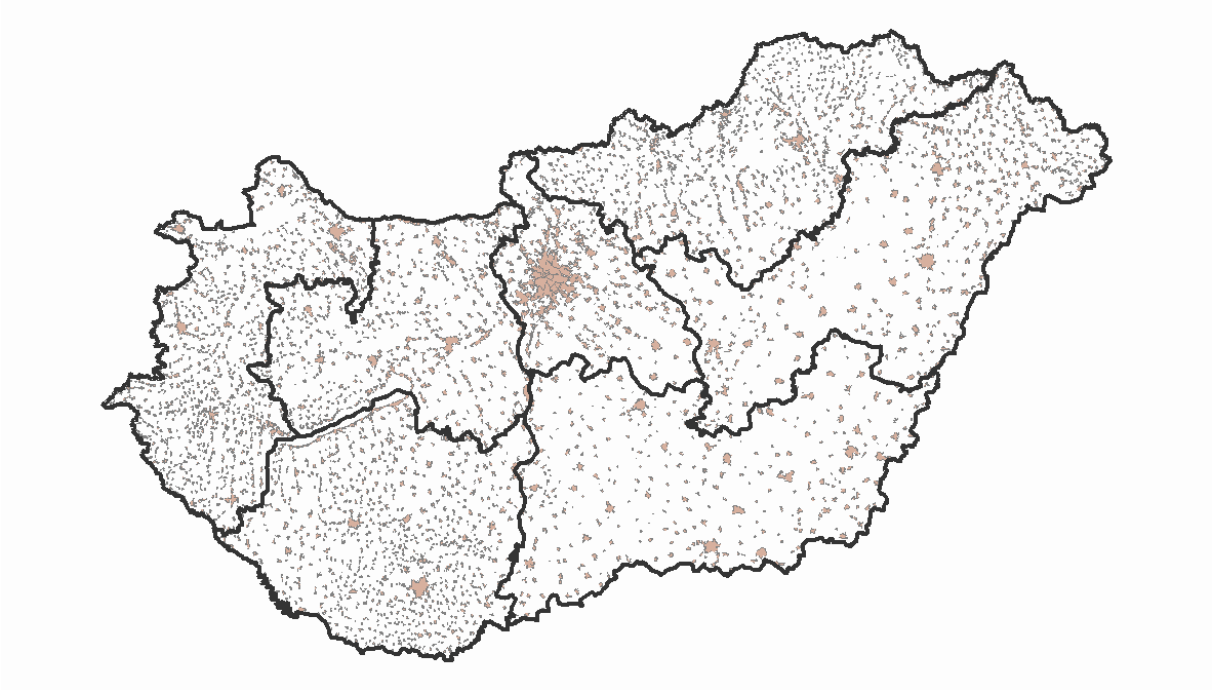
Hungary established the nobiliary county system. Fortifications of the county system were of great importance during the Ottoman occupation, and changed hands several times. After a course of battles the Habsburgs put the region under a military dominion, lands got to foreign hands at the whims of the authority, and huge taxes were imposed on any kind of income.

From the 18th century, different ethnic groups were relocated here to stop the decline of the population, and today a varied ethnicity can be found almost anywhere in this region.

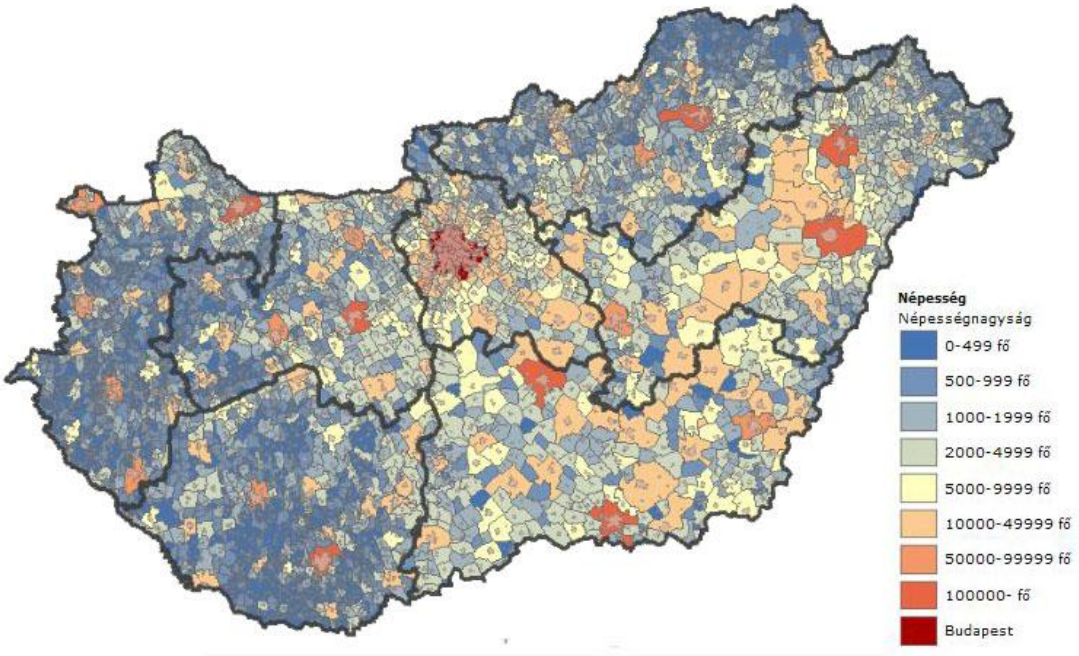


4. ábra Settlement structure of the TransDanubian-Region
Source: VÁTI TeIR adatbázis
http://arcgis.vati.hu/teirgis_kozigazgatas/

2.3 Population today

The region's current demographic situation is characterized by the fact that the region makes up 15% of the country, while the population registered here in early 2011 is 9%

of the total population. Consequently, the region's population (66/km2) density is significantly lower than the rest of the country (107/km2). Unfortunately the decrease in population is common in most of the country, which is not due to the peculiarity of the region, but the peoples' unfortunate natural movement. The decrease in population amounted to 7400, of which 5400 was of natural cause, as opposed to 2000 migration cases. With decreasing figures of birth rate and increasing numbers of mortality, diminishing process of the population has further accelerated in the South-Transdanubian region, surpassing last year's figures by 16%. Furthermore, the rapid decline in the region's age structure is a direct consequence of the low birth rate.



5. ábra Népességnagyság alakulása Magyarország régióiban 2010
Forrás: VÁTI OKIR-TeIR adatbázis
http://okirteir.vm.gov.hu:8080/okirteir_html/

The direction of domestic migration and size can significantly change the given area's population which is determined by the births and deaths of the inhabitants. As of 2011, nearly 201 thousand people changed their permanent residence, which is less then 1

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percent decrease from the previous year. Among the counties Tolna and Baranya have poor indicators concerning population maintenance.

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Cities and towns

County, Capital, Region	Town of County Rank	Other towns	Municipalities	Area (square kilometre
	2011			
Budapest	1	–	–	525,13
Pest	1	47	139	6 391,14
Közép-Magyarország	**2**	**47**	**139**	**6 916,27**
Fejér	2	13	93	4 358,45
Komárom-Esztergom	1	10	65	2 264,52
Veszprém	1	14	202	4 492,86
Közép-Dunántúl	**4**	**37**	**360**	**11 115,83**
Győr-Moson-Sopron	2	9	172	4 208,05
Vas	1	11	204	3 336,14
Zala	2	8	248	3 783,89
Nyugat-Dunántúl	**5**	**28**	**624**	**11 328,08**
Baranya	1	13	287	4 429,59
Somogy	1	15	229	6 035,86
Tolna	1	10	98	3 703,16
Dél-Dunántúl	**3**	**38**	**614**	**14 168,61**
Dunántúl	**12**	**103**	**1 598**	**36 612,53**
Borsod-Abaúj-Zemplén	1	27	330	7 249,67
Heves	1	8	112	3 637,21
Nógrád	1	5	125	2 545,48
Észak-Magyarország	**3**	**40**	**567**	**13 432,36**
Hajdú-Bihar	1	20	61	6 210,51
Jász-Nagykun-Szolnok	1	19	58	5 581,61
Szabolcs-Szatmár-Bereg	1	26	202	5 935,83
Észak-Alföld	**3**	**65**	**321**	**17 727,95**
Bács-Kiskun	1	21	97	8 444,81
Békés	1	20	54	5 629,71
Csongrád	2	8	50	4 262,71
Dél-Alföld	**4**	**49**	**201**	**18 337,23**
Alföld és Észak	**10**	**154**	**1 089**	**49 497,54**
Summary	**24**	**304**	**2826**	**93 026,33**

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Population

County, Capital, Region	Population		Population density/square kilometre
	2001	2011	
Budapest	1 759 209	1 733 685	3 301
Pest	1 071 898	1 237 561	194
Közép-Magyarország	**2 831 107**	**2 971 246**	**430**
Fejér	428 115	426 120	98
Komárom-Esztergom	316 998	311 411	138
Veszprém	371 608	356 573	79
Közép-Dunántúl	**1 116 721**	**1 094 104**	**98**
Győr-Moson-Sopron	438 218	449 967	107
Vas	269 149	257 688	77
Zala	300 496	287 043	76
Nyugat-Dunántúl	**1 007 863**	**994 698**	**88**
Baranya	408 147	391 455	88
Somogy	337 930	317 947	53
Tolna	251 594	231 183	62
Dél-Dunántúl	**997 671**	**940 585**	**66**
Dunántúl	**3 122 255**	**3 029 387**	**83**
Borsod-Abaúj-Zemplén	753 497	684 793	94
Heves	327 733	307 985	85
Nógrád	221 605	201 919	79
Észak-Magyarország	**1 302 835**	**1 194 697**	**89**
Hajdú-Bihar	553 264	539 674	87
Jász-Nagykun-Szolnok	420 461	386 752	69
Szabolcs-Szatmár-Bereg	589 989	555 496	94
Észak-Alföld	**1 563 714**	**1 481 922**	**84**
Bács-Kiskun	547 954	524 841	62
Békés	401 919	361 802	64
Csongrád	430 514	421 827	99
Dél-Alföld	**1 380 387**	**1 308 470**	**71**
Alföld és Észak	**4 246 936**	**3 985 089**	**81**
Összesen	**10 200 298**	**9 985 722**	**107**

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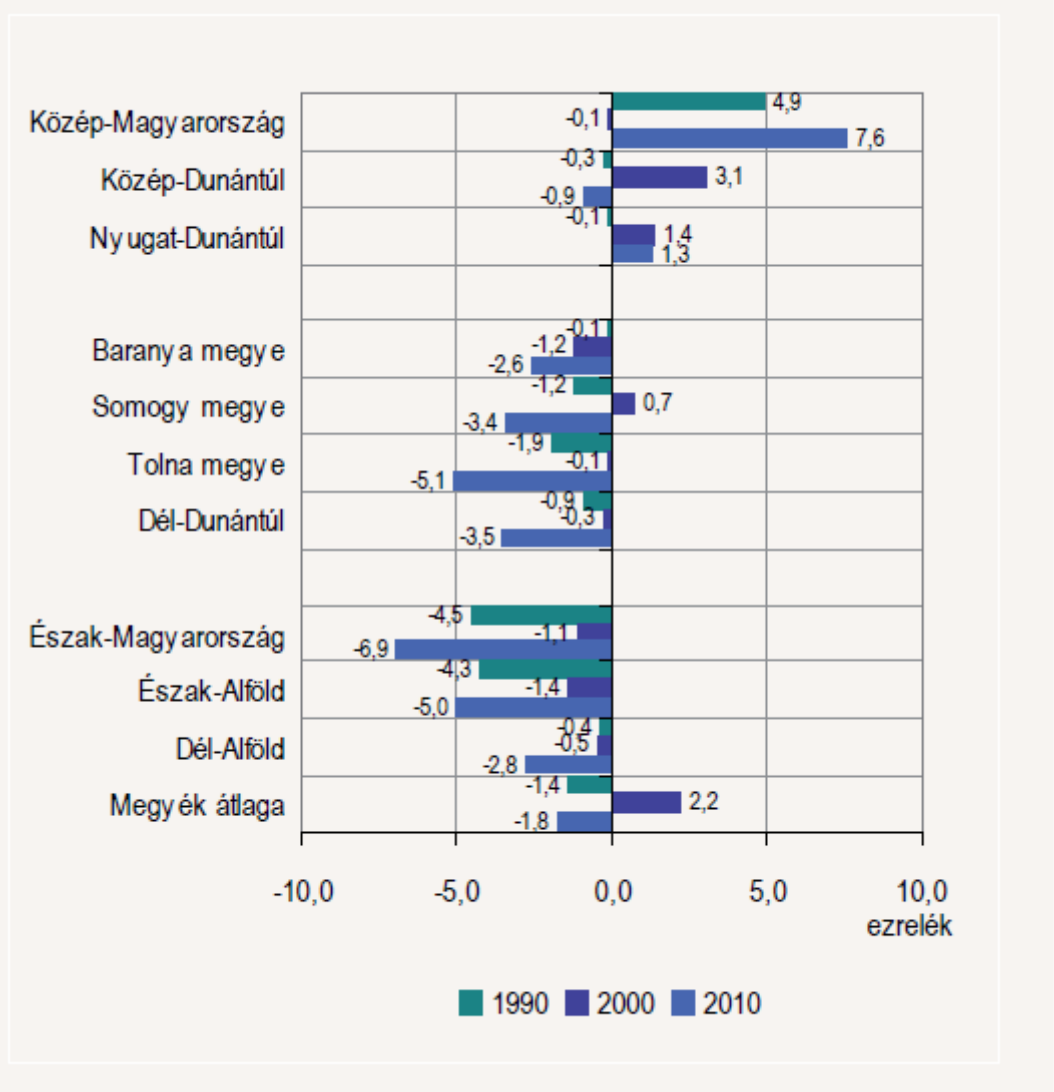
Domestic migration balance per thousand inhabitants, 2011:



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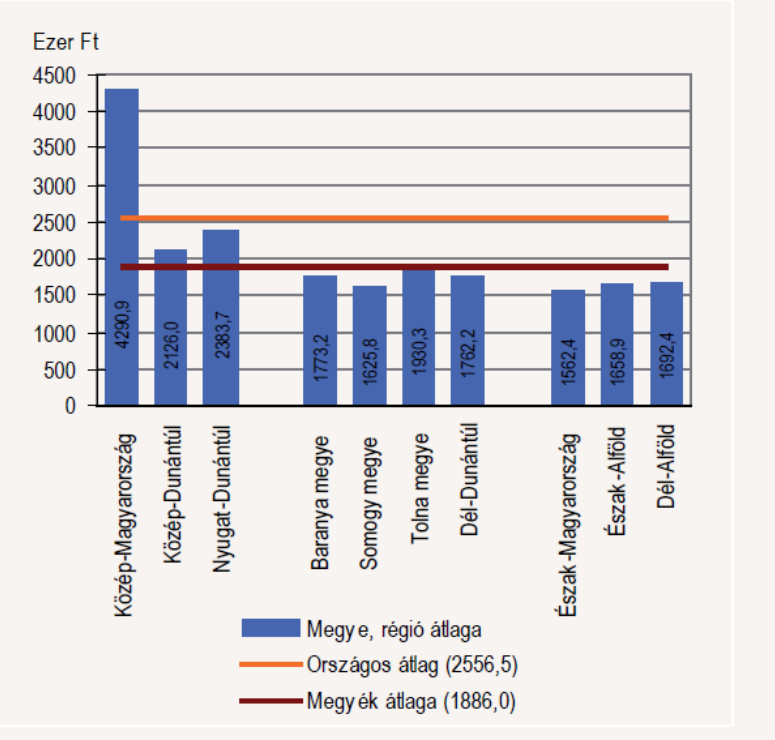
3. Economic analysis of the region's situation

3.1 Gross Domestic Product in the region

According to 2009 annual GDP analysis, the South-Transdanubian region produced 6,5% (1.674,9 billion HUF) of the overall GDP of the country (25.622,9 billion HUF). This ratio is consistent with the last two years' figures as well. The recession of the last few years has affected the regions differently; the GDP per capita value in this region was 1.762 thousand HUF, which is approximately 69% of the national average, and 93% of the national average without the capital.

GDP per capita (2009)



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County, region average Country average Average of all counties average

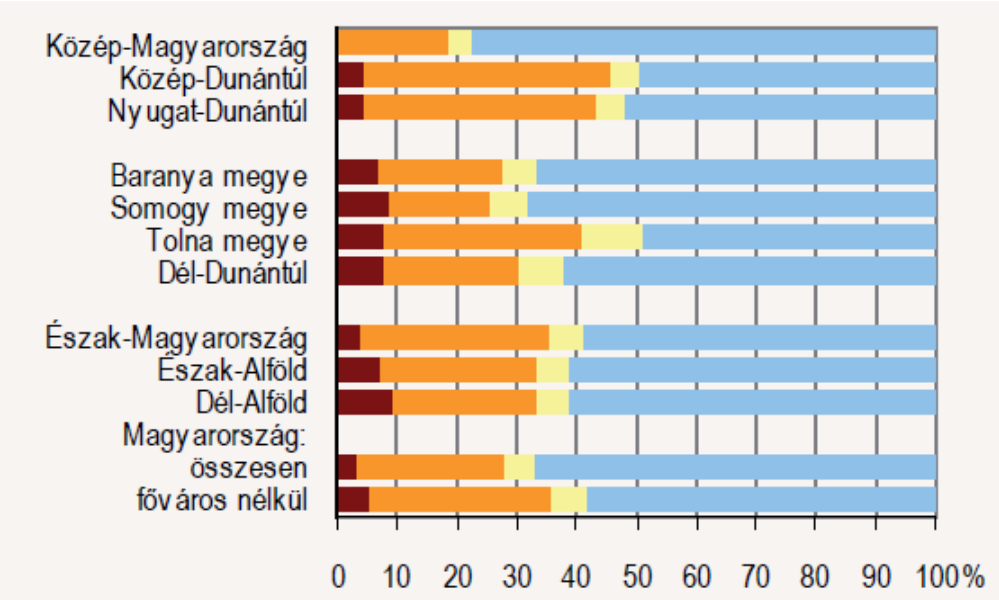
Thus its arrears compared to the county and national-wide average has not changed, and it retained its 4th place in the country's seven regions. In the last two years, among the counties of South-Transdanubia, Tolna county was in the forefront position, in 2009 its 1.930 thousand HUF figure made up more than one fifth of the national average, and its relative rank compared to the state counties, including the capital, has been promoted to the 8th place. Its advancements are mainly due to a few significant national investments, like the M6 motorway and the Bátaapát medium level radioactive waste storage facility. Baranya county stepped up by one rank compared to the last year, to the 12th place, Somogy county's rank of 16th has not changed over the last year. So, while the capital's vantage has further increased, the difference in specific figures between the well-performing county of Győr-Moson-Sopron and the counties of South-Transdanubia has reduced fallen.

3.2 The role of sectors in producing GDP (based on 2009 annual data)

In the sectorial structure the gross added value in South-Transdanubia was as follows. The agriculture's 7,7% and the building industry's 7,2% share is higher than the national average, that reflects a stronger role, but the 23% degree of industrialisation is lower than the nationwide average (25%). The share of services (62%) is lower than the national average, including the capital city (67%), but higher than the average not including the capital (58%). On a region-wide scale Somogy produced a higher figure in agriculture and services, just like Tolna in the building and general industry, and

Baranya in service industry. According to figures in sector specific population, it can be stated that figures in the agricultural sector were only higher in the Southern Great Plain region, which suggests the presence of an above-average agricultural industry.

GDP's sectoral structure



Order: Agriculture, Industry, Construction, Services

6. ábra Agricultural areas of the Transdanubian –Region
Source: VÁTI TeIR adatbázis

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In Tolna county the building industry performed well due to a series of investments, while due to figures in the sector-specific population in the industry, Somogy and Baranya counties lag behind the national and county-wide average. All three counties are characterized by poor performance of manufacturing industries. The dominance of the capital and the central region leaves its mark on the performance of the service industry, especially in the information, communication and financial sectors. As a result, like in other regions, relatively low figures were produced, compared to the national average. Though, when compared to other regions, South-Transdanubia performed almost equally, due to the good performance of Somogy and Baranya counties. Typically strong areas were the financial and insurance sectors, public administration, art, entertainment, recreational activities, all which proved to have higher figures than the average of the 19 counties.

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4. Tourism

The tourism sector took a positive turn to revitalisation in 2010 after three years of relapse due to the effects of the recession. The sector went through a nationwide increase both in visitors (3,3%) and in overnight stays(2,3%). Figures in South-Transdanubia differ from the national values. While there were 750.000 registered visitors, which means a 1,4% increase, there was a 1,7% decline in overnight stays. Because of the 10% share of national tourism, South-Transdanubia has stepped down to the 4th rank among the regions. Our counties experienced a varied year of tourism. The decline in demand for commercial accommodation was stronger in Tolna, and moderate in Somogy, while travellers showed an increased interest in Baranya. The number of visitors in Somogy was mainly influenced by the region's main attraction, the Lake Balaton, and wet weather conditions of 2010, while the escalating figures of Baranya (13,4% more visitors) were due to a great number of cultural programmes. The number of visitors from abroad is strongly restricted to the national capital, as the 160 thousand guests visiting our counties is only the 5% of the total number of tourists, thus increasing the figure to 7,5% compared to the reference year. The number of domestic visitors was 590 thousand; their number has not changed compared to the reference year. An interesting fact is that while nationwide the ratio of foreign-domestic visitors is 46-54%, it is 21-79% in our region. Two thirds of the foreign guests, and more than half of the domestic visitors chose hotel services. In contrast with other regions, owned accommodation has a significant role in South-Transdanubia. The number of owned apartments decreases every year, but still, 16 thousand worked in the accommodation sector in the three counties combined. The second most popular settlement in the country according to spent nights is Somogy county's Fonyód, which lies on the shores of Lake Balaton, and the third is Harkány, Somogy county's traditional spa town.

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5. Investments

In regards to investments, in 2011 opposing processes affected the region. While in Tolna county the national investments and constructions had already been completed, in Baranya county the comprehensive projects of Pécs Cultural Capital 2011 and the finishing stages of M60 motorway construction were still underway. A total investment of 324,9 billion HUF has been realised, which shows a 12% decrease compared to the relatively high reference figure of the previous period's . In contrast with other more industrialised regions, in this region building constructions have a higher share of investment, as opposed to machinery and equipment. While the former was stimulated by national infrastructural and building-related investments, the latter was held up by confusion on the market caused by economic recession. The investment ratio of 344 thousand HUF per capita did not reach the national average in 2010, but still exceeded the 19 counties' average figure, and put the region on the 4th place in the regions' rankings. The aforementioned two cannot be classified into the main groups of construction investment (plantation, forests, acquisition of yoked cattle, etc.), are typically related to the economy, were formed according to the region's economic state of development, and only represent a relatively small portion of the total investments (6,7 thousand HUF).

5.1 Hungary's energy strategy

After the almost one and a half year reconciliation and consultation the Parliament gave grant to Hungary's long-term energy strategy under the name of "National Energy Strategy 2030", where it is declared that:

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- the agriculturally arable lands-,
- the drinking water supply-,
- and because of the rapid decline in fossil energy reserves

a) the age of cheap and infinite amount of fossil energy reserves is over,

b) the recent consumption habits of the society are no longer sustainable,

c) the time of structure and the paradigm has come in the energetics, that's why

The government's aim with the creation of the National Energy Strategy is

- To reach the balance of energy and climate politics together with the economic development and environmental sustainability,
- To define the future directions of energetic developments,
- To prepare the necessary economic decisions in order to:

a) Preserve the healthy environment,

b) Be able to produce healthy food, drinking water and ensure sustainable energy supply.

The energy security (e.g. the effects of political activities on the energy market, the fusion reactor accident in Fukushima, the German nuclear energy decisions, etc.) is becoming a strategic request of geopolitics as well, this is why it is important to be able

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to paste our energy policy flexibly into the global, dynamically changing external case maps and to offset the negative effects induced by the climate changes as well.

It's content:

- 6 electric power-,
- 3 gas market-,
- 3 heat market scenarios
- The analysis of the European gas infrastructure and its related opportunities with capacity dependent scenarios, and the analysis of the effects on gas market pricing
- It investigates the phase out of German nuclear capacities' regional effects

This study has been conducted on the basis of the "National Energy Strategy".

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6. The End use of the energy

Dr László Elek said: The end use decreased by 17% between 1990 and 1992 because of the economic transformation's sequels. A slight increase (0.5%) is visible in the trend between 1992 and 2007. The end use in the transportation sector showed the most dynamic growth (5.1%/year) from 1992. The fuel price increases or the speed limitations dampened the growth of transportation use.

The end use decreased by 1.3% on average in the Industry sector. After the transformation in numerous energy-intense industries the production has fallen significantly, while in less energy demanding sectors the production increased.
The domestic, tertiary and agricultural sector's end use stagnated. The annual growth was only 0.2%.

Examining the distribution of end use in the sectors the transportation's increase is conspicuous. Transportation's share in the end-use increased from 15.8% in 1990 to 26.8% in 2007. The industry's share decreased from 34.2% to 20.1%. In this decrease the structural industry changes played an important role. In the domestic, tertiary and agricultural sectors the consumption rate increased from 49.9% in 1990 to 53.1% in 2007.

In the domestic sector the residential floor space growth shows a significant decline in the recent years.

In the early 90's the inflow of the high-efficiency gas furnaces' huge decreased the unit consumption. As of 2000 the unit consumption returned to the original level. In the last

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two years the rise of the domestic gas prices is in parallel with the lower consumption of the lower-income deciles, because more and more people are substituting the natural with firewood.

The floor space increased continuously in the tertiary sector. In parallel, the tertiary sector's energy consumption grew rapidly until 2005. The governmental actions from 2006 had a huge effect on the consumption's significant decrease.

Examining the end use broken down by energy sources. The oil and oil products fell from 31.5% in 1990 to 29.7% in 2007. The share of natural gas grew from 31.1% in 1990 to 36.1% in 2007. The use of natural gas is very remarkable in the domestic, in the tertiary sector and in the energy sector as well. The use of biomass - taking only commercial sources into account - increased from 1.8% in 1990 to 5.6% in 2007. The real domestic consumption is six times more than the energy balances figures according to Central Statistical Offices domestic energy consumption research.

The electricity's market share rose from 14.3% in 1990 to 17.2% in 2007. The demand for electricity increased in all sectors, as a matter of fact fastest growth was visible in the tertiary and in the domestic sector.

The market share of coal decreased from 13.1% in 1990 to 4.4% in 2007. Its largest role is in the energy sector, because of the coal-fired power plants. The demand for coal decreased significantly in the tertiary and in the domestic sector.

Hungary's expected electricity production, according to the various energy mixes Source: REKK – Regional Centre for Energy Policy Research:

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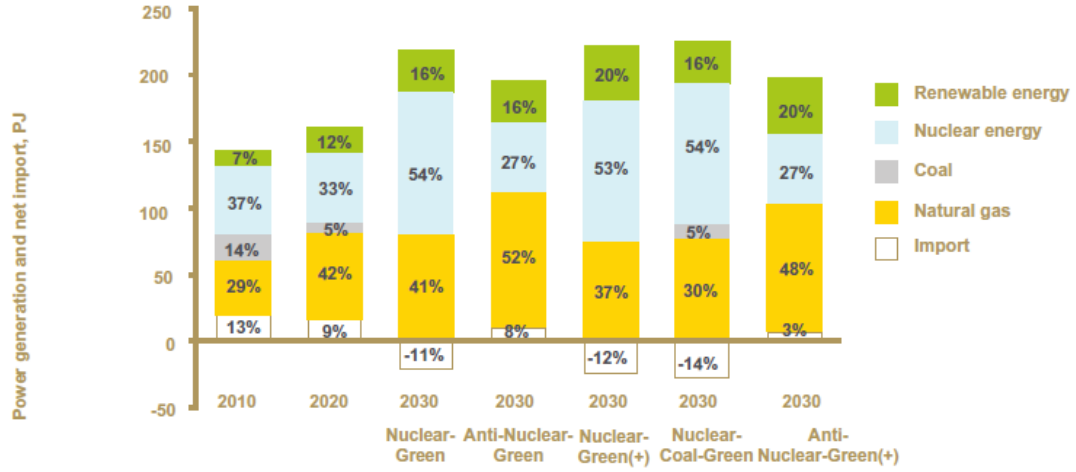
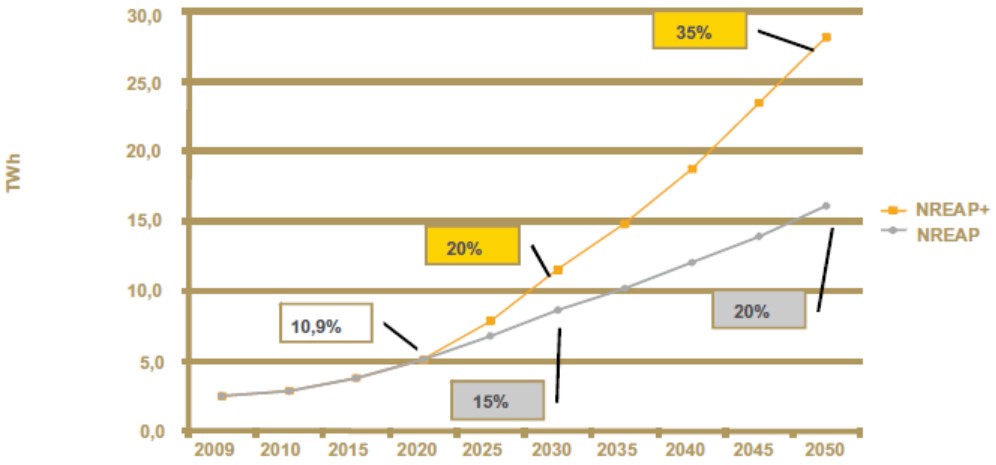


The share of renewable energy in electricity generation

Source: Hungary's NREAP and REKK – Regional Centre for Energy Policy Research:



Envisaged household and tertiary heat energy consumption in Hungary, based on the 'Reference' building energy scenario

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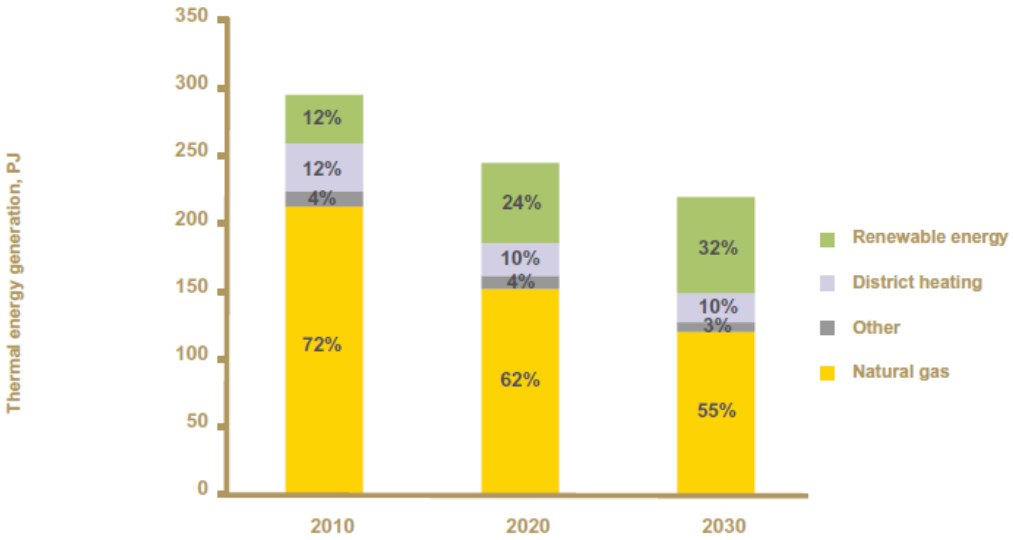
Source: REKK – Regional Centre for Energy Policy Research



7. Renewable Energy Potential

Solar energy potential:

The radiation created during thermonuclear processes in the Sun is what we call solar radiation. The Sun's annual emitted energy is approximately $1{,}2 \cdot 10^{34}$ J, within +/- 1% variation. The amount of energy reaching the Earth is $2 \cdot 10^{24}$ J, but due to its eccentric orbit, this figure varies +/- 3% annually, and is ten times more than the energy requirement of the whole planet. At the average Earth-Sun distance, the average amount of energy absorbed by surface perpendicular to the axis of the radiation is 1353 W/m^2, which is called the solar constant.

The mediums of energy are the photons, from which a few are absorbed by the Earth's atmosphere. The amount of solar energy per perpendicular unit area is called global radiation, which is made up of direct and diffuse radiation.
The annual amount of global radiation is 1.265 kWh/m^2 (4,914 GJ/m^2).

The solar energy can be utilised in the following ways:

- Active solar-thermic: energy is transformed and transported by a solar collector using a medium that carries absorbed direct heat radiation. According to calculations of the Hungarian Academy of Sciences, its potential in Hungary is 48,815 PJ, where this region represents 7,44 PJ. In the next decade, according to estimations, the available surface for solar collector installation will rise to 32 million km^2 nationwide, which means 4,88 million km^2 in this region.

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- Solar photovoltaic: solar panels transform solar radiation directly into electricity. Surveys regarding available surface estimate that there is a net area of 4051,48 km^2 that can be used for solar panel installation, which means a capacity of 405.158,06 MW on a nation-wide scale. Annual energy production: 486x103kWh/year, or 1749 PJ /year, and 266,46 PJ in the region.

Hungary's theoretical geothermal energy potential

The Carpathian Basin including Hungary's territory possesses excellent geothermal characteristics. The average crustal thickness is 23-25 km, so the outward flow of the interior heat is equal to the average of 90-100mW/m^2, which is twice as much as the continental average. The geothermal gradient is the rate of increasing temperature with respect to increasing depth in the Earth's interior. It is generally between the rates of 0.042-0.066C/m, however the Earth's geothermal gradient can be measured between 0.020-0.033C/m. Due to the above mentioned figures, Hungary can reach or somewhere can exceed in 1000M depth the stratum temperature of 60 C/t, from a depth of 2000 M it can even be 100C degrees. National researches suggest that we also proved that the energy accumulation is arisen in the faults of the plate tectonic units and subductional zones. Additionally appropriate amounts of sedimentary, porous rocks can be found in the stratums of the Carpathian Basin, which are available as low-enthalpy reservoirs, but there are medium enthalpy resources in greater depth with 90-150C degrees as well. These are pressurized, geothermal indications, from which the fluids rise up that supply electricity production suitable steam. The VITUKI's approximate estimations suggest that the exploitable geothermal energy is now around 343000PJ and its annual replenishment from the Earth's convection is 264PJ/year. It is a scientific evidence that the geothermal energy is a "renewable" energy resource, because the heat and the water flows back and the re-charge occurs a thousand times faster than in the rate of the

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exploitation period. Thus, the sustainable production from 100 to 300 years is ensured in case of appropriate technology utilization.

Its basic systems:

- Hydro geothermal systems
- Hot and Dry systems
- Magma chambers
- Geopressurized reservoirs

The national geothermal energy resources belong to the first two groups. The Carpathian Basin is uploaded by a thick sediment cover, which contains many aquifers, porous or fractured carbonated rock stratums, which make the production and utilization of thermal water possible.

The Southern Transdanubian Region together with the Southern Great Plain contributes significantly to Hungary's energy capacity. The estimated geological wealth for the Southern Transdanubian region is 75000PJ/year (1.385PJ)

The theoretical hydro energy potential in the Southern Transdanubian Region.

Since the region's two main rivers, namely the Danube and the Drava flow on the boarder of the region, which are also within the territory of Danube-Drava National Park, so the exploitation of the hydro energy is not possible. The production of hydro energy is only possible on our smaller rivers (Kapos and Sió) with lower performance than 10MW. By calculating with this the performance can be in case of ideal discharge development (50%) 0.02GWh/year.

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Wind energy potential

The share of wind energy in the electricity supply in some regions is mostly up to the decision-makers' environmental awareness. The large-scale spread of the wind turbines is estimated in the near future, thanks to the technological advancements. Looking ahead, however, questions have arisen in several aspects:

To what extent do our country's climatic conditions allow the use of wind turbines?

- How to implement the fitting of the growing equipment into the landscape of the country?
- What kind of risks can appear in the prominent ecological values of the Carpathian Basin by the spread of wind farms?
- What legislative background and planning is needed for fitting the renewable energy based power plants into the Hungarian conditions?

The regulatory background of wind turbines is not solved at the moment. It is advisable to prefer renewable energy resources, especially in the South-Transdanubian region, which is very rich in natural and agricultural values.

Biomass potential

When considering sustainable aspects, biomass can be considered as a renewable source of energy. Renewable but exhaustible. Based on its place in the production-utilisation chain it could be primary, secondary or tertiary, depending on the conversion technology. Coal is the fourth most widespread source of energy after crude-oil and natural gas. Due to its favourable agriculture, Hungary, and within that, South-Transdanubia has a higher than average biomass potential.

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- Primary types of biomass:
  - products of forestry (main and by-products)
  - tree processing
  - main products of agriculture (seeds, derivatives)
  - agricultural by-products and waste (straw, stem, vines, processing by-products (sunflower hull, etc.))
  - grown, (new) biomasses

- secondary biomasses (animal biomass and products)
  - meat (protein), different kinds of fat, other products (milk, eggs, etc.)

- tertiary biomasses
  - retained substances after processing and utilising primary and secondary biomass (skin, other types of tissue, blood, manure, faeces, urine, food remains, cooking oil, etc.)

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8. Energy Efficiency

In order to spread the use of the renewable energy use to a wider range, it is expedient to prefer the most proper green energy production. Taking into account the private, the business and the public administration sector's specific needs, structure and with the selection of the appropriate energy production technology these must be adjusted to the environmental, economic and political factors.

In the case of the private sector the conscious energy use and efficiency have to be increased and the use of renewable energy can be done in a cost-effective way to produce electricity for heating and cooling. We have to strive to popularize the most common solar panels and photovoltaic systems and to extend the use of geothermic energy.

The opportunities for increasing energy efficiency:

- Raising the environmental awareness with
    a. Construction of appropriate information channels (Internet, TV, daily newspapers)
    b. Installation of the knowledge in the pre-school and school education
    c. Providing appropriate, vocational training to the existing professionals
    d. Qualified Higher Education

- Paying special attention to reduce power consumption without any investments, when
    e. Selecting and using technical equipment
    f. Cooking, washing

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g. Heating, ventilating and shading patterns
h. Water use
i. Selecting and using lighting equipment

- Investments to reduce energy consumption:
  j. Thermal insulation of building
  k. Replacement of windows
  l. Integration of shading equipment
  m. Application of heat-exchanger ventilation systems
  n. Selection of the appropriate walling
  o. Rainwater utilization

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9. Available Tender Resources and Other Incentives

The priority axis influencing the structure of energy sources, namely increasing renewable energy utilization aims at contributing to the enhancement of security of supply, to the decrease of import reliance, and furthermore to fulfil the environment and climate protection policy-related goals.

The developments being realized within the framework of "Increase of the use of renewable energy sources" priority axis will be supported by the **European Regional Development Fund** in order to achieve the "Convergence" objective. The following NUTS II regions are eligible for support: **West Pannonia, Central Transdanubia, South Transdanubia, North Hungary, North Great Plain, and South Great Plain.**

Intervention logic:

In the energy policy of the European Union, increased use of renewable energy sources occupies a very prominent position – in harmony with strengthening environment protection.
This has numerous **national economic advantages**, since renewable energy sources

- do not overload the environment , or only to a smaller degree than in the case of fossil

fuels, contribute to meet the Kyoto Protocol obligations (climate policy), furthermore CO2 savings may evolve that can be traded internationally.

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- replace fossil fuels, the **energy import reliance** of traditional energy sources is reduced ,thus the balance of payments improves

- **may create new jobs**,

- could facilitate a change in **agricultural structure,** thus having a favourable impact of preventing the migration of population, and the budgetary expenses on grain intervention may be decreased,

- facilitate the application of new, **high level technologies,**

- by generating energy from **materials** that otherwise would increase the **environmental load** (e.g. sewage sludge), the environmental load can be reduced significantly. According to the January, 2007 strategy of the EU, the ratio of total renewable energy sources, and bio-fuels must reach 20% and 10%, respectively by 2020.

SATISFACTION OF THE LOCAL HEATING AND COOLING NEEDS WITH RENEWABLE ENERGY RESOURCES

Code number: KEOP-2011-4.2.0. / A

The objective of the grant: The prior aim of the tender– in line with national and EU strategy - to inspire the usage of the decentralized, eco-friendly renewable resources using systems; and support with non- repayable grants the following technologies:

- Geothermal heat pump systems
- Ground source heat pumps

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- Heat pump systems using drilled wells, heat content of the thermal water and heat content of the over ground water

The available resource: The construction's budget is 19.67 billion HUF between 2007 and 2013 (together with KEOP-4.2.0/B)

SATISFACTION OF THE LOCAL HEATING AND COOLING NEEDS WITH RENEWABLE ENERGY RESOURCES

Code number: KEOP-2011-4.2.0. / B

The objective of the grant: The tender's prior aim – in line with national and EU strategy –is to inspire the decentralized, eco-friendly, renewable resources based systems' usage. The application of the tender can be submitted with the involvement of the already existing systems' energy-resource change, extra energy need satisfaction and for the development of other production processes.

The available resource: The construction's budget is 19.67 billion HUF between 2007 and 2013 (together with KEOP-4.2.0/B)

RENEWABLE ENERGY BASED REGIONAL DEVELOPMENT

Code number: KEOP-2011-4.3.0
The application can be submitted only for the realization part of the project.

The objective of the grant: Supporting the communication, realization, financing(in non-repayable form) and the professional help of preparation and realization of sample projects which have positive effects on regional development and are based on energy

resource consumption and their place is considered as the near environment of realization.

The available resource: Within the construction of the fund there is 6 billion HUF for realizing the projects between 2011 and 2013.

PRODUCTION OF RENEWABLE ENERGY BASED ELECTRICITY, COMBINED HEAT POWER AND BIO-METHANE

Code number: KEOP-2011-4.4.0

The objective of the grant: The tender's prior aim – in line with national and EU strategy –is to inspire the decentralized, eco-friendly, renewable resources based systems' usage. The application of the tender can be submitted with the involvement of the energy-resource change of the already existing systems', extra energy need satisfaction and for the development of other production processes.

SUPPORTING THE GEOTHERMAL HEAT AND ELECTRICITY PROJECTS' PREPARATIONAL AND PROJECT DEVELOPMENTAL ACTIVITIES

Code number: KEOP-2011-4.7.0

The objective of the grant: Supporting the realization of the medium- and high performance, geothermal energy based projects, primarily the help of the preparation of decision making, licensing and exploration drilling.

Available resource: The budget of the grant is 3 Billion HUF between 2007 and 2013.

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COMBINING THE BUILDING ENERGETICAL DEVELOPMENT WITH THE USAGE OF RENEWABLE ENERGY RESOURCES

Code number: KEOP-2011-4.9.0

The objective of the grant: Contributing to the realization of projects with which the enhancement of the energy efficiency and renewable energy utilisation of the buildings can be accomplished.

Available resource: 2 Billion HUF in 2011 and 8 Billion HUF is available during the period of 2011-2013.

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10. SWOT analysis

STRENGTHS:

- Excellent environmental capability in South-Transdanubia for utilising biomass, solar and geothermic energy
- The agricultural productivity of the region is the second nationwide (the region of Southern Great Plains surpasses it alone)
- Significant unexploited potential in the field of renewable energy sources (e.g. agricultural products, by-products and produced waste)
- With further improvements, using uncultivated areas for instance, biomass potential can be increased
- Required agricultural capability is available
- An active exchange of experience in the region between research and economic sectors
- Existing experimental projects for utilising renewable energy sources
- Existing national tender resources

WEAKNESSES:

- Low utilisation of renewable energy sources in the region
- The number of energy efficient financial budgets in the past did not improve as expected
- In the case of public facilities, energy efficiency needs to be improved
- There are no significant energy consumers in the region (docks, airports)
- The region has a low industrial performance
- There are only a few financially strong enterprises in the region
- Complicated authorisation processes

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- Compulsory purchase prices do not significantly affect realisation
- Low environmental awareness of both individuals and enterprises
- Counselling services are hard to find in the region, and there is little word about renewable energy sources in informal and regional media. Little number of special programmes and market events
- Problematic accessibility of tender resources (complicated application system, slow assessment, precedents for belated or suspended funding)

POSSIBILITIES:

- With the increase in the prices of fossil energy sources, less utilised renewable energy sources could attain prominence
- With the use of renewable energy sources the region and thus the nation is less dependent on energy-import
- Environmental stress can be reduced using locally produced green energy
- Improvements on environmental figures can be achieved by utilising animal and slaughterhouse by-products that are otherwise handled as waste
- By utilising by-products, enterprises could produce extra profit
- There are significant possibilities in using geothermic energy for heating-cooling purposes, especially for local government facilities and for enterprises providing long-distance heating
- While retaining existing ones, creating further jobs, especially in the field of agriculture
- Enterprises using renewable energy sources function in a more cost-efficient way, making them more competitive
- Securing a better welfare in rural areas, thus keeping the local population in place and preventing migration

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- Existing possibilities of expansion in the fields of education, training and in research and development
- Developing new ways of utilising renewable energy sources are integrated into the region's other development plans (e.g. wine and spa tourism)
- With the proper financial support the related industries in the region can be further improved (e.g. production of boilers, solar collectors and other equipment)
- Meeting the expectations of The European Union regarding renewable energy sources

THREATS:

- Failure in creating unison between energy crop production and utilisation would lead to great expenses of unused crop storage
- Tension could develop between the production of comestible or fodder and energy crops
- Increase in performance of the tendering system and other financial incentives could further hinder achievements and goals to be met (especially in the field of heat supply)
- Due to the economic stimulus, increasing energy consumption without increased energy efficiency could lead to shortage in biomass material.
- Through decreasing amount of rainwater, the changing climate also has a negative effect on biomass production
- The natural and environmental risks of certain energy producing methods are not known in detail, further research and analysis is required
- The cost of technologies producing renewable energy does not decrease at expected rate

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