

The Eight Indicators

Eight Indicators of Energy Sustainability for Hungary

	1990		2000		% change	
	Metric	Vector	Metric	Vector	Metric	Vector
1. Carbon emissions	1861 kgC/capita	1,347	1543,5 kgC/capita (1999)	1,066	-17,06%	26,40%
2. SO2 emission	43 kgSO2 /capita		45 kgSO2 /capita (1998)	1,039	0,47%	
3. Households electrification	99%	0,01	99%	0,01	0%	0%
4. Clean energy investment	1,4% (1992)		5,50%	0,956	392%	
5. Resilience: energy trade				0.66		
6. Government investment						
7. Energy productivity	26, 49 MJ/€ of GDP	2,655	20,47 MJ/€ of GDP	2,029	-22,70%	
8. Renewable energy			3,04%	1,064		

► Indicator 1: Per Capita Energy Sector Carbon Dioxide Emissions

Vector calculations and values of indicator 1

According to the data provided by Hungary to the UNFCCC in its first¹² and third¹³ national communication, the carbon emissions of the Hungarian energy sector, due to fossil fuels combustion for 1999 totalled 15.48 million metric tons. For a population of 10,2 million people¹⁴, this is 1514 kgC/capita. This compares to 1798 kgC/capita in 1990. Based on these data, the vector for Hungary values in both years is greater than one and shows an almost 20% decrease, as it is 1,292 for 1990 and 1,040 for 1999.

Metric (actual data)

for 1990: 1514 kgC/capita
for 1999: 1798 kgC/capita

Vector values:

for 1990: 1,292
for 1999: 1,040.

Discussion of indicator 1

Hungary has been taking part in the climate negotiations from the very beginning. She ratified the UN Framework Convention on Climate Change quite early in 1995¹⁵.

¹² First national communication of Hungary for the UNFCCC www.unfccc.int/resource/docs/natc/hunnc1.pdf

¹³ Third national communication of Hungary for the UNFCCC, www.unfccc.int/resource/docs/natc/hunnc3.pdf

¹⁴ Website of the Central Statistical Office, www.ksh.hu/pls/ksh/docs/index_fontosabb_adatok.html

¹⁵ 1995 évi LXXXII törvény az ENSZ Éghajlatváltozási Keretegyezményének kihirdetéséről (LXXXII Act of 1995 on the UNFCCC)

Hungary's activity in the field of climate protection at both international and national levels has been fluctuating ever since. She did not sign the Kyoto Protocol, being the only in Europe apart from Iceland in this respect, and decided ratifying it on 16 July 2002.

Climate change has just recently become a separate item in the official environmental policy in the National Environmental Programs, especially in the second one, currently under construction. The first step towards a complex climate change strategy was taken in 2000, when a Governmental decree on Hungary's climate change strategy was adopted¹⁶, and the implementation plan is under elaboration.

Even though there were some energy efficiency -see below- and waste management programs initiated in the 90s, the fallback of the energy sector's carbon emissions is mainly due to the structural changes in the Hungarian economy after the years of transition, when the old, energy intensive, Soviet type industry collapsed.

Another important factor of the fallback of carbon emissions is the intensive spreading of natural gas both in residential and power sectors, replacing coal and lignite by the much cleaner natural gas. Almost 70 % of the households are connected to the gas network¹⁷, satisfying 40% of the residential sector's total energy demand. In the power sector, gas is used mainly in combined heat power plants, producing 20 % of the electricity. The role of coal stayed stable at 30% (115 PJ in 2000) in electricity production, due to the legislation that requires power plants to purchase domestic coal.

The promotion of RES seems to get a bigger emphasis: in the New Electricity Act (2001) the purchasing obligation of electricity produced by RES is well defined and in the operative legislation the purchasing price is quite high. It is very important because the role of RES in Hungary's energy supply is around 2,2 % including traditional firewood combustion.

It is important to note, that despite of the decreasing contribution of the energy sector to CO2 emissions, Hungary's total GHG emissions almost went back to the 1990 level in 2000 producing around 10% increase compared to the lowest emitting year (1994). This undesirable phenomenon is mainly due to other GHGs, the transport and the agricultural sectors.

¹⁶ Kormányhatározat a klímavédelem magyarországi stratégiájáról 39. Határozatok Tára A Kormány 2206/2000/(IX.13) rendelete (Governmental decree No. 2206/2000 (IX.13) on the National Strategy of Climate Protection)

¹⁷ Annual Report 2000, Association of Gas Distribution Companies

► **Indicator 2: Most Significant Energy-Related Local Pollutant: SO₂**

Vector value calculations and values of indicator 2

Within the country's SO₂ emissions – that fell back significantly from 101 kg SO₂ /capita in 1990 to 59 kg SO₂ /capita in 1998 – the energy sector's sulphur-dioxide emissions show some increase because the metric value increased from 43 kg SO₂ /capita in 1990 to 45 kg SO₂ /capita in 1998.

Metric (actual data)

for 1990: 43 kg SO₂ /capita

for 1999: 45 kg SO₂ /capita

Vector value

for 1998: 1.039

Discussion of energy related SO₂ emissions

It is important to note that the most hazardous, damaging, local pollutant is nuclear waste that Hungary's only nuclear power plant produces while satisfying 40% of the country's electricity demand. All types of radioactive wastes are stored at the power plant, as since 1993 Russia has rejected transporting it to its country and no deposit possibility has been built in Hungary.

From the many pollutants that the energy sector emits we chose sulphur-dioxide. The reason is its unique place in the legislation.

Hungary's total SO₂ emissions decreased in the 90's by almost 40%, due to the above mentioned collapse of the polluting heavy industry, to the improved quality of vehicles and to the fact that the households replaced other more polluting fuels with natural gas. Due to the slowly growing electricity demand, the mines-power plants integration (power plants must buy domestic coal and lignite) and the increased usage of oil (18,6 PJ in 1990, 43,1 PJ in 2000) the electricity sector's SO₂ emissions slowly increased. This process is slowed down by the intensive spreading of CHPs and the replacement of some oil power plants (PP) by gas turbines.

Since 1995, when a governmental decree on clear air was adopted¹⁸, the sulphur emissions legislation became stricter. The results are the renovation of power plants to meet the requirements – it happened in most of the privatised (efficient, attractive for investors) PPs on one hand, and because of the growing amount of fines paid by the others on the other hand. The Matra PP which is the second biggest SO₂ emitter (99 thousand tons in 2000) has done recently the sulphur retrofit, and has been operating according to the legislation since then. The biggest polluter, Vértes PP (130 thousand tons of SO₂ in 2000), was to be shut down in 2004 as it cannot meet environmental requirements and produces at high cost. Both PPs are run by the state-owned Hungarian Electricity Works (MVM). The Vértes PP got 56 million EURs¹⁹ state subsidy and will get around 1,8 EUR cents for every kWh totalling an additional 172 million EURs of subsidy during its extended lifetime (10 years). The decision was clearly political, based on

¹⁸ Governmental decree No. 97/1995. (VIII.24.) of 1995

¹⁹ For all exchange rate calculations we used the Hungarian National Banks yearly average exchange rates. www.mnb.hu

unpublicised calculations, and also against the will of the Hungarian Privatisation and State Holding Company (ÁPV Rt) which is a shareholder in the MVM²⁰. The Ministry of Environment granted the power plant a promise for letting off its environmental punishments, this would clearly violate the polluter pay principle²¹, and also violates economic sustainability and postpones the transition to a less polluting sustainable energy system.

Note for future Observer-Reporter:

Data: The latest version of Environmental Statistics contains data on 1990 and 1998 for the latest. This was the peak SO₂ emissions of the electricity sector. According to the Yearbook of Electricity Statistics in 2000 the emissions of PPs started to decrease. We could not use this data – and chose 1998 – because the methodological differences between the two sources were not clear. Transport sectors emissions are excluded.

Follow-up on the state subsidy, and let off of punishments for Vértes PP and the other high polluting power plants. Check and follow if the Hungarian practice on subsidies, liberalisation and competition are in accordance with the EU's legislation. Follow the MVM's attempts to extend its polluting power plants lifetime (nuclear PP, lignite and coal fired ones) even if it cause price increases, and of course hinders the spreading of RES.

²⁰ Az MVM leszavazta az ÁPV Rt-t (The MVM voted against the ÁPV Rt) , Népszabadság, 04 May 2002,

²¹ Environmental Club of MVM, 20 June 2002, see www.vert.hu

► **Indicator 3: Households with Access to Electricity**

Vector value calculations and values

According to the Central Statistical Office in the last two years national census (in 1990 and 2001), the questioners did not deal with access to electricity as in both years they took it to be practically 100%. Based on this statement²² we took the percentage of the households that have access to electricity in both years for 99%, which results in 0,0100 value for the vector.

Metric (actual data)

for 1990: 99%

for 2001: 99%

Vector value

for 1990: 0,0100

for 2001: 0,0100

Discussion of indicator 3

Back in the socialist era (before 1989), a ranch electrification program was initiated and resulted that even the remote and small (two- three houses) settlements got access to electricity. The price of electricity was the same for everybody, and there was no capacity charge (which could have been different based on pure cost reflecting pricing).

In Hungarian statistics there are no categories for households with electricity. There are data for dwellings (naturally not equal with the number of households), and data for the number of residential consumers of electricity. Both are slightly different from households with access to electricity category. This last data is much higher (4,7 million) than the number of households (4,05 million)²³. The difference is the result of the fact that not only households fall under the residential electricity tariff category and one household can have several electricity meters (in one dwelling, for the garage, for holiday house, for night tariff). The reason for not taking access to electricity for 99% was data found in the Yearbook of Regional Statistics 2000²⁴, that 1,6 % of the dwellings owned by local governments does not have any kind of comfort level. This 1% "discount" is clearly an assumption which does not effect the final value of the vector significantly.

Note for future Observer-Reporter

However from a social point of view this level of electrification in Hungary seems very nice, it makes the diversification very hard, as well as the utilisation of local, renewable resources both from technical/financial and public acceptance point of view. In the future it would be very useful to carry out a public poll on RES awareness and acceptance of RES technologies. Another field of possible research is to study the Hungarian electricity system's tolerance to RES input (now the base power plant's proportion is quite high, so taking that RES – especially solar and wind – technologies may produce altering output), thus the system/system operator might have problems to keep the desired voltage level.

²² Népszámlálás 1990, 2001, Adatfelvétel és feldolgozási összefoglaló ismertetése (Data Collection and Data Processing Summary of National Census), KSH Budapest, 2002

²³ Lakásstatiztika 2000, (Yearbook Statistics of Dwellings), kKSH Budapest 2001,

²⁴ Regionális Statisztikai Évkönyv 2000, (Yearbook of Regional Statistics 2000), KSH Budapest 2001,

Another issue to be studied can be the electricity export- import right which could decrease this tension.

► Indicator 4: Investment in Clean Energy **(a proxy for employment)**

Vector calculation of indicator 4

Energy efficiency and renewable energy investments were for 1992 (the first year available) 4,22 million 1992 ECU, and 34,5 million 2000 EUR for year 2000. These data are to be compared with the total energy sector investment for 1992, which was 320 million 1992 ECU and increased to 636,3 million 1999 EUR.

Metric (actual data)

for 1992: 1,4%

for 2000: 5,5%

Vector value

for 2000: 0,956

Discussion of indicator 4

The calculation of this vector is one of the most challenging which is due to the following facts. However, total energy sector investment data are available²⁵, but the state subsidies are not calculated into them. E.g. the above-mentioned 228 million EUR subsidy for 10 years for the Vértés PP, the instalments that the Paks Nuclear Power Plant pays to the Hungarian state on which there is no interest (!).

The percentage of clean energy investments is increasing. New programs were initiated to support these developments, but these are far less than what could utilise the huge energy efficiency potential of the Hungarian economy, and let's say there is almost nothing to promote the renewable potential.

It is important to note the difficulties of collecting data that reflects the reality, as past, present and future subsidies or the lack of subsidy in case of RES makes the comparisons difficult. As it was mentioned in the introduction, after privatisation and before the strict regulation was in place there had not been any significant investment (like power plant shutdown, lifetime expansion or building a new big one). It is to happen in the following years.

It is even more difficult to gather the energy efficiency and renewable investments data that are not directly subsidy related. We used state or internationally co-financed programs to estimate the total investment into clean energy. As the first data available were those of 1992 for total energy sector investments, we calculated the clean investments generated by subsidies for this year too, which were 4,22 million 1992 ECU. For clean energy investment calculations in year 1992 we have no data on RES investment, compared to 320 million 1992 ECU total energy sector investments. In this year the only fund for clean energy was the Energy Saving Credit Fund which became a revolving fund and was financed by the German Coal Aid.

In the year 2000, the main sources of clean energy investments were the following:

- the Energy Saving Credit Fund generating 6,577 million 2000 EUR;
- the Energy Saving Credit Program (1997); later the Energy Saving Program generating 9,135 million 2000 EUR;

²⁵ Based on the combined data of Statistical Yearbook of Hungary 2000, KSH 2001 Budapest; Vízgazdálkodási adatok (Water management data) 1992-95, KSH Budapest 1996; Vízgazdálkodási adatok (Water management data) 1997-2000, KSH 2001 Budapest

- and the Energy Efficiency Co-Financing Scheme generating 18,8 million 2000 EUR; totalling 34,512 million 2000 EUR investment into energy efficiency and renewables²⁶. This is to be compared to the 636,28 million 2000 EUR²⁷.

Note to future Observer-reporter

The Hungarian development plan (Széchenyi Plan) is to be monitored: the total credit to be granted and the direct financial support, the items that it can be allocated to. Investment data should be collected and calculated on the same basis, for the same year. For this state subsidy should be carefully measured.

²⁶ Calculation is based on data in Good Practices in Policies and Measures for Climate Change Mitigation (Draft), Regional Environmental Center, 2002,

²⁷ We used 1999 data as this was the latest available on the basis as it is for 1992, and based on the investment trends simply calculated as if investments in 2000 had been in real terms equal with 1999 investments.

►Indicator 5: Energy Resilience: Energy Trade

Value and calculation of the vector 5

Hungary is definitely an energy import-dependent country.

In 2000, the total energy import was 668 842 TJ while the country's total non-renewable energy consumption was 1 013 825 TJ. Whence: $668\,842/1\,013\,825 = 0,660$

For the calculation of the indicator we took 100% of the energy import to be non-renewable, as only less than 2% of the imported electricity is produced by hydro power plants purchased mainly from Slovak large hydro-power plants.

Vector: 0,660

Discussion of indicator 5

Security of energy supply should be one of the main issues of all countries' energy policy. In the official Hungarian energy policy²⁸ it is mentioned, but not really reflected concretely in practice as far as domestic renewable use, energy efficiency, demand side management are concerned.

In addition to that, the energy policy in practice is not really in favour of clean energy, Hungary does not take significant steps towards source and fuel diversification. Almost 70% of the total energy demand are covered by import. Domestic production of almost all kinds of fuels is decreasing, due to the scarce sources. The most critical is the issue of natural gas as Hungary is historically dependent on Russian gas (80% of the import, more than 50% of gas consumption), while 40% of total energy demand is covered by natural gas. 70% of the country's natural gas consumption takes place in the heating season. As domestic sources are decreasing, demand – especially residential demand – is increasing, Hungary is very sensitive to price changes. This extreme situation is due to the residential sector's gasification and the intensive fuel switch in the power sector, by CHP promotion²⁹.

The main short-term challenge for the Hungarian energy sector is to meet the EU requirement of liberalising the market, eliminating cross subsidies, while elaborating a compensation scheme for the vulnerable consumers and meeting security of supply needs. Now there is a tension in the gas sector because the import price is changing, while the domestic prices are partly regulated. As the MOL (Hungarian Oil and Gas Co.) runs both the import and the domestic production, and it is the wholesaler, it is the state that suffers losses due to the regulation.

Note to the future Observer-Reporter

The MOL (Hungarian Oil and Gas Co) is the exclusive gas importer and the producer of (cheap) domestic gas. It would be very useful to study the production, import and storage costs, to have a picture on MOL's real and reclaimed losses that are due to imported gas price changes.

²⁸ 21/1993. (IV.9) OGY határozat a magyar energiapolitikáról (Parliamentary Resolution on the Hungarian Energy Policy)

²⁹ A földgáz szerepe a magyar energiapolitikában (The Role of Natural Gas in the Hungarian Energy Policy), EU Enlargement Watch, Budapest, 2000

►Indicator 6: Burden of Energy Investments

Discussion of indicator 6

In Hungary, the state is involved into the development of the energy sector. Before the years of transition (1988/89) the whole energy sector was run by the state. The electricity sector was run by the Hungarian Electricity Works (MVM), while the oil and gas industry was run by the Hungarian Oil and Gas Trust (later the MOL Co.).

Mainly due to the huge amount of state debt, the government decided privatising the energy sector, which took place very fast mainly in 1996/96. By this time the gas and electricity distributors, plenty of power plants and a great proportion of MOL Co. (still exclusively produces oil and gas, importers, transports and it also stores stocks) were privatised.

What the state kept for itself are the MVM which runs among others and owns the Paks Nuclear Power Plant, Vértés Power Plant and some other smaller power plants, generating more than 50% of the electricity. The state also has 25% of MOL shares.

For a quantitative analysis, even for an estimation that could provide a basis for the calculation of this vector, more time and deeper research are needed. Below are some points.

To estimate the non-renewable energy investments and the burden on the budget is the biggest challenge in this review for the following reasons:

- As it was mentioned above, after privatisation, no significant investment did take place either by the private sector or by state run companies. In Hungary, the mainly hidden and direct subsidies from the state to different players puts the main burden on the budget. To estimate the state's role, these subsidies should be studied by future Observer – Reporters.
- For the companies run by MVM, the Hungarian State gave capital for capital increase.
- Uneconomical power plants (like Vértés) get a subsidy for every kWh electricity produced.
- The Paks Nuclear Power Plant (producing 40% of the electricity and satisfying 13% of total energy demand of Hungary) does not clearly provision the needed funds for its shutdown, retrofit, and the radioactive wastes deposit. These enormous costs will be a burden on the budget- and would have a high present value if they were calculated.
- It would be crucial to estimate the real costs reflecting market prices for both natural gas and electricity, which could be the first step to calculate the volume of state subsidies.
- State guaranties given to borrowing companies also should be counted as budget costs related to investments.

► **Indicator 7: Energy Productivity (energy consumption/GDP)**

Value and calculation of indicator 7

Hungary's GDP production was 8,7% (46 977 million 2000 EUR) lower in 1990 than in 2000 and used 1 244,2 PJ¹ energy for producing it. It is to be compared to the 50 568 million EUR GDP in 2000 and 1 036,1 PJ. The energy intensity of Hungary was 26,49 in 1990 and 20,47 MJ/ EUR of GDP³⁰ in 2000 more than double of the world average in 1990. Therefore to say the vector for 1990 is 2,655 and for 2000 is 2,029 which means that Hungary uses 92% more energy to produce one EUR of GDP than the rest of the world on average.

Note that energy intensity data are not calculated on purchasing power parity basis.

Metric

for 1990: 26, 49 MJ/EUR of GDP

for 2000: 20,47 MJ/EUR of GDP

Vector

for 1990: 2,655

for 2000: 2,029

Discussion of indicator 7

After the collapse of the energy-wasteful heavy industry in Hungary, western type investors bought them out and therefore invested into energy efficiency or financed firms. Also some foreign and governmental programmes provided some funding for energy efficiency investments. Generally under market pressure, inspired by some foreign and domestic support, and also due to structural changes in the economy, the energy intensity of Hungary slowly decreased after the collapse of GDP production and energy use. The GDP production exceeded the 1990 level just in 1999, while the energy consumption remained under the 1990 energy consumption level by almost 20%. But still the Hungarian economy uses almost double of the world average energy, and almost three times more than the EU.

Energy efficiency investment should work under market conditions and would favour energy saving companies. To favour such investments, one of the key issues is to develop a bank culture that can rely on future energy savings as a guarantee behind loans³¹.

Despite gasification, the residential sector remained very inefficient. It is especially true for the district heating sector which covers 1/5 of the population, where up to 26% of energy saving could be achieved, without counting the impact of changed heating habits³². It is due to the following factors:

³⁰ Gross Domestic Product 2000, KSH Budapest 2002

³¹ Presentation of Landis and Staefa – Siemens ESCO at a workshop of Hungarian Energy Efficiency Workshop run by the International Finance Corporation on 4 July 2002

³² Kovacsics István: Fogyasztó oldali energiahatékonyság a távhőszolgáltatásban (Consumers' Side Energy Efficiency in the District Heating Sector), presentation of earlier studies at a Hungarian Energy Efficiency Workshop run by the International Finance Corporation on 4 July 2002

- huge heat loss (lack of insulation);
- consumers behaviour (flat rates are paid in most cases, so more efficient heating and warm water use are not necessary decreasing district heating costs);
- pricing practice (40-60% of the district heating cost is a fixed charge for capacity which cannot be affected by any kind of energy saving, so the rate of return of energy efficiency investments is lower).

Note for future Observer – Reporter

An other important issue for energy saving companies (ESCOs) is that the Hungarian taxation system does not know about the ESCO category and therefore they have to pay 25% VAT, and not the 12% like energy trading companies.

The energy saving potential in the district heating sector is huge. In 2002-2003 the problems of this sector should be somehow solved: pricing, demand-side management, the district heating companies involvement into secondary side investments, etc. This process should be followed, and the energy savings should be measured.

The main role player is the Budapest District Heating Company (FŐTÁV) which has the worst system in the country, but has the biggest lobby power. The calculation of FŐTÁV's operational costs should be the key step to possible capacity charge backdrop, which is crucial for secondary side energy efficiency investments.

►Indicator 8: Renewable Energy Deployment

Value and calculation of vector 8

Hungary's primary energy consumption in 2000 was 1 036 096 TJ while using 31,5 PJ of renewables. Therefore the 3,04% of the energy consumed can be considered to be renewable, which result in a quite poor 1,064 for the indicator which is quite far away from the world average and the desired 8,64%.

Metric

for 2000: 3,04%

Vector

for 2000: 1,064

Discussion of vector 8

In a country where only 3 % of the energy demand is satisfied by renewable sources there are huge RES potentials. Many studies emphasise the possibilities^{33 34 35} for technical utilisation of RES potentials calculating with 220-250 PJ technical potential. The basis of these calculations is doubtful, as there are no updated overviews on biomass, wind and geothermal potentials.

Traditional renewable energy consumption decreased to almost zero level due to gasification and electrification programs. These also hindered the creation of small, flexible energy systems on a local basis. There are some places where biomass and geothermal sources are used.

The main issue is not the potential itself, but the legislation, awareness raising and attractiveness for investments. The main step for RES promotion is being taken in 2002 when the price of renewable electricity with purchasing obligation is defined. The other big issue is bank loans, which can be more easily gotten in case the legislation and RES promotion are coordinated.

In Hungary, we do not know about studies on public acceptance of clean technologies that would facilitate the RES promotion. The slowly increasing amount in the development program (Széchenyi Plan) will hopefully increase the household sector's RES utilisation and acceptance.

It is a fact that the lobby power of the Nuclear Power Plant and the other polluting power plants is huge, and they practice it against system reforms and changes.

³³ A közös megvalósításban való hazai részvétel stratégiája (National Strategy for Participation in Joint Implementation), MAKK és Env-Int-Cent, Budapest 2001, background study

³⁴ Kocsikk, K.. Intenational Collaboration for Decentralized Energy Supply of Rural Areas, International Agrophysics, 1998

³⁵ Állásfoglalás a biomassza energetikai felhasználásról, (Position paper on Utilisation of the Biomass for Energy), Centre for Environmental Studies, Budapest, 2000