**Renewable Energy Country Profile**
**Version 0.6b**

These profiles are a work in progress. They are presented to the international community for review and comment. The profiles are undergoing continual updating for technical content, formatting, grammar, and other issues. Each country profile will be modified on a continuous basis as new information is made available.

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# 13.0 Hungary

## 13.1 Overview of Electricity Supply

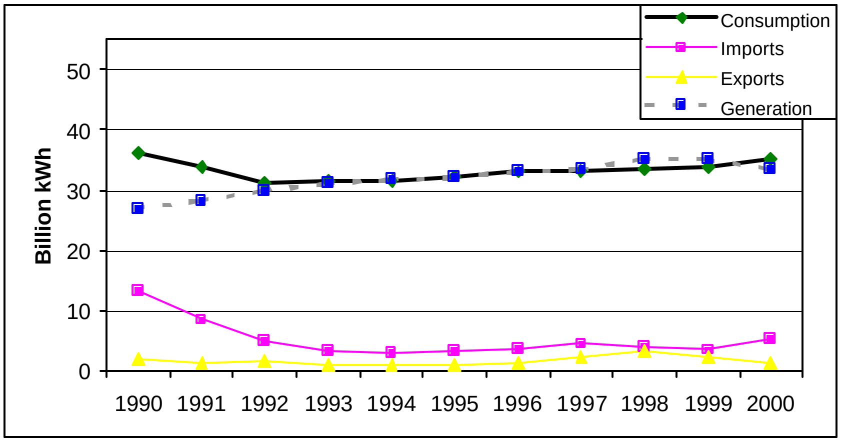
Hungary gained independence from communist party rule in 1991, however it had begun the process of economic reform in the late 1980's. Hungary experience high inflation and GDP depreciation throughout the early 1990's, however, in the latter part of the decade the economy began to grow, while inflation was reigned in to below 10% for the first time in 1999.

The power sector in Hungary currently utilizes a broad range of fuels to meet the demand for electricity. The balance of installed generation resources is detailed in Figure ___.

Figure ___
Installed Generation Capacity

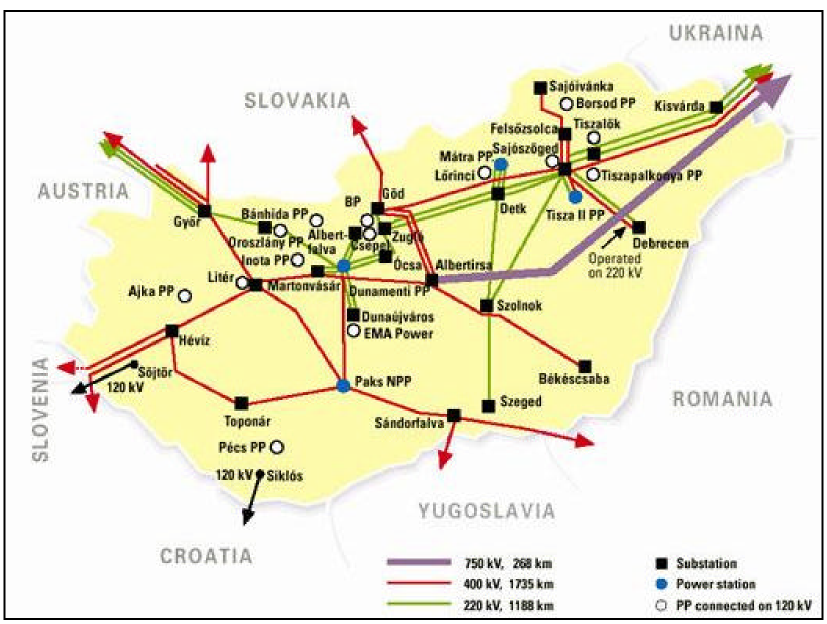
| Fuel | Number of Facilities | Capacity (MWe) | Percent of Total |
|---|---|---|---|
| Nuclear | 1 | 1,851 | 22.4% |
| Coal | 8 | 1,852 | 22.5% |
| Natural Gas | 2 | 556 | 6.7% |
| Natural Gas & Fuel Oil | 6 | 3,369 | 40.8% |
| Fuel Oil | 4 | 580 | 7% |
| Hydro | 3 | 50 | 0.6% |
| Other Renewables | -- | -- | |
| **Total** | 21 | 8,258 | 100% |

There is currently a push in the Hungarian energy sector to move from coal and fuel oil dependent generation to Natural Gas. Units have been repowered with combustion turbines, and all new proposed facilities are simple cycle combustion turbine, or combined cycle plants.




Domestic production of electricity was insufficient to meet demand. Throughout the 1990's Hungary maintained active electricity trade with its neighbors to meet domestic needs. Hungary remains as a net importer of power, however, proposed power projects will help to alleviate its dependence on foreign electricity.

The following, Figure ___, shows the location of existing generation and transmission systems in Hungary. The transmission grid consists of an extensive network of 750 kV, 400 kV, 220 kV, 120 kV lines. The grid was expanded in two major projects: the interconnection with the Western Europe UCPTE system in 1995; and the 400 kV interconnection with Croatia in November of 1999.




Privatization has been planned and implement throughout the 1990's and continues to progress. The Hungarian Energy Office was created in the early 1990's in preparation of the privatization and liberalization that continues to take shape. A 1999 energy plant issued by the government indicates a movement toward cleaner technologies including emissions controls for coal-fired generation, and replacement of existing generation with natural gas. Additionally, the 2001 Electricity Act brought Hungary in line with EU directives in terms of third party access, subsidy elimination, and segmenting the electricity market into generation, distribution, and power trading companies, while providing for an electricity grid operator to manage the system. At the moment, all generation within Hungary has been privatized, except the nuclear facility, meaning that they are all investor owned. Hungarian Power Companies Ltd. (MVM), formerly the state-owned electricity monopoly, currently manages all trade

### *1.1.1 Wind Resources*

**Current Status of Wind Energy [1)]**

Currently there is only 600 kW operational wind power in Hungary, consisting of an Enercon E-40, installed 50km south of Budapest.

A country wide wind-atlas is supposed to be available but it was not possible to secure a copy.

Wind generated electricity in Hungary is eligible for just HUF 10/kWh (EUR 0.039/kWh), just under half the premium rate paid in Germany. Rates were expected to rise under new legislation to HUF 15/kWh year 2001. If this has happened or not is not known.

Government had the intention to reduce domestic oil and gas production to extend resource life, for this purpose a target had been set for renewables to meet 6-8 % of primary energy demand by 2000. If this goal was achieved is not known

Governments plans for nuclear expansion is being considered despite public concern and the claimed low wind conditions in the country are the main set-backs for the development of wind energy in this country.

**Wind Energy Resource Potential[1)]**

It is generally assumed that Hungary has a low wind energy resource potential.

We do not believe that the wind conditions are unfavorable in Hungary, because

1. The largest Austrian wind park is being built just across the border to Hungary. It is not possible to believe that the wind stops at the border.
2. The E-40 installed close to Budapest is estimated to produce 1.5 Mio kWh/y, which corresponds to a capacity factor of 28.5%, which again would imply an average wind speed of 6.7 m/s at hub-height.

Therefore it is indispensable to assess country wide wind energy potential, before rating the wind energy potential of Hungary as poor.

Under these circumstances we would rate the technical wind energy resource potential of Hungary as fair- good, but this can only be documented by a country wide appraisal of wind energy resource potential by state of the art wind measurements.

**Identification of Areas/Projects with High Potential for Wind Energy[1)]**

The most promising sites are probably towards the Austrian border, north of the lake Balaton.

**A copy of the wind atlas of Hungary was not available.**

**Table 1-2** Hungary Areas/Projects with High Potential for Wind Energy..

| Project Name and Location | Size (MW) | Description |
|---|---|---|
| Austria Border | | Austria's largest wind station is being built near the town of Bruck and der Leitha close to where Austria borders Slovenia and Hungary |
| Wind resource study | | The town of Bruck and Leitha close to where Austria borders Slovenia and Hungary |

## Barriers/Incentives for Wind Energy

Specific incentives for the implementation of wind projects in Hungary include:

- Wind generated electricity in Hungary is eligible for just HUF 10/kWh (EUR 0.039/kWh), just under half the premium rate paid in Germany. Rates could be raised under new legislation to HUF 15/kWh year 2001.
- Government intention to reduce domestic oil and gas production to extend resource life.
- A known Renewables target to meet 6-8 % of primary energy demand by 2000

Specific barriers to the implementation of wind projects in Hungary include:

- Nuclear expansion is being considered despite public concern
- Low wind conditions in the country

**Table 1-3. Hungary Wind Energy Profile.**

| | |
|---|---|
| **Current status of wind energy** | |
| Installed capacity | 600 kW, Pilot Project, 1 Enercon E40, Kulcz, 50 kilometers south of Budapest |
| Projects under construction | None |
| Supporting regulations? | Yes. Announced price for wind energy. |
| Industry association? | Yes. Wind Energy Committee. |
| **Wind energy resource potential** | |
| Level of information available | Poor |
| Highest wind class | Class 3 (estimated from production of E-40) |
| Country-level wind atlas available? | Yes |
| Estimated potential (Interwind) | 500 MW (minimum) |
| Target established? | Yes. Renewables to 6-8% of primary energy demand |
| High wind speed locations | Kulcz, North of lake Balaton, Austrian and Slovenian borders |
| **Identification of areas/projects with high potential for wind energy** | |
| Recommended strategic assessments | Study 1 : Country wide appraisal of wind resources by wind measurements at 50 m height |
| Identified areas/projects | ? MW, Pilot Project of University of Agricultural Science, Gödöllö |
| **Incentives/barriers for wind energy** | |
| Significant incentives | Renewables target |
| Significant barriers | • Assumption that the wind resources are not favorable<br>• Lack of interest in technology |
| **Overall Prospects** | **Fair**<br>In spite of a renewable energy target and favorable legal and economical frame work, lack of state of the art measurements condemn Hungary to poor wind energy resource potential although Austrian projects across the border imply otherwise. |

1) Wind Power Monthly, various issues

# 1.0 Renewable Energy Country Profiles

## PROFILE FOR HUNGARY

## 1.1 Hungary Renewable Energy Profile

Hungary is well advanced in its transition to an open energy market and has very good prospects for biomass energy projects. There are additional opportunities for hydro and geothermal energy development (especially for heat applications). However, opportunities for large scale wind or solar projects appear limited.

### *1.1.1 Overview of Electricity Supply (US DOE 2002a)*

Hungary was one of the leading countries in dismantling communism in Eastern Europe in 1989; however, it had begun the process of economic reform earlier in the 1980's. Following the governmental transition, Hungary experienced high inflation and GDP depreciation throughout the early 1990's. In the latter part of the decade the economy began to grow, while inflation was reigned in to below 10 percent for the first time in 1999.

The power sector in Hungary currently utilizes a broad range of fuels to meet the demand for electricity. The balance of installed generation resources is detailed in Table 1-1.

**Table 1-1. Hungary Electricity Overview (EBRD 2001, EBRD 2002, US DOE 2002a).**

| | | | |
|---|---|---|---|
| **General information** | | | |
| Population, millions | | 10.0 | |
| Land area, thousand Ha | | 9,234 | |
| **Macroeconomic Information (2001)** | | | |
| GDP, billion US$ | | 52.9 | |
| Real GDP growth rate, percent | | 3.8 | |
| Foreign direct investment (net), million US$ | | 1,167 | |
| EU accession status | | EU association agreement signed Dec 1991 | |
| **Electricity sector** | | | |
| EBRD electric power transition indicator | | 4 | |
| Electricity tariff, US¢/kWh (year of data) | | 7.26 (1999) | |
| Collection rate, percent (year of data) | | 90 (1997) | |
| Load utilization factor, percent (2000) | | 48.7 | |
| **Electricity disposition, billion kWh (2000)** | | | |
| Generation | | 33.4 | |
| Consumption | | 35.1 | |
| Exports | | 1.2 | |
| Imports | | 5.2 | |
| **Generation capacity mix (2000)** | No. of Plants | Capacity (MWe) | Percent of Total |
| Nuclear | 1 | 1,851 | 22.5% |
| Coal | 8 | 1,852 | 22.5% |
| Natural gas | 2 | 556 | 6.7% |
| Natural gas & fuel oil | 6 | 3,369 | 40.8% |
| Fuel oil | 4 | 580 | 7% |
| Hydro | 3 | 44 | 0.5% |
| Other renewables | – | – | – |
| *Total* | 21 | 8,252 | 100% |

There is currently a push in the Hungarian energy sector to move from coal and fuel oil dependent generation to natural gas. Units have been repowered with combustion turbines, and all major new proposed facilities are simple cycle or combined cycle plants.

As Figure 1-1 shows, domestic production of electricity has been insufficient to meet demand. Throughout the 1990's, Hungary maintained active electricity trade with its neighbors to meet domestic needs. Hungary remains as a net importer of power. However, proposed power projects will help to alleviate its dependence on foreign electricity.

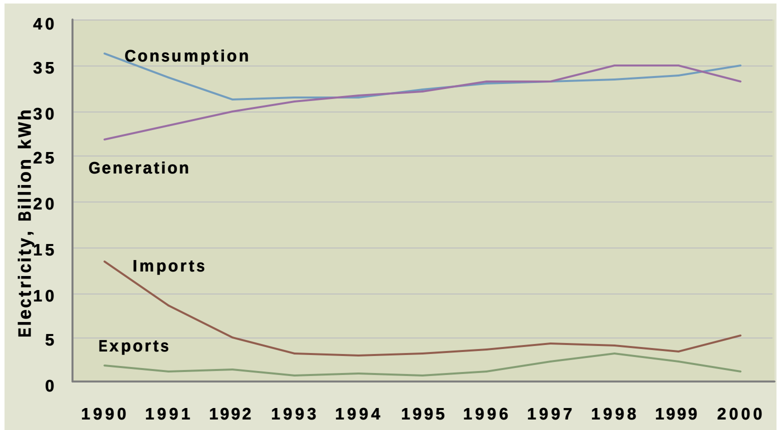



**Figure 1-1. Hungary Electricity Market Trends (US DOE 2002a).**

Figure 1-2 shows the location of existing generation and transmission systems in Hungary. The transmission grid consists of an extensive network of 750 kV, 400 kV, 220 kV, and 120 kV lines. To provide further opportunity for trade and stability of supply, the grid has been recently expanded in two major projects: interconnection with the Western Europe UCPTE system in 1995; and 400 kV interconnection with Croatia in November 1999.

Progress in the Hungarian energy sector is relatively good and has been focused on the goal of accession into the EU. Hungary was the first post-communist country to apply for EU membership in 1994 and is one of five on the “fast-track” to full membership, planned for 2004. Privatization has been planned and implemented throughout the 1990’s and continues to progress. The Hungarian Energy Office was created in the early 1990’s in preparation for the privatization and liberalization that continues to take shape. This body was made responsible for licensing producers of gas and electricity, and determines, but does not set, tariffs for third-party access for electricity, gas, and district heating.

According to a 1998 Report of the IEA on RENEWABLE ENERGY POLICY IN IEA COUNTRIES (Vol.II. Country Reports), renewable energy in Hungary is promoted via economic incentives, indirect subsidies and interest-free loans for research and development activities. The primary reason for promoting increased use of renewables is to mitigate local pollution: over 13% of Hungary’s land is at least moderately polluted. Much of the pollution is due to the use of indigenous low-quality high-ash and high-sulphur coal in power generation.

Subsidies are available from certain funds e.g. the central environment protection fund and the regional development fund that operate under the Action Programme for Energy

Conservation. While these funds do not target only renewable energy systems, renewable energy applications are preferred.

A 1999 energy plan issued by the government indicates a movement toward cleaner technologies including emissions controls for coal-fired generation and replacement of existing generation with natural gas. This plan seeks to reduce pollution levels to EU standards. Additionally, the 2001 Electricity Act brought Hungary in line with EU directives in terms of third party access, subsidy elimination, and segmenting the electricity market into generation, distribution, and trading companies, while providing for an electricity grid operator to manage the system.


**Figure 1-2. Hungarian Electricity Infrastructure (US DOE 2002a).**

To date, all generation resources, excluding the nuclear power facility, have been converted to private ownership. Additionally, the Hungarian Power Companies Ltd. (MVM), formerly the state-owned electricity monopoly, currently owns and operates the national transmission grid. MVM has recently formed MAVIR to handle electricity dispatch and balancing for the grid. At the present time MAVIR is an entirely owned subsidiary of MVM, however, once MAVIR is fully operational, ownership is planned to revert to the Ministry of Economic Affairs. This organization of the transmission system is expected to remain in place for the foreseeable future.

Competition will be introduced gradually into the electricity sector. In 2003, the largest industrial customers, totaling about 35 percent of total consumption in Hungary, will be allowed to choose their electricity supplier. Additionally, during this period, third-party access to the grid will begin. The structure for the other 65 percent of the electricity market will remain in place until 2010, when the market is expected to be fully liberalized.

### Renewable Energy Installed Capacities

According to the IEA Country Submissions (2001) in the Year 200 Hungary had a total generation of electricity from RES of 0,29 twh. Electricity generated was defined to be Gross Production minus amount of electricity produced in Pumped Storage Plants.

Its Generating capacity of RES totaled 73 MW of which 48 MW from Hydro, 24 MW from Municipal Solid Wastes and 1 MW from Solid Biomass. However, Table 1-1 shows an installed capacity for electricity production of 44 Mwe and none for other renwables.

According to EUROREX (The European Research Energy Exchange), the Renewable Energy Installed Capacities (Gross) in 2000 were as follows:

**25.2 Mtoe**

**Renewable energy installed capacities**

**(Gross MW unless otherwise specified)**

| Electricity | MW |
|---|---|
| Wind | 0 |
| Small Hydroelectric | 7 |
| Large Hydroelectric | 30 |
| Photovoltaics | 0.01 |
| Wave | 0 |
| Tidal | 0 |
| Geothermal electric | 0 |

| Heat/electricity/cogeneration | MW |
|---|---|
| Solar Thermal | 8 |
| Energy crops (wood) | 0 |
| Energy crops (ethanol/million litres) | 0 |
| Energy crops (biodiesel/million litres) | 0 |
| Forest residues | 175 |
| Solid Agricultural waste | 25 |
| Liquid Agricultural waste | 0 |
| Municipal Solid waste | 70 |
| Municipal Digestible waste | 0 |
| Solid industrial waste | 300 |
| Liquid industrial waste | 2 |
| Landfill gas | 1 |
| Geothermal heat | 350 |

Gross electricity and heat produced for sale from renewable sources amounted in total to 286 Gwh in 2000, of which 178 from hydro, 105 from MSW and 3 from solid biomass.

On the other hand the Energy Centre of Hungary, reported to us the following "statistical" and "estimated" levels and structure of Renewable Energy Resources in the Year 2001.

**Renewable Energy Resources in 2000**
**in HUNGARY**

| | Unit | Statistical data | Estimated data | Total |
|---|---|---|---|---|
| Solar | TJ | 0 | 56 | 56 |
| Wind | TJ | 0 | 0 | 0 |
| Hydropower | TJ | 641 | 0 | 641 |
| Geothermal | TJ | 0 | 3.600 | 3.600 |
| Biomass | TJ | 14.925 | 17.204 | 32.129 |
| Total renewables energy | TJ | 15.566 | 20.860 | 36.426 |

| | | |
|---|---|---|
| TPES | Mtoe | 24,4 |
| Total renewables energy | Mtoe | 0,87 |

**Source:** Energy Centre

### *1.1.2 Wind Resources*

**Current Status of Wind Energy**

There is currently little use of, or potential for, wind energy in Hungary. This technology has almost exclusively been used in remote locations for water pumping and feed grinding. However, two larger unit installations have recently been made. The first is a 250 kW unit built in 2000 in Inota in western Hungary. The second wind plant was recently built about 40 miles south of Budapest in the small village of Kulcs. The cost of the installation was around $700,000, about 40 percent of which was subsidized by government grants. The project is expected to provide around 1.2 million kWh of electricity annually (23 percent capacity factor). (US DOE 2002b)

## Wind Energy Resource Potential

*A country-level wind map is reported as being available. The authorities concerned have been requested to provide it.*

*The potential for wind energy is the subject of an ongoing national assessment. Currently, resources at an altitude of 30 m have been identified at 150 W/m$^2$, while the point at which wind energy becomes economically feasible is estimated at 600 W/m$^2$. The potential for wind energy is limited because of the surrounding mountain ranges that typically limit the wind speed to 6 m/s over the majority of Hungary. (EC 1992)*

## Identification of Areas/Projects with High Potential for Wind Energy

There are (poor or limited) opportunities for wind development in Hungary, due to the reasons explained above.

## Barriers/Incentives for Wind Energy

Specific incentives for the implementation of wind projects in Hungary include:

- No incentives are recommended, since as even a 30% subsidy derived from green taxes will not secure sustainability

Specific barriers to the implementation of wind projects in Hungary include:

- Mainly low wind speeds and frequencies
- Lack of finance

**Table 1-3. Hungary Wind Energy Profile.** **Year 2001**

| | |
|---|---|
| **Current status of wind energy** | |
| Installed capacity | XX MW, Project Name 1, Project at Inota 0,25<br>XX MW, Project Name 2, Project Location 2 none?<br>~~XX MW, Project Name 3, Project Location 3, etc.~~<br>XXXX MW Total |
| Projects under construction | XX MW, Project Name 1, Project Location 1 none known<br>XX MW, Project Name 2, Project Location 2 none “<br>XX MW, Project Name 3, Project Location 3, etc.<br>XXXX MW Total |
| Supporting regulations? | Yes/No. Very brief description. |
| Industry association? | Yes/No. Name. |
| **Wind energy resource potential** | |
| Level of information available | Poor |
| Highest wind class | Class 1-7 |
| Country-level wind atlas available? | Yes. Reported as existing but not received yet |
| Estimated potential | XXXX kWh/yr or MW, gross (theoretical) potential<br>XXXX kWh/yr or MW, technical potential<br>XXXX kWh/yr or MW, economic potential |
| Target established? | Yes/No. Very brief information. |
| High wind speed locations | Location 1<br>Location 2<br>Location 3, etc. |
| **Identification of areas/projects with high potential for wind energy** | |
| Recommended strategic assessments | Study 1<br>Study 2, etc. |

| | | |
|---|---|---|
| Identified areas/projects | XX MW, Project Name 1, Project Location 1<br>XX MW, Project Name 2, Project Location 2<br>XX MW, Project Name 3, Project Location 3, etc. | |
| **Incentives/barriers for wind energy** | | |
| Significant incentives | Incentive 1<br>Incentive 2, etc. | Incentives such as subsidies of 30-40% are not recommended since they will not achieve sustainability |
| Significant barriers | Barrier 1<br>Barrier 2, etc. | |
| **Overall Prospects** | Poor | |

### *1.1.3 Solar Resources*

**Current Status of Solar Energy**

Adequate potential for low intensity solar energy has been identified. However, currently there is no widespread implementation of this resource. Limited use of solar energy for water and space heating has been observed, based on flat plat collectors. Photovoltaic applications have been implemented on an experimental basis in the telecommunications and other sectors. But this technology has not yet reached wide scale of commercialization in Hungary.

**Solar Energy Resource Potential**

The solar insolation in Hungary is relatively poor averaging 1,000-2,000 kWh/m$^2$/day (BP / Solarex 1996).

**Identification of Areas/Projects with High Potential for Solar Energy**

As stated above, there are only poor or limited prospects or opportunities for solar development in Hungary based on photovoltaics. Their cost is 300-500% higher than electrical or thermal energy produced from traditional sources of energy.

Likewise the potential and prospects for flat plate collectors are also limited.

**Barriers/Incentives for Solar Energy**

The primary barrier to solar energy utilization in Hungary for commercial purposes is its high cost (especially that of photovoltaics). Other restrictive factors are

- The poor insolation and its wide fluctuation over the day and amongst seasons, which would dictate investment in back-up systems.
- The relatively low per capita income of the population.

Uses of photovoltaics will most likely be restricted to installations, which cannot conveniently or economically be served by the grid (e.g. telecommunications), to daring individuals or for use by research organizations, which normally will try to obtain subsidies or grants.

Government incentives in the form of subsidies or grants of the order of 30-40%, will be restricted to cases such as the fore-mentioned.

Subsidies are normally financed by funds created by fees from licenses purchased in the electricity, natural gas and heating subsectors. The constraints mentioned above will also be an impediment to the use of Solar flat plate collectors for hot water and heating purposes.

**Table 1-2. Hungary Solar Energy Profile.**

| | |
|---|---|
| **Current status of solar energy** | |
| Installed capacity | XX MW, Project Name 1, Project Location 1<br>XX MW, Project Name 2, Project Location 2<br>XX MW, Project Name 3, Project Location 3, etc.<br>XXXX MW Total |
| Projects under construction | XX MW, Project Name 1, Project Location 1<br>XX MW, Project Name 2, Project Location 2<br>XX MW, Project Name 3, Project Location 3, etc.<br>XXXX MW Total |
| Supporting regulations? | Yes/No. Very brief description. |
| Industry association? | Yes/No. Name. |
| **Solar energy resource potential** | |
| Level of information available | Poor |
| High range of solar insolation | XX - XX kWh/m2/day 1 000-2 000 kwh/$m^2$/day |
| Country-level solar atlas available? | Yes/No. Very brief information. ? |
| Target established? | Yes/No. Very brief information. No |
| High solar insolation locations | Location 1<br>Location 2<br>Location 3, etc. |
| **Identification of areas/projects with high potential for solar energy** | |
| Recommended strategic assessments | Study 1<br>Study 2, etc. |
| Identified areas/projects | XX MW, Project Name 1, Project Location 1 )<br>XX MW, Project Name 2, Project Location 2 ) See text<br>XX MW, Project Name 3, Project Location 3, etc. |
| **Incentives/barriers for solar energy** | |
| Significant incentives | Incentive 1<br>Incentive 2, etc. |
| Significant barriers | Barrier 1<br>Barrier 2, etc. |
| **Overall Prospects** | Poor |

### *1.1.4 Geothermal Resources*

#### Current Status of Geothermal Energy

Hungary has some of the largest reserves of geothermal energy in Eastern Europe. Generally, the identified resources are low to medium enthalpy, 50 C to 200 C, and more suitable for heat supply than electricity production. Because of this, there is currently no utilization of geothermal energy for electricity production. However, there has been considerable use of the low to medium enthalpy geothermal energy throughout Hungary.

Current demand for geothermal energy has been for direct heating and balneology. Direct heating is most extensively used in horticulture on the Great Hungarian Plain. The majority of horticultural facilities heated with geothermal energy in the world are in Hungary. The residential and industrial demands have led to over 2000 wells currently in operation supplying over 270,000 toe (tons of oil equivalent) of energy to Hungary. (US DOE 2002a, EC 1999).

Geothermal installations in Hungary have been estimated as having a total capacity of 350 MW used only for heat generation. They are put to a variety of applications: crop drying, green house heating and district heating, with "one third" of the country having useful geothermal resources (EUROREX).

**Geothermal Energy Resource Potential**

The average heat flux from many areas in Hungary is as much as three-times the average heat flux from the Earth's surface. However, Hungary's reserves are primarily low to medium enthalpy, which are not suitable for electricity generation. There is some evidence of the existence of high-energy resources capable of electricity generation, but none have been identified to date. High temperature zones have been discovered at depths of 3,000 to 5,000 m during oil-drilling operations. However, these sites have not been extensively studied. (EC 1999)

The primary geothermal resource area in Hungary is the Upper Pannonian reservoir system that extends through nearly the entire country and enters some of the adjoining countries. The basin is surrounded by the Alps, Carpathians, and Dinarides, which form the large low enthalpy aquifer. This is the system that is used for heating of horticultural facilities. Figure 1-3 identifies the large low to moderate enthalpy geothermal basins. (EC 1999)

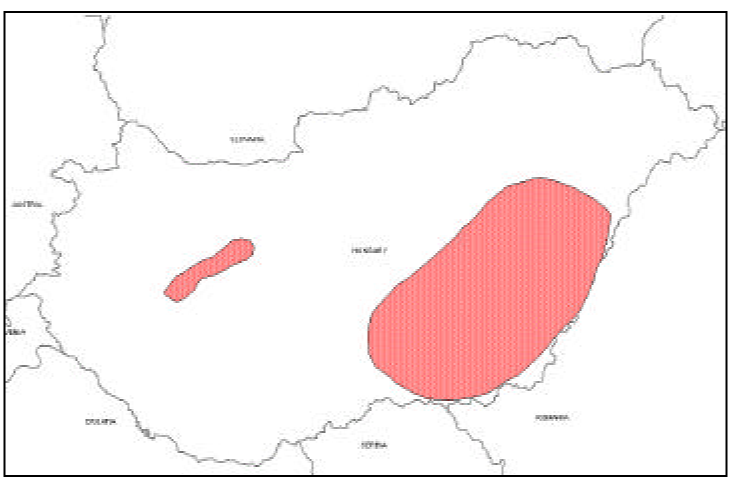


**Figure 1-3. Hungary Geothermal Resource Areas (EC 1999).**

**Identification of Areas/Projects with High Potential for Geothermal Energy**

There are **good and very good** opportunities for geothermal development in Hungary, as the foregoing text indicates

**Table 1-6. Hungary Geothermal Energy Profile.**

| | |
|---|---|
| **Current status of geothermal energy** | |
| Installed capacity (electric) | XX MWe, Project Name 1, Project Location 1<br>XX MWe, Project Name 2, Project Location 2, etc.<br>XXXX MWe Total |
| Installed capacity (thermal) | XX MWth, Project Name 1, Project Location 1 – Several locations<br>XX MWth, Project Name 2, Project Location 2, etc.<br>XXXX MWth Total 350 (See text). |
| Projects under construction (electric) | XX MWe, Project Name 1, Project Location 1 )<br>XX MWe, Project Name 2, Project Location 2, etc. ) none<br>XXXX MWe Total - None |
| Supporting regulations? | Yes/No. Very brief description. |
| Industry association? | Yes/No. Name. |
| **Geothermal energy resource potential** | |
| Level of information available | Poor / Fair / Good / Very Good |
| Country geothermal atlas available? | Yes/No. Very brief information. Not established yet. |
| Estimated potential (electric) | XXXX kWh/yr or MW, gross (theoretical) potential<br>XXXX kWh/yr or MW, technical potential<br>XXXX kWh/yr or MW, economic potential |
| Target established? | Yes/No. Not as far as we know. |
| High enthalpy geothermal locations | Location 1<br>Location 2<br>Location 3, etc. |
| **Identification of areas/projects with high potential for geothermal energy** | |
| Recommended strategic assessments | Study 1<br>Study 2, etc. |
| Identified areas/projects (electric) | XX MWe, Project Name 1, Project Location 1 )<br>XX MWe, Project Name 2, Project Location 2 ) none<br>XX MWe, Project Name 3, Project Location 3, etc. ) |
| **Incentives/barriers for geothermal** | |
| Significant incentives | Incentive 1 ) No information available<br>Incentive 2, etc. ) |
| Significant barriers | Barrier 1 Mainly Competitiveness vis-à-vis<br>Barrier 2, etc. other energy sources for heating purposes |
| **Overall Prospects** | Poor / Fair / Good / Very Good. Brief summary. |

### *1.1.5 Biomass Resources*

**Current Status of Biomass Energy**

Biomass accounts for the largest share of Hungary's renewable energy consumption. Currently fuelwood combustion is the primary use of biomass. Forestry wastes and sawmill byproducts are currently burnt in furnaces to provide heat for the forestry industry or briquetted for retail sale. Nearly 40 percent of the roundwood production is used for energy purposes (FAO 2002).

Consumption of solid biomass in 2000 amounted to 14792 TJ according to IEA/OECD sources.

As explained earlier, Heat/Electricity/Cogeneration in Hungary had the following installed capacities in the Year 2000 (EUROREX Source):

| | | MW |
|---|---|---|
| Forest residues | : | 175 |
| Solid agricultural waste | : | 25 |
| Liquid agricultural waste | : | - |
| Municipal Solid Waste | : | 70 |
| Municipal Digestible Waste | : | 300 |
| Liquid Industrial Waste | : | 2 |
| Landfill gas | : | 1 |

**Biomass Energy Resource Potential**

Despite the extensive use of forestry wastes for energy production, it is estimated that only 10 percent of this resource is currently being utilized. The significant amount of forestry byproducts could potentially be used to generate electricity on a large scale, or more completely utilized to supply for heat residential and industrial needs.

**BLACK & VEATCH WILL PROVIDE THE TABLE BELOW FOR EACH OF THE COUNTRIES.**

Table 1-3 shows agricultural and forestry statistics for Hungary.

**Table 1-3. Hungary Biomass Resource Data (FAO 2002a, FAO 2002b).**

| Biomass resource type | Total production, units | Production density, (unit) / 1000 Ha |
|---|---|---|
| **Primary crop production, tonne** | (avg. 1999-2001, tonne) | (tonne/1000 Ha) |
| Total all primary crops, tonne | 8,322,126 | 434 |
| Top 10 Primary Crops, tonne | | |
| Mixed Grasses & Legumes | 3,066,667 | 160 |
| Wheat | 1,154,405 | 60 |
| Potatoes | 1,019,732 | 53 |
| Maize for Forage & Silage | 622,667 | 32 |
| Sugar Beets | 448,490 | 23 |
| Forage Products nes | 376,667 | 20 |
| Maize | 281,806 | 15 |
| Barley | 203,353 | 11 |
| Onions, Dry | 151,005 | 8 |
| Tomatoes | 147,999 | 8 |
| **Animal units, number** | (number) | (number / 1000 Ha) |
| Cattle | *Coming soon* | *Coming soon* |
| Poultry | *Coming soon* | *Coming soon* |
| Pigs | *Coming soon* | *Coming soon* |
| **Forest products, cubic meters** | (avg 1999-2000, cu meters) | (cubic meters /1000 Ha) |
| Wood fuel and charcoal | 2,549,950 | 276 |
| Wood residues | 455,000 | 49 |

The above-mentioned information will need significant supplementation in order to enable its conversion to estimates of energy potential, theoretical and practical.

For instance, estimates will be needed as to which part of the production comprises harvest losses, which part comprises waste, which can practically be collected and be transformed into energy with appropriated technology: incineration for electricity and/or heat and anaerobic digestion through CHP plants.

A similar exercise will be imperative for the animal sector and abattoirs. Waste (solid and liquid) from animals will have to be estimated as a basis for calculating energy potential in biogas, electricity, heat etc. Realistic prospects will be determined on the basis of commercial livestock units; or where liquid and solid manure can be conveniently collected, transported and processed economically.

The organic component of MSW (Municipal Solid Waste), being about 40% of Total MSW, can be estimated from typical parameters of per capita production of waste.

As to landfill gas produced from organic waste buried in landfills, the size of each major landfill, its age etc. will be the main factors in establishing its potential.

Information on agro-industrial production and wastes will also be required. Most probably special surveys will be essential to estimate solid and liquid wastes from agro-industry, particularly the organic component of the food and drink industry.

As to MSW (Municipal Solid Waste), the Hungarian Energy Centre has provided us with the following aggregate information on rural and urban population

Urban: 4.577.000
of which Budapest: 1.811.000
Rural: 3.622.000

This can form a basis for estimating MSW and its organic component in aggregate. But for seeking finance, projects will need to be formulated for each urban centre individually, for major rural communities or for groups of villages lying within an “economic distance” from each other (say maximum 50km).

Likewise for sewage liquid wastes or sludge.

**Identification of Areas/Projects with High Potential for Biomass Energy**

There are **very good** opportunities for biomass development in Hungary.

**Table 1-10. Hungary Biomass Energy Profile.**

| | |
|---|---|
| **Current status of biomass energy** | |
| Installed capacity | XX MW, Project Name 1, Project Location 1<br>XX MW, Project Name 2, Project Location 2<br>XX MW, Project Name 3, Project Location 3, etc.<br>XXXX MW Total |
| Projects under construction | XX MW, Project Name 1, Project Location 1<br>XX MW, Project Name 2, Project Location 2<br>XX MW, Project Name 3, Project Location 3, etc.<br>XXXX MW Total |
| Supporting regulations? | Yes/No. Very brief description. |
| Industry association? | Yes/No. Name. |
| **Biomass energy resource potential** | |
| Level of information available | Very Good |
| Relative biomass potential (total / density) | Total: 0-100; Density: 0-100 |
| Country-level biomass investigations available? | Yes/No. Very brief information. |
| Estimated potential | XXXX kWh/yr or MW, gross (theoretical) potential<br>XXXX kWh/yr or MW, technical potential<br>XXXX kWh/yr or MW, economic potential |
| Target established? | Yes/No. Very brief information. |
| High density biomass areas | Location 1<br>Location 2<br>Location 3, etc. |
| **Identification of areas/projects with high potential for biomass energy** * | |
| Recommended strategic assessments | Study 1<br>Study 2, etc. |
| Identified areas/projects | XX MW, Project Name 1, Project Location 1<br>XX MW, Project Name 2, Project Location 2<br>XX MW, Project Name 3, Project Location 3, etc. |
| **Incentives/barriers for biomass energy** | |
| Significant incentives | Incentive 1 Incentives & barriers<br>Incentive 2, etc. Same as applying to other RES |
| Significant barriers | Barrier 1<br>Barrier 2, etc. |
| **Overall Prospects** | Very Good. Brief summary. |

* Should be estimated after receiving the information discussed on the preceding page

### *1.1.6 Hydroelectric Resources*

#### Current Status of Hydroelectric Energy

Hungary is one of the less mountainous countries in central Europe, and therefore has only limited hydroelectric potential. There are only three small commercial hydroelectric power plants in the country, and these are summarized in the Table below:

**Hydroelectric Power Plants in Hungary**

| Power Plant | Capacity (Mwe) | River |
|---|---|---|
| Hernadviz | 4.4 | Hernad |
| Kiskore | 28 | Tisza |

| | | |
|---|---|---|
| Tiszalok | 11.4 | Tisza |

**Source: MVM as reported in IEA Report**

Their total capacity is about 44 MW. They provide about 200 Gwh of electricity annually. The Henadviz power plant is owned by Hungarian Innoventa 2001 Ltd., while the Kiskore and Tiszalok power plants are owned by Tiszaviz Hydro Power Plants Ltd. The new owner of the small Hernadviz power plant is the Hungarian subsidiary of the German company Innoventa Energy AG; previously the power plant had been owned by a retired teacher who had purchased it in 1997 from the Hungarian government for 200 million forints, but subsequently and in violation of the privatization agreement, could not invest further in the facility.

**Hydroelectric Energy Resource Potential**

Being relatively flat Hungary has limited Hydro-power potential.

**Identification of Areas/Projects with High Potential for Hydroelectric Energy**

There are **(poor)** opportunities for further hydro development in Hungary, for the reasons stated above.

### *1.1.8 Contact Information*

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### 1.1.9 References


BP / Solar, "World Design Insolation," Map, 1996.

European Bank for Reconstruction and Development, Transition Report 2001: Energy in Transition, London: EBRD Publications Desk, 2001.

European Bank for Reconstruction and Development, Transition Report Update: May 2002, London: EBRD Publications Desk, 2002.

European Commission, Blue Book on Geothermal Resources, Luxembourg: Office for Official Publications for the European Communities, 1999.

European Commission. The European Renewable Energy Study. Luxembourg: Office for Official Publications for the European Communities, 1992.

UN Food and Agriculture Organization, FAOSTAT Database [Accessed July-August 2002], http://apps.fao.org/default.htm.

UN Food and Agriculture Organization, "Forestry Information System (FORIS) - Country Profiles" [Accessed July-August 2002], http://www.fao.org/forestry/fo/country/nav_world.jsp.

US Department of Energy, "An Energy Overview of the Republic of Hungary," 19 August 2002 [Accessed July-August 2002], http://www.fe.doe.gov/international/hungover.html.

US Department of Energy, "International Energy Outlook 2002: Hydroelectricity and Other Renewable Resources," 26 March 2002 [Accessed August 2002], http://www.eia.doe.gov/oiaf/ieo/hydro.html.