

TURKEY'S HYDROPOWER POTENTIAL and REVIEW of ELECTRICITY GENERATION POLICIES from EU PERSPECTIVE

TURKEY'S HYDROPOWER POTENTIAL

Turkey is not a rich country as far as primary energy sources such as petroleum and natural gas reserves are concerned, but has an abundant hydropower potential which can be used for generation of electricity. Despite this, it is observed clearly that inappropriate energy strategies are adopted and such an abundant natural resource is not being sufficiently utilized. Turkey, by letting its waters flow without utilization, as our famous proverb “**water flows, idiot stares**” implies, deprives itself from billions of kWhours of cheap electricity each year. Turkey is being pushed into a position of a country which is unaware of and cannot defend its interests by giving priority to thermal power plants using imported fuel, thus increasing foreign dependence in energy, instead of developing its own natural resources first. **Turkey must base its energy strategy on developing the whole hydroelectric potential at the earliest possible time.** Let us now review some of the existing data and facts concerning hydropower potential of Turkey.

DSI (State Hydraulic Works) and EIE (Electricity Works Administration) have calculated Turkey's hydropower potential, which is economically feasible to develop, to be around 123 TWh per year. The key concept here is "the economical feasibility" and the criteria used for deciding what is feasible and what is not. We believe the existing criteria are biased against the hydropower. The brief summary of the existing criteria, which are used in the feasibility studies, and how these studies are conducted are given below.

The feasibility studies and the criteria used for these studies are based on the "internal costs" only, of thermal power plants, which are considered as the alternative to hydro plants, and "external costs" of the thermal power plants are wholly disregarded. It is a widely accepted fact that such "external costs" are approximately 30% of "internal costs". DSI is using the following criteria for the feasibility studies of hydroelectric power plants for the year 2001.

- **Firm Energy (electricity) Benefit :** **6.0 cents / kWh**
- **Secondary Energy Benefit :** **3.3 cents / kWh**
- **Peak Power Benefit :** **85 \$ / kW**

These values are based upon the internal costs of sample thermal power plants group (which is assumed to be 450 MW Import Coal + 150 MW Natural Gas/LPG combined cycle plant for the year 2001), which is the alternative to the hydro plant to be evaluated. Firm Energy Benefit (6 cent/kWh) is based upon the fixed and operational costs of the sample thermal plant group corresponding to each kWh generated, whereas secondary energy benefit is calculated from the operational costs only. Peak Power Benefit (85 \$/kW) is based upon fixed and operational costs of sample thermal plant group corresponding to each kW of installed power.

Firm Energy is defined as the energy generated by the hydro plant utilising the minimum discharge of water available 95% of the time. This discharge value is obtained from the flow continuity curve. Total quantity of firm energy thus calculated is further reduced by 5%. Total firm energy benefit of that hydro plant is then calculated by multiplying the total firm energy with firm energy benefit (6 cents/kWh).

Any quantity of electricity generated by the same plant, over the firm energy value as calculated above, is classified as secondary energy, and total secondary energy benefit is calculated by multiplying this quantity with secondary energy benefit (3.3 cents/kWh).

If the hydro plant has sufficient storage capacity, it will contribute to compensate the peak loads. Such contribution is calculated as below and defined as "Peak Power Contribution";

$$\text{Peak Power Contribution} = \text{Installed Power} - \text{Firm Energy} / (8,760 * 0.64)$$

The value thus calculated is multiplied by Peak Power Benefit (85\$/kW) to find the total peak power benefit of this plant to the national economy.

These three benefits described above are the benefits of this particular plant to the national economy and against these there are investment costs as well as operation, maintenance and repair costs to be considered for feasibility studies. Naturally, hydro plants have no fuel costs.

As explained above, some benefits of hydro plants are undervalued, and some others are totally ignored. Thus they are subjected to unfair competition against thermal power plants (especially NG and Import Coal Plants).

There are mainly two issues to be discussed. The first issue is concerning hydropower in Turkey in general, and it is proposed by the author that the hydro plants, instead of being evaluated individually, must be evaluated as part of the whole hydro system of Turkey. Because Turkey has huge storage capacity in her dams (presently 6 months' generation can be stored in the dams), and these HEPP with dams can function as the storage and buffer for smaller units without storage. As a matter fact, even the wind plants can be considered as part of the system. Thus, all electricity produced by hydro plants (renewable), small or large, with or without storage must be classified as firm energy. Because of storage capacity of the system, there is always reliable power supply. Not only this, but the whole load variations throughout the country during the day is being balanced by the hydro plants with storage. This is also a very valuable asset for the hydro plants. Starting or stopping the generation within a matter of seconds bring huge flexibility to the transmission system operator to balance the loads. These plants additionally carry out the vital function of regulating frequency in the system. All These must have an additional economical value, which is estimated to be 1.25 cents/kWh, using weighted average of electricity prices at peak loads.

The second issue is the external costs of thermal power plants. These are the indirect costs related with air pollution and other environmental problems thermal plants cause. The value of such costs is estimated to be at least 1.5 cents/kWh. Therefore, taking these two issues into consideration, we propose to use the following criteria instead of the existing ones in the feasibility studies of hydro plants.

In Case External Costs Are Taken Into Consideration:

For HEPP with Dams:

Either; Firm/Peak Energy Benefit = $6.0 + 1.25 + 1.50 = 8.75$ cents / kWh

Or; Firm Energy Benefit = $6.0 + 1.5 = 7.5$ cents / kWh

Secondary Energy Benefit = $6.0 - 1.25 = 4.75$ cents / kWh

Peak Power Benefit = 250 \$ / kW

For HEPP without Dams (RoR)

Firm Energy Benefit = $6.0 + 1.5 = 7.5$ cents / kWh

Secondary Energy Benefit = 4.75 cents / kWh

In Case External Costs Are NOT Taken Into Consideration:

For HEPP with Dams:

Either; Firm/Peak Energy Benefit = $6.0 + 1.25 = 7.25$ cents / kWh

Or; Firm Energy Benefit = 6.0 cents / kWh

Secondary Energy Benefit = 4.75 cents / kWh

Peak Power Benefit = 250 \$ / kW

For HEPP without Dams (RoR)

Firm Energy Benefit = 6.0 cents / kWh

Secondary Energy Benefit = 4.75 cents / kWh

If these criteria are used instead of the ones used by DSI, even those hydro plants that are 20-25 % more expensive than the currently feasible ones will become feasible themselves, even if the external costs are not taken into consideration. In case external costs are taken into consideration, this ratio goes up to the levels

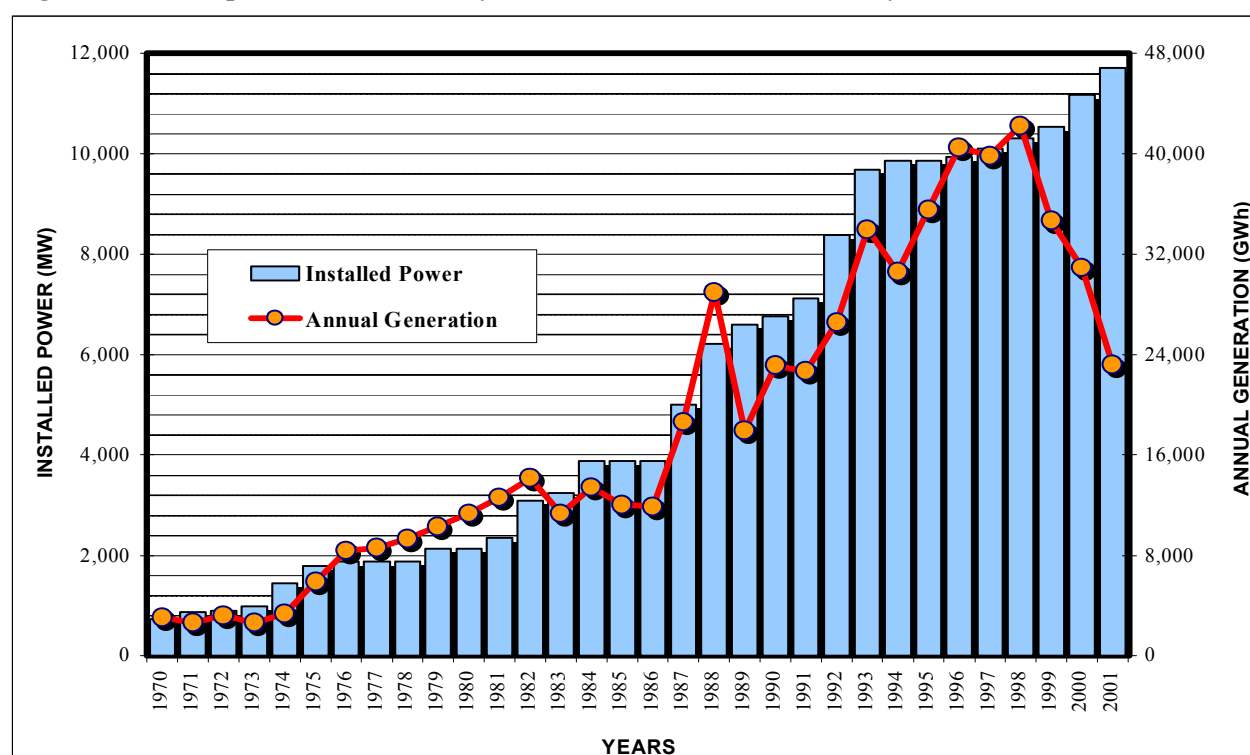
of 40-45 %. Below is a table showing the hydropower potential of Turkey and each individual river basins as calculated by DSI and estimated values by using the proposed criteria.

Table: 1- Turkey's Hydropower Potential As Calculated By DSI And According To New Criteria

Basin	Hydro Power Potential calculated by DSI			Estimates acc. to New Criteria	
	Gross Gen. Pot. (GWh)	Econ. Feasb. Pot. (GWh)	Installed Power (MW)	Econ. Feasb. Pot. (GWh)	Installed Power (MW)
Fırat (Euphrates)	84 122	37 961	9 648	46 267	12 176
Dicle (Tigris)	48 706	16 751	5 051	24 353	7 610
Eastern Black Sea	48 478	11 062	3 037	24 239	6 925
Eastern Medit.	27 445	5 029	1 390	10 978	3 137
Antalya	23 079	5 163	1 433	9 232	2 638
Western Bck.Sea	17 914	2 176	624	7 166	2 108
Western Medit.	13 595	2 534	674	5 438	1 511
Seyhan	20 875	7 571	2 001	9 394	2 609
Ceyhan	22 163	4 652	1 413	8 865	2 860
Kızılırmak	19 552	6 320	2 094	7 821	2 697
Sakarya	11 335	2 373	1 096	3 967	1 984
Çoruh	22 601	10 540	3 134	12 431	3 825
Yeşilirmak	18 685	5 297	1 259	8 408	2 213
Susurluk	10 573	1 602	507	2 643	881
Aras	13 114	2 287	588	5 246	1 418
Others (total)	30 749	1 722	510	1 722	510
Total	432 981	123 040	34 459	188,169	55,099

Let us now look at how much of this hydropower capacity was developed over the years in a graphic form.

Figure: 1- Development of Installed HydroPower and Annual Electricity Generation



As seen from the graph above, there is a considerable slowdown in the development of HydroPower in the last decade. The installed power in year 1993 was **9,682 MW**. This could be raised to **11,643 MW** in year 2001. If the same rate of progress is maintained, it will take about 100 years to develop the full hydro power capacity of Turkey as calculated by DSI, and around 175 years as estimated by the author. According to data and “Medium and Long Term Planning of Electricity Generation Study” published by TEAS in December 1997, share of the hydropower in the overall generation is dropping down to 16.6 % in year 2020 from 38.5 % in year 1997. Whereas, electricity generation from imported fuels jump to 65% from 28.3% in the same period. This trend is alarming for Turkey and shows an ironic contrast to the targets of EU countries for the development of green energy, as seen from the figures given below.

	<u>Year 1997</u>	<u>Year 2010</u>	<u>Year 2020</u>
<u>Turkey’s HydroPower Generation :</u>	38.5%	24.6%	16.6%
<u>Generation by Imported Fuel :</u>	28.3%	51.0%	65.0%
<u>Electricity Generation From Renewable</u>			
<u>Energy Sources in EU Countries :</u>	13.9%	22.0%	

Developing the full hydropower capacity in the shortest possible time is a necessity and must be the first priority for Turkey’s national interests. Following is the brief list of advantages and benefits of hydropower which show clearly why investment in hydropower must be supported and promoted by all means available.

Advantages and Benefits of Hydroelectric Power Plants :

Economical :

- Local Expenditures form the major portion (70-80%) of the investment. This has a significant contribution to GNP and positive impact on the national economy.
- Minimum Foreign Dependency and Foreign Exchange in the Investment. Imported equipment and services comprises very small portion of all expenses and the need for foreign funds for hydroelectric power plants are the smallest among all types of power plants.
- Hydroelectric power plants have the longest economical life (75 years). Even after that, by replacing electro mechanical equipment completely for a very small investment (200-400 \$/kW), they can continue to generate electricity for second, third, fourth economical lives of 75 years each.
- Lowest operation cost and no fuel cost.
- Cheap electricity generation provides the biggest contribution to forming a competitive energy market.
- Simplicity and flexibility in operation. Almost all material and services are locally provided.
- Performs the vital functions of load compensation and frequency regulation for the transmission system.
- Export of electricity generated to EU countries is easier because it is green energy. Additionally, huge storage capacity of dams brings the opportunity of exporting electricity at peak load periods.

Environmental :

- Environmentally friendly, minimum emission of green house gasses and pollution (almost none). Whereas, the alternative thermal energy sources consume either 450 g of imported coal or 215 litre of natural gas, which will mean the emission of 1.35 kg of GHG to atmosphere for each kWh of electricity generated. If 190 TWh of electricity, which is Turkey’s Hydroelectricity potential, is to be generated in thermal power plants instead, then the quantity of fuel consumed each year would have been either 41 billion cubic meters of natural gas or 86 million tons of imported coal, which would have meant extra emission of 257 million tons of GHG to the atmosphere.
- Prevention of erosion through rivers. Average slope of rivers is very high in Turkey, which contributes to erosion through rivers. Dams on rivers, slow down the flow of water and hence erosion.
- Provides support for the other green (renewable) energy sources. HEPP with dams can function as storage and buffer for other renewable energy sources, such as run-of-river plants and wind energy.

Social and Strategic Benefits :

- Energy storage capacity. Existing dams have the storage capacity equivalent to 6 months' generation.
- Decrease foreign dependency in energy. Hydroelectric power plants use the drop of water only (do not consume water) to produce electricity and they have no foreign dependency.
- Social economical benefits to local population, such as employment, fishing, irrigated agriculture, water sports, etc.
- Other strategic benefits.

EU POLICIES ON THE PROMOTION OF RENEWABLE ENERGY SOURCES

Directive 2001/77/EC of the European Parliament and the Council of 27 September 2001 on “**The Promotion of Electricity Produced from Renewable Energy Sources in the Internal Electricity Market**” was published in the Official Journal of the European Communities on 27 October 2001 and came into force (see http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf). Brief outline of this directive is given below.

Main items of justification for this Directive are summarised as follows;

- The promotion of electricity produced from renewable energy sources is a high Community priority for reasons of security and diversification of energy supply, of environmental protection, and of social and economic cohesion.
- The potential for the exploitation of renewable energy sources is underused in the Community at present.
- The increased use of electricity produced from renewable energy sources constitutes an important part of the package of measures needed to comply with the Kyoto Protocol.
- All member states should be required to set national indicative targets in the medium term for the consumption of electricity produced from renewable sources, and these targets should be consistent with any national commitment accepted by the Community under the Kyoto Protocol.
- A legislative framework for the market in renewable energy sources needs to be established.

The Purpose of the Directive is stated to be to promote an increase in the contribution of renewable energy sources to electricity production in the internal market for the electricity and to create a basis for a future Community framework thereof.

In this directive, an indicative target of 22.1 % is set for the year 2010 as the share of renewable energy sources in the whole electricity consumption of all EU countries, and “**renewable energy sources**” are defined to be wind, solar, geothermal, wave, tidal, **hydropower**, biomass, landfill gas, sewage treatment plant gas, and biogasses. **Table : 2** below shows the indicative targets for each of the Member States, the Community and Turkey's hydroelectric production is added at the bottom for comparison.

EU countries, for the purpose of achieving the indicated targets for the share of renewable energy, have been implementing various promotions and support policies to increase investment in the supply side (such as green certificates, investment grants, tax exemption or reduction, tax refunds, direct price supports), as well as tax exemptions and subsidies in the demand side for more widespread use of renewable energy by the consumers. Some examples are given below for such promotions and supports, types and mechanisms of which differ in each country.

Germany's “Act on Granting Priority to Renewable Energy Sources” which came into force in the year 2000 arranges the purchase, transmission and distribution of electricity produced by the renewable energy sources such as small hydroelectric (<5MW), wind, solar, geothermal, biogas, etc. as well as the minimum prices to be paid for each kWh produced by these, with the purpose of doubling the share of renewable energy sources in the total power consumption by the year 2010. According to this Act, for example, the compensation to be paid for electricity produced by hydroelectric plants will be at least 15 pf/kWh corresponding to the first 500 kW of installed power, and 13 pf/kWh for the rest. The compensation to be

paid for electricity generated from wind shall be at least 17.8 pf/kWh for the first five years. **In the explanatory memorandum of the Act, it is indicated clearly that the hydroelectric potential in Germany is largely exhausted and therefore what is left to be promoted is small hydro and other new renewable sources such as wind, solar, etc.** The reasons for the promotion of wind energy are explained clearly in this memorandum and it is stated that wind turbines are cutting-edge technology, and promotion of renewable energy helps this technology develop in Germany and create jobs for additional 20,000 people, in addition to its contribution to the manufacturing sector and exports. Germany, by such promotions and support policies, is targeting to cut CO₂ emissions in 2005 by 25% (compared to the value in 1990), and reduce the emission of all green house gasses by 21% in 2010.

The Netherlands taxes (as of 2001) electricity consumption by 5.2 cents/kWh for the first 10,000 kWh, and 1.7 cents/kWh for the consumption above, but exempts the green energy from this tax.

The subsidy paid (in the supply side) for the electricity produced by the wind and small hydroelectric plants in Sweden is 1.54 cents/kWh. Additionally, there is an “investment grant” of 15% provided to the investments in wind and small hydroelectric plants (<1.5 MW), as well as an “environmental discount” of 2.77 cent/kWh in the price of electricity for the wind energy consumers, in Sweden. (see <http://www.swedenvironment.environ.se/no0004/0004.html>)

Electricity traders will in the near future be forced to use “green energy quota” in Denmark, Sweden and some other countries, which will mean a certain portion of the electricity sold must be from renewable energy sources. The same will apply to consumers importing electricity directly from another country.

All such information emphasises the fact that there is a great deal of activity, effort and support for the promotion of green energy throughout Europe within EU.

Table : 2 – National indicative targets of Member States for the contribution of electricity produced from renewable energy sources to gross electricity consumption by 2010.

Member State	RES-E TWh 1997	RES-E % 1997	RES-E % 2010
Austria	39.05	70.0 %	78.1 %
Sweden	72.03	49.1 %	60.0 %
Portugal	14.30	38.5 %	39.0 %
Finland	19.03	24.7 %	31.5 %
Spain	37.15	19.9 %	29.4 %
Denmark	3.21	8.7 %	29.0 %
Italy	46.46	16.0 %	25.0 %
France	66.00	15.0 %	21.0 %
Greece	3.94	8.6 %	20.1 %
Ireland	0.84	3.6 %	13.2 %
Germany	24.91	4.5 %	12.5 %
United Kingdom	7.04	1.7 %	10.0 %
Holland	3.45	3.5 %	9.0 %
Belgium	0.86	1.1 %	6.0 %
Luxembourg	0.14	2.1 %	5.7 %
Community	338.41	13.9 %	22.0 %
Hydroelectricity in Turkey	39.82	38.5 %	24.6 %

Whereas in Turkey, only those hydroelectric power plants which are to be transferred to TETTAŞ (Public company for electricity trade) and the details of how and when these plants will be privatized are mentioned in the “Electricity Market Implementation Handbook” which is intended to be the basis for the directives to be prepared for the implementation of the “Electricity Market Law” no 4628. But, there is no mention of hydroelectric power plants to be constructed by the private sector in this “Handbook”. Actually, the Ministry of Energy and Natural Resources had in their BOT and Autoproducer portfolios, offers by the

private sector for the development of hydroelectric power plants with capacities totaling 10,000 MW installed power and above 40 billion kWh/year electricity generation.

It is stated in the proposals brought forward in this “Handbook” for the promotion of renewable energy sources that there is no need for the promotion of large hydroelectric plants to be constructed in future, because Turkey already generates big portion of its power needs from hydroelectric plants. **In fact, all sorts of promotions and support are definitely needed in order to develop full hydroelectric capacity in the shortest possible time, which is the most important national energy resource of Turkey.** It is normal for the individual European countries to exempt the big hydro from the promotions, because almost all their hydroelectric capacities are already developed. In spite of this, the term “small hydro”, which was used for the plants of 10 MW or smaller in the previous drafts, is removed and “all hydroelectric plants” are defined as renewable energy sources and therefore promoted in the EU Directive “**The Promotion of Electricity Produced from Renewable Energy Sources in the Internal Electricity Market**”, which came into force on 27 October 2001 (see http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf). Whereas in Turkey, a large part of calculated capacity is still not utilized and waiting to be developed, and waters flow by with no use. Furthermore, a study made by our company showed that Turkey’s economically feasible hydroelectric capacity is about 190 billion kWh per year, which is 50% more than the figure known as the capacity currently. Developed portion of this capacity at the present is only 40 billion kWh per year. There is no proposal in the “Handbook” for the development of the remaining 150 billion kWh. **The monetary value of this unused capacity is at least 9 billion dollars, and the Turkish economy will be deprived of this income yearly so long as this capacity is not developed. Moreover, whole of this green energy, which is worth 9 billion dollars, can be exported to EU countries.**

Additionally, there is no mention of any specific measures for the promotion of small and/or run-of-river hydroelectric power plants in the “Handbook”. Implementation of “Green Energy Quota” is proposed in general terms for the promotion of renewable energy in the preparatory studies for the Handbook. In this case, electricity suppliers are obliged to obtain certain portion of electricity they supply from green energy sources. This can be implemented in Turkey’s electricity export to Europe. But, the method used by Germany is more convenient for Turkey to promote new green energy investments. Germany fixed the minimum prices to be paid for electricity produced by each kind of green energy sources, and thus provided a legal guarantee to the investors in the supply side, by the “Renewable Energy Sources Act” which came into force in 2000.

There are some incentives given to green energy in the newly published “Licence Directive”. These are briefly described at the end of this paper, and clearly are not sufficient for encouraging investors in the field of renewable energy sources. The Handbook which is published by EMRA (Energy Markets Regulatory Authority) in September 2002 states that a separate law is needed to regulate the other measures for the promotion of electricity generation from renewable energy sources.

Turkey is and will be generating significant portion (at least 25%) of its electricity from hydroelectric power plants. In case sufficient connection capabilities are provided with EU countries, Turkey’s electricity production characteristics create an important opportunity for exporting electricity. Turkey should take advantage of being a significant producer of green energy, which is promoted by the EU countries both in the supply and demand side. Energy strategies of EU, demand forecasts, supply alternatives and basic principles of green energy promotions are reported in a striking manner in the “Green Paper” published by the European Commission. (see http://europa.eu.int/eur-lex/en/com/gpr/2000/com2000_0769en01.html). In the year 2020, 22% of estimated 800,000-900,000 MW installed power must be green energy, which will mean an additional 300 billion kWh/year green energy must either be produced by EU countries or bought from neighboring countries by that time. According to newly enacted EU Directive 2001/77/EC, additional 200 billion kWh/year green energy production is targeted until 2010. In case, Turkey’s currently unused capacity of 150 billion kWh/year is developed, the buyer will be ready –with a higher price of green energy– for this electricity produced; EU countries. Therefore, the aim in the local energy market must be to reach excess supply, especially in the green energy, and this must be adopted as a policy. This policy will require an active support for all green energy investments including hydroelectric.

Being green energy is not the only advantage of electricity produced in hydroelectric plants. The capability of storing and supplying electricity to meet peak demand is more important and far more valuable economically. The basic policy to be adopted in our country, for both the existing and newly constructed hydroelectric power plants with storage, must be to utilize them mainly to meet peak demands, and the goal must be exporting electricity to EU countries at peak periods. The electricity prices in Europe go up occasionally to very high levels at peak hours, since the hydroelectric power plants with dams in EU countries do not have sufficient capacity to meet the peak demands fully. In order to have an idea about the price level, we can say that there are many days during winter when prices often go up to **45 to 60 cent/kWh** level during peak hours in the Amsterdam Power Exchange (<http://www.apx.nl>). For example, the price of electricity traded reached **100 Euro cent/kWh** level at 6 p.m. on 17-Dec-2001, and stayed at that price level during the same hours in the following few days. (see http://www.apx.nl/marketresults/Historicaldata/historicaldata_dec01.htm).

There is only one transmission line connection between Turkey and Europe at present, that is the connection Turkey uses for importing electricity from Bulgaria. This connection consists of two 400 kV lines with a total capacity of 1,250 MW. Another connection to Greece with 750 MW capacity is already planned. There are some problems in the connection of currently used Bulgarian lines to Europe because of Yugoslavian transit route. Another important subject to be dealt with will be the transmission fee asked by the countries on the transit route. But, the problem more important and more difficult to resolve than these is to adopt the totally import oriented energy sector of Turkey –bureaucracy included- to exporting activities. Turkey can earn serious income from electricity exports. Even if the existing lines and capacity is used, 10-15 billion kWh electricity can be exported yearly. This will mean additional income of at least 500 million dollars per year. **Turkey is obliged to think about, plan and succeed exporting energy (electricity). The easiest and the most convenient way to achieve this is to develop the hydroelectric capacity fully in the shortest possible time, which is the country's own renewable energy source.**

The capacity and quality of connection to Europe must be increased urgently, in order to realize and promote exporting green energy in general and electricity at peak hours in particular to Europe. Increasing the capacity and quality of the connection is not sufficient by itself. Turkey is obliged to upgrade the operation standards of its own network to EU level. Membership to UCTE (Union for the Coordination of Transmission of Energy) must be actively sought after. Although TEAŞ applied to UCTE for membership in the past, our electricity network is not at the level such membership would require. In order to upgrade the network, an operation **system must be designed and implemented** urgently for the development of data base at TEAŞ (İletim A.Ş.), additional control and measuring systems, communication, data processing and accounting automation, etc. These two items must take place in the documents as the most important and highest priority duties of İletim A.Ş. (Transmission System Operator)

The connection of national network and its integration with the European network will be the biggest promotion and the guarantee for the investment in the energy sector in our country. When Turkey becomes UCTE member, any energy investor in Turkey will be able to sell freely the electricity he produces to any consumer in the EU countries. Since such sales agreements will be accepted as guarantee by the international banks, financing problems of energy investments in Turkey (green energy in particular) will totally be resolved. **This will help increase the investments in energy sector as well as flow of more international capital to Turkey.**

In conclusion, the directives to be prepared for the implementation of “Electricity Market Law” no. 4628 must contain articles encouraging and promoting investments in the hydroelectric plants. Following are the short list of what are required;

- License fees for hydroelectric plants must relatively be lower.
- License periods must be at least 49 years. Renewal of the license after the expiry of the first period must be part of the agreement. The Economical life of electromechanical parts of the hydroelectric plants is 75 years, and that of other parts consisting the major portion of the investment is hundreds of years. Licenses in developed countries are therefore granted for very long periods (see <http://www.ferc.gov/hydro/docs/waterpwr.htm>). Whereas in our country, the period of concession

for BOT projects were mistakenly limited to only 15-20 years, which effectively stopped the investments in the hydroelectric power plants. The same mistake must not be repeated again.

- Green energy promotion policies may be implemented for the electricity produced for the first 8-10 years, during which there are intense repayments of finance. There is no need for such promotion in the remaining period. A surcharge of 1.5-2 cents can be applied on each kWh of electricity produced by thermal power plants (against the external costs they cause) to compensate for the promotions to be provided to hydroelectric plants.
- A price/compensation guarantee must be devised in order to facilitate and promote investments to especially small and mini hydroelectric plants (European Union envisages promotion of all hydroelectric power plants as renewable energy sources by the Directive 2001/77/EC mentioned above, and it is both necessary and more beneficial for Turkey to take measures in compliance with this directive). Besides investments of plants, it is also necessary to promote the manufacturing of electromechanical parts and control systems used in these plants locally.
- An additional yearly fund of 700 million dollars can be generated by applying a surcharge of 1.5-2 cents on each kWh of electricity produced by the existing hydroelectric power plants belonging to DSI or TETTAŞ, for the continuation of public investments in hydroelectric plants.
- The highest priority of Turkey's electricity generation strategies must be developing its full hydroelectric potential first, and the aim should be to attain excess supply especially in green energy and export of electricity. Excess supply will contribute to more competition, cheaper price and export of electricity.
- Turkey must upgrade the standards of its transmission and distribution network to European level and increase the capacity and the quality of connection to Europe in order to export green energy at good prices to EU countries. Priority must be given to green energy in capacity allocation, and fees for transmission, distribution and connection must be relatively lower.

Besides, there are many economically feasible hydroelectric plants in Turkey, which can be developed without any promotion or support. The only thing needed is not to put additional hurdles in front of the private sector that is willing to invest in these plants. The BOT model, which could have never been operated as envisaged, must be the last example for such hindrances, and "Energy Market Regulatory Authority" must take confidence building measures by removing or at least reducing such hurdles in order to encourage private sector to invest in the energy projects.

The new "Licence Directive" published in the official gazette on August 4, 2002 by the EMRA (Energy Market Regulatory Authority) now defines all run-of-river hydroelectric power plants and HEPP with dams with installed capacity of 20 MW and less as renewable energy sources. It is indicated in this Licence Directive that all renewable energy sources will pay 1/100 of Licence Issuing fee, and no licence fee in the first eight years of operation, provided that they are put into operation without delay in accordance with the program submitted to EMRA. Additionally, renewable energy sources will have priority in connection to the distribution and/or transmission system. Licences may be given for as long as 49 years, according to this new directive.

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