

## TURKEY

The country report for Turkey was prepared by TUBITAK.

### Current situation on CHP and biomass CHP in the national energy sector.

Total energy production capacity in Turkey was 27000 MW in 2001. 18200 MW of total capacity is owned by Turkish Electric Generation Company (TEGC), 3500 MW by TOR, 2700 MW by autoproducers and 1800 MW by BOT.

### Energy balances in Turkey (Source: Energy Policies of IEA Countries, 2001)

	1999	%		1999	%
<b>Population (millions)</b>	<b>65.82</b>		<b>Total final consumption</b>	<b>52.00</b>	
<b>Energy consumption/capita</b>	<b>0.79</b>		<b>Coal</b>	7.36	14.2
<b>Total energy production (Mtoe)</b>	<b>26.90</b>		<b>Oil</b>	25.92	49.8
<b>Coal</b>	13.29	49.4	<b>Gas</b>	4.04	7.8
<b>Oil</b>	2.91	10.8	<b>Biomass &amp; Wastes</b>	6.71	12.9
<b>Gas</b>	0.60	2.2	<b>Geothermal</b>	0.13	0.3
<b>Biomass &amp; Wastes</b>	6.81	25.3	<b>Solar/Wind/Other</b>	0.11	0.2
<b>Nuclear</b>	-	-	<b>Electricity</b>	7.72	14.8
<b>Hydro</b>	2.98	11.1	<b>Heat</b>	-	-
<b>Geothermal</b>	0.20	0.7	<b>Total industry consumption</b>	<b>19.03</b>	
<b>Solar/Wind/Other</b>	0.11	0.4	<b>Coal</b>	5.71	30.0
<b>Net energy imports (Mtoe)</b>	<b>43.04</b>		<b>Oil</b>	7.84	41.2
<b>Coal</b>	6.69	15.5	<b>Gas</b>	1.64	8.6
<b>Oil</b>	26.11	60.7	<b>Biomass &amp; Wastes</b>	-	-
<b>Gas</b>	10.06	23.4	<b>Geothermal</b>	-	-
<b>Electricity</b>	0.18	0.4	<b>Solar/Wind/Other</b>	0.02	0.1
<b>Total supply - TPES (Mtoe)</b>	<b>70.33</b>		<b>Electricity</b>	3.82	20.1
<b>Coal</b>	20.07	28.5	<b>Heat</b>	-	-
<b>Oil</b>	29.38	41.8	<b>Transport consumption</b>	<b>11.87</b>	
<b>Gas</b>	10.59	15.1	<b>Total other sectors consumption</b>	<b>21.10</b>	
<b>Biomass &amp; Wastes</b>	6.81	9.7	<b>Coal</b>	1.65	7.8
<b>Nuclear</b>	-	-	<b>Oil</b>	6.29	29.8
<b>Hydro</b>	2.98	4.2	<b>Gas</b>	2.37	11.2
<b>Geothermal</b>	0.20	0.3	<b>Biomass &amp; Wastes</b>	6.71	31.8
<b>Solar/Wind/Other</b>	0.11	0.2	<b>Geothermal</b>	0.13	0.6
<b>Electricity Trade</b>	0.18	0.3	<b>Solar/Wind/Other</b>	0.09	0.4
<b>Electricity generation</b>	<b>10.01</b>		<b>Electricity</b>	3.87	18.3
<b>Electricity generation (TWh)</b>	<b>116.44</b>		<b>Heat</b>	-	-

The share of CHP plants in total production was about 15% in 2001. It is expected to increase to 22% by the year 2005.

## **RTD and Demonstration projects on biomass CHP**

The Technology Monitoring and Evaluation Board (TMEB) of TUBITAK has R&D Assistance Programme for Industrial Companies. This programme includes a financial contribution by the Scientific and Technical Research Council of Turkey and by the Undersecretary of Foreign Trade for up to 60% of the total eligible cost incurred over the duration (up to 36 months) of an individual R&D project. The Technology Development Foundation of Turkey (TDFT) within the scope of the decree provides low-interest loans [1]. There are 15 types of legal and administrative incentives to promote R&D. Two of them are the Decree on Investment Incentives and The Tax Credit for R&D expenses. The decree covers R&D, environment, quality improvement and small- and medium-sized enterprises (SMEs). The tax credit makes it possible to postpone the annual corporate tax payments for three years without interest up to an amount equivalent to 20% of R&D expenses.

The State Planning Organisation provides fund to relevant university departments for infrastructure developments of R&D studies. Electrical Power Resources Survey & Development (EPRD) also provides some support to industry.

Technology Monitoring and Evaluation Board (TMEB) of TUBITAK, Electrical Power Resources Survey & Development (EPRSD) and DPT act as implementing agencies. Some ministries provide financial support as well.

R&D projects proposed in the areas of cost-effective power production from municipal wastes and forest and agricultural residues, the development of fluidised bed technology for using biomass/coal blends in thermal power plants, the development of technologies using energy crops as fuel for power/heat production and the development of technologies for pyrolysis, gasification and liquid fuel production from biomass are encouraged. The industrial sector and the municipalities are primarily interested in larger scale, cost effective, profitable and applicable R&D projects.

Total expenditure of renewable energy R&D in Turkey for the year 1996 was reported to the IEA as 0.15 M USD (including the biomass energy), representing 4.6% of the total energy R&D expenditures. The main renewable energy resources being supported are solar, geothermal, and wind. R&D on the development of demonstration of advanced bio fuels technology, such as direct electricity generation from biomass and liquid bio fuel production is also underway [1].

Financing of R&D projects are offered via national funds by DPT, TUBITAK-TIDEB and research funds of universities. The project budgets are quite small. International co-operation is sought not only in terms of funds but also in terms of know how exchange.

## **Legislation and support mechanisms**

The main objectives of the energy policy of Turkey concerning biomass energy can be summarized as follows:

- To meet energy demand using preferentially domestic energy resources as the highest priority.
- To develop existing sources and to accelerate the penetration of new and renewable sources such as biomass.
- To diversify energy sources in order to decrease the dependence on energy imports from a single source or country.
- To protect the environment and public health towards sustainable development.

The Ministry of Energy and Natural Resources is the main body for establishment and implementation of diversified energy policies with special emphasise on the development of cost- effective and preferably domestic environmentally friendly energy sources. Within this frame, financially viable options have to be sought. The potential of biomass should be reviewed and evaluated regularly along with other new and renewable energy sources in the country.

Turkey's energy policy is being improved. Currently, there are only a few Government-backed incentives to promote new and renewable energy investments. The Ministry of Energy and Natural Resources (MENR) is preparing draft legislation for such systems. This legislation would also set incentives, pay - back rates and the prices for electricity from new and renewable energy mixes [2].

Recently, the number of biomass energy applications in Turkey has been increasing in spite of the lack of specific subsidization. Biomass based energy production appears to be applicable primarily in the industrial sector. Solar and biomass - based heat generation gains an increasing attention from both the industry and residential heat markets.

The Ministry of Energy and Natural Resources (MENR), the State Planning Organization (DPT) and the Electric Power Resources Survey and Development Administration (EPRSDA) are the main decision – making and implementing institutions in Turkey. The ministry of environment is also indirectly involved in the decision making process. All of these institutions are involved in establishment and/or implementation of new and renewable energy promotion policies as well. Some promotions and related policies exist with respect to the development and implementation of some selected renewable energy production options. Low-interest loans up to 45% of the capital cost are applicable to appropriate investments [1].

### **Existing CHP plants**

Biomass and waste fuelled CHP plants in Turkey are given in Table ?. There are four power plants using biogas: Aksa, Belka, Izaydas and Kemberburgaz. Their detailed specifications are given in Table 4.4- 4.7 respectively.

## Biomass and waste fuelled CHP plants in Turkey

NO	COMPANY	TOWN	SITE	CAPACITY (MW)	PRODUCTION (GWh/yr)	FUEL TYPE	CONTRACTION	COSTX1000 (EURO)
<b>COMPLETED</b>								
1	AKSA ENERGY	BURSA	BURSA	0.83	1.93	LAND FILL	26.05.1999	1363
2	BELKA	ANKARA	ANKARA	3.20	22.20	BIOGAZ	28.01.1997	9267
3	IZAYDAS	IZMIT	KOSEKOY	5.40	104.00	GARBAGE	05.09.1996	237000
4	ISTAÇ	ISTANBUL	KEMER-BURGAZ	4.00		LANDFILL	01.05.2002	7400
<b>UNDER INVESTIGATION</b>								
1	ALIAGA BEL.	IZMIR	ALIAGA	1.20	3.5	RESIDUAL		
2	BARES	BALIKESIR	BALIKESIR	165	575.2	RESIDUAL		
3	DIVAPAN	DUZCE	TOKUSLAR	20		WASTE/NG		
4	EZSE LTD.	OSMANIYE	KAMAN	60		RESIDUAL		
5	P&T ELECTRIC	BALIKESIR	BALIKESIR	45		RESIDUAL		
6	P&T ELECTRIC	ISTANBUL	SILE	45		RESIDUAL		
7	P&T ELECTRIC	URFA	BIRECIK	45		RESIDUAL		
8	P&T ELECTRIC	ISTANBUL	SILIVRI					
9	SEL ENERJI	AYDIN		16		BIOMASS		
10	TUNC GIDA	MARDIN		45		RESIDUAL		
11	AKENERJI	BALIKESIR	BANDIRMA	25	76	RESIDUAL		
12	AKIN HOLDING	CANAKKALE	AYVACIK	15		RESIDUAL		
13	EZSE LTD.	OSMANIYE	YUKARIDERE	60		RESIDUAL		
14	FE-PAL	ISTANBUL		100		RESIDUAL		
15	FKKGUNY OTO	SAMSUN		1.5		RESIDUAL		
16	IHLAS HOLDING	YALOVA	ARMUTLU	18	27	RESIDUAL		
17	YUKSEL INSAAT	URGUP		20.4		RESIDUAL		

- **Aksa Enerji, Turkey**

The plant is located in Demirtas/Bursa and it was constructed in 1999. The plant area has been used for storage until the plant was settled down. In the plant the methane gas is gathered by the active gas storage method and then it is purified for the electricity generation in gas engines by combustion. The annual production of grid electricity is 1.93 GWh.

- **Bel-ka, Turkey**

This plant is located in Sincan Ancara and it was constructed in 1997. The sludge gathered from wastewater treatment plant is processed under anaerobic conditions to produce methane gas. Then, the methane gas is used for the electricity generation in gas engines by combustion and for the hot water cauldrons. The annual production of district heat is 2.2 GWh and the annual production of grid electricity is 20 GWh.

- **Izaydas, Turkey**

This plant is located in Kosekoy/Izmit and it was constructed in 1996. Disposal of waste by incineration is carried out in the plant. The waste is first stored at the intermediate storage sites according to the results of laboratory analysis. Then it is disposed following the combustion menu laid down by the laboratory. Electricity is produced and the heat from the

exhaust gas is used to produce steam. The district heat produced annually is 44.6 GWh and the grid electricity produced is 59.4 GWh.

- **Kemberburgaz , Turkey**

The plant is located in Kemberburgaz /Instambul and it was constructed in 2002. The plant area has been used for residual storage till 1995 when the plant was settled down. In the plant the methane gas is gathered by the active gas storage method and then it is purified for the electricity generation in gas engines by combustion. The annual grid electricity produced is 33.6 GWh.