



World Energy Council
CONSEIL MONDIAL DE L'ENERGIE

Turkish National Committee
COMITE NATIONAL TURC

Dünya Enerji Konseyi Türk Milli Komitesi

Energy management in the building sector: Turkish experience

Tülin KESKİN

Auditor Committee Member
Chairperson of Energy Efficiency
Working Group

WORLD ENERGY COUNCIL
TURKISH NATIONAL COMMITTEE

enerGaia
SALON INTERNATIONAL DES
ÉNERGIES RENOUVELABLES
MONTPELLIER
10 > 12 DÉCEMBRE 2008

Outline of Presentation

- Turkish energy sector including renewable energy use
- Energy efficiency framework in Turkey (EE potentials, new law on EE),
- Building code of Turkey, household equipment, air conditioner and lighting energy efficiency potential in Turkey and actual situation of solar and geothermal energy use in buildings

GENERAL VIEW of TURKEY -2007



World Energy Council
CONSEIL MONDIAL DE L'ENERGIE

- Total area is about 783 500 km², 34th big land in the world.
35 % agricultural, 27 % forest area
- Turkey is surrounded by the Mediterranean, Black Sea, Marmara and Aegean Sea
Length of coast 8333 km
Administrative divisions : 81 provinces
- GDP \$ 489 billion
- GDP per capita 6 625 US\$
- Population 70.5 million

Primary energy consumption: 107 mtoe
In 2020 it is projected to rise: 222 mtoe

Very dependent on foreign energy imports.
75 %

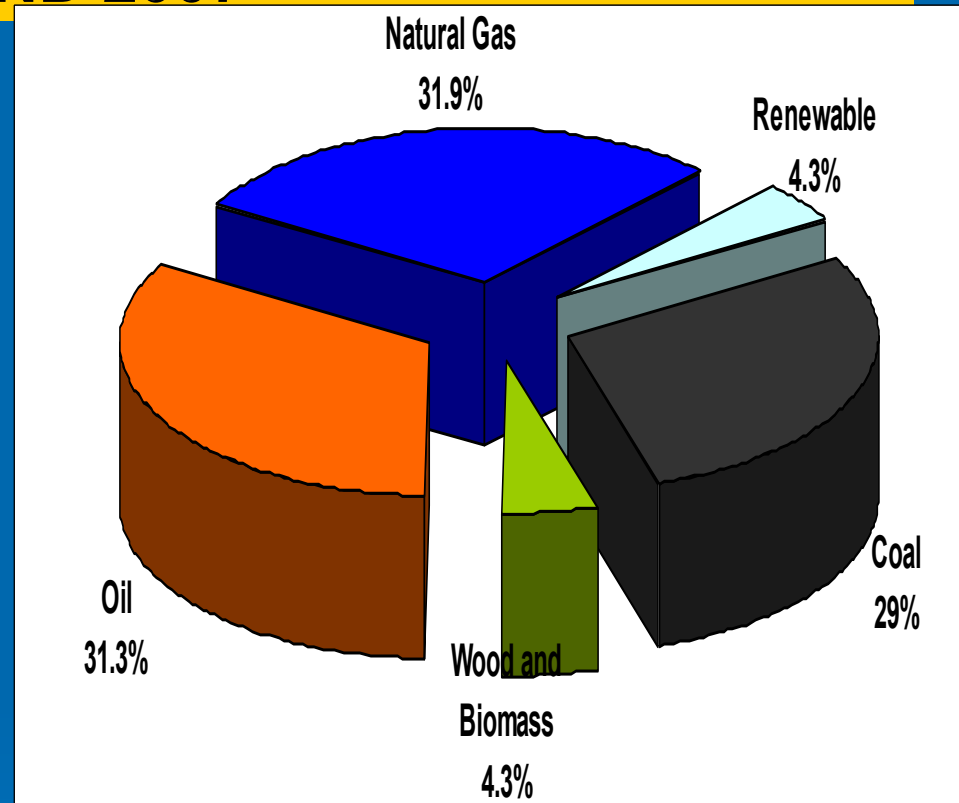
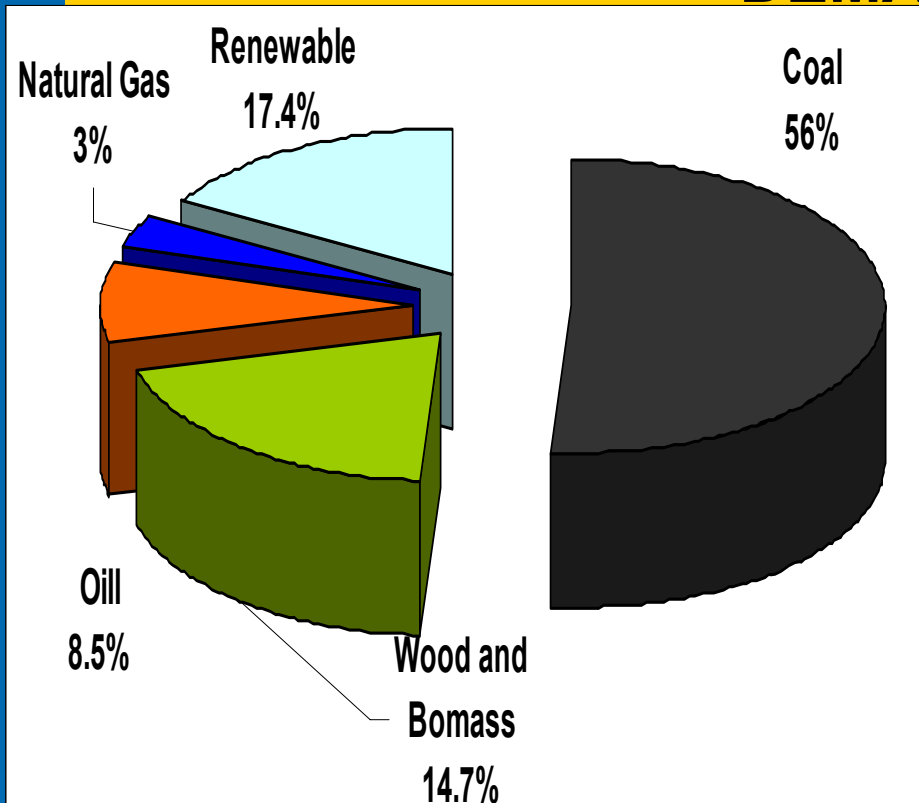
- Electricity Production: 191 TWh
- Installed capacity (MW): 40 836

- Per capita energy consumption: 1.5 toe/yr
- Per capita electricity consumption: 2 692 kWh/yr

Energy Intensity(1000\$/toe) : 0.36

Carbon intensity per capita : 3.3

ENERGY SUPPLY and DEMAND 2007



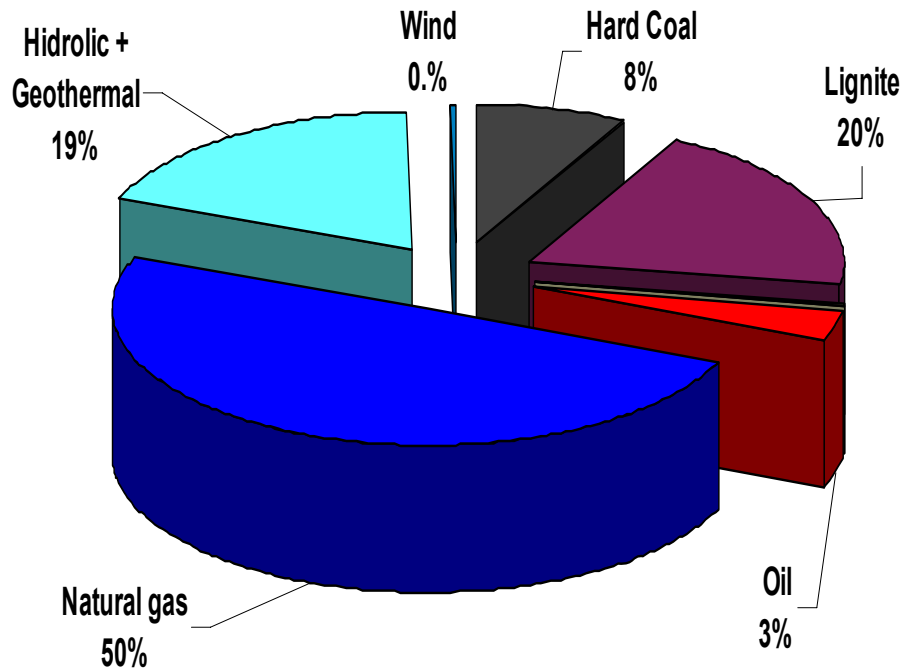
Production
27,4 mil toe

Import share
75 %

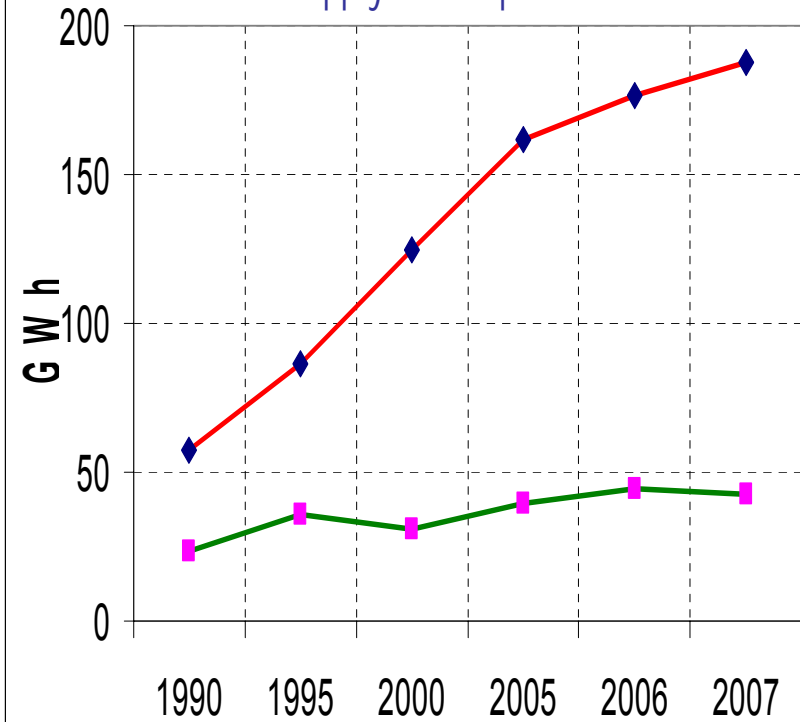
Consumption
107,6 mil toe



ELECTRICITY PRODUCTION by SOURCES and RENEWABLE ELECTRICITY -2007



Total Electricity and Renewable Electricity Supply and Population



◆ Total Electricity
■ Renewable TWh

RENEWABLE ENERGY SOURCES POTENTIAL



World Energy Council
CONSEIL MONDIAL DE L'ENERGIE

Hydro

Feasible potential app.170 TWh/year 36 % of potential has been exploited

Geothermal

The possible geothermal heating capacity is 31,500 MWt.(equal to 5 million dwellings)

120 000 dwellings and 900.000 m² green house heated by geothermal,

Proven geothermal electricity capacity is 550 MWe , 29 MW installed

Solar

Turkey is geographically well located with respect to solar energy potential.

The average **2640 hours annual sunshine, solar intensity is 3.6 kWh /m²-day.**

Solar energy utilization in domestic hot water, collector capacity is approximately 18 million m² and the corresponding annual energy production is 420 000 TOE ..

Photovoltaic power installed capacity 1000 kWp.

Wind

According to Turkey Wind Atlas wind potential 48 000 MW, There are 333 MWe installed capacity and they generated 355 GWh energy in 2007

Biomass

50-60 million tons of animal wastes and 50-100 million tons of agroindustry wastes can be used for utilization of energy ,15 million tons of forest residues and 5,4 million ton of



Turkish Energy Policy

➤ The Ministry of Energy and Natural Resources policy as;

“meeting energy demand in a reliable, sufficient, timely, economic and environmentally sound manner so as to realize the economic and social development targets of the country”

- limited indigenous energy sources,
- the steep rise in energy prices
- international environment –EU accession necessities for Climate Change

Policy should lean on energy saving and renewable energy



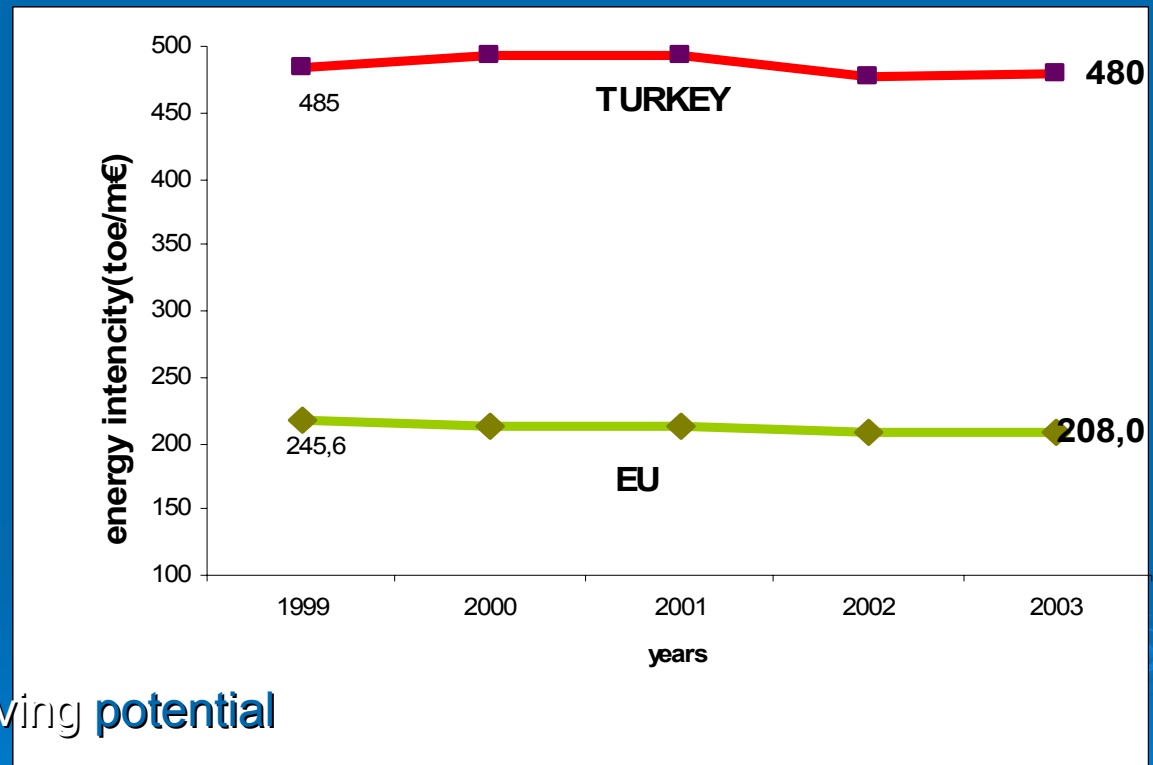
Energy Intensity in Turkey

Energy intensity of Turkey

0.36....OECD average 0.2

480.....EU25 average 208

It can be interpreted as,
up to 50 % energy
saving potential still
exist for Turkey



it is supporting evidence for
the revealed 20-50 % energy saving **potential**

Turkey has energy conservation potential as

20%– 25% in industry

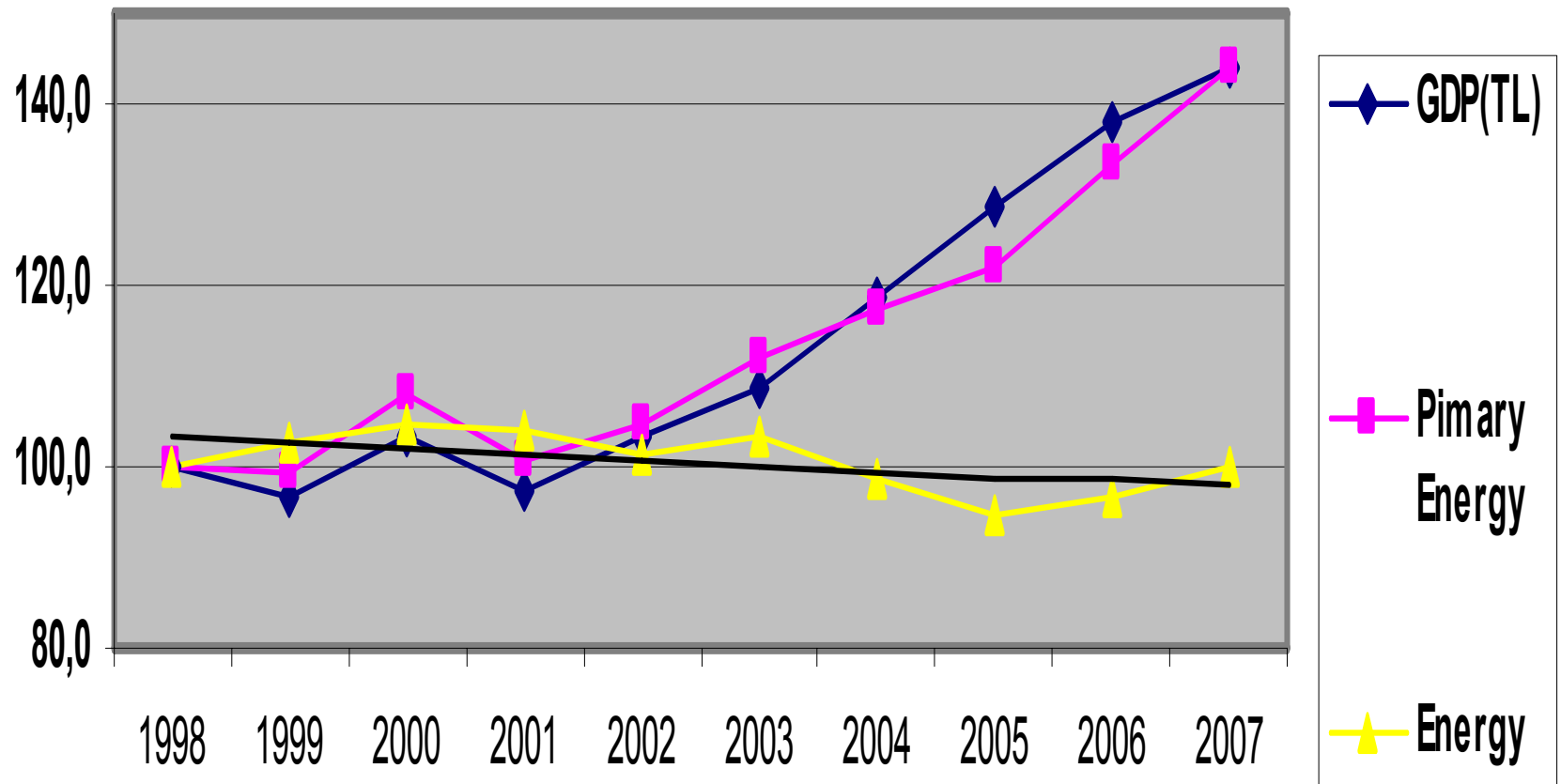
30% - 50% in building

15% - 20% in transportation

ENERGY INTENSITY TREND OF TURKEY WITH NATIONAL CURRENCY , 1998 Fixed Price



World Energy Council
CONSEIL MONDIAL DE L'ENERGIE



ENERGY EFFICIENCY ACTIVITIES

- Energy efficiency policy : Ministry of Energy and Natural Resources,
- Energy efficiency implementation: General Directorate of Electrical Power Resources Survey and Development Administration (EIE),
- Some energy efficiency projects supported by international donors such as UNIDO, World Bank, JICA, gtz, and European Union,
- Big scale energy efficiency enhancement was not ensured in all sectors but capacity building and awareness rising achieved in some extend on EE in Turkey
- Barriers: lack of an umbrella law, financial supports, capacities
- “Energy Efficiency Strategy” for Turkey was prepared and adopted by MENR on June 2004.



Energy efficiency studies



World Energy Council
CONSEIL MONDIAL DE L'ENERGIE

Energy management system in industry is one of the best practices of Turkey which would be good example for other countries.

Almost 1000 Energy Managers trained in a program comprises lectures and practical applications on energy management methods and certified. With this program in industrial plants which consume energy more than 2000 toe, a perceptible energy efficiency increase was achieved.



In the scope of energy audit scheme more than 100 plants were audited.

The mandatory regulation for heat insulation on new buildings, labeling of households equipments, air conditioners and lamps are the other effectively implemented program.





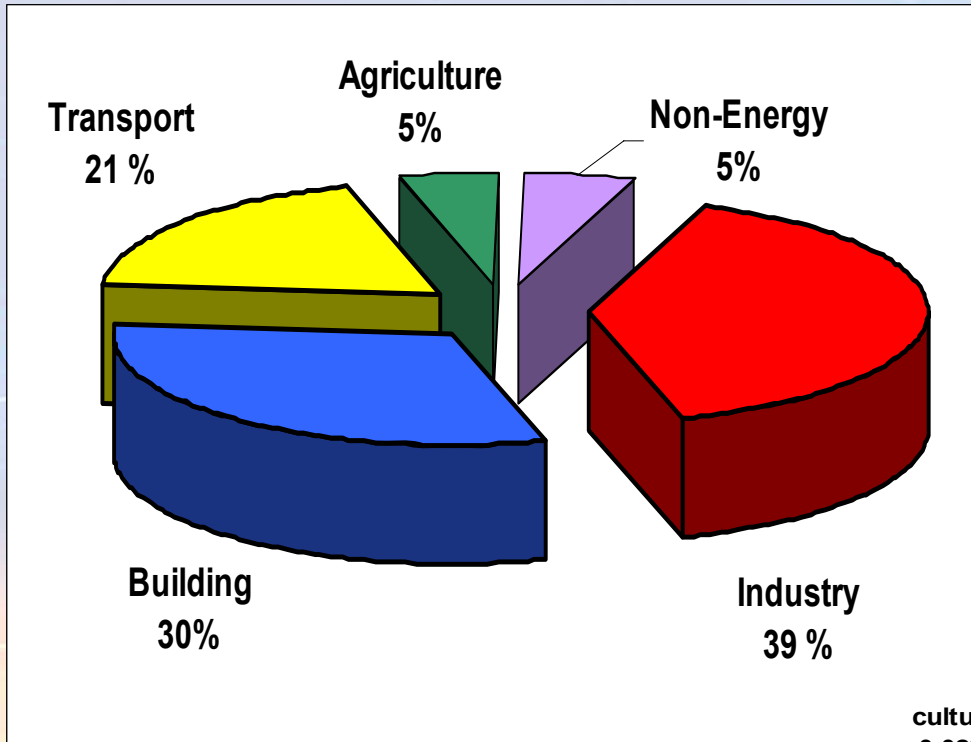
Energy Efficiency Law

- To give a new impulse to energy to energy efficiency, the Energy Efficiency Law was enacted on May 2007.
- The objective of this Law is to increase the efficient use of energy and energy resources for reducing the burden of energy costs on the economy and protecting the environment. This law comprises **organization, principals and procedures** in order to increase the energy efficiency **in industry, electrical power plants, transmission and distribution systems, building, and transport sectors.**

Energy Efficiency Law

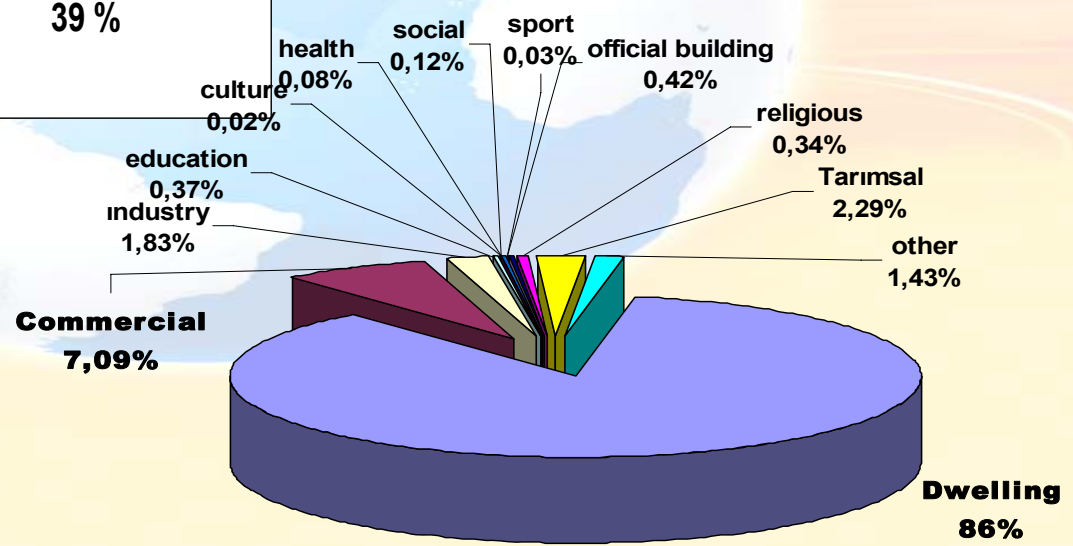
The main components of the Law are:

- To set up an administrative structure (the establishment of an **“Energy Efficiency (EE) Coordination Board”** under the Secretariat of the EIE, with responsibility to implement, supervise and coordinate the energy efficiency activities of relevant organisations) and mechanism for energy management and efficiency services;
- To increase **energy efficiency awareness** through energy conservation week, the media, training in schools, competitions, etc;
- To **promote energy efficient equipment and vehicles**;
- To supply **financial support to energy efficiency projects** and enterprises through voluntary agreements.
- The Law also states that **Energy Managers** should be assigned in industrial and commercial enterprises and buildings (which have a certain level of annual energy consumption).
- In addition, energy labelling/energy usage identification for efficient energy use, a **“Building Energy Performance Certificate”** will be issued by the Ministry of Public Works, especially for larger buildings.

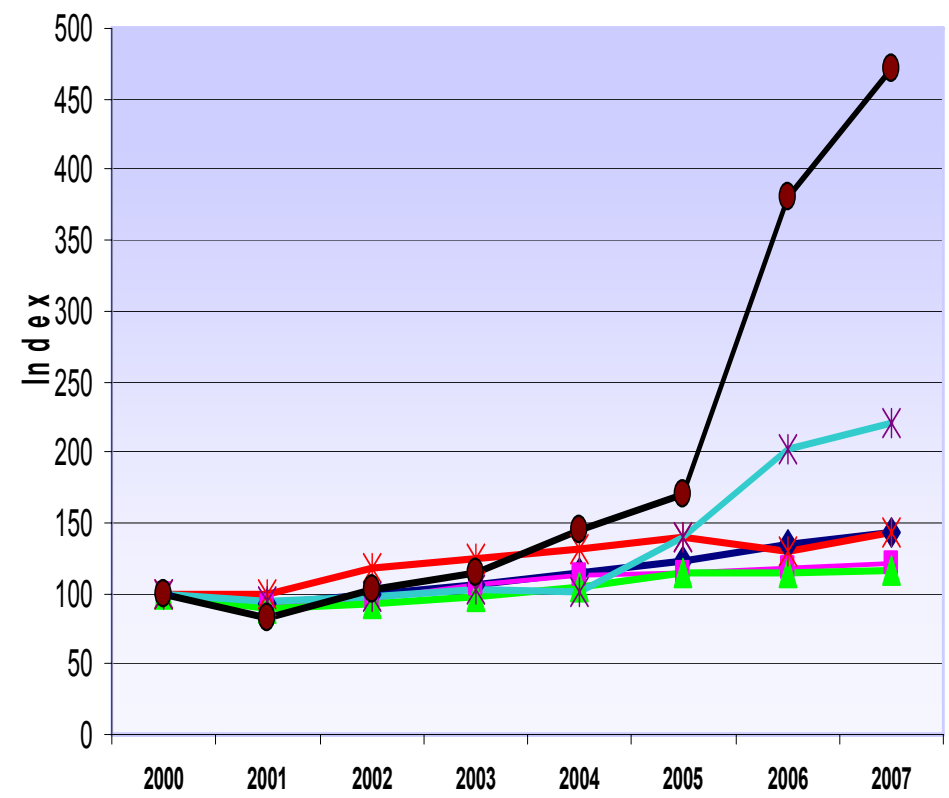
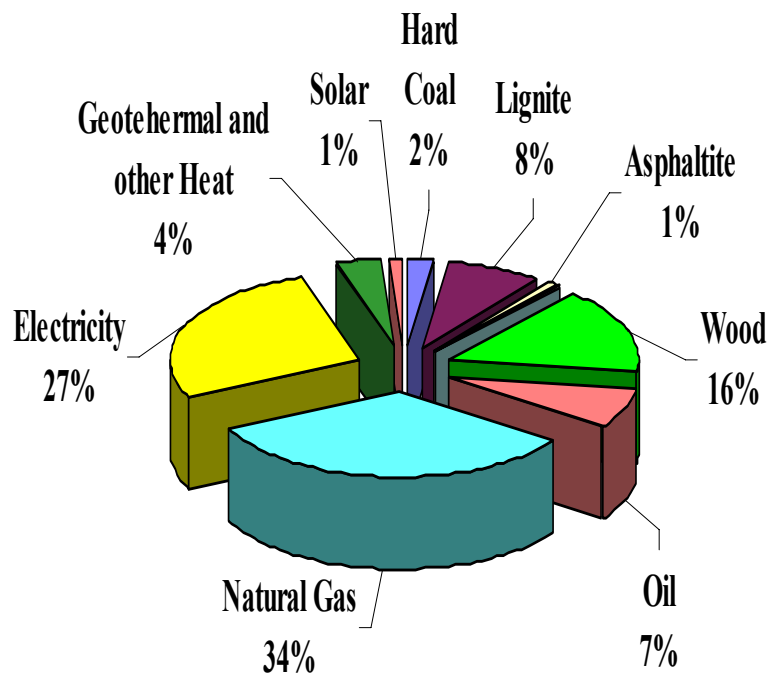


- Between 2000 (building census) and 2006, 550,000 new buildings received construction permits
- 470,000 received occupancy permits
- By 2006, Turkey's skylines 8.2 million buildings, not including unregistered or illegal construction

Residential and tertiary - commercial and service buildings is the second biggest sector representing 30 % share in end use



CONSUMPTION and PRICE TREND



- ◆ GDP (x106 US\$) (at constant prices 2000 US\$)
- ▲ Final energy consumption (mtoe)
- ▲ Households and Services Energy Cons. (mtoe)
- ▲ Electricity (households) (US\$/kWh)
- ▲ Natural Gas (Households) (US\$/toe)
- Lignite (Households) (US\$/ton)

BUILDING ENERGY EFFICIENCY REGULATORY FRAMEWORK



World Energy Council
CONSEIL MONDIAL DE L'ENERGIE

The Ministry of Public Works and Settlement (MPWS) is responsible body for the regulatory framework of the building sector

- Building standard (TS 825),(mandatory 2000)
It sets thermal insulation standards for new buildings and at renovations of existing buildings with 15% ratio or more

- Regulation on Heating Insulation at Buildings

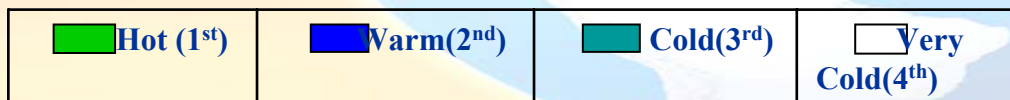
last revision October 2008.

After the 1999 earthquake, in 2001 to carry out the inspections “Building Inspection Agencies” were established in 19 provinces of Turkey. These agencies are also authorized to control new buildings heat insulation.





Turkey is divided into four main climatic zones on a heating degree-days



This regulation limits heat loss through the envelope of the buildings.

Heat loss limits have been reduced by half compared with the old standards. This legislation has resulted in annual energy consumption of new buildings being reduced from 200-250 kWh/ m² to 100-120 kWh/ m².



Recommended Thermal Conductivity Coefficients according to the degree days regions

W/m2/ K	U _{Wall}	U _{roof}	U _{floor}	U _{window}
1.region n	0.70	0.45	0.70	2.4
2. region	0.60	0.40	0.60	2.4
3. region	0.50	0.30	0.50	2.4
4. region	0.40	0.25	0.40	2.4



Existing buildings, in Turkey 8,5 Millions buildings, 86 % are residential. Existing regulation covers only new construction.

Old buildings generally have low levels of roof insulation (10 %) and double glazing (12 %).

**Energy Saving Potential in 6,1 Million Buildings
7 billion US Dolar ~85.000 GWh**

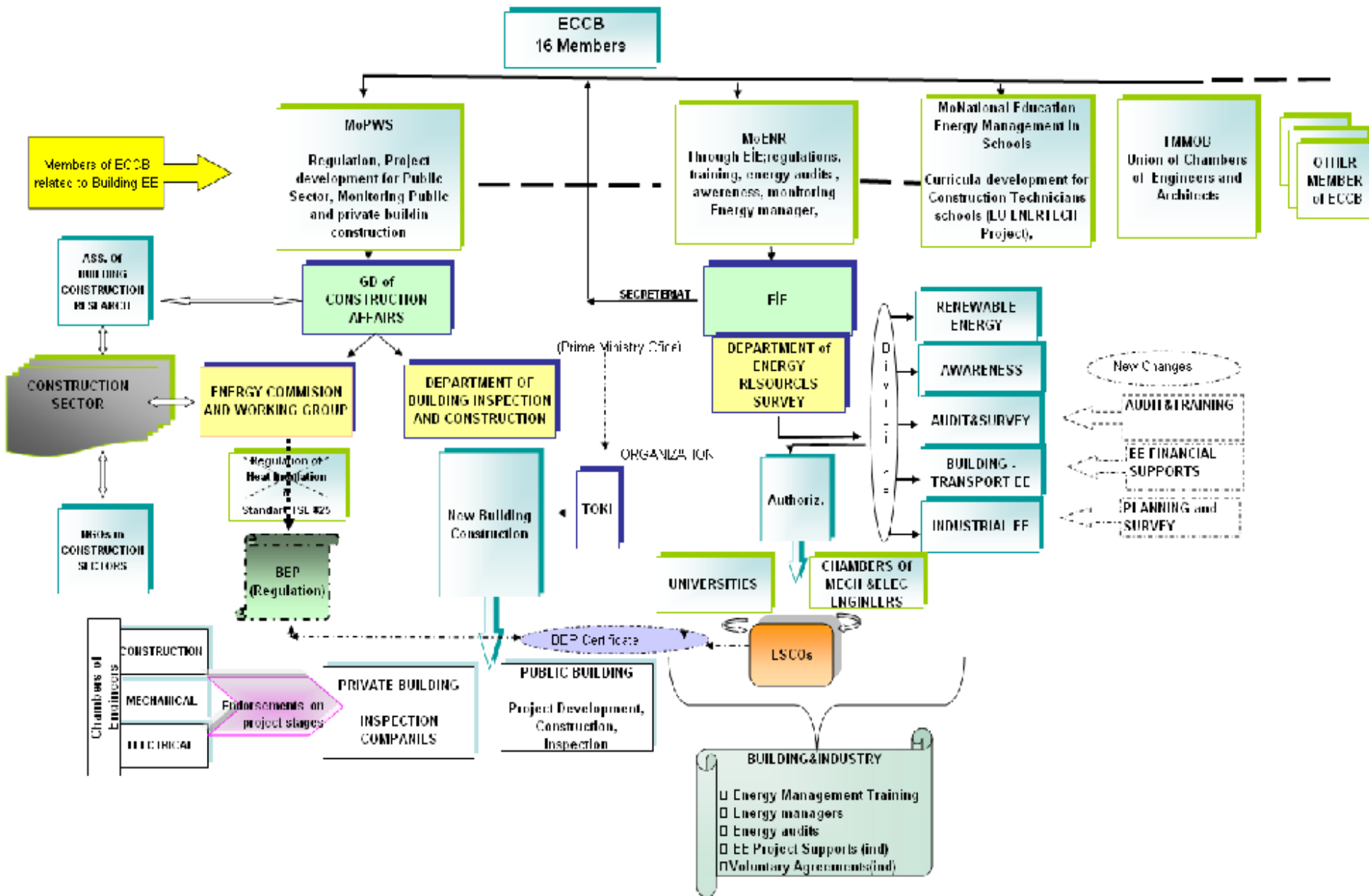
➤ Secondary Legislation of Dividing Heat Expenditures in Buildings

April 14, 2008



Individual heat meters application for the buildings having central heating systems

BUILDING ENERGY EFFICIENCY ORGANIZATION



RECENT REGULATIONS RELATED TO ENERGY EFFICIENCY (2)



World Energy Council
CONSEIL MONDIAL DE L'ENERGIE

Secondary Legislation on Increasing Energy Resources and Energy Efficiency on Energy Usage

October 25, 2008

- Appointment of **Energy managers** for services and public buildings with a minimum construction area of **twenty thousand square meters** or with an annual energy consumption of **five hundred toe** (for public building the limits is decreased by half).
- The Mass Housing Administration shall primarily analyze the possibilities of using **cogeneration and heat pump** systems and **solar energy** in mass housing projects. The applications not exceeding ten percent of house cost shall be carried out.
- In opening mass housing areas to settlement, Municipalities and Mass Housing Administration shall **give priority to regions where central and local heating and cooling is possible through thermal power plant waste heat** and shall take necessary measure for heat distribution infrastructure plans.
- Measures for increasing energy efficiency at buildings and enterprises belonging to the **public sector** is also defined with this regulation

➤ Secondary Legislation in Energy Performance in Buildings

December 5, 2008

- For more efficient buildings, minimum performance criteria concerning the architectural design, heating and/or cooling, equipment, insulation requirements, materials, electrical installations, lighting and control will be implemented.
- Establishment of energy certificates called “Building Energy Performance Certificates” which will contain information on the energy requirements, insulation features and efficiency of the heating and/or cooling systems of a building as well as the building’s energy classification for use during selling, renting or owner transferring.

ENERJİ KİMLİK BELGESİ

Belge No : Bina tipi : İnşaat yılı : Kapalı Kullanma alanı: Ada, Parsel : Adres :	Tarih : Belgeyi Düzenleyen : Oda Sicil No : Belgenin Son Geçerlilik Tarihi : İmza :
MÜLK sahibi: İsim: Adres:	Müşterek tesisatların sahibi (gerekliyse): İsim: Adres:

Enerji tipine göre yıllık tüketimler

Enerji Kullanım Alanı	Nihai Enerji tüketimleri kWsaat	Birincil Enerji tüketimleri kWsaat
Isıtma :		
Sihhi sıcak su :		
Soğutma :		
Aydınlatma :		
TOPLAM :		

Isıtma, sihhi sıcak su üretimi, soğutma ve aydınlatma için enerji tüketimleri (birincil enerji olarak)

Isıtma, sihhi sıcak su üretimi, soğutma ve aydınlatma için sera etkisi gazı (SEG) emisyonları

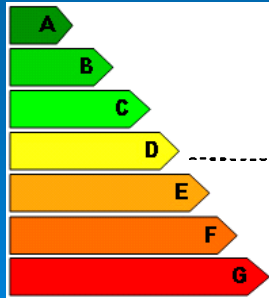
Nihai tüketim:

.....kWsaat/ m².yıl

Emisyon salımı:

.....kg eşd. CO₂ / m².yıl

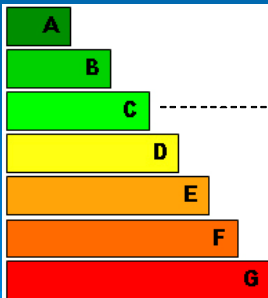
Tasarruflu Bina



Enerji Tüketimi Yüksek Bina

Bina

SEG Emisyonu Düşük Bina



SEG Emisyonu Yüksek Bina

Bina

kg_{eşd}CO₂/m²yıl

Integrated building design concept is new for Turkey. Some pilot-demo applications are exist for mostly research purposes.

Solar Hot water collector is commonly used in the provinces Mediterranean and Aegean Regions of Turkey.

18 million m² flat plate solar collectors are been in use as of 2007.



Geothermal heat

117 000 dwellings in 13 different region of Turkey have been heated with geothermal energy. It is estimated that this energy equal to 1 million tons of fuel oil in 2007 . With the new Geothermal Law enforced in June 2007, administrative matters and ownership rights on geothermal resources were clarified. Number of the dwelling heated by geothermal is expected to be increased.

Biomass one of the main heating source of rural dwellings. Agricultural residues such as shell of nuts, animal wastes are used as energy source.

With the Renewable Law and other new law complementing it is possible to produce electricity and sell to the system without getting license under **half MW** installed capacity

A world map is visible in the background, showing the continents of North America, South America, Europe, and Africa. The map is overlaid on a blue grid pattern.

RENEWABLE ENERGY USE IN BUILDING



World Energy Council
CONSEIL MONDIAL DE L'ENERGIE

UNDP GEF PROJECT and EU Project is under preparation to enhance new building design and application

The aims of the projects are:

- Strengthen the institutions, regulations, and implementers to raise the energy efficiency building standards as well as understand and implement the new EE laws;***
- Introduce an integrated building design approach to Turkey;***
- To established a building research center to support implementation of BEP regulation***
- To construct big scale demonstration buildings use them as training purposes***
- Develop and introduce new tools to support energy efficiency and an integrated building design approach;***
- Lead to measurably improved energy efficiency and GHG emissions reductions in new buildings.***

Conclusion

- Turkish existing building stock especially build before 2000 is energy intensive, the new approach and initiative (financial support) is required;
- New regulatory framework will help to change energy efficiency level with the support of the projects under design stages;
- There is a good PPP established in this sector to enhance energy efficiency it will help to capacity building.

Thank you very much

tulinkeskin@gmail.com

tulin.keskin@mmo.org.tr

tulinkeskin@yesilguc.com



Yearly sum of solar electricity generated by 1kWp photovoltaic system
(system performance ratio=0.75, optimally inclined modules)
Turkey

