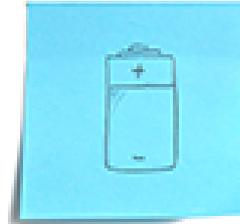
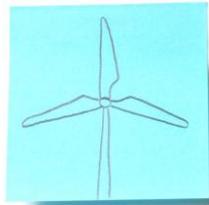


Renewable Energy & Environmental Technologies



REPUBLIC OF TURKEY PRIME MINISTRY
INVESTMENT SUPPORT AND
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Glossary of Terms

Acronym	Definition
BOTAŞ	Petroleum Pipeline Corporation
BRIC	Brazil, Russia, India, China
BSR	Balancing and Settlement Regulation
CAGR	Compound Annual Growth Rate
DSI	General Directorate of State Hydraulic Works
EIU	Economist Intelligence Unit
EML	Electricity Market Law
EMRA/EPDK	Energy Market Regulatory Authority
ENTSO-E	European Network of Transmission System Operators - Electricity
EPIAŞ	Independent Energy Exchange (to be established)
EU	European Union
EÜAŞ	State Owned Generation Company
FDI	Foreign Direct Investment

Acronym	Definition
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GW	Gigawatt
GWh	Gigawatt Hours
HEPP	Hydroelectric Power Plants
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
LEED	Leadership in Energy and Environmental Design
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
M&A	Mergers and Acquisitions
MoEU	Ministry of Environment & Urbanization



Glossary of Terms

Acronym	Definition
MENR	Ministry of Energy and Natural Resources
MMTCDE	Million Metric Tons of Carbon Dioxide Equivalents
MTA	The General Directorate of Mineral Research and Exploration
NGO	Non-Governmental Organization
NMVOG	Non-Methane Volatile Organic Compounds Emissions
OECD	Organization for Economic Co-operation and Development
OSB	Organized Industrial Zones
PMUM	State-Owned Market Operator within TEİAŞ
R&D	Research and Development
REL	Renewable Energy Law
ROR	Run of River
TEDAŞ	State-Owned Distribution Company
TEİAŞ	State-Owned Transmission Company

Acronym	Definition
TETAŞ	State-Owned Wholesale Company
TOE	Ton of Oil Equivalent
TL	Turkish Lira
TSE	Turkish Standard Institution
TÜBİTAK	Scientific and Technological Research Council of Turkey
TÜİK	Turkish Statistical Institute
TWEA	Turkish Wind Energy Association
US\$	United States Dollar
USDC	Unit Service and Depreciation Charge
VAT	Value Added Tax
VCM	Voluntary Carbon Markets
WPP	Wind Energy Power Plant
YEGM	General Directorate of Renewable Energy



Introduction

Unprecedented population growth, increasing energy demand, concerns over energy security, and climate change have begun a new era in renewable energy and environmental technologies worldwide.

As the 17th largest economy in the world and 6th largest in Europe, Turkey is experiencing a precipitous increase in its energy demand. Therefore, Turkey has initiated an ambitious energy policy in which renewable energy plays a significant role. For example, Turkey aspires to have an installed capacity of 30% of renewable energy by 2023. Considering the miniscule 5% share of renewables in 2012, Turkey offers various opportunities for investors within the alternative energy landscape.

Numerous government incentives and funds are available for emerging renewable energy and environmental technologies. Nevertheless, adoption of renewables was accelerated after the amendment of the Renewable Energy Law in 2010, which specifies the feed-in tariffs for different types of technologies. After the revised feed-in tariffs, companies in Turkey have been very eager to integrate renewables into their energy portfolio.

As emerging technologies appear on the horizon supported by various incentives, investments in alternative energy will continue to increase in Turkey.

Similar to renewable energy policies, energy efficiency and environmental technologies also play a critical role in Turkey's energy agenda. Turkey aspires to reduce its energy consumption per unit of GDP (energy intensity) by 20% compared to 2011 levels, which will also create a reduction of greenhouse gasses.

In order to achieve this target, Turkey has set various principles and procedures into the Energy Efficiency Law to promote energy efficiency in all stages of the energy chain including: generation, transmission, distribution and consumption. Energy efficiency improvements also apply to transportation, water management and buildings. Investors can benefit from ample incentives offered by the government and private institutions.

Over the past several years, Turkey has also taken steps towards the improvement of waste water treatment facilities and infrastructure, most importantly Turkey aims to move toward compliance with the EU Environmental Acquis.

This report provides comprehensive information on Turkey's renewable energy market, environmental technologies and its growing energy efficiency policies. As impressive as these achievements have been in Turkey, tremendous potential still remains in the development of alternative energy and energy efficiency projects.



I. Renewable Energy in Turkey



A. Renewable Energy Policies and Regulations in Turkey

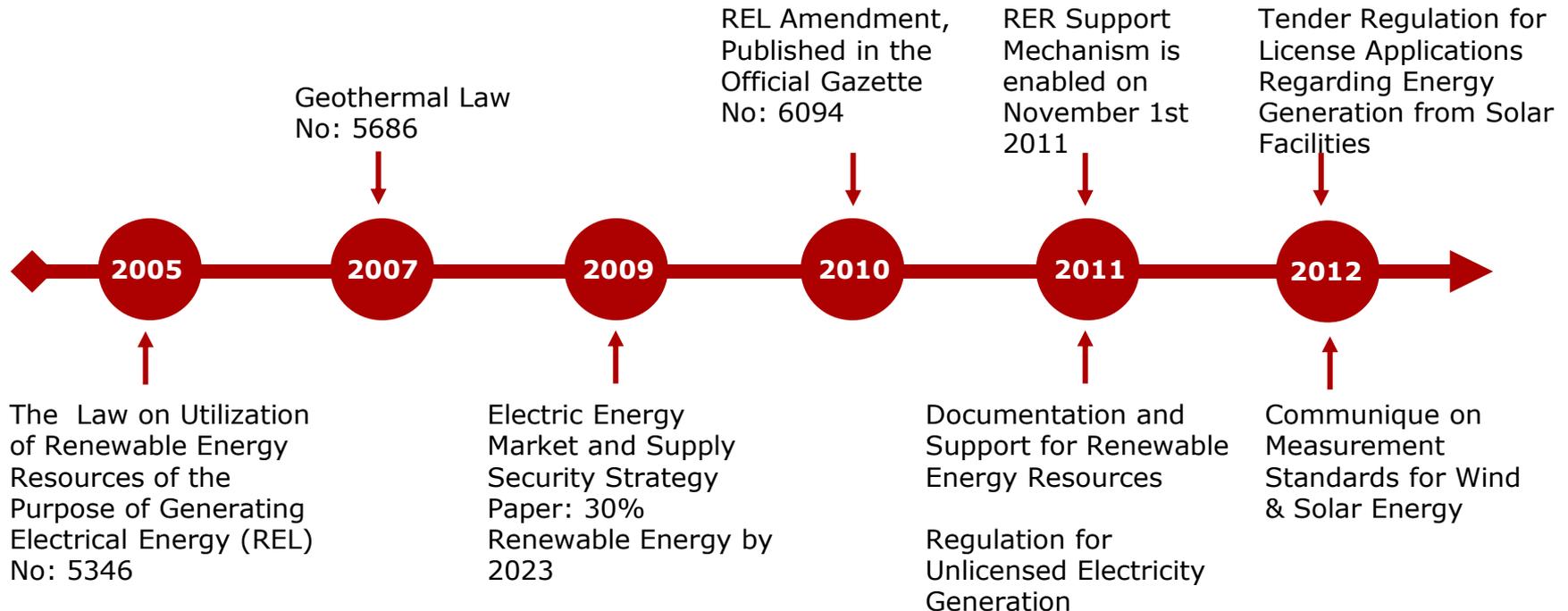
- i. Overview of the Renewable Energy Market and Targets in Turkey
- ii. Licensed and Unlicensed Generation
- iii. Energy Sales Options for Renewable Energy Investors



Renewable energy policies and regulations have a rather short, but effective history in Turkey.

Renewable energy has been one of the hot topics on Turkey's energy agenda. Significant progress has been made in the field of renewable energy starting from 2005, after the enactment of the Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy (Renewable Energy Law, REL).

Investments in renewable energy technologies remained limited between 2005 and 2010 due to the lack of secondary legislation and relatively low feed-in tariff prices. Nevertheless, the REL amendment in December 2010 introduced higher feed-in tariff rates for separate technologies, and various other monetary and non-monetary incentives.



Each type of renewable energy has a special regulation enabling secondary regulations to be more precise.

According to the REL, renewable energy resources are defined as non-fossil energy resources such as hydro, wind, solar, geothermal, biomass, biogas (including landfill gas), wave, current and tidal energy.

Common Laws & Regulations for Renewable Energy Generation

- Electricity Market Law No: 6446
- Law on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy Law No: 5346

Wind

- Technical Regulation for Evaluating Applications of Wind Energy Generation
- Communique on Measurement Standards for Wind & Solar Energy

Solar

- Communique on Measurement Standards for Wind & Solar Energy
- Technical Regulation for Evaluating Applications of Solar Energy Generation

Geothermal

- Regulation on the Utilization of Geothermal Energy Sources for the Purpose of Electricity Generation
- Geothermal Law No: 5686

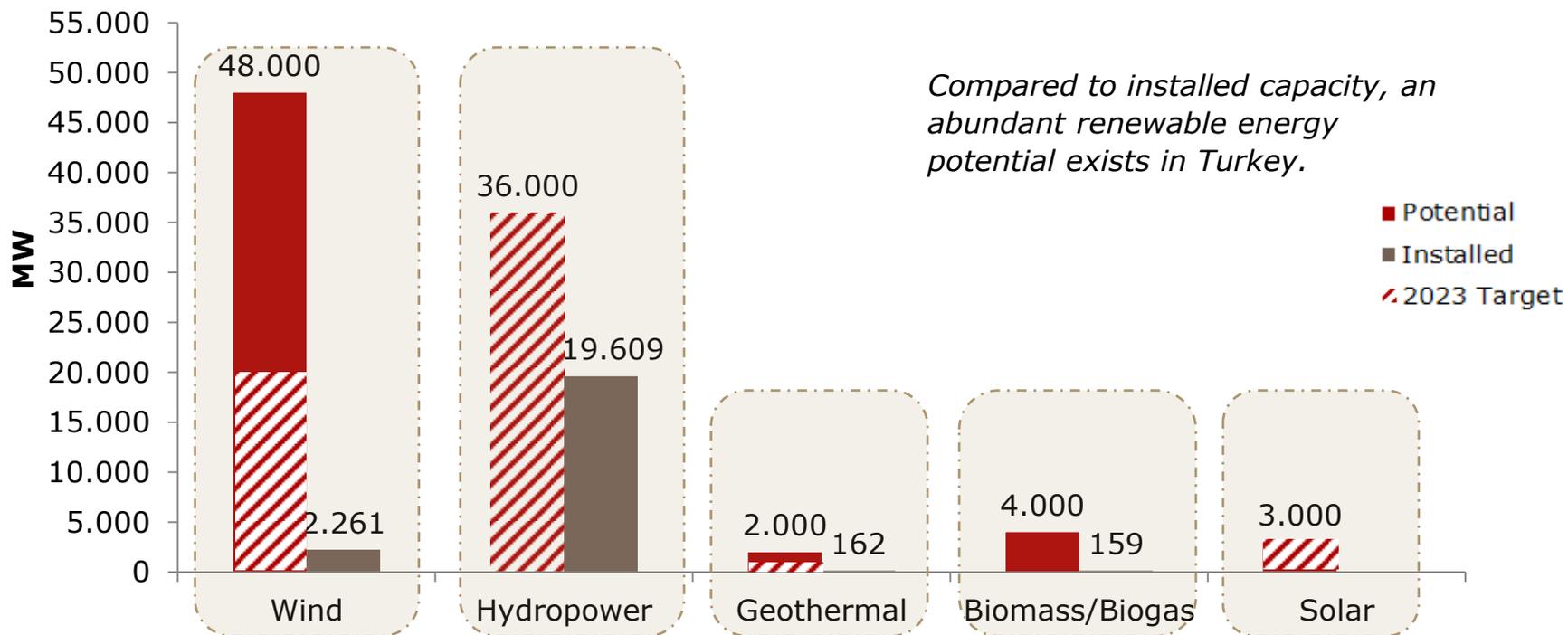
Biomass and Waste

- Environmental Law No: 2872
- Solid Waste Control Regulation
- Regulation on the General Principles of Waste Management



Unlocking Turkey's full renewable energy potential will be achieved by its ambitious renewable energy targets and the resulting investment opportunities.

Figure 1: Installed and Potential Renewable Energy Capacity of Turkey, 2012



Source: TEİAŞ, Strategy Paper, YEGM

Wind Energy Target

Increasing installed capacity of wind energy to 20,000 MW by 2023.

Hydropower Target

Utilizing all economical and possible 36,000 MW hydroelectricity potential by 2023.

Geothermal Energy Target

Utilizing 600 MW of potential geothermal energy by 2023.

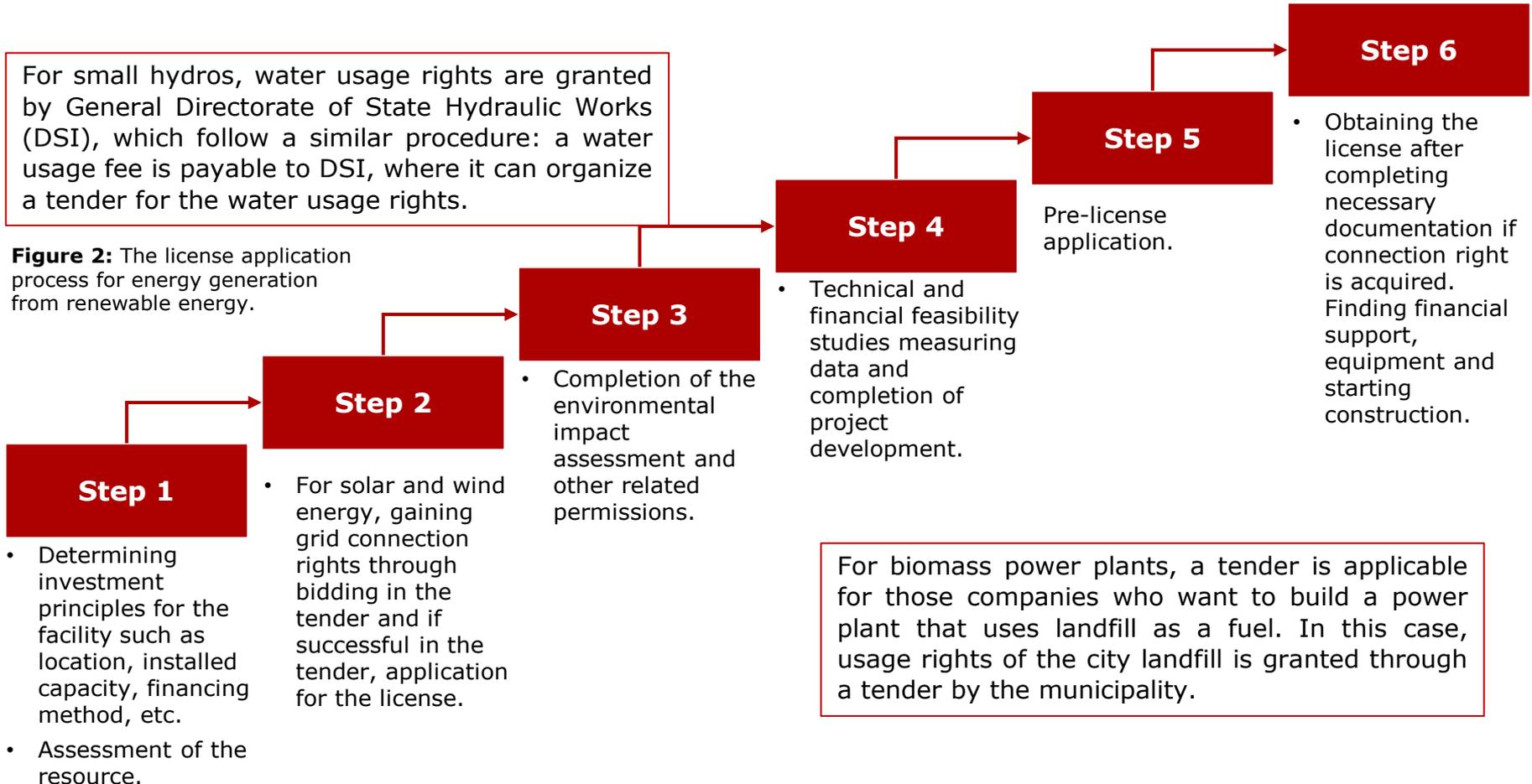
Solar Energy Target

Popularizing the use of solar energy in electricity generation and achieving 3,000 MW installed capacity.



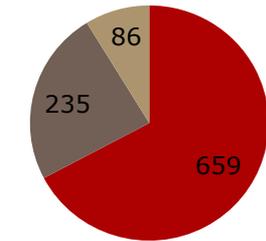
The licensing procedure for renewable energy generation facilities.

Power plants that have an installed capacity greater than 1 MW are required to obtain a generation license from the Energy Market Regulatory Authority (EMRA). The licensing procedure of some of the renewables differ a bit from others: for solar and wind power plants, grid connection is the most critical step before obtaining a license. The new Electricity Market Law regulates the tender process for grid connection rights. A tender based on a «contribution fee» payable to the Transmission System Operator for the first 3 years following commissioning is mandatory for solar and wind investments whose application cover overlapping or intersecting areas aiming for the same transformatory center.



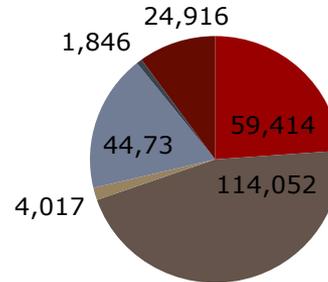
Unlicensed generation will gain more popularity in the near future with the updated 1 MW capacity limit.

Figure 3: Total Number of Unlicensed Generation Applications



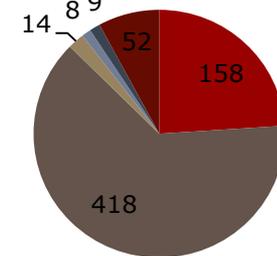
■ Approved, 67%
 ■ Denied, 24%
 ■ Evaluation, 9%

Figure 4: Power Rating (MW) of Technologies for Unlicensed Generation Applications



■ Wind, 24%
 ■ Biomass, 2%
 ■ Hybrid (WEPP + SPP), 1%
 ■ Solar, 46%
 ■ Cogeneration, 18%
 ■ Hydro, 10%

Figure 5: Breakdown of Technologies for Unlicensed Generation Applications



■ Wind, 24%
 ■ Biomass, 2%
 ■ Hybrid (WEPP + SPP), 1%
 ■ Solar, 63%
 ■ Cogeneration, 1%
 ■ Hydro, 8%

Source: Li-DER – Unlicensed Electricity Generation Association

- Any natural or legal entity with a capacity of less than 1 MW in its facility can benefit from the feed-in tariff defined by the Renewable Energy Support Mechanism. Further, renewable energy power plants that are installed at the point of consumption without grid connection are regarded as unlicensed, regardless of their installed capacity.
- As described in the Electricity Market Law (EML), distribution companies holding retail licenses are obligated to purchase the excess electricity generated by the unlicensed renewable energy generators via relevant feed-in tariff prices.
- Initially, the capacity limit for unlicensed generation was 500 kW, however, it has been upgraded to 1 MW with the new EML. The updated capacity level of 1 MW is expected to increase interest in utilization of renewable energy technologies especially in households and in industrial sites.
- As of May 2013, unlicensed generation applications account for 249 MW. As seen in Figure 4, the most popular preference for power production is from solar and wind energy resulting in total of 576 applications (see Figure 5) with an installed capacity of 173 MW.

Laws, Regulations and Agreements Regarding Unlicensed Generation

- 1 Law on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy
- 2 Regulation Regarding Unlicensed Generation in the Electricity Market
- 3 Regulation Regarding Documentation and Support of Renewable Energy Resources
- 4 Agreement for Unlicensed Electricity Generators Regarding Distribution System (DS) Connection
- 5 Agreement for Unlicensed Electricity Generators Regarding DS Usage



Different energy sales options are available for renewable energy investors.

Trade Opportunities for Renewable Energy Resources

	Organized Markets <i>Day-Ahead Market</i>	Bi-lateral Contracts – Wholesale Companies – Distribution Companies – Eligible Consumers	Feed-in Tariff
Price Risk	High: Seasonal and hourly fluctuations in price. Unpredictable imbalance costs.	Medium: Prices are negotiable. Possible hedging exists for medium/long term price risks. Reference price is the market price.	None: Fixed price indexed to USD.
Sales Risk	None: Can sell all of the proposed amount.	Low: Amount is determined according to negotiations. Amount that cannot be sold via bi-lateral contracts can be sold to the day-ahead market.	None: Has to sell all of the generation amount.
Revenue Expectation	High volatility: Volatile due to price fluctuations and imbalance costs.	Low/medium volatility: Possible to guarantee a set revenue through medium/long term contracts.	Fixed: Due to fixed prices there are not any surprises in revenue expectations. Investor is not responsible for imbalance costs.

- Cross-border trading opportunities also exist for renewable energy investors. Turkey was synchronously connected to ENTSO-E in September 2010 and is currently in the trial phase. If Turkey meets all requirements by autumn 2013, Turkey will be a full member of ENTSO-E.
- Turkey has various interconnections with neighboring countries such as Georgia, Iran, Azerbaijan and Syria. Transmission operators of Turkey, Bulgaria and Greece regularly auction interconnection capacities on the Greek and Bulgarian borders of Turkey. Private sector players have shown great interest in these auctions which has resulted in a boost in trade compared to previous years.



B. Public and Private Incentives for Renewable Energy Projects

- i. Incentives Provided by the Ministry of Economy
- ii. Incentives Provided by the Renewable Energy Support Mechanism
- iii. Private Financing Institutions
- iv. The Young and Skilled Labor Force of Turkey



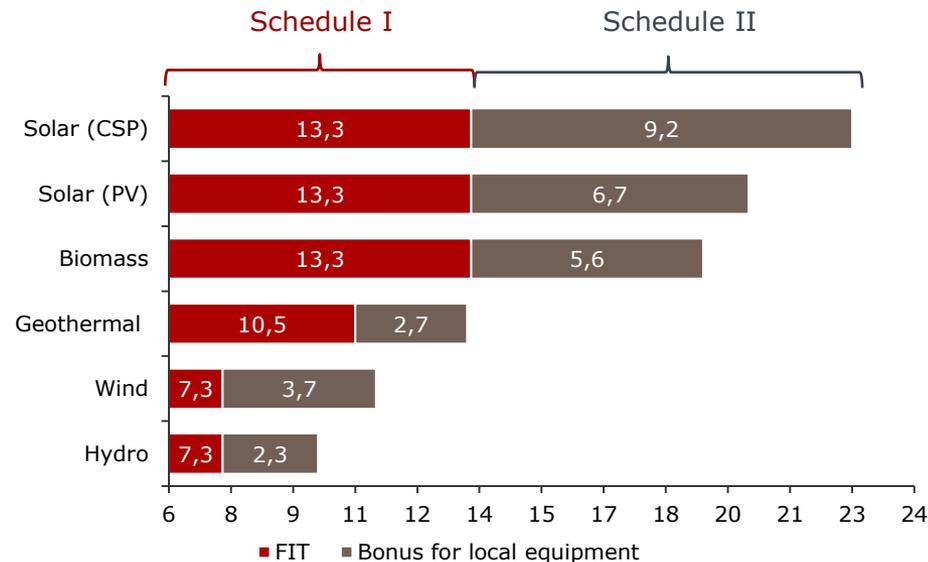
Government incentives provide the impulse for growth.

RES Mechanism (Feed-in Tariff)

Generation licenses subject to the RES Support Mechanism that are or will be commissioned before December 31, 2015 will benefit from:

- Feed-in tariff (Schedule I) for a period of ten years.
- Local equipment bonus (Schedule II) for a period of five years, if domestically manufactured mechanical and/or electromechanical equipment is used in the generation facility. Schedule II in Figure 6 demonstrates the total amount of bonuses offered for each technology (the breakdown per component is provided in the upcoming slides).

Figure 6: Feed-in Tariff and Local Equipment Bonus



Investments

- Establishing energy generation facilities;
- Provision for domestically manufactured electromechanical systems;
- R&D and manufacturing of generation systems by utilizing solar cells and focusing units;
- R&D facilities for the generation of electric energy or fuel by utilizing biomass sources shall be eligible for incentives, based on the decision of the Council of Ministers.

Acquisition of Land

- Utilization permits for the real estate under the ownership of the Treasury or the state in its entirety shall be granted by the Ministry of Environment and Forestry or the Ministry of Finance in exchange for remuneration. A 50% deduction shall be implemented for permission, rent, right of access and usage in the investment period.
- Lease, easement and usufruct permission fees shall be 85% discounted during the initial 10 years of investment & operation of facilities that will be commissioned until December 31, 2015.
- Leasing or easement will be established by the MOF in exchange for remuneration in relation to any publicly owned pasture, quarter, grazing and grassland.
- Collection of the Forest Villagers Development Revenue and Erosion Control Revenue will not be made.



The Ministry of Economy provides further incentives for renewable energy technologies.

- Currently, energy investments are eligible to benefit from the General Investment Incentive Program which allows investors to be exempt from custom duty and VAT.
- Even before the General Investment Incentive Scheme, the Ministry of Economy provided incentives to energy projects. For instance, 718 incentives regarding energy generation technologies were issued between 2005 and 2012. 90% of these incentive documents were issued for new projects, whereas the remaining 10% were issued for improving existing ones.
- Out of these 718 documents, an astounding 86% were issued to renewable energy technologies with 615 applications.
- The scope of the General Investment Incentive Program offers incentives for six different renewable energy generation technologies, including hydroelectric, wind, geothermal, biomass, thermal power, cogeneration and solar energy power plants.
- Table 1 demonstrates the incentive documents issued according to energy production technologies between 2005 and 2012. As shown, the highest share of incentive documents were issued to hydroelectricity power plants with 65%, followed by wind which accounts for 11% of renewable energy generation.
- The total number of incentive documents for renewable energy technologies account for an installed capacity of 17,171 MW. The highest share of investment belongs to hydropower with approximately 26 billion TL followed by wind with approximately 7 billion TL.

Table 1: Technical Details of Incentives for Renewable Energy Technologies

Facility Type	Power (MW)	Investment Amount (TL)
Hydro	12,005	25,781,261,382
Wind	3,081	6,776,348,012
Biomass	83	317,653,795
Geothermal	1,374	792,092,825
Cogeneration	628	404,477,808
Thermal	13,671	4,154,947,422
Total	30,842	38,226,780,244

Source: Ministry of Economy

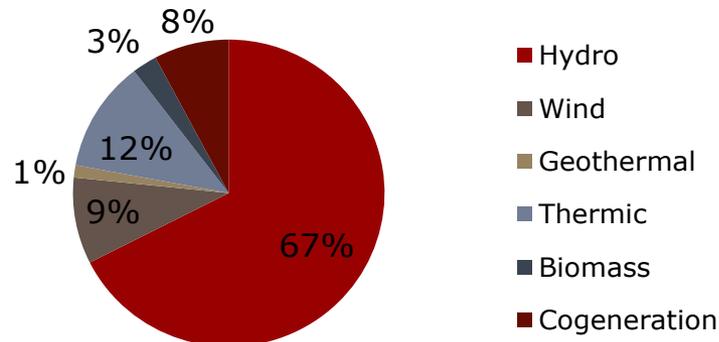


All investors, foreign and domestic, can take advantage of incentives offered by the government.

- The Ministry of Economy provides incentives for all foreign and domestic investors.
- According to the Ministry of Economy, the total number of 77 incentive documents were issued to companies with foreign capital for the purpose of energy generation. 73 of these investment documents are still in the process of completion.
- Similar to domestic investment trends, the highest number of incentive documents were issued to hydroelectric power plants with 52 documents, followed by wind which accounts for 7 incentive documents (see Figure 7).

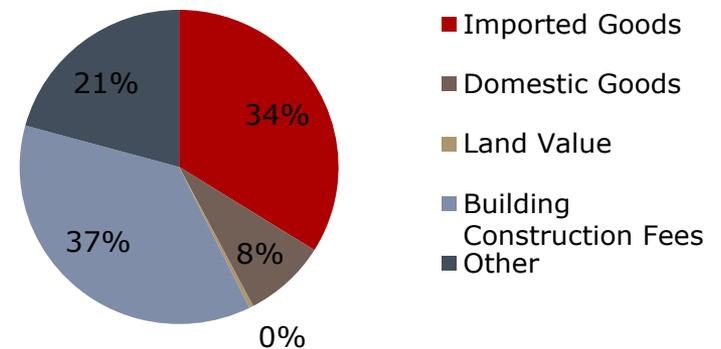
- Incentives provided to foreign investors account for an installed capacity of 6,398 MW. This corresponds to 21% of the total installed capacity achieved via incentive documents.
- According to the Ministry of Economy, approximately 12 billion TL worth of incentives were provided to companies with foreign capital. Figure 8 displays the distribution of expenses in foreign energy investments. Building construction fees and imported goods led the way with 37% and 34%, respectively.

Figure 7: Distribution of Foreign Capital Investment Incentive Certificates According to Energy Production Types



Source: Ministry of Economy

Figure 8: Distribution of Expenses in Foreign Energy Investments



Source: Ministry of Economy



A List of Major Renewable Energy Financing Institutions

The World Bank

Numerous funds exist in Turkey for renewable energy development projects. Major ones can be summarized as TurSEFF and MidSEFF provided by EBRD, the World Bank, the Industrial Development Bank of Turkey (TSKB), the International Finance Corporation (IFC), and the Technology Development Foundation of Turkey (TTGV).

TurSEFF

TurSEFF offers up to USD 5 million for energy efficiency and energy renewable projects. USD 300,000 are available for Small-Scale Projects, whereas USD 75,000 is granted to Residential Sector Projects.

MidSEFF

MidSEFF was developed for mid-size sustainable energy financing and was launched by EBRD with support from the European Investment Bank (EIB) and European Commission (EU). This program provides EUR 975 million to those in the private sector developing mid-size projects in renewable energy, waste-to-energy and industrial efficiency. These loans are provided through some of the major banks in Turkey such as Akbank, Denizbank, Finansbank, Garanti, İşbank, Vakıfbank, and Yapı Kredi.

IFC

Turkey has been a member of the International Finance Corporation (IFC) since 1956, and is the fourth largest client in terms of commitment portfolio. IFC invests in energy efficiency, renewable energy, municipalities and poorer regions of countries. According to their data, IFC invested USD 40 million and mobilized USD 130 million for 13 projects in Turkey.

TSKB

TSKB is one of the most important Turkish banks that provides financing to the private sector for renewable energy projects. TSKB has provided loans to 65 HEPPs, 2 WPPs, 2 GPPs and 1 biomass facility with an installed capacity of 2,150 MW, 53 MW, 58 MW, and 11 MW, respectively.

TTGV

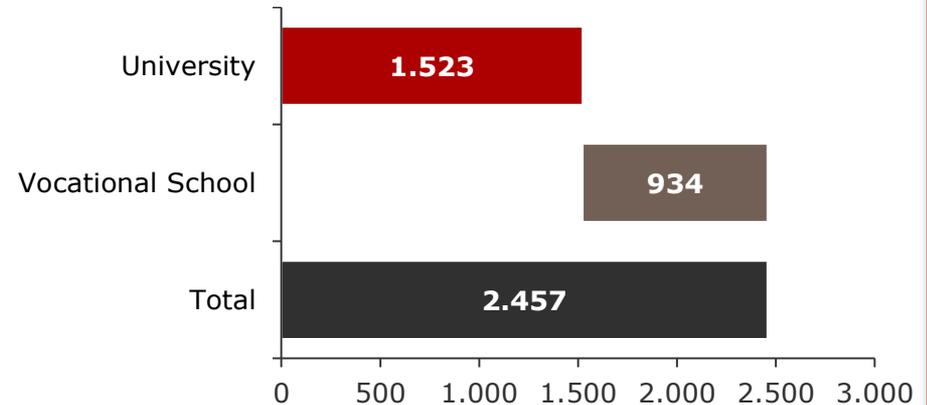
TTGV provides financing for clean production technologies for 1.5 years with a maximum of USD 1 million and 50% of the project budget.



A positive outlook on the human resources side: a young and skilled labor force combined with favorable wages.

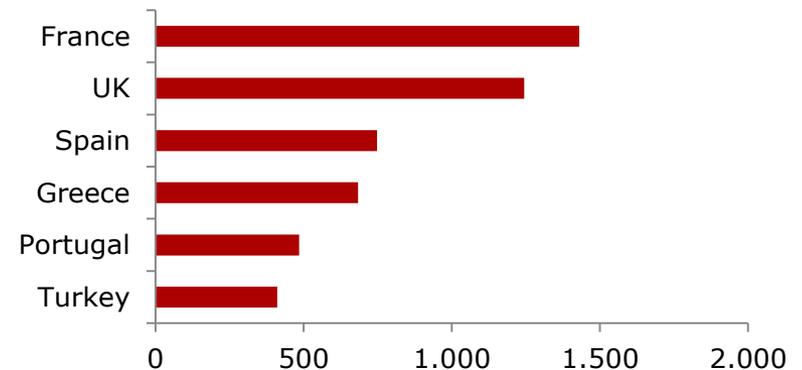
- The liberalization process in the energy sector created a new segment of employment opportunities in Turkey. Developments in the energy sector resulted in the creation of significant and innovative academic departments related to energy and alternative energy technologies.
- Figure 10 demonstrates the openings in universities and vocational schools in energy related departments. There were a total number of 2,457 openings in 2012 within the Turkish education system. 1,523 were in universities, whereas the remaining 934 openings were in vocational schools.
- As Turkey's energy market continues to evolve, and renewable energy becomes an inevitable part of Turkey's agenda, the demand for skilled labor will increase dramatically.
- Besides vocational schools and universities, there are various companies and NGOs that provide energy specific training along with graduate and certification programs. Most importantly, these programs are highly popular among students and professionals in the energy field.
- Turkey has a young, dynamic and educated population. However, monthly wages are relatively lower than the EU or the US. According to Turkstat, the average gross monthly wage in Turkey was 2,510 TL in 2010. With regards to minimum wage, Eurostat states that Turkey's minimum wage was 411 Euros in 2012 (see Figure 11).

Figure 10: Number of Openings in Energy Specific Institutions for 2012



Source: ÖSYM

Figure 11: Minimum Monthly Wage (EUR)



Source: Eurostat



C. The Renewable Energy Market in Turkey

i. Renewable Energy Capacity in Turkey

i. Hydropower

ii. Wind

iii. Solar

iv. Geothermal

v. Biomass

ii. Reasons to Invest in Turkey's Vibrant Renewable Energy Market

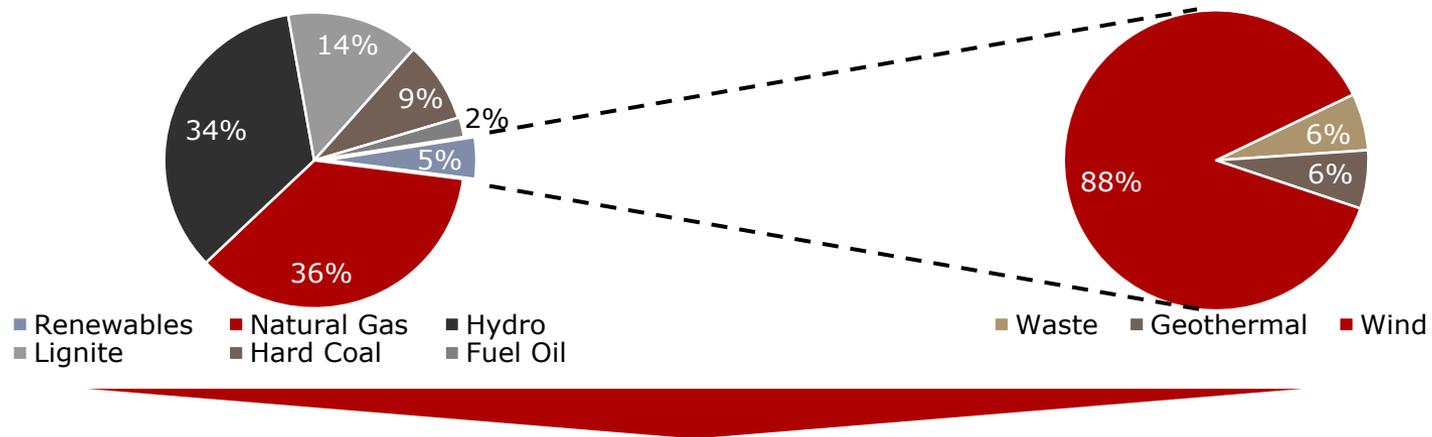
iii. Major Public Institutions and NGOs in Renewable Energy



The share of renewables in Turkey's installed capacity is continuously increasing.

- Turkey's installed capacity in December 2012 was 57,058 MW. Renewables including waste, geothermal and wind accounted for only 5% of the installed capacity, wind energy being the highest with 2,261 MW.
- Regulations designed specifically for wind energy and its growth potential of 48 GW has attracted the interest of domestic and international investors.
- The share of renewables will increase significantly due to the upcoming licensing process for solar power plants and wind project stock.

Figure 12: Turkey's Installed Capacity Including the Share of Renewables, 2012



	Hydro	Natural Gas*	Hard Coal** (Local & Imported)	Lignite	Fuel Oil	Wind	Geothermal	Other Renewables	Total
Installed Capacity (MW)	19,609	20,439	5,058	8,143	1,227	2,261	162	159	57,058
Share	34.37%	35.82%	8.87%	14.27%	2.15%	3.96%	0.28%	0.28%	100%

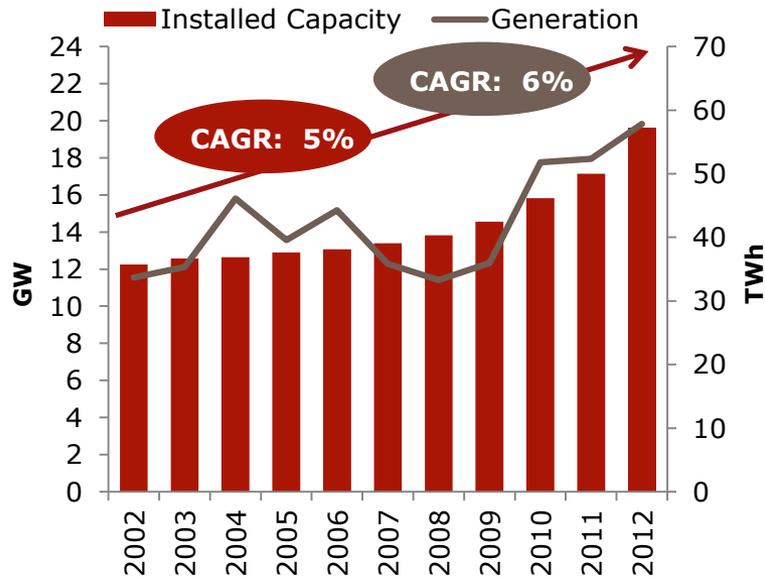
* Including dual fuel plants

** Including local and imported coal plants & asphaltite plants



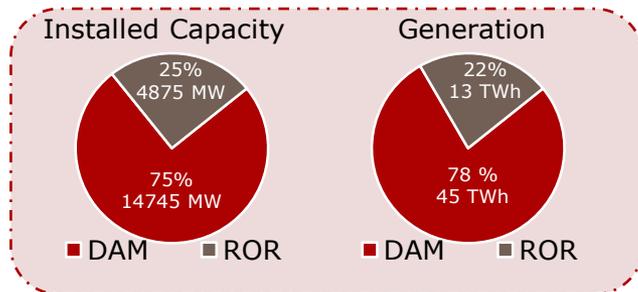
Turkey's hydropower potential constitutes 16% of Europe's theoretical hydropower potential and 1% of the world's total.

Figure 13: Hydropower Development in Turkey, 2002-2012



Source: TEİİS

Figure 14: DAM vs. ROR values in 2012



Hydropower is the most commonly utilized renewable energy resource in Turkey. According to the Ministry of Energy and Natural Resources' forecast, Turkey's technically feasible hydroelectric potential corresponds to approximately 36,000 MW.

- Additionally, according to the General Directorate of State Hydraulic Works (DSI), Turkey has hydroelectric resources providing a potential 140 TWh of economic electricity generation. As of the end of 2012, installed hydroelectric power was at 19,609 MW which constitutes 54% of the abovementioned potential. In terms of generation, hydropower generation reached 57.8 TWh at the end of 2012.
- This data includes renewable and non-renewable hydro plants. It should be noted that according to the Renewable Energy Law, only power plants with less than 15 km² of reservoir area and river hydroelectric power plants are considered renewable energy resources. In 2012, dams composed 75% of the installed capacity, whereas RORs accounted for only 25%. (See Figure 14).
- The base line feed-in tariff for hydroelectricity generation is defined in REL as 7.3 USD cent/kWh and facilities can benefit from bonuses provided for locally manufactured equipment. The maximum feed in tariff price hydroelectricity generation facilities can benefit is 9.6 USD cent/kWh including locally manufactured components.

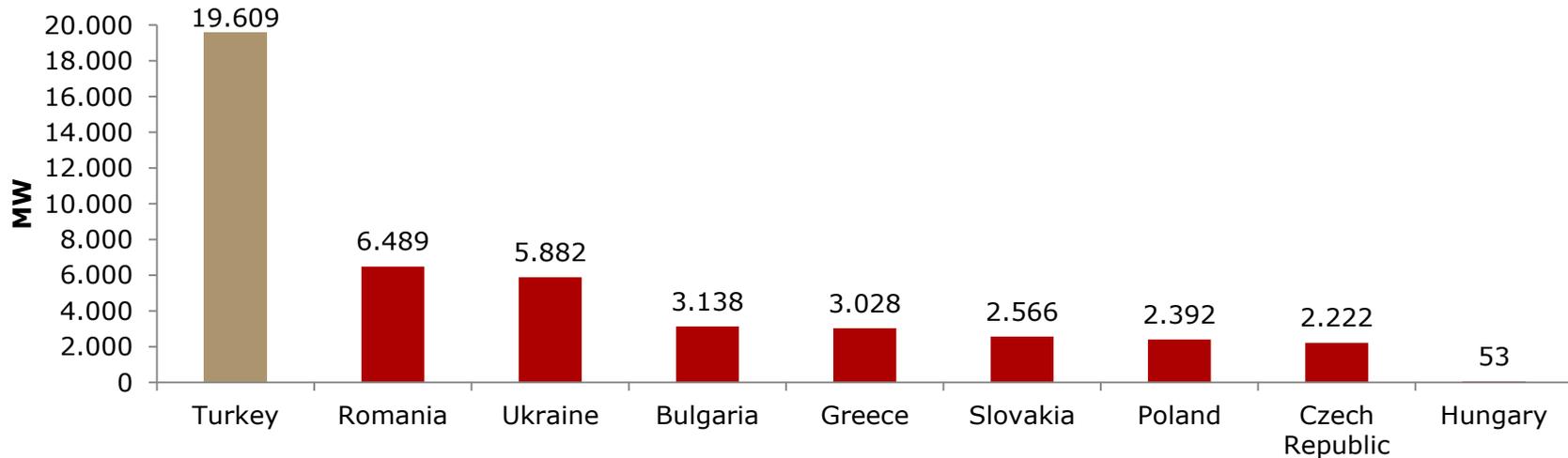
Table 2: Feed-in Tariff, Locally Manufactured Component

Feed-in-tariff and Local Equipment Bonus Prices for Hydro	
Locally manufactured component	Bonus (USD cent/kWh)
Turbine	1.3
Generator and power electronics	1
Total	7.3 + 2.3 = 9.6



Turkey has the highest installed hydropower capacity in Eastern Europe.

Figure 15: Installed Hydropower Capacity in Selected Eastern European Countries and Turkey, 2012



Source: TEİAŞ, Economic Intelligence Unit

One of the major advantages of hydropower is its ability to stabilize the grid through its storage capacity: Hydroelectric power plants allow intermittent sources such as wind and solar energy systems to be integrated to the grid more easily. As technologies based on renewables gain more importance than ever, the relevance of hydropower increases proportionally.

As Figure 15 shows, Turkey has the highest hydropower installed capacity among Eastern European countries. Notably, Turkey has 25 river basins which would make 16% of Europe's and 1% of the world's theoretical capacity. Considering Turkey's ambitious targets regarding renewable energy resources, the need for hydropower plants with hydro pumping technologies will become even more prevalent. Having the potential of 36,000 MW, and an installed capacity of only 19,609 MW of hydropower poses numerous opportunities for investors.



Pumped-storage hydroelectricity developments: gateway to higher renewable energy penetration.

Grid reliability is an essential part of Turkey's system operator, and achieving a stable grid is challenging due to intermittent energy sources such as wind and solar energy. Renewables will not always be available during peak hours, and existence of energy storage technologies such as pumped-storage hydroelectricity (PSH) is needed, due to their rapid start-up nature, and ability to change their electrical output according to varied demand.

The Electrical Power Research Institute stated in 2012 that pumped-storage hydroelectricity constitutes 99% of storage capacity worldwide representing 127,000 MW. It is the quickest and most widespread technique for modern electricity grids.

Turkey has ambitious goals for renewables and their implementation increases constraints on the grid which calls for utilization of pumped-storage systems.

Hydropower in Turkey accounts for 34% of the total installed capacity and has abundant resources for electricity generation. According to a study conducted in 2012 by the Joint Research Center of the European Commission, Turkey has a potential to produce 3,800 GWh from its non-hydropower dams and reservoirs.

One of the main reasons for Turkey's selection in this research was its large number of dams with 260 large and 413 small dams in operation.

Pumped-storage hydroelectricity (PSH) research in Turkey was initially started by EIE in 2009. Japanese expertise was utilized in PSH co-generated with wind energy. Projections of Turkey's peak energy demand was also included in the scope of the project. Conceptual designs were created for Gökçekaya and Altınkaya HEPPs rating 1,400 MW and 1,800 MW respectively for possible PSH system implementation.

Currently, there is a project in progress regarding the mitigation of negative effects of wind energy generation on the grid with the utilization of PSH systems, and is located in Yahyalı district of Kayseri. The project will consist of 4 MW PSH and 4x2.5 MW wind turbines.

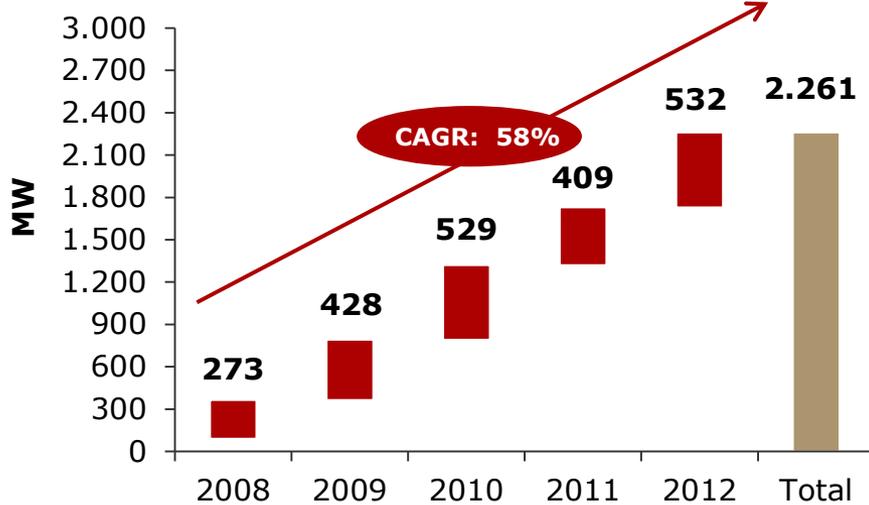
Turkey realizes the importance of large-scale energy storage for a reliable grid. Therefore, several studies have also been conducted by governmental organizations.

Turkey offers tremendous benefits to investors who utilize the ample resources of hydropower.



An official target of 20 GW, a potential of 48 GW and installed capacity at slightly above 2 GW: the wind energy market offers tremendous opportunity.

Figure 16: Wind Energy Capacity Additions, 2008 - 2012



Source: TEİAŞ

Table 3: Feed-in Tariff, Locally Manufactured Components, Wind

Feed-in-tariff and Local Equipment Bonus for Wind Power	
Locally manufactured component	Bonus (USD cent/kWh)
Blade	0.8
Generator and power electronics	1
Turbine tower	0.6
All mechanical equipment in rotor and nacelle (excluding blade group, generator, and power electronics)	1.3
Total	7.3 + 3.7 = 11

- In 2012, wind energy constituted 4% of Turkey's installed capacity at 2,261 MW. The wind energy share will increase further since there are many projects that are under construction.
- Installed wind capacity experienced significant growth in the last decade at a CAGR of 62% along with an increase of 30% from 2011 to 2012.
- Considering that Turkey is surrounded by the Black Sea, the Marmara Sea, the Aegean Sea and the Mediterranean Sea, it has abundant wind power sources. According to the Ministry of Energy, Turkey's potential wind capacity is approximately 48 GW.
- EMRA does not accept wind energy license applications on a rolling basis, instead applications are accepted only on specific pre-determined and pre-announced dates. Application dates and deadlines are announced on EMRA's website and in the Official Gazette once they are determined.
- The first set of applications in 2007 demonstrated an exceptionally high interest in wind energy with a total of 751 license applications with a potential of 78 GW. Even though this number was later drastically reduced due to grid connection compliance, the high number of license applications indicates interest in investment and the immense potential of the wind energy market.
- The feed-in tariff determined by EMRA for wind energy is 7.3 USD cent/kWh. However, extra bonuses are available for facilities that utilize locally manufactured mechanical and electronic components for their projects (see Table 3).



The Marmara and Aegean regions have the highest wind potential.

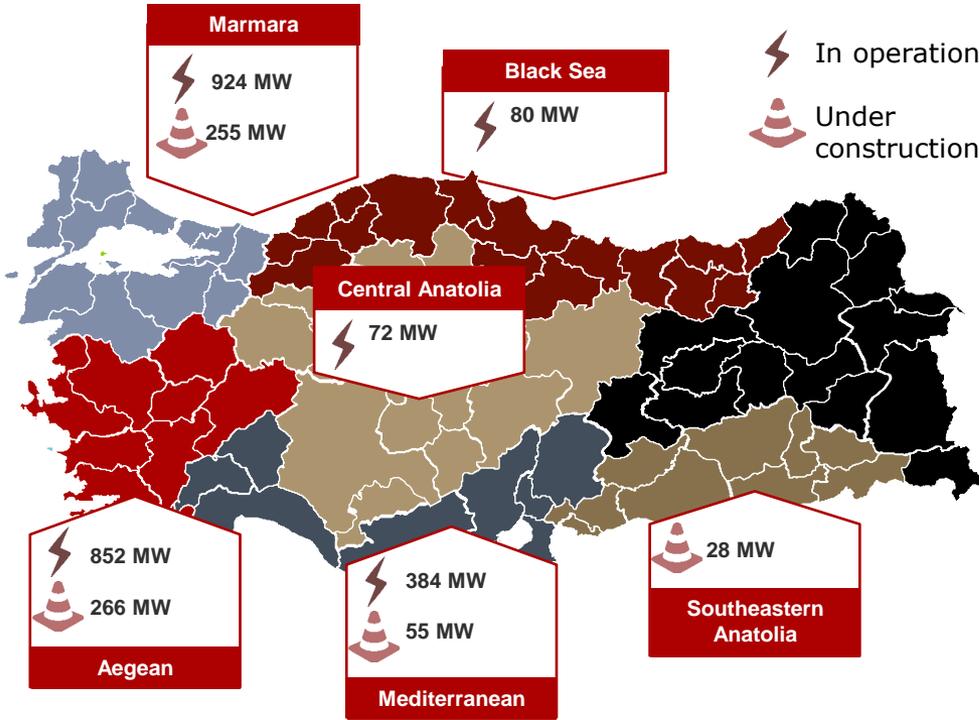
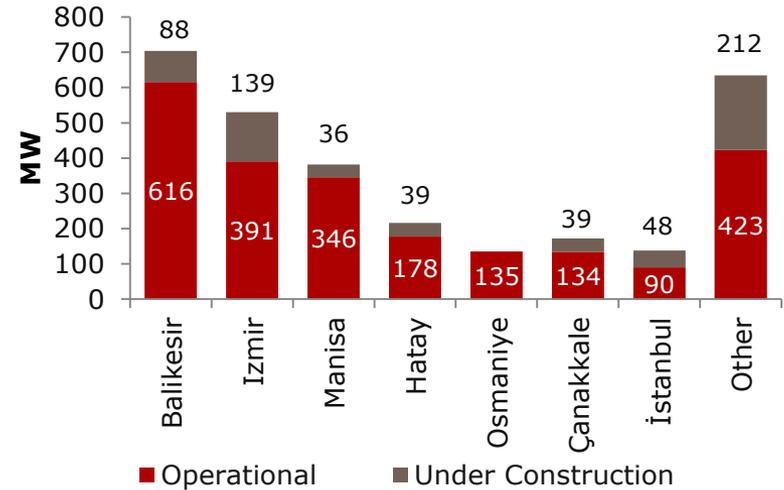


Figure 17: Cities that have the Highest Installed and Under Construction Wind Capacities



Source: TWEA Statistics Report

The highest share of installed wind capacity belongs to the Marmara region with 924 MW, followed by the Aegean region with 852 MW. Considering the wind power capacity of the seven regions, each possesses immense potential even after the current project stock is completed. Currently, Balıkesir has the highest share of installed operational wind capacity with 27%, followed by İzmir at 17% and Manisa at 15%. İzmir holds the highest share of projects under construction with 23%, followed by Balıkesir with 15% and finally by Tekirdağ at 11%. Considering İzmir has the highest wind speed in the Aegean region, it is not surprising to see the increase of investments and projects within that city.



Success Stories: The wind energy market attracts the attention of both local and international players.

Figure 18: Installed Operational Capacity According to Investors

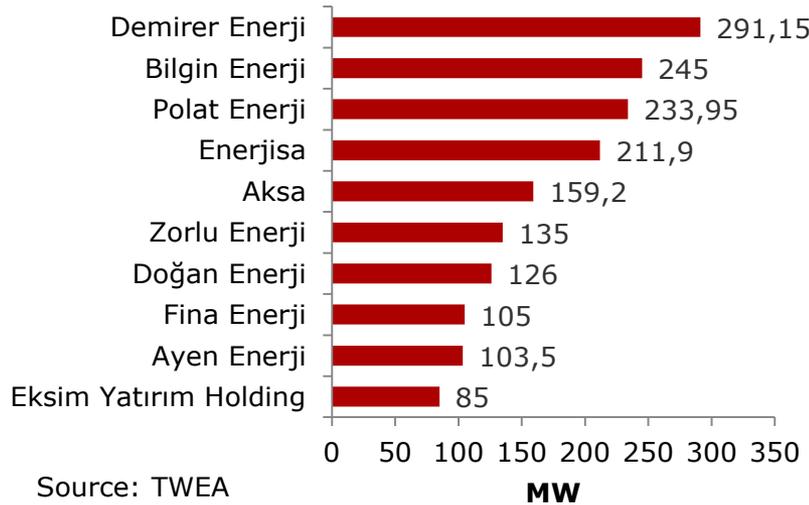
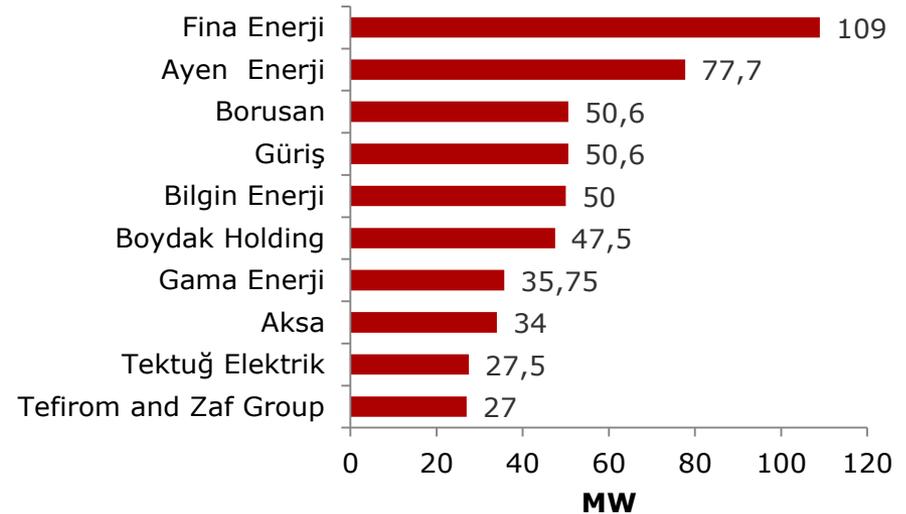


Figure 19: Wind Power Plants Under Construction According to Investors

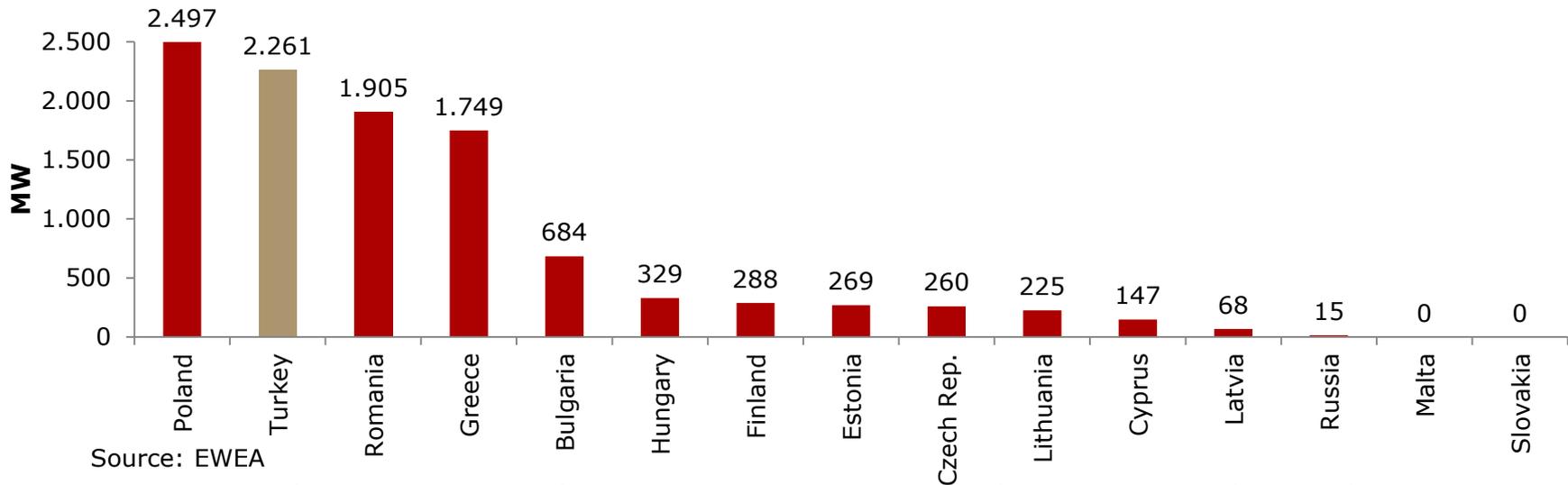


- Figure 18 demonstrates the installed operational capacity according to investors, and TWEA's data states that Demirer Enerji had the highest installed capacity in 2012.
- However, more investments were announced by some of the leading companies in Turkey. For example, Türkerler Holding announced 150 million TL investments in wind energy and with plans to increase its capacity to 522 MW.
- As of May 2013, the largest wind farm is located in Balıkesir and belongs to Enerjisa with an installed capacity of 143 MW. Enerjisa, a joint venture between the Turkish conglomerate Sabancı Holding and E.ON, announced its plans to reach an installed capacity of 5,000 MW by 2015 where renewable energy will constitute 5-10% of its portfolio.
- Unprecedented investments in wind energy under these circumstances demonstrate the potential of the wind energy market in Turkey and its ability to exceed current targets that are already being met.



Turkey has one of the leading installed wind capacities in Eastern Europe.

Figure 20: Installed Wind Power Capacity in Selected Eastern European and EU Countries, 2012



Interest in wind energy continued to increase in Europe in the last year. According to the European Wind Energy Association (EWEA), the astounding amount of 11,895 MW of wind energy was installed in the EU during 2012. Total investments in the wind energy business was worth between 12.8 to 17.2 billion Euros. In terms of annual installations, Germany held first place with 2,415 new installations, followed by the UK, Italy and Spain.

In terms of installed wind capacity in Eastern European countries, Turkey is leading the way with an installed capacity of 2,261 MW – an amount that is higher than Romania, Greece, Bulgaria, Hungary and other Eastern European countries displayed in Figure 20.

It is also important to note that in the list of candidate countries for the EU which includes Serbia and Turkey; Turkey has the highest installed wind capacity among all the candidate countries.

The large wind energy potential of Turkey and its investment friendly environment has enabled various projects to be implemented over the years. Nevertheless, in order to achieve its 2023 targets and compete with Western European countries, Turkey still has significant investment potential.



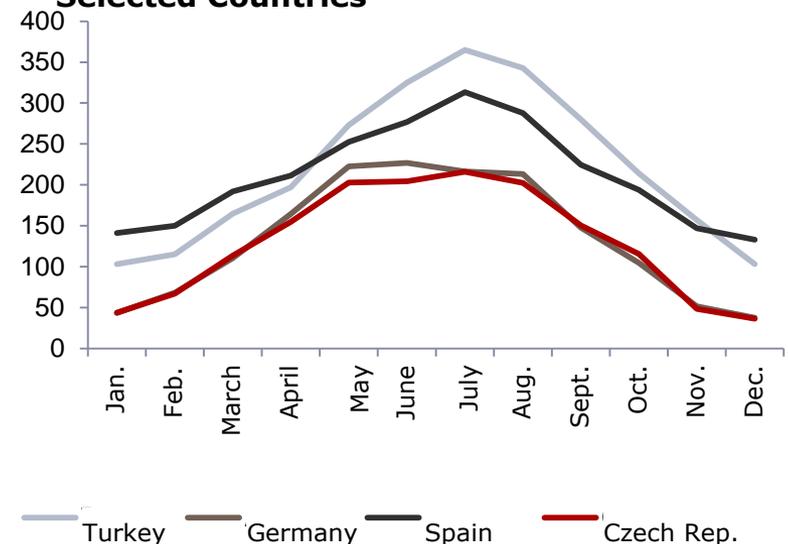
Turkey has abundant potential for solar power, especially in SE Anatolia and the Mediterranean region.

- Turkey's abundant source of solar power is a well-known and often cited fact. Despite this abundance, Turkey has not utilized solar energy efficiently until recently, and requires significant investment to tap its full potential.
- Momentum for solar power accelerated after the enactment of REL which specified a feed-in tariff price of 13.3 USD cent/kWh for solar power plants. The publication of the Tender Regulation Regarding Electricity Generation from Solar Energy by EMRA also sparked interest by providing the processes for participating in solar power tenders.
- According to the General Directorate of Renewable Energy, the average annual radiation in Turkey is 2,640 hours per year and the average solar radiation received is 1,311 kWh/m² per year.
- Table 4 demonstrates the average sunshine duration (hour/year) and total average solar radiance (kW/m²) in the seven main regions of Turkey.
- Southeastern Anatolia has the highest average sunshine duration along with the highest average solar radiance total followed by the Mediterranean and the Eastern Anatolian regions.
- Compared to some of the leading European Union member states in solar power, Turkey has the highest sunshine duration among Germany, Spain and the Czech Republic (see Figure 21).
- The Turkish solar energy sector offers an exceptionally high untapped potential, and a concise regulatory framework enables investors to participate in the solar power market effectively.

Table 4: Average Solar Radiance and Average Sunshine Duration.

Region	Average sunshine duration (hour/year)	Total average solar radiance (kWh/m ²)
SE Anatolia	2,993	1,460
Mediterranean	2,956	1,390
E Anatolia	2,664	1,365
C Anatolia	2,628	1,314
Aegean	2,738	1,304
Marmara	2,409	1,168
Black Sea	1,971	1,120

Figure 21: Sunshine Duration of Selected Countries



Source: YEGM, National Oceanic and Atmospheric Administration



PVs are prevalent in the solar market, yet interest and investments in CSPs are growing.

Concentrated Solar Panel (CSP)

CSPs use various mirror configurations to convert the energy captured by solar power into heat. The thermal energy generated is then used in a steam turbine or a heat engine to produce electricity. Use of CSPs gained popularity in recent years and global installed capacity grew by 35% in 2011. CSPs have the ability to be utilized with conventional power generation plants, such as natural gas, which allows CSPs to be integrated into electricity grids easily. As seen in Table 5, CSP technology has the highest feed-in tariff with 22.5 USD cent/kWh, which includes all local equipment bonuses, followed by PVs with 20 USD cent/kWh.

Photovoltaic Module (PV)

PV cells convert solar radiation into electricity by using semiconductor cells. Currently, PVs dominate the solar market and global PV installed capacity grew by 74% in 2011. Generous subsidies around the world have been the main drivers of this significant growth. Even though prices of PVs have fallen dramatically over the years, additional reductions are needed for further implementation. Research and development projects exist in many Turkish universities as well as in government institutions for the development and adaptation of efficient PV modules.

Table 5: Feed-in Tariff, Locally Manufactured Components, CSP

Feed-in-tariff and Local Equipment Bonus Prices for CSP	
Locally manufactured component	Bonus (USD cent/kWh)
Radiation collector tube	2.4
Reflective surface	0.6
Sun tracking system	0.6
Mechanical components of heat energy storage system	1.3
Mechanical components of the steam generation system	2.4
Stirling engine	1.3
Panel integration and production of structural solar mechanics	0.6
Total	13.3 + 9.2 = 22.5

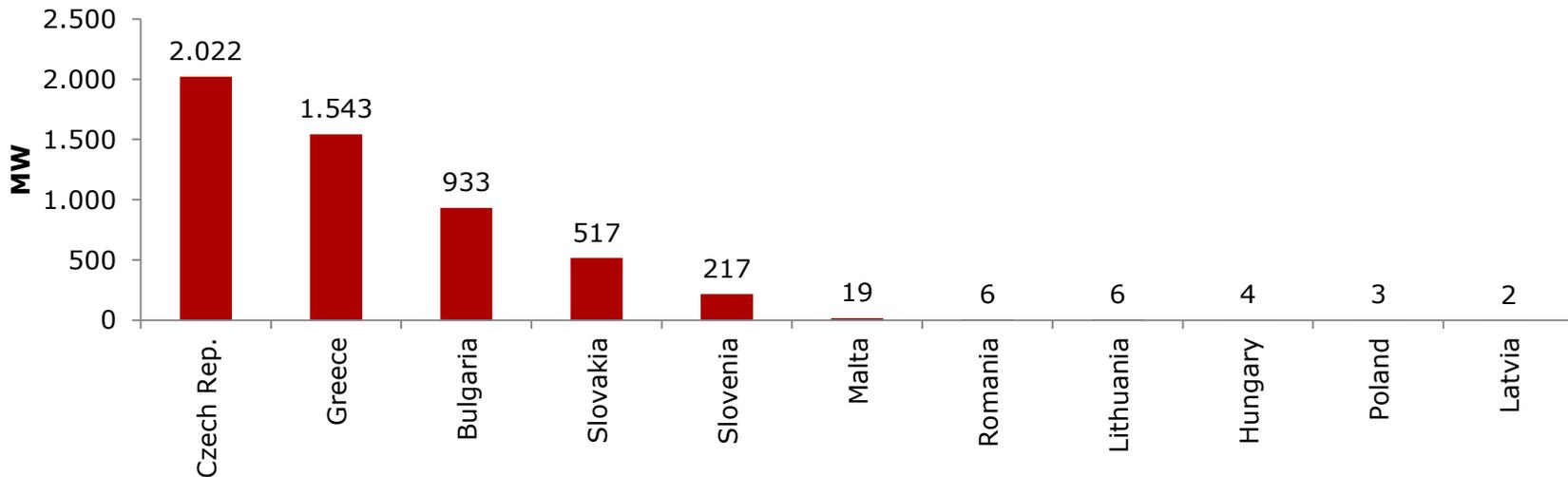
Table 6: Feed-in Tariff and Incentives, Locally Manufactured Components, PV

Feed-in-tariff and Local Equipment Bonus Prices for Solar PV	
Locally manufactured component	Bonus (USD cent/kWh)
PV panel integration and production	0.8
PV Modules	1.3
PV Module Cells	3.5
Inverter	0.6
Material which focuses radiation on PV Module	0.5
Total	13.3 + 6.7 = 20



The stabilization of solar energy regulations has captured the attention of major energy players.

Figure 22: Installed Solar Power Capacity in Selected EU and Eastern European Countries, 2012



Source: EurObserv'ER 2013

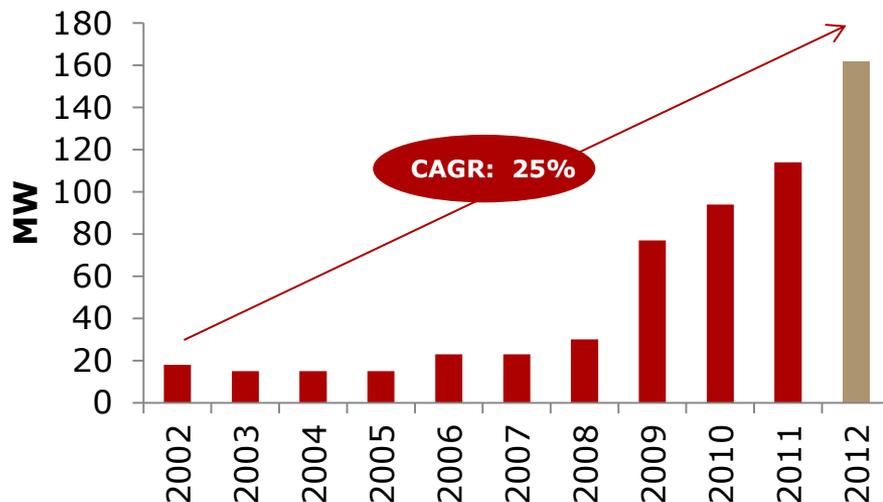
Solar energy, especially photovoltaics, experienced exceptional growth in the past few years and has become more mainstream. According to the European Photovoltaic Industry Association, installed PV capacity in 2012 exceeded 100 GW.

Even though Turkey currently does not possess large scale solar power plants, the seeds towards the implementation of solar power were planted in mid-2012. In June 2012, the first applications were received by EMRA for solar power plants greater than 1 MW. Astounding interest in solar energy was observed during this process when EMRA received 496 applications. EMRA had specified that only 600 MW of solar energy will be implemented into the grid and even though the date for the second round of applications has not been determined. Next application process is expected to propose 2,500 MW of available solar power.



Geothermal development has been slow, but steady since 2008 – yet there is still considerable untapped potential.

Figure 23: Installed Geothermal Power, 2002-2012



Source: TEİİAŞ

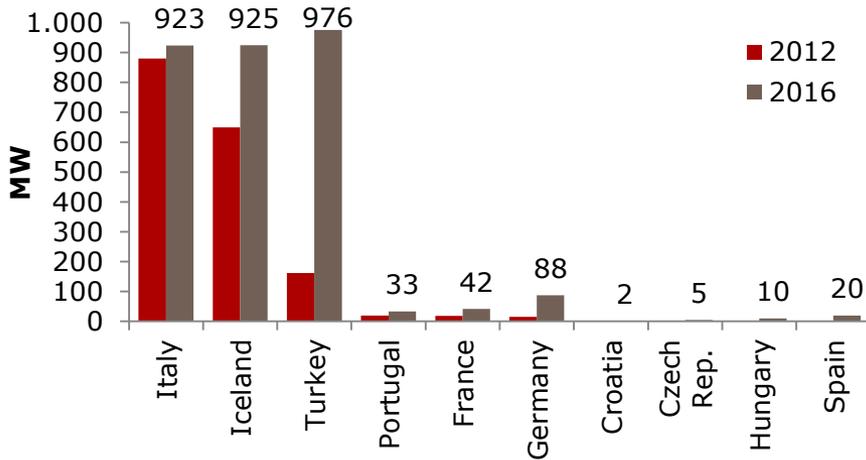
- Research regarding geology and mineral exploration is conducted by the General Directorate of Mineral Research and Exploration (MTA).
- Geothermal resources in Turkey are mostly used in heating, thermal tourism, greenhouse heating and electricity production.
- According to the MTA, there are 17 settlements that use geothermal resources for central heating which corresponds to 85,903 residences, 773.14 MWt. 15 fields are used for GHG heating rating at 2267.2 decare, 444.34 MWt. Lastly, there are 350 thermal resorts that employ balneotherapy treatments which attract tourists from all over the world.

- According to the General Directorate of Renewable Energy (YEGM), Turkey has an estimated 2,000 MW of generation capacity from geothermal sources.
- Currently, there are 18 geothermal fields that have been discovered by the MTA which are suitable for electricity production and all of them are located in Western Anatolia.
- Figure 23 demonstrates the development of Turkey's installed geothermal capacity from 2002 to 2012. The capacity increased at a CAGR of 25% during this time frame. It is also crucial to emphasize the precipitous 42% increase between 2011 and 2012, which indicates the growing interest in geothermal resources.
- Even though Turkey's potential in geothermal energy is very high – 2,000 MW – the installed capacity was 162 MW at the end of 2012. This discrepancy signifies the need for large scale investment to tap into the full potential. This potential is described further in the next slide.
- The biggest players in electricity production from geothermal resources are: Zorlu Enerji, Gürış Enerji and BM Holding. Zorlu Enerji is investing in additional capacity adding to its current 15 MW portfolio, and the company plans to have 95 MW by the end of 2013.
- Gürış Enerji has portfolio of 47 MW and is planning to complete a project consisting of 7.25 MW and 4 units of 22.5 MW of geothermal power stations by 2018. Lastly, BM Holding has a GEPP in the Gümüşköy reserve that is rated at 13 MW.



Turkey is one of the hottest markets in Europe for geothermal energy.

Figure 24: Highest Installed Geothermal Capacities in EU



Source: European Geothermal Energy Council, 2012

Table 7: Feed-in Tariff and Incentives, Locally Manufactured Components, Geothermal Energy

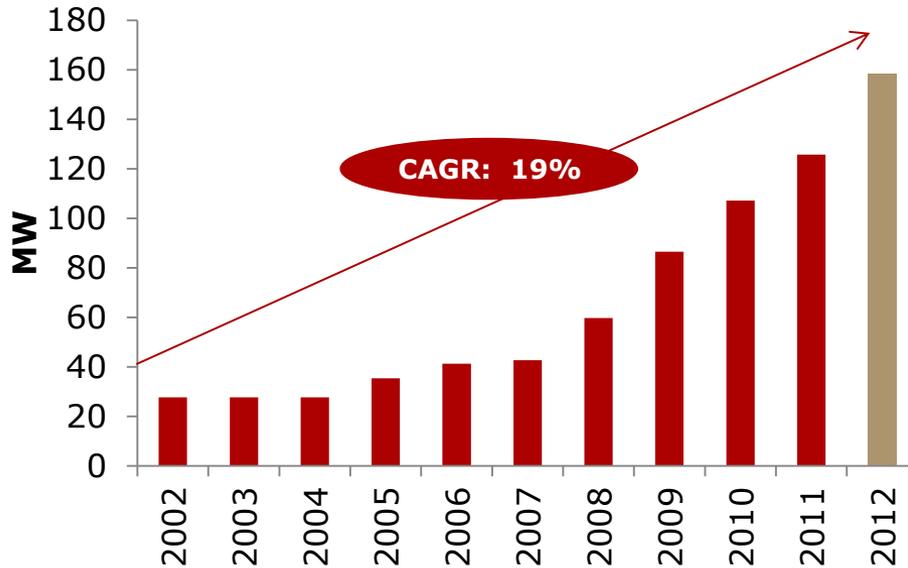
Feed-in-tariff and Local Equipment Bonus Prices for Geothermal	
Locally manufactured component	Bonus (USD cent/kWh)
Steam or gas turbines	1.3
Generator and power electronics	0.7
Steam injector or vacuum compressor	0.7
Total	10.5 + 2.7 = 13.2

- According to the European Geothermal Energy Council (EGEC), Turkey is one of the hottest markets in Europe for geothermal energy.
- Figure 24 demonstrates the major EU players in electricity production from geothermal sources. The EGEC predicts an installed capacity of 976 MW will be achieved in Turkey by 2016. Considering Turkey's current installed capacity, 814 MW of investment opportunity exists if the potential given by the EGEC is to be reached.
- In Europe there are a total of 62 geothermal power plants for electricity generation and 15% of these plants exist in Turkey.
- *The Electrical Energy Supply Security Strategy Paper* written by Ministry of Energy and Resources, on the other hand, aims for a capacity of 600 MW by 2023.
- The Renewable Energy Support Mechanism's feed-in tariff for geothermal energy is 10.5 USD cent/kWh. Extra incentives exist for steam or gas turbines, generators, power electronics components, steam injectors and vacuum compressors manufactured in Turkey which equals 13.3 USD cent/kWh.



Biomass is one of the rising stars of renewable energy.

Figure 25: Installed Biomass Capacity in Turkey, 2002-2012



Source: TEİAŞ

- At the end of 2012, installed biomass capacity in Turkey was 158 MW, this was an increase of 26% compared to 2011 (see Figure 25).
- It is also important to note that installed biomass capacity increased at a CAGR of 19% in the last decade. The given installed capacity combines the installed capacity of electricity generation from all types of biomass activities.
- Considering the potential gasification capacity of 600 MW from forestry waste, Turkey continues to hold opportunities for investors.
- Waste management and disposal are high priorities in the public sector. In 2010, a total of 3 billion TL worth of investment was allocated by the government to environmental technologies where 91 million TL was used for waste management activities.
- Some of the major municipalities in Turkey such as Ankara, Istanbul and Adana already utilize electricity generation from waste. Major players in the industry include ITC (Integrated Solid Waste Management Systems) and Ortadoğu Enerji.

- The role of biomass in the share of renewables experienced significant growth especially in the last few years. Steady growth in the early 2000s gained momentum after 2007 due to the enactment of the Renewable Energy Law.
- According to REL, biomass is a resource obtained from agricultural and forestry products including vegetable oil waste, agricultural harvesting waste as well as from organic waste, and from the byproducts formed after their processing.



Biomass investments are eligible for a high feed-in tariff similar to solar power investments.

Table 8: Feed-in Tariff and Incentives, Locally Manufactured Components, Biomass Including Landfill Gas

Feed-in-tariff and Local Equipment Bonus Prices for Biomass	
Locally manufactured component	Bonus (USD cent/kWh)
Steam boiler with fluid bed	0.8
Liquid or gas fired steam boiler	0.4
Gasification or gas removal group	0.6
Steam or gas turbine	2
Internal combustion or stirling engine	0.9
Generator and power electronics	0.5
Cogeneration system	0.4
Total	13.3 + 5.6 = 18.9

- The feed-in tariff applied to biomass and biogas projects is 13.3 USD cent/kWh which also includes electricity generation from landfill.
- Biomass technologies receive the second highest incentive rate after solar CSP technologies. The total feed-in tariff that can be applied to biomass technologies is 18.9 USD cent/kWh.

- Generation of electricity from waste has attracted the attention of foreign investors. The South Korean company CEV-Clean Energy & Vehicle has a project in Gaziantep to produce 3.3 MW of electricity from methane gas. Additionally, the company is involved in a research and development project regarding solid waste storage and its ability to be utilized in electricity generation.

Investment Tip: The high feed-in tariff of 18.9 USD cent/kWh, is similar to solar power investments and makes biomass investments very attractive. Biomass power plants have the advantage of high capacity and this allows the plant to operate as a base load power plant. Since biomass power plants do not compete for grid connection rights - unlike solar and wind projects - this makes them even more attractive for investment.



Turkey has relatively higher feed-in tariffs than many other countries in Europe and the Caucasus.

Table 9: Feed-in Tariff Comparison of Turkey and Selected Countries

USD cent/ kWh	Turkey (Min. FIT)	Turkey (Including Local Bonus)	Slovakia	Bulgaria	Ukraine	Armenia	Latvia
Solar	13.3	20	15.8	11.4	25.3	-	31
Wind	7.3	11	10.4	7.2	8.4	8.9	5
Biomass	13.3	18.9	14.9	16.1	16.2	8.9	7
Hydro	7.3	9.6	8.2	10.8	5.6	2.0	11
Geothermal	10.5	13.2	25.3	-	-	-	-

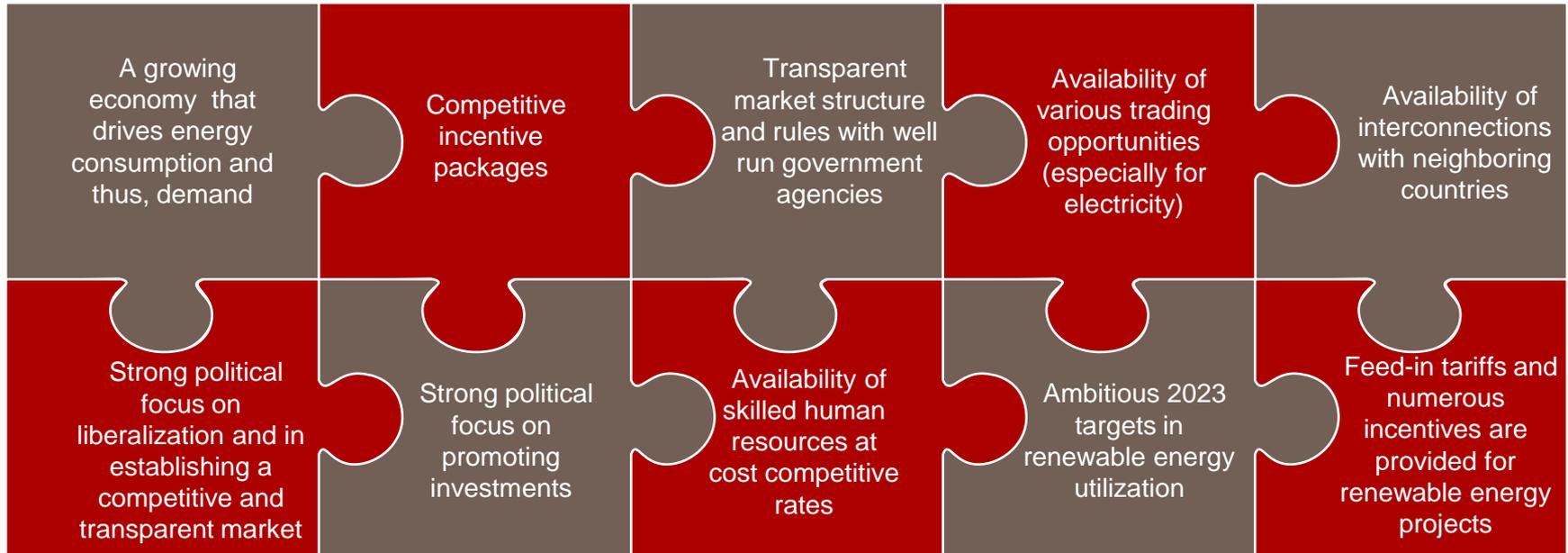
A Feed-in tariff (FIT) is a pricing mechanism designed to promote investment in renewable energy technologies. FITs have been implemented by various countries all around the world in the last two decades to provide long term contracts to renewable energy producers. In many cases, FIT payments are awarded for 10 to 20 years depending on the economic policy adopted.

Countries leading in renewable energy implementation such as Germany and Spain have advocated the use of FITs. After successfully integrating renewable energy resources into their portfolios, Western European countries have started to lower their FIT levels. For instance, Spain has completely removed their FIT structure since the country has achieved its renewable energy targets. As Western European countries reach a maturation level in the renewable market, Eastern Europe and the Middle East offer various opportunities.

As seen in Table 9, Turkey has one of the highest levels of FIT within Eastern Europe with regards to various technologies.



Various reasons exist to invest in Turkey's vibrant renewable energy market



- Turkey's successful emerging economy creates a broad spectrum of investment opportunities. Ambitious energy targets for 2023 such as 125 GW of installed capacity, compared to 2012's 57 GW and 30% renewable installed capacity by 2023 can only be achieved through significant investment.
- Turkey offers tremendous benefits for foreign and domestic investors such as exemption from VAT and customs duty. The government's feed-in tariffs over the course of 10 years is another reason that investors are attracted to the renewable energy market.
- As universities enhance their alternative energy programs, the labor force in Turkey becomes more knowledgeable and innovative regarding renewable energy projects.
- Due to its geographical location and connection with ENTSO-E cross-border trade opportunities also exist for investors who are interested in renewable energy projects.



Some selected major renewable energy success stories are...



Güriş İnşaat ve Mühendislik A.Ş. undertook the biggest geothermal projects in Turkey with a capacity of 47.4 MW including all construction, mechanical installation and electricity related operations.



Zorlu Doğal Elektrik Üretimi A.Ş. possesses the operational rights of the first geothermal power plant in Turkey, the Denizli Kızıldere Electric Power Plant. The plant's capacity is 15 MW. The company is trying to increase the company's installed capacity from 80 MW to 95 MW in 2013.



ITC provides a combination of processes from the rehabilitation of wild landfills, design and operation of sanitary landfills, energy production from biomethanazation, gasification incineration, RDF production and the like. The company's facilities are located in Ankara, Adana, Konya, Bursa and Antalya. The company undertakes waste management operations in several plants located in Ankara. Regarding their total power plants, 100 MW is in operation and 80 MW is under construction. 200 MW installed capacity, which will supply the energy demands of approx. 500,000 households, will be put into operation once the projects are completed.



Soma RES has 140.1 MW installed capacity and 119 wind turbines. An investment of 170 million Euros was made for the project. Currently, Polat Enerji is undertaking the Geycek RES project which will have an installed capacity of 150 MW and 190 million Euros of investment will be made for the project.



Aksa Enerji has three WEPPs in operation. The largest is Şamlı WEPP with a capacity of 90 MW. Şamlı's capacity will increase by 24 MW thanks to an agreement signed with Vestas. The company has 1 wind project under construction which will have a capacity of 30 MW once completed.



Rotor Elektrik Üretim A.Ş, which is operating within Zorlu Energy Group, built a WEPP in Osmaniye which has a generation capacity of 135 MW. Zorlu Energy also built the first WEPP in the country with an installed capacity of 56.4 MW. The first phase of this project has been completed.



Several NGOs are active in developing the capacity necessary for increasing renewable investments.

GENSED – Turkish Photovoltaic Industry Association

- Assists firms in the solar energy sector to obtain solar related laws and regulations by connecting them to government ministries.
- Gathers organizations working in the production and distribution of electricity obtained from solar energy under a single roof and creates a forum for their concerns.

TWEA – Turkish Wind Energy Association

- Turkey's most important non-governmental organization dealing with wind energy. It is also the official branch of EWEA in Turkey.
- Expanding the use of wind energy.
- Capacity building for wind energy.

Li-DER – Unlicensed Electricity Generation Association

- Supports individuals and organizations who work on the production of unlicensed electricity through capacity building.
- Works to increase usage of unlicensed electricity in Turkey.
- At the forefront of the formation of regulatory standards.

BIYOGAZDER – Association of Biogas Investments Development

- Capacity building: Informs investors and lawmakers about production of electricity, thermal energy and natural gas from biogas.
- Builds sample facilities and helps in determining the feasibility of current ones.
- Supports research and development in the biogas sector.

TJD – Geothermal Association of Turkey

- Supports the research of geothermal resources and implementation.
- Creates a platform where experts gather to share information from the industry.
- Works to increase the awareness of geothermal usage not only for electricity production but also in heating, cooling and tourism.

RESSİAD – Wind and Hydropower Plants Businessmen's Association

- Gathers private sector organizations working in wind and the hydroelectric energy sector under one roof.
- Solves problems regarding production of electricity from wind and hydro power in Turkey.



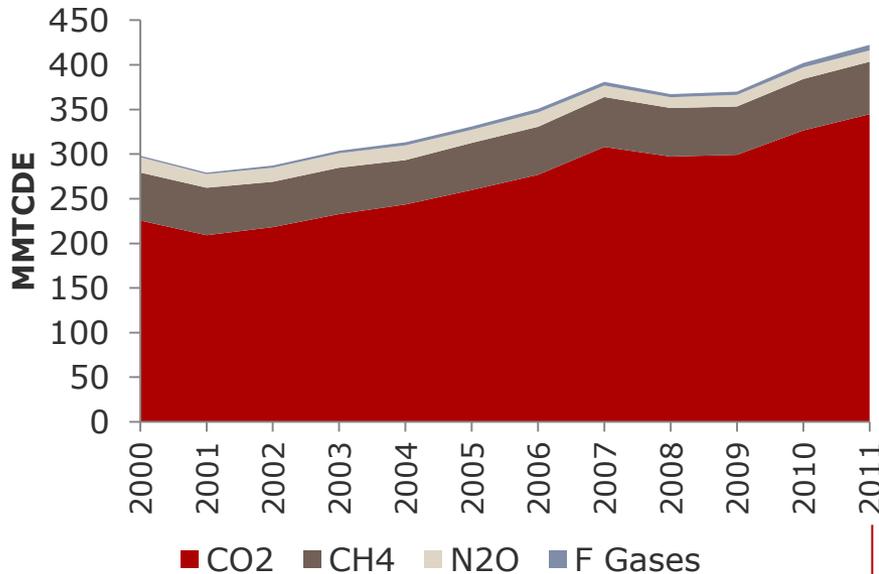
E. Air Quality & Greenhouse Gas Emission Control

- i. Greenhouse Gas Emissions in Turkey
- ii. Greenhouse Gas Emissions by Sector
- iii. The Current and Future State of Carbon Markets in Turkey

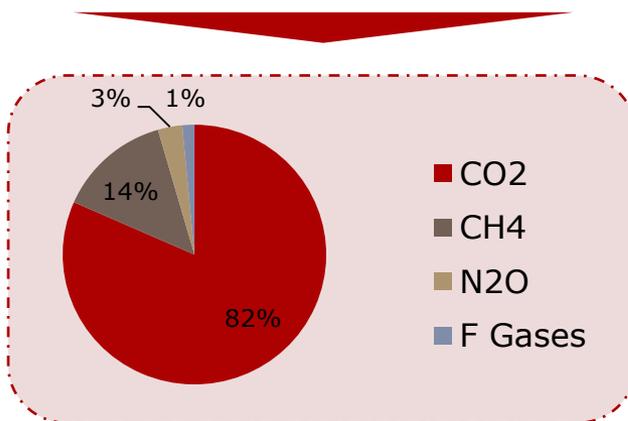


High economic growth is coupled with increases in GHG emissions.

Figure 26: Total GHG Emissions by Gas, 2000-2011



Source: TÜİK



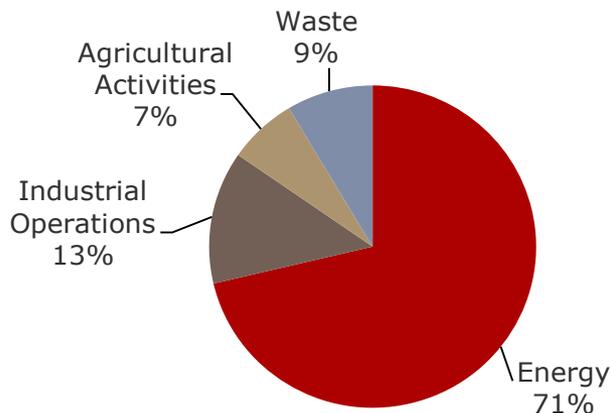
- Over the last few decades, Turkey has been experiencing significant growth in its economy and its industry. This is also reflected in the amount of greenhouse gas (GHG) emissions in the country. A survey of data culled over a 21 year period reveals Turkey's prospering economy, but also its alarmingly high GHG emission levels.
- Total GHG emissions in Turkey are assessed based on the Intergovernmental Panel on Climate Change (IPCC) standards and gauge GHG emissions in the following sectors: energy, industrial operations, agricultural activities and waste disposal.
- GHG emissions inventory as shown in Figure 26 reflect some of the most potent GHGs including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and F-gases comprising nitrogen oxide (NO_x), NMVOCs and finally, carbon monoxide (CO).
- According to this inventory, CO₂ is the predominant GHG gas emitted in Turkey at about 345 million tons and accounts for 82% of GHG emissions. Methane, nitrous oxide and F-gases follow carbon dioxide.
- Compared to 1990, GHG emissions increased by 124% in 2011 at a CAGR of 4% between 2000 and 2011.
- Turkey has already launched efforts to curb GHG emissions with a new set of regulations focusing on the measurement of GHG emissions along with new energy efficiency programs, which are described later in the report.



The energy sector creates the highest share of greenhouse gas emissions.

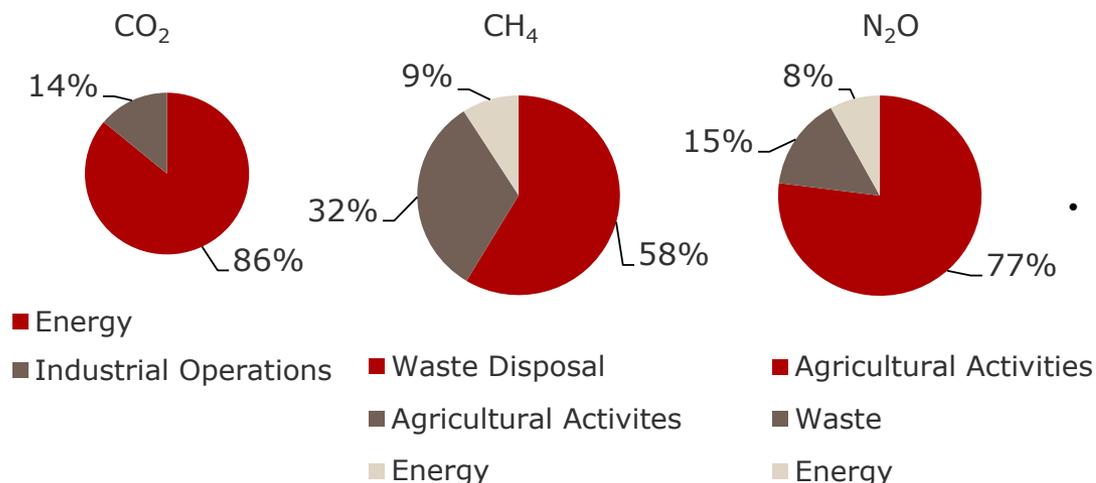
Figure 27: GHG Emissions by Sector, 2011, MMTCDE

Primary sources of GHG emissions in Turkey can be summarized in four distinct categories:



- The **Energy sector** generates the highest share of GHG emissions with 71% and consists of the burning of fossil fuels, recycling, energy generation, industry and transportation. The energy sector also has the largest share of CO₂ emissions with 86%.
- **Industrial operations** follow the energy sector with 13% of the GHG emissions and are the second largest contributor to CO₂ emissions with 14%.
- **Waste disposal** management is a pressing issue for Turkey and accounts for 58% of methane gas (CH₄) produced. Considering the comparative impact of methane, which is about 20 times greater than CO₂, waste disposal poses many challenges along with new business opportunities in waste management.
- **Agricultural activities** have the lowest contribution in GHG emissions with 7%. However, agricultural activities account for over 75% of nitrous oxide emissions, followed by waste disposal with 15%. It is not surprising to see high levels of nitrous oxide emissions from these sectors since N₂O is mostly emitted during agricultural activities along with combustion of solid waste.

Figure 28: GHG Emissions by Sector, 2011



Source: TÜİK

As fragmented carbon markets emerge globally, Turkey expects to launch its carbon market by 2015.

- The Kyoto Protocol has crucial significance in managing greenhouse gas emissions by imposing a cap-and-trade system. Not only did the Kyoto Protocol set binding obligations to reduce greenhouse gasses in industrialized countries, it also initiated the establishment of the carbon market. Although, the Kyoto Protocol set out to propose a global solution to greenhouse gas emissions, its success remains debatable since countries with the largest emissions such as the United States and China never actually signed the treaty.
- Besides the Kyoto Protocol, myriad carbon markets and regulations are appearing on the horizon. Turkey is not obliged to a quantitative reduction commitment due to its 'special circumstances' in the Kyoto Protocol (listed under Annex I, but not Annex B), and is one of the many countries that plan to pursue their own policies. The abovementioned special condition has prevented Turkey from engaging in flexibility mechanisms including the Clean Development Mechanism and Joint Implementation.
- Even though Turkey cannot participate in CDM and JI projects, it performs in voluntary markets where carbon credits are bought by companies and organizations that are interested in balancing or neutralizing their carbon emissions. In May 2012, there were a total of 201 GHG mitigation projects. Hydro projects account for 59% of GHG emission reduction projects followed by wind with 29% and geothermal with 6%. Other projects include biogas, energy efficiency and energy generation from waste.

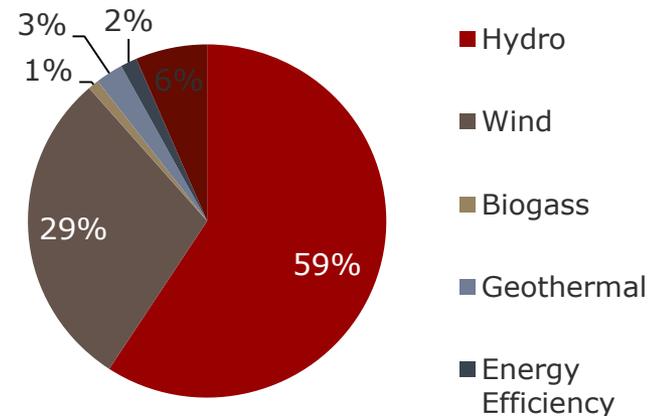
The National Climate Change Action Plan

- Plans to carry out negotiations to ensure Turkey's participation in the most advantageous way into the existing and new, global and regional carbon markets in 2013.
- Aims to finalize studies to establish the carbon market in Turkey by 2015.

Energy Efficiency Strategy Paper

- Related to the context of sustainable financing mechanisms (with the exception of members of the public who seek applications related to energy efficiency and renewable energy sources), and is concerned with developing the infrastructure of carbon trading and the carbon market which shall be completed by mid-2014.

Figure 29: Carbon Mitigation Projects



Source: The Carbon Market in Turkey, Ministry of Environment and Urban Planning



Integrated Pollution Prevention and Control in Turkey will start a new era in the industry.

As was previously mentioned, the energy sector and industrial operations generate the highest share of GHG emissions in Turkey. A strong economy and continuous growth is expected to increase the share of hazardous GHG emissions and the implementation of Integrated Pollution Prevention and Control (IPPC) in Turkey will decrease the emission levels significantly. It is important to note that IPPC is a European Union Directive enacted in 2008 in order to prevent hazardous air and water emissions caused by industrial and agricultural activities.

Turkey realizes the importance and consequences that can be encountered due to these emissions and has taken several steps to integrate environmental protection policies. For instance, The Turkish Industrial Strategy Document published by the Ministry of Industry and Trade for the years between 2011 and 2014 states that preparations for the implementation of the IPPC legislation will continue until it is adopted.

According to the European Commission the IPPC Directive is based on several main principles and they are as follows:

Source: European Commission



1. An Integrated Approach

- The permit must take into account the following environmental criteria, emissions in the air, water and land, generation of waste, use of raw materials, energy efficiency, noise, and prevention of accidents. The IPPC Directive looks at the environment as a whole.

2. The Best Available Techniques (BAT)

- In order to determine the Best Available Techniques, the Commission arranges meetings between experts in EU member states and within the industry and environmental organizations. Implementation of BAT in Turkish companies will require immense investments.

3. Flexibility

- The Directive allows licensing authorities to determine permit conditions such as, the technical characteristics of an installation, its geographical location and the conditions of the local environment.

4. Public Participation

- According to the Directive, the public has a right to participate in the decision making process and has a right to access permit applications in order to give opinions, the permits themselves, the results of the monitoring of the emissions and the like.

F. Special Focus: Electric Vehicles

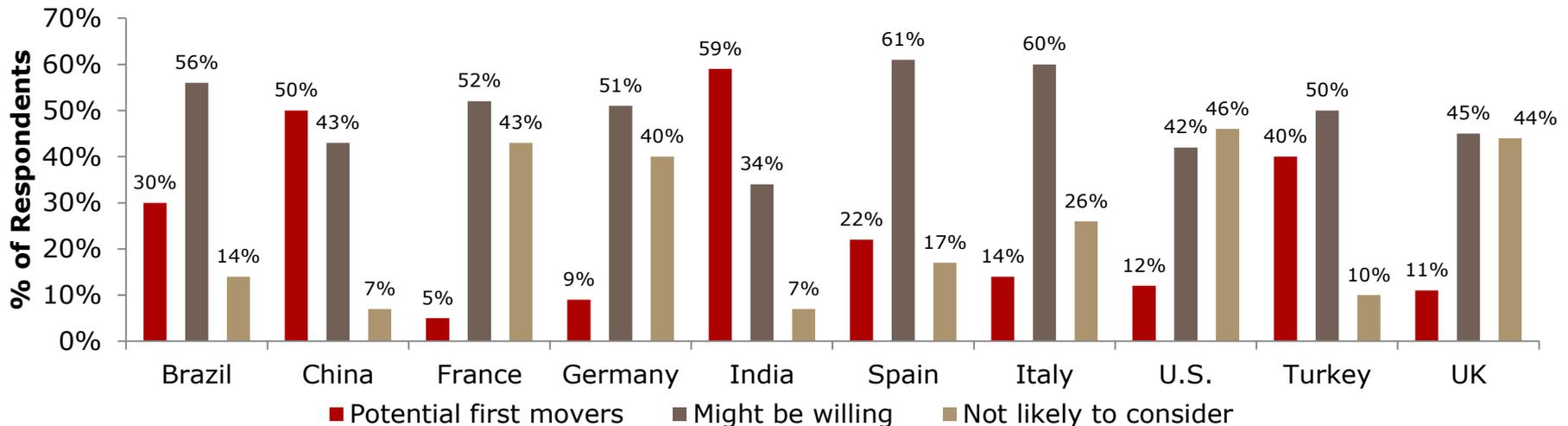
i. The Current State of Electric Vehicles in Turkey



Electric vehicles in Turkey: Widespread acceptance in the foreseeable future.

- Rising oil prices and concerns regarding the environment have started a revolution in the automotive industry. Examples are emerging from all over the world regarding electric vehicles and their increasing popularity. Major automotive companies are investing in clean and efficient technologies in order to serve their customers with a wide range of possibilities. These include hybrid cars (which combine an internal combustion engine and electric motor), hydrogen-fuelled cars, pure electric vehicles and efficient motors running on petrol and diesel.
- The idea of EVs has started gaining importance in Turkey recently and, a survey conducted by Deloitte in 2011 regarding electric vehicles and customer expectation indicates Turkey's eagerness in adopting EVs. The study was completed based on a survey of 13,000 individuals in 17 countries. According to this survey, 40% of the respondents in Turkey stated that they would be potential first movers, whereas 50% of respondents declared that they might be willing to purchase EVs. Turkey's interest in EVs was significantly higher than France, Germany, Spain, Italy and the United Kingdom, making Turkey one of the most attractive markets in the EU region.
- TÜBİTAK recently announced an incentive program called the '1007 Program' to support universities, private and public sector R&D activities in order to create EV studies in Turkey, which would eventually lead to manufacturing activities.

Figure 30: Global Consumer Segmentation for EVs



Source: Deloitte Analysis



II. Energy Efficiency in Turkey



A. Energy Efficiency

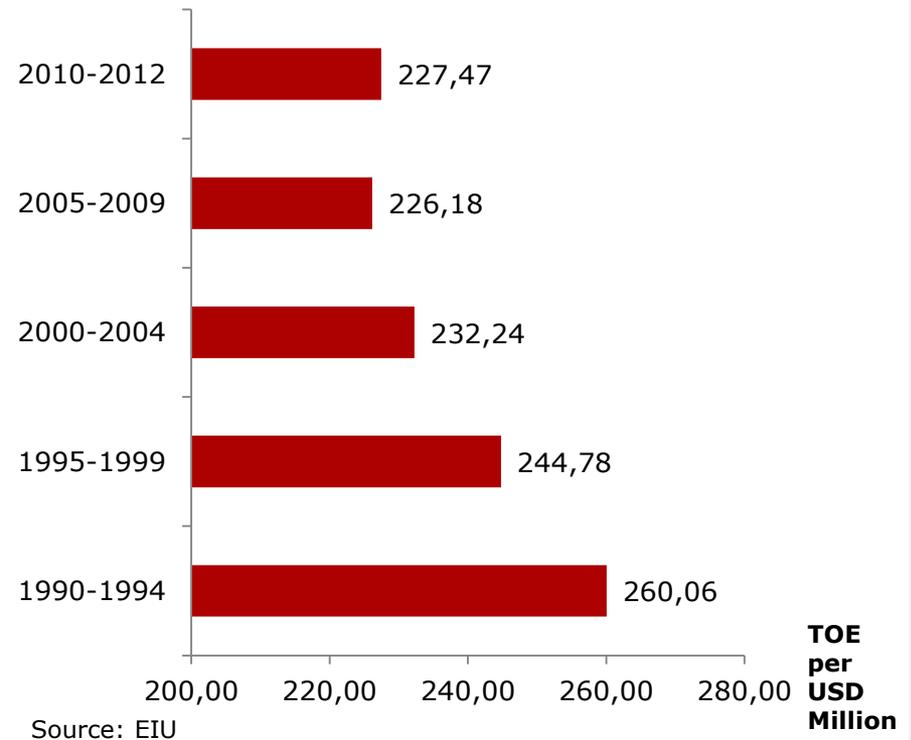
- i. The Global Outlook on Energy Efficiency
- ii. The Development of Energy Efficiency in Turkey
- iii. Turkey's Targets In Regards to Energy Efficiency
- iv. Potential Sectors for Energy Efficiency
- v. Green Buildings
- vi. Smart Grid
- vii. Incentives for Energy Efficiency Projects



Negawatts are on the rise globally...

- Energy efficiency improvements refer to a reduction in the energy used for a given service (heating, lighting, etc.) or level of activity.
- Energy intensity, defined as the amount of energy used to produce a unit of gross domestic product (GDP), is the most common proxy for energy efficiency improvements; although effects of the economy, climate and industry dynamics should also be considered.
- In many countries, energy efficiency policies are introduced in the field of industry, building and transportation. Policies that target the industry sector consist of tax and R&D incentives, equipment performance standards, energy management programs, etc. For the building sector, labeling the energy usage of buildings and appliances is becoming mandatory as well as energy conservation policies for residential and commercial buildings. In the transportation sector, fuel economy policies as well as increasing the share of public transport are other measures for creating energy efficiency.
- While the increasing energy demand drives capacity investments in megawatts, there is a great emphasis on increasing «negawatts», which is energy conserved by energy efficiency measures.

Figure 31: Energy Intensity Development of World



- Figure 31 shows the global energy intensity, indicating that energy intensity has fallen over the years with an increasing emphasis on the energy efficiency and energy management activities. The reason of this decline can be explained with both energy efficiency improvements as well as transition away from energy intensive industries¹.

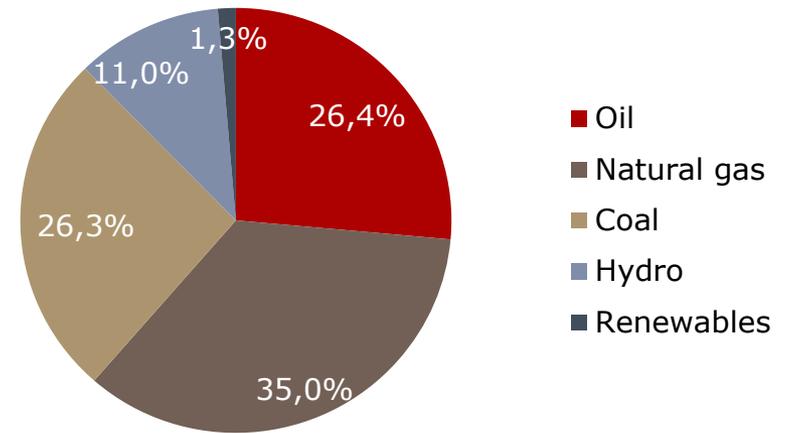
1: World Energy Outlook, 2012



And Turkey is committed to this change...

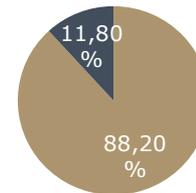
- Strengthening its energy security via decreasing the dependency on the importation of its energy resources is one of Turkey's top priorities.
- Dependency on energy imports, especially oil and gas, is a primary concern of the government. Therefore, investments in local energy resources and energy efficiency are highly favored.
- Turkey's primary energy consumption can be seen in Figure 32. Oil, natural gas and hydro power have the highest share in primary energy consumption.
- Nearly all natural gas is imported while over 88% of petroleum is imported, as seen in Figure 33 and 34.
- Energy import dependency is also one of the major concerns for electricity generation. According to TEİAŞ's data, in 2012 the share of energy generated by natural gas was 45%.
- In addition to increasing the share of domestic energy resources (coal, hydrocarbon and renewables, including hydropower) in its total electricity generation, Turkey gives importance to energy efficiency projects to overcome this dependency.

Figure 32: Primary Energy Consumption of Turkey, 2012



Source: BP Statistical Review of World Energy, June 2013

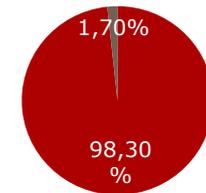
Figure 33: Turkey's Petroleum Supply



■ Import ■ Domestic Production

Source: EMRA

Figure 34: Turkey's Natural Gas Supply



■ Import ■ Domestic Production

Source: EMRA



To promote energy efficiency measures, several regulations have been enacted over the years in Turkey.

The Year of Energy Efficiency

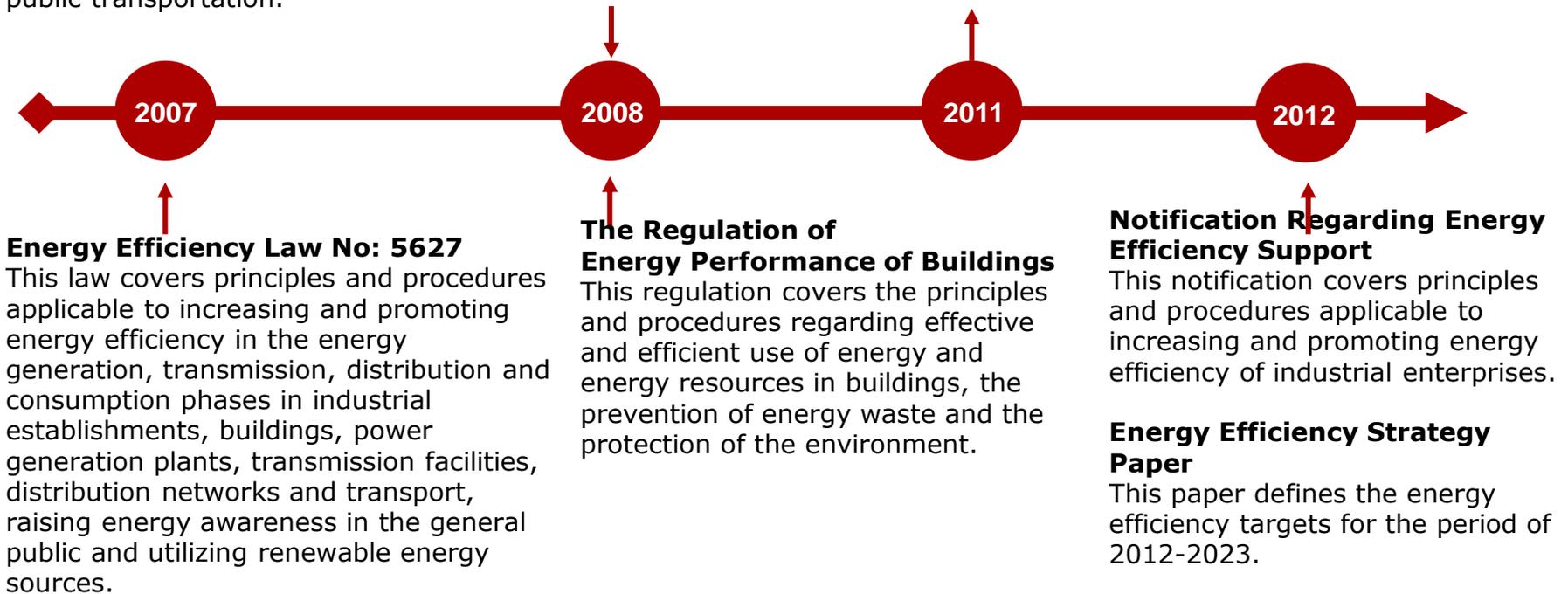
2008 was declared The Year of Energy Efficiency to draw attention to energy waste and the importance of energy efficiency.

The Regulation on the Principles and Procedures for Increasing Energy Efficiency in Transportation

This regulation covers the principles and procedures regarding effective use of energy in vehicles and promotes public transportation.

The Regulation on Increasing Efficiency in the Use of Energy Sources and Energy*

This regulation directs the efficient use of energy, alleviating the burden of energy costs on the economy.



**This regulation was published in 2008 and updated in 2011.*



The Energy Efficiency Strategy Paper has been published for the period of 2012-2023 and its aims are to...

Reduce energy intensity and energy losses in the industry and services sectors.

Decrease the energy demand and carbon emission of buildings: promoting sustainable environment-friendly buildings using renewable energy sources.

Enable market transformation through energy efficient products.

Increase efficiency in production, transmission and distribution of electricity and decrease energy losses and harmful environmental emissions.

Strengthen institutional capacities and collaborations, increase the use of state of the art technology and awareness activities and developing financial support for these innovations

Reduce the unit fossil fuel consumption of motorized vehicles, increasing public transportation on roadways, railways and in maritime transport, and preventing unnecessary fuel consumption in urban transportation.

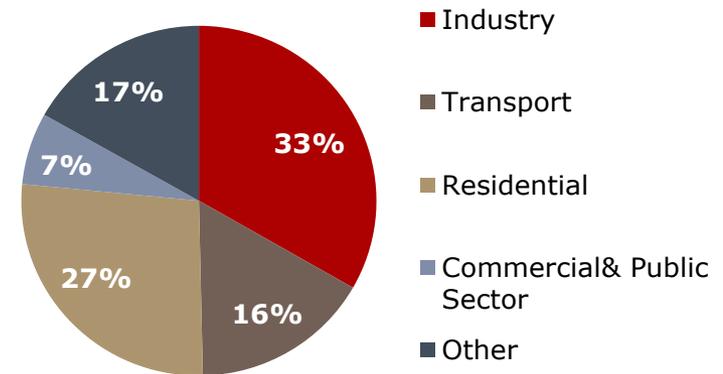
Enable the use of energy effectively and efficiently in the public sector.



The need for reductions in energy intensity enables the huge potential in energy efficiency projects in Turkey.

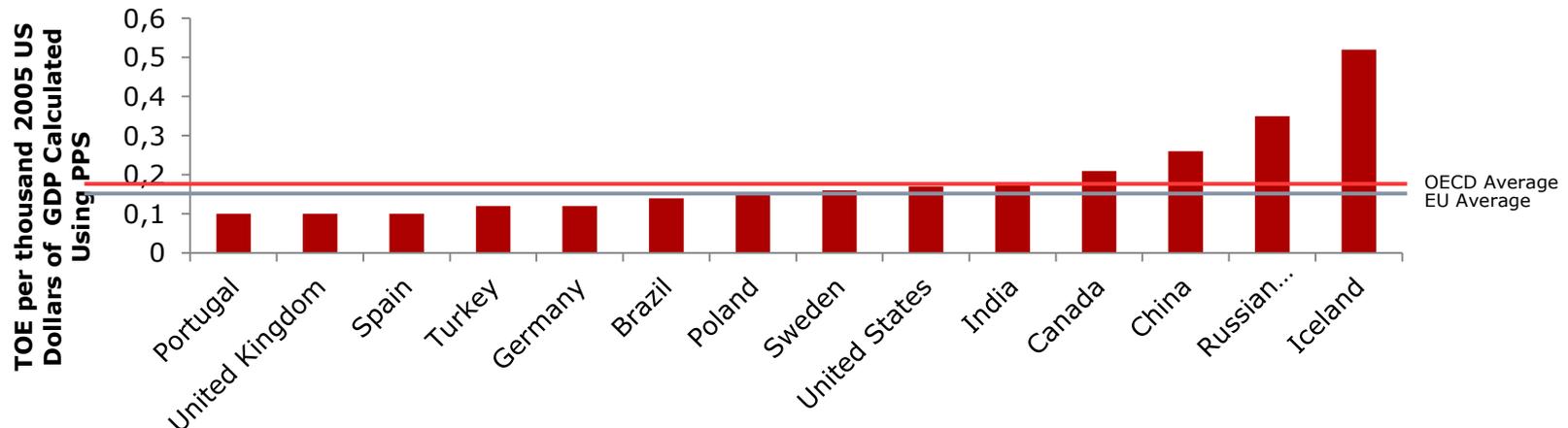
- When viewing total energy consumption, the industrial sector has the highest share with 33% in total amount. Approximately 50% of the total electricity consumption belongs to the industrial sector as well, and the same percentage is also true for the natural gas consumption of industries.
- The basic structure of the major industries in Turkey is energy-intensive and includes such things as the base metal, chemical, stone and soil industries.

Figure 35: Energy Consumption by Sectors, 2012



Source: EIU estimates

Figure 36: Energy Intensity of Selected Countries, 2010



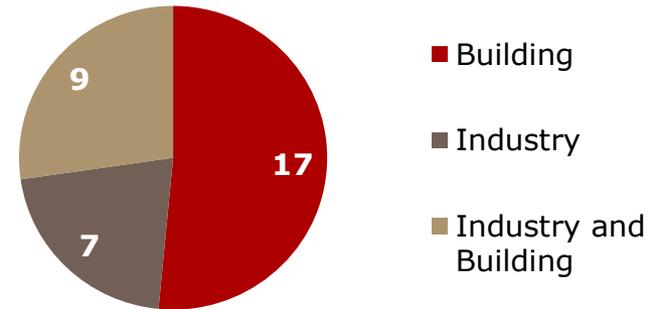
Source: OECD Fact book



Authorized energy efficiency consulting companies (ESCOs) are performing energy efficiency services in industrial enterprises and buildings.

- Companies that provide energy efficiency services require authorization by the Directorate of Renewable Energy (YEGM) or institutions authorized by YEGM, such as NGOs and universities.
- Energy efficiency services refer to consulting, training, audit and implementation services. The activities conducted by authorized companies (ESCOs) are:
 - Carrying out training, certification, audit and consulting activities under service contracts made with industrial establishments, building owners or management.
 - Preparing projects for implementing the measures identified by energy efficiency audits.
 - Implementing changes according to the projects under implementation agreements to guarantee energy savings.
- There are two types of authorization certificates: one for the industrial sector and one for the building sector. The two types of certificates call for different benchmarks, e.g. in order to obtain an industry ESCO authorization, the ESCO should provide proof of significant experience in at least one of the industrial segments such as iron, steel, cement, etc., and should limit its activity to the sector that it has proven experience.

Figure 37: Number of Energy Efficiency Companies in Turkey



Source: The Directorate General of Renewable Energy, 2013

- Currently, there are 33 active energy efficiency consulting companies in Turkey. 9 of them are authorized to provide certificates for both industry and buildings, 17 of them are authorized to provide building certificates and 7 of them are authorized to provide industry certificates.
- Certified Energy Managers offer another option when adopting efficiency measures. Delegating or employing a Certified Energy Manager is an obligation for high energy consuming industrial establishments and buildings. Energy managers are responsible for activities such as analyzing energy consuming equipment including their maintenance and calibration, market analysis for efficiency improvement projects, energy audits as well as presenting the feasibility of these projects to the management board. In Turkey, there are approximately 5000 Certified Energy Managers as of 2013.



The total amount of savings potential for the industrial sector is estimated at 5.7 million TOE, which corresponds to 2.85 billion USD.

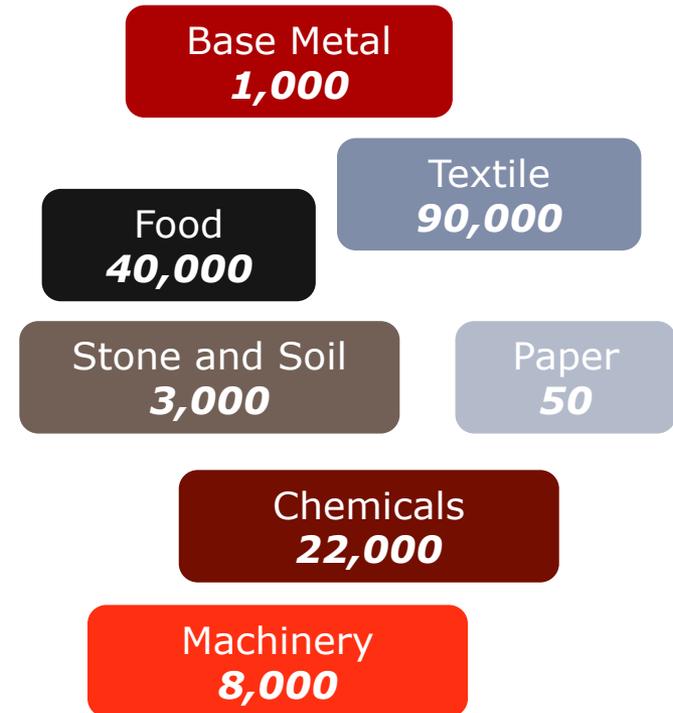
- The high energy intensity of the industrial sector means an estimated 20% potential for energy efficiency. The energy efficiency and savings potential by sub-sectors are shown in Table 10.

Table 10: Energy Efficiency and Saving Potential by Sectors

Sub-Sectors	Energy Efficiency Potential (%)	Total Energy Usage by Industry (%)	Amount of Potential Saving(TOE)
Base Metal	20	25	1,531,400
Stone and Soil	18	19	1,047,478
Textile	35	8.5	911,183
Chemical	18	12	661,565
Food	25	7.5	574,275
Paper	20	4	245,024
Machinery	10	3	91,884
Other	10	21	643,188
Total			5,705,996

*1 TOE is taken as 500 USD.

Number of Industrial Enterprises



Investment Tip: In Turkey, due to the large number of energy intensive industrial facilities, there is great opportunity for energy efficiency services.

*The number of enterprises are taken from sector reports of the Ministry of Industry and sector associations.



Source: Chamber of Mechanical Engineers

Investment Support and Promotion Agency of Turkey

Energy efficiency applications in the industrial sector offer various business opportunities along with integrated solutions.

Consulting

Consulting services cover:

- audits for energy consumption, heat, waste, water use, etc.
- identification of projects for improvement of energy and resource use and
- conducting the feasibility studies for these projects

Implementation (Turn-Key)

Implementation refers to the services that both design energy efficiency measures and their implementation to achieve the benchmark that has been established by the ESCO. According to regulation, ESCOs are required to commit to the performance level in the design phase and undersign it.

Equipment & Material

Equipment and material covers the production and sales of energy efficient equipment, ranging from cogeneration and trigeneration equipment, efficient motors, energy management software, lighting equipment, insulation materials, etc.

SIEMENS Schneider Electric



Investment Tip: Opportunities exist in all three segments, but especially within implementation and equipment & material. Global companies are already active in these segments. Highly qualified turn-key solution providers are needed as the energy efficiency sector is in its earliest stage, and know-how is of the utmost importance.



Buildings have an energy efficiency potential of 30%.

12%
Water

40%
CO₂ Emission

71%
Electricity

65%
**Waste
Generation**

- In Turkey, buildings account for 12% of total water usage, 65% of total waste, 71% of electricity consumption and 40% of the total CO₂ emissions. ¹
- In buildings, the majority of energy is consumed for heating and cooling. Insulation can improve energy savings by 50-60%. According to the Energy Efficiency Association of Turkey, only 5% of the buildings in Turkey are insulated.
- On the lighting side, compact fluorescent bulbs or other energy efficient bulb usage is not common in Turkey. Following the Memorandum of the Prime Ministry in 2008, 1,828,742 inefficient bulbs were replaced with 1,758,934 compact fluorescent ones in public institutions. In addition to lighting and insulation, A class (energy efficient) home appliances can improve energy efficiency in buildings. Energy efficient appliances typically have higher initial costs and therefore, are not preferred by consumers. However, with increasing awareness about energy efficiency, this is expected to change.

1: Energy Efficiency Magazine,2012

- According to the Ministry of Energy and Natural Resources, the energy efficiency potential of buildings is 30%.
- According to the Energy Efficiency Law, the following measures are planned to increase the energy efficiency in buildings:
- Systems that allow the distribution of heating costs based on the quantity of heat consumption by central or local heat/temperature control devices for the buildings with a central heating system
- Providing energy identity certification, which as a minimum, has information regarding energy requirements, insulation characteristics, efficiency of heating and/or cooling systems and the energy consumption classification of the building.
- Appointment of Energy Managers.

Investment Tip: The Urban Renewal Project imposes renewal and strengthening of building stock and it presents a considerable opportunity for energy efficiency services. New buildings will be designed and built according to new building/energy efficiency standards. By 2013, about 47,000 buildings were constructed under these new standards. The target is to increase this number to 200,000 by the end of 2013 and to 400,000 by the end of 2014.



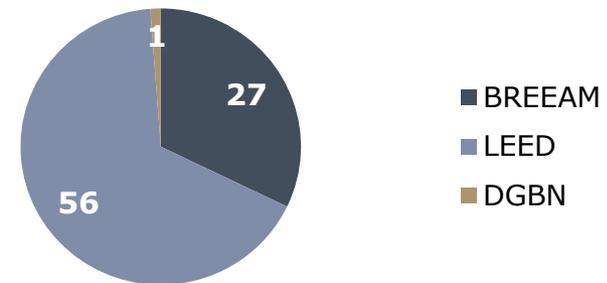
The concept of green buildings is an emerging trend in Turkey - and all over the world.

- Green buildings are constructions that are environmentally responsible and resource efficient throughout a building's life-cycle: from site selection to design, construction, operation, maintenance, renovation and destruction.
- Green buildings are certified by several green building institutions. Green building certification delivers energy and water efficient, healthy, environmentally friendly cost saving buildings to the market.¹

Investment Tip: The Ministry of Health has recently required all new hospital buildings to be «green», which paves the way for green public buildings and indicates the potential for growth within this sector.

1: U.S. Green Building Council

Figure 38: Number of Certified Buildings, Turkey



Source: Green Building Association of Turkey

- In Turkey, there are 84 certified green buildings. The majority of them are certified by LEED.
- As of January 2013, the Turkish Standard Institution (TSE) also finalized its study regarding issuing green building certifications. With this latest development, the number of green building certificates in Turkey is expected to rise.
- Although the cost of green building construction is more than regular construction by approx. 5-10%, the overall energy cost can be reduced by upwards of 50-70% in these buildings due to improvements in efficiency.
- Under the scope of the Urban Renewal Project, an estimated 6.5 million buildings are to be rebuilt in Turkey. Using green building practices, 30,000 tWh energy can be saved annually from these buildings.



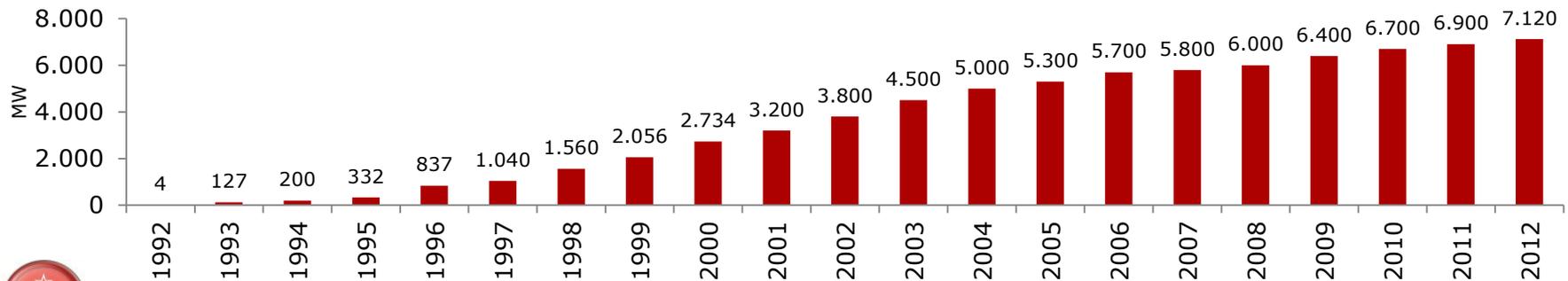
Waste heat recovery, cogeneration and trigeneration technologies offer opportunities in efficient energy generation.

- According to the Turkish Cogeneration and Clean Energy Association, when electricity is produced with a steam turbine of 100 MW, 25 MW of heat energy is wasted per hour.
- Utilization of waste heat in thermal plants is an opportunity for energy efficiency. In Turkey, 20,000 MW of thermal capacity is available by utilizing this waste.
- The waste heat can be utilized in various areas such as greenhouse cultivation, cooling and heating systems and regional heating.
- In addition, cogeneration and trigeneration technologies are becoming widespread. Cogeneration and trigeneration mean simultaneous generation of electrical power and thermal energy.
- These technologies achieve greater energy efficiency than conventional systems producing power, heat or cooling separately. These technologies are suitable for:
 - Hotels
 - Hospitals and health facilities
 - Shopping centers
 - Educational facilities and universities
 - Multi-dwelling residential buildings
- In industrial facilities the use of these technologies has been common since 1992. Especially in industries such as cement, steel and glass manufacturing, which require high temperatures for these processes, would benefit greatly from waste heat recovery systems.
- In Turkey, only a small number of hospitals and shopping centers benefit from cogeneration or trigeneration. However, there is growing awareness of the benefits of these investments.
- In addition to an increase in efficiency, these systems allow on-site generation where consumption and generation are within the same location. Thus, transmission and distribution losses are prevented.

Major Players in the Sector are:



Figure 39: Cogeneration Development, Turkey



Smart Grid technology will pave the way for several new applications - and will create a paradigm shift.

- According to the Institute of Electrical and Electronics Engineers, the smart grid has come to describe the next-generation electrical power system that is typified by the increased use of communications and information technology in the generation, delivery and consumption of electrical energy.
- Balancing supply and demand has become increasingly difficult due to intermittent nature of renewable resources and electricity consumption habits. The smart grid is the solution that will balance supply and demand, reduce struggles with shortages during peak demand as well as increase service quality.
- In fact, Turkey has witnessed the deployment of smart grid technology in the power market with AMI, SCADA and Energy Management Systems. These can be considered the key elements of the emerging smart grid systems.
- Application of SCADA is very common especially among electricity distribution companies due to requirements regarding the quality and continuity of electricity supply. Investments in these systems are expected to increase following the liberalization of the market due to increasing penalties related with quality requirements.
- Smart grids can be divided into three components. These are:

Advanced Metering Infrastructure

- Reducing loss & theft, quick restoration after power disturbances

Demand Response

- Reduce peak demand, decrease consumption

Grid Management Programs

- Automatic meter reading, reduce bad debt

Recipe for Demand Side Management : Demand Response

Demand response is defined as the changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.

In the Regulation on Increasing Efficiency in Energy Resources and Energy Use of 2011, participation of industrial and commercial consumers to such demand side management programs is included.

Since demand response reduces the need for investment in flexible, **peaking power** plants, increasing interest is expected regarding this issue.

Smart grids will enable the implementation of demand response practices and a possible demand response market like the ones in the US or France.

«Turkey will spend \$5 billion on smart grid technologies by 2015 to modernize its electricity sector» proceedings from Turkey's Smart Grid Workshop in February 2013.



YEGM promotes energy efficiency activities through incentive programs.

Support of Efficiency Improvement Projects

- Efficiency Improvement Projects refer to measures that eliminate energy waste and inefficiencies in industrial businesses.
- Businesses engaged in the production of goods, of which electricity consumption exceeds 1000 TOE except the ones engaging in electricity generation, and all kind of businesses engaged in the production of goods are able to receive this grant.
- To receive support, an energy audit should be conducted by an authorized energy efficiency company. Only the projects that are approved by YEGM can receive support and only as long as the project cost and payback period terms are satisfied.
- The maximum amount that can be granted to each project is 1 million TL, of which the payback period should be less than 2 years.
- Although the budget for this grant planned to allocate 5 million TL annually, only 20%-30% of the budget was utilized each year between 2009-2012. However, the number of projects that have applied for this grant in 2013 is greater than the total of the last 4 years combined. Thus, the grants to be allocated is expected to increase in the upcoming years.

Support of Voluntary Agreements

- Companies who commit to reducing their energy intensity by a minimum average of 10% in three years can enter into an agreement with YEGM and 20% of the company's energy cost will be covered up to a limit of 200,000 TL.
- The aim of these voluntary agreements is to promote the use of waste, cogeneration and renewables as energy sources.
- In 2009 and 2010, a total of 22 companies made agreements with YEGM, a very small number when compared to the total number of industrial enterprises in Turkey.



Several domestic and international financing options exist in addition to incentives provided by Turkish institutions.

The Small and Medium Industry Development Organization (KOSGEB)

- KOSGEB supports activities such as energy audit services, consultations for energy efficiency improvement projects and energy manager training programs that SMEs get from authorized energy efficiency companies.
- 50%-60% of the cost of these services are covered by KOSGEB as long as the maximum limits are not exceeded.



Turkey's Sustainable Energy Financing Facility (TurSEFF), Turkey's Mid-Size Sustainable Energy Financing Facility (MidSEFF)

- These entities were developed by the European Bank for Reconstruction and Development for energy efficiency projects.
- Energy efficiency projects in the industrial and the construction sector such as the thermal isolation of buildings, application of micro-cogeneration and trigeneration or building management systems are financed with the support of these credits.



The Technology Development Foundation of Turkey (TTGV)

- The aim is to ease the financing of energy efficiency projects such as waste utilization, improvement on production processes and technology improvements.
- The total amount of support varies between \$100,000 and \$1,000,000, and will reach a maximum of 50% of the total cost of the project. The repayment period is 4 years with a one year grace period.



Other Financing Options for Energy Efficiency Projects



Waste Water Treatment



Regulatory Structure and Incentives

Environmental Law

The Regulation on the Control of Water Pollution

The Regulation on the Principles and Procedures Regarding the Incentives Applied to Waste Water Treatment Facilities

Communiqué on the Technical Procedures of Waste Water Treatment Facilities

Regulation on Urban Waste Water Treatment

Public Institution:
The Ministry of Environment and Urban Planning



Some Waste Water Treatment Plant Equipment and Services Companies



According to the Regulation on the Principles and Procedures Regarding the Incentives Applied to Waste Water Treatment Facilities, the energy cost of these facilities can be covered up to 50% by the Ministry of Environment and Urban Planning.

- Within the scope of this incentive, the Ministry granted approximately 27 million TL to 159 facilities in 2012.
- **Today, with 412 waste water treatment facilities, 530 of 2950 municipalities are being served.**
- The Ministry has set a target regarding waste water treatment by 2023. According to this target, the Ministry plans to provide waste water treatment services to all of the municipalities by that date.



Waste water treatment has increased over the years, and the Ministry's target is 100% by 2023.

- According to the Turkish Statistical Institute, 76% of waste water discharged was treated in 2010.
- Looking at data for the history of waste water treatment shows that the percentage of treatment has increased significantly over years.
- Figure 40 shows that each year, Turkey spends a considerable amount of its public spending on waste water treatment.

Figure 40: Amount of Public Spending on Waste Water Management

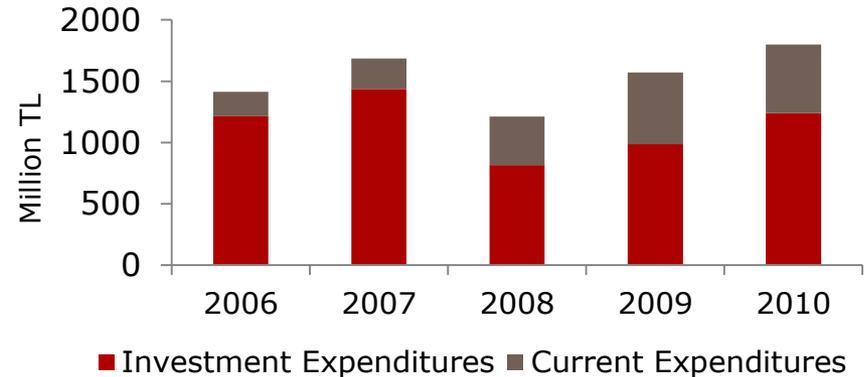
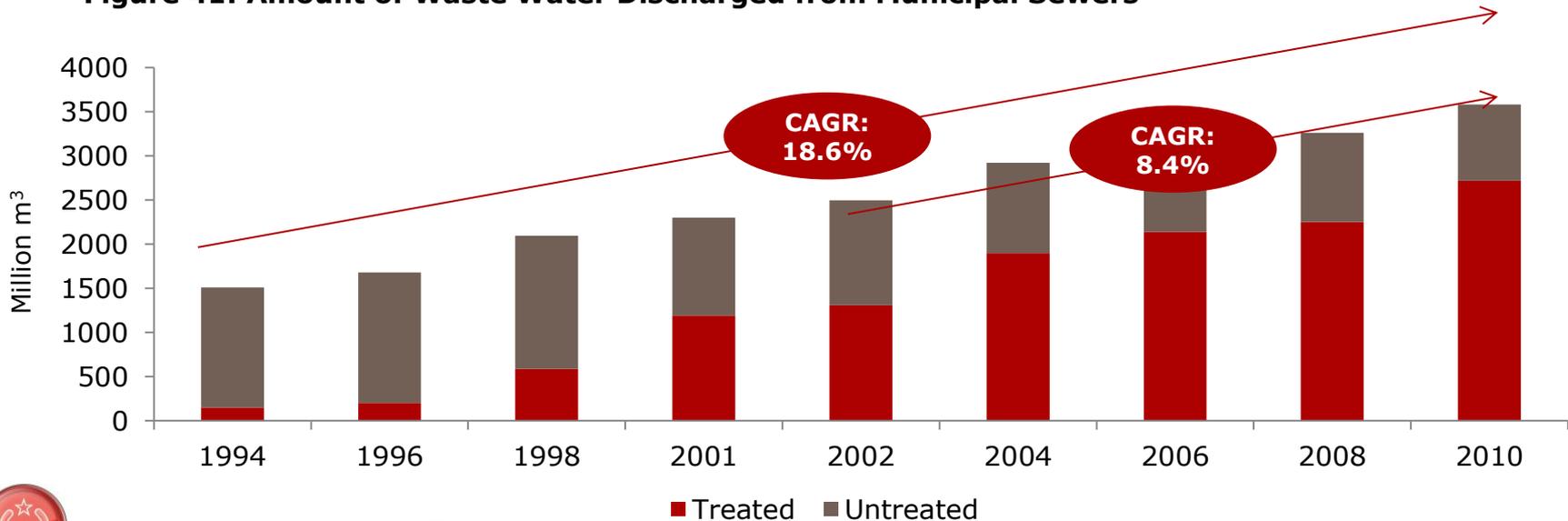


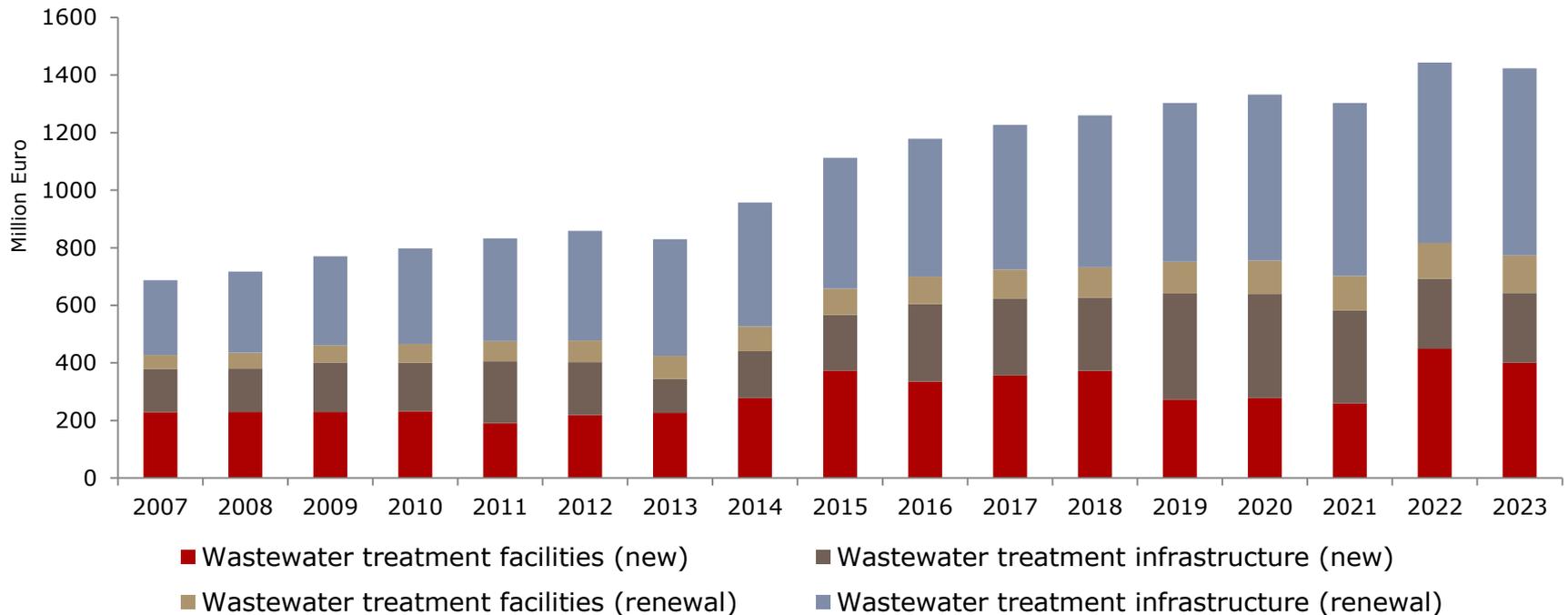
Figure 41: Amount of Waste Water Discharged from Municipal Sewers



There are huge investment needs regarding construction of waste water treatment facilities and infrastructure, as well as the renovation of existing ones.

In 2006 the Ministry of the Environment and Forestry* conducted a study within the scope of complying with the EU's environmental *acquis*. This study examined waste water treatment investment needs up to 2023 and put emphasis on the investment opportunities in this sector.

Figure 42: Waste Water Treatment Investment Needs



Source: EU Integrated Environmental Approximation Strategy, 2006

- **Investment Tip: The economic life-cycle of a waste water treatment facility is 10-15 years, which creates an investment need for renewal.**

*: The Ministry was divided into the Ministry of Environment and Urban Planning and the Ministry of Forestry and Water Works in 2011.



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