



Energy And Emission Analysis in the Highway Transportation Sector of Turkey

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ABSTRACT: This paper presents energy, emission analysis and emissions reducing policies aimed was examined in the transportation sector flows for the next decades in Turkey. The transportation sector is a two type in road, which commercial transportation sector and public service sector. The transportation sector using as a fossil fuels and Turkey is a country dependent on foreign countries that imports fossil fuel needs. The transport sector is responsible for about 14% of total final energy demand and import dependency was over about 90% by the year 2015 in Turkey. The transportation technologies and using alternative fuel in transportation sector; energy use, emissions reducing policies aims and dependent on crude oil imports for the transportation system is very important how it will changes in the next decades years. In addition to the impacts of using fossil fuels and alternative fuels together with energy polices and aimed at reducing emissions was investigated from the Turkey highway transportation sector.

Keywords: Turkey, transportation sector, energy policy, energy analysis, emissions.

I. INTRODUCTION

The importance of energy in economic development has been recognized almost universally and energy is accepted a prime factor in the generation of wealth and also a significant factor in economic development. Over the past two decades, as a result of industrial production-oriented and human transportation activities, the dramatic increase in environmental pollution and made this problem more apparent [1]. Generally, transportation system may be defined as consisting of the fixed as a planned network of elements or physical components facilities, the flow entities, vehicles by fuel types and the control system that permit people and goods to overcome, the friction of geographical space efficiently in order to participate in a timely manner in some desired activity. In all countries of the world, especially in developed and developing countries; energy consumption has risen rapidly in accordance with increase in economic growth in the last decades[2]. In the term 1998-2008 yearly average increase rate in Turkey's total final energy consumption is %3,81. It has seen that yearly average increases are about %3,56 for industry sector; %3,49 for building sector; %4,07 for transport sector and %7,44 for service sector for the same term. Due to the increase in personel car usage and investments in transportation service sector, it is draw attention that the highest increases recorded in last decade in these two sectors[3]. As developing country Turkey's energy demands, for all kind of energy was increased rapidly and since 1990, energy consumption is increasing at annual average rates of 4.3%. During the period 2000-2010, the primary energy consumption rate increased by 34.6% and it was reached 109.3 mtoe by the year 2010[4]. Oil has been one of the main energy sources in Turkey, accounting for some 28% of the country's total primary energy supply in 2011. According to the international energy agency's report for the year 2013; Turkey's Total Primary Energy Supply (TPES) has risen considerably from 24.4 million tonnes of oil equivalent (Mtoe) in 1973 to 114.1 Mtoe in 2011 at a compound annual growth rate of 4%. Total Primary Energy Supply (TPES) is most likely considered to continue to grow at a compound annual growth rate of around 4.5% from 2015 to 2030, rising to over 237 Mtoe in 2030[5]. The transportation sector has characteristics of commonly using crude oil fuel products. Turkey is not rich energy resources and import dependency was about 90% and will increase in time as energy consumption increases by the year 2012. In addition to taking steps to diversify Turkey's sources of supply, Ministry of Energy and Natural Resources has been working to establish a properly functioning internal energy market for the country's all energy sectors. The demand for alternative fuels has increasing rapidly in transportation the Turkey over the future years. 99% of petroleum products used in the transportation industry and percent 49.37% vehicles of transportation using of diesel fuel. The possible fuel

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policies must be evaluated in use of their potential cost, emission of exhaust gases, and determinations for strengthening to Turkey transportation sector of energy security. For this reason, new and renewable energy sources to investigate an alternative to oil for our country both economically and strategically very important as well. This study, analysis is based on recent values, on fuel consumption, energy and emission analysis in the highway transportation sector which was designed and conducted in for near future in the Turkey. This information is included the (collection) detailed data about the type of vehicles and quantity of fuel used for various, as well as the potential of using as transportation fuels. Figure 1 show that energy variety used primary energy consumption by the terms includes main sectors in Turkey[6,7].

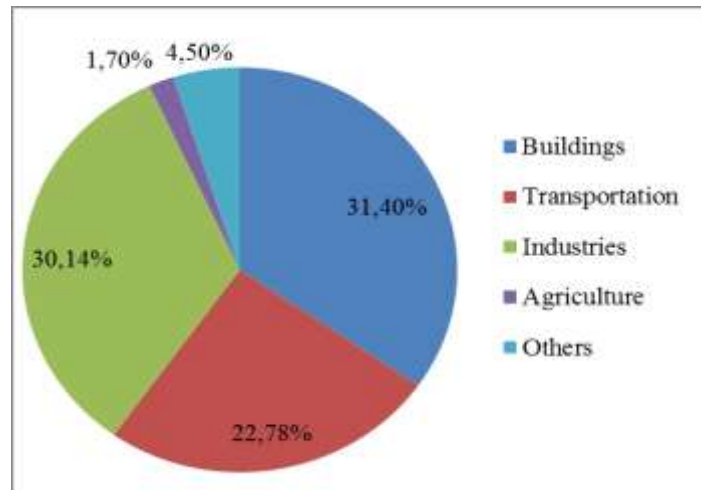


Figure 1. Distribution of sectoral energy consumption in Turkey [7]

At the end of May 2016, the total number of road motor vehicles registered reached 20 456 556. The total number of road motor vehicles registered to the traffic reached 20 million 456 thousand 556 by the end of May 2016. Within the total, cars represented 53.2%, followed by small trucks 16.3%, motorcycles 14.5%, tractors 8.5%, trucks 4%, minibuses 2.2%, buses 1.1% and special purpose vehicles 0.2%. Table 1 show that the number of road motor vehicles and vehicles of classified by years, 2002-2016 in Turkey. As a Table 1, in Turkey, the number of vehicles reached 20 456 556 of which 4153923 lorry and trucks, 456 456 minibus, 219 308 bus, 10885629 car are classified vehicles. The gasoline engine and the diesel engine (represent) most of the internal combustion engines for the automobile and as an alternative fuel using LPG is increasing in the last decade year. The different type diesel engines were commonly using for the lorries, trucks, city bus, intercity bus and others. Today, the gasoline and the diesel fuel, LPG are still the main fuels for transportation sector in Turkey and the demand for these types of fuel have been tend increased over the next years[8].

Table 1 The number of road motor vehicles and vehicles of classified by years 2002 - 2016 in Turkey[8].

| The number of road motor vehicles by years, 2002 - 2016 | | | | | | | | | |
|---|------------|------------|---------|---------|-------------|----------------------|------------|---------|-----------|
| Year | Total | Car | Minibus | Bus | Small truck | Truck ⁽²⁾ | Motorcycle | Special | Tractor |
| 2002 | 8 655 170 | 4 600 140 | 241 700 | 120 097 | 875 381 | 567 152 | 1 046 907 | 23 666 | 1 180 127 |
| 2003 | 8 903 843 | 4 700 343 | 245 394 | 123 500 | 973 457 | 579 010 | 1 073 415 | 24 468 | 1 184 256 |
| 2004 | 10 236 357 | 5 400 440 | 318 954 | 152 712 | 1 259 867 | 647 420 | 1 218 677 | 28 004 | 1 210 283 |
| 2005 | 11 145 826 | 5 772 745 | 338 539 | 163 390 | 1 475 057 | 676 929 | 1 441 066 | 30 333 | 1 247 767 |
| 2006 | 12 227 393 | 6 140 992 | 357 523 | 175 949 | 1 695 624 | 709 535 | 1 822 831 | 34 260 | 1 290 679 |
| 2007 | 13 022 945 | 6 472 156 | 372 601 | 189 128 | 1 890 459 | 729 202 | 2 003 492 | 38 573 | 1 327 334 |
| 2008 | 13 765 395 | 6 796 629 | 383 548 | 199 934 | 2 066 007 | 744 217 | 2 181 383 | 35 100 | 1 358 577 |
| 2009 | 14 316 700 | 7 093 964 | 384 053 | 201 033 | 2 204 951 | 727 302 | 2 303 261 | 34 104 | 1 368 032 |
| 2010 | 15 095 603 | 7 544 871 | 386 973 | 208 510 | 2 399 038 | 726 359 | 2 389 488 | 35 492 | 1 404 872 |
| 2011 | 16 089 528 | 8 113 111 | 389 435 | 219 906 | 2 611 104 | 728 458 | 2 527 190 | 34 116 | 1 466 208 |
| 2012 | 17 033 413 | 8 648 875 | 396 119 | 235 949 | 2 794 606 | 751 650 | 2 657 722 | 33 071 | 1 515 421 |
| 2013 | 17 939 447 | 9 283 923 | 421 848 | 219 885 | 2 933 050 | 755 950 | 2 722 826 | 36 148 | 1 565 817 |
| 2014 | 18 828 721 | 9 857 915 | 427 264 | 211 200 | 3 062 479 | 773 728 | 2 828 466 | 40 731 | 1 626 938 |
| 2015 | 19 994 472 | 10 589 337 | 449 213 | 217 056 | 3 255 299 | 804 319 | 2 938 364 | 45 732 | 1 695 152 |
| 2016 ⁽¹⁾ | 20 456 556 | 10 885 629 | 456 456 | 219 308 | 3 338 065 | 815 858 | 2 968 700 | 48 199 | 1 724 341 |

TurkStat, Road Motor Vehicles, May 2016

(1) Data is by the end of May.

(2) It also covers heavy vehicles (tractor truck, dumper truck, tanker, garbage truck etc.).

II. ENERGY CONSUMPTION AND DIVERSITY AT THE TRANSPORTATION SECTOR IN TURKEY

The increase in energy consumption continued between 2004 and 2008 equalling 102 million tons of oil equivalents. Together with the global economic crisis, energy consumption slowed down since mid-2008 with an annual growth rate of 1.4% in 2008, compared to a rate of 5.3% in 2007. The decline continued in 2009 with an estimated fall of 5.3%; however an increase of 2.5% annually is realized thereafter between 2010 and 2013. Turkey's primary energy consumption increased by 9.8% in 2010 compared to the previous year, according to an international company's report. The country consumed energy equivalent to 110.9 million tons of oil during 2010, 9.8 % increase from 2009. Oil consumption in Turkey in 2010 was 28.7 million tons, accounting for 0.7% of the world total a 1.7% increase compared to 2009, when it was 28.2 million tons, the report read. This is equivalent to approximately 3% of national primarily energy consumption in that year. On the other hand, economic development and the population are increasing rapidly consequently, the demand to engine vehicles is increasing in the transportation sector. Figure 1 shows the distribution of final energy demand for various types of petroleum products and natural gas that are consumed domestic. It would be interesting to know what underlies this statistic and it estimated that car ownership has continued to expand countered by oil-fired power generation being replaced with coal and gas. Most recent growth in energy consumption has been gas and coal. Turkey imports gas by pipeline from Russia, Azerbaijan and from Iran. It appears imports from Iran have continued despite sanctions. Turkey also receives LNG from all over the world but Algeria is the main supplier. Turkey's energy consumption has increased by about 45% since 2000, when it was 76.7 million tons, according to data published in the report and the amount accounted for 0.9% of total world energy consumption. With a rapidly growing economy, Turkey has become one of the fastest growing energy markets in the world. Turkey has been experiencing rapid demand growth in all segments of the energy sector for decades. Projections show that demand growth trend will continue. The limits of Turkey's domestic energy sources in light of its growing energy demand have resulted in dependency on energy imports, primarily of oil and gas. At present, around 25% of the total energy demand is being met by domestic resources, while the rest is being provided from a diversified portfolio of imports. The total primary energy demand is estimated to reach 218 Mtoe by 2023 from the current level of 125 Mtoe. Currently, primary energy demand is met by natural gas (35%), coal (28,5%), oil (27%), hydro (7%), and other renewables (2,5%). Turkey imports around 89% of its oil supplies. In 2015, Turkey imported 25 million tons of crude oil in 2015 mainly from Iraq (45,6%), Iran (22,4%), Russia (12,4%) Saudi Arabia (9,6%), Colombia (3,5%), Kazakhstan (2,6%) and Nigeria (2,1%). Figure 2 shows that Turkey's crude oil imports by source[6,9].

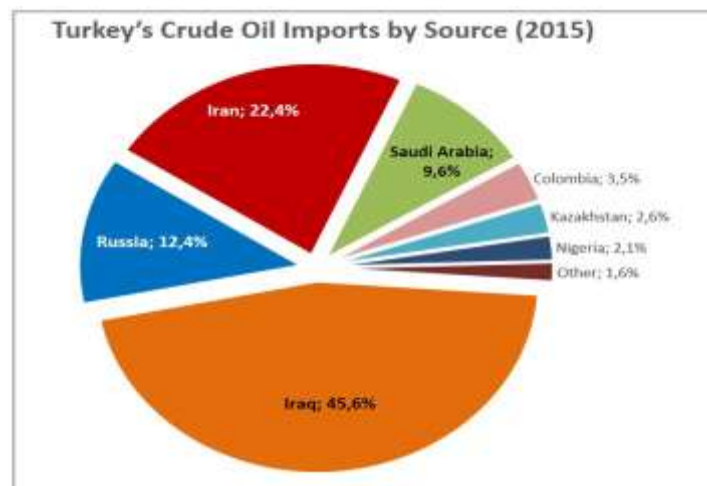


Figure 2 Turkey's Crude Oil Imports by Source[9]

Although it is a Middle Eastern country as a Geographically, Turkey can very little oil producing country and is nearly fully dependent on import oil from other countries. Turkey is very dependent on crude oil imports and the share of crude oil in energy consumption is 40% and its dependence on crude oil is also increasing day by day. Turkey imported 90% of its oil needs from different countries, generally at the Middle East region. Crude oil has been the major energy source for economic and social developments. Price fluctuations and price of increasing on crude oil, Turkey's economy is adversely affected. Depending on the increasing number of vehicles; concern about energy consumption have been increasing in Turkey, especially, transportation which was probably affected the most by the economic and technological changes that the country has seem during the next decades. Crude oil has primarily dominated especially transportation sector the

Turkey energy sector for future decades. Primary energy consumption between 2007 and 2012 increased at 2% and according to the Economist Intelligence Unit (EIU), energy demand in Turkey is estimated that increase an annual rate of 4.5% until 2015 in alignment with the growth expected within the GDP[10]. All energy consumption classified among four main sector, transportation, industries, buildings(heating systems for residential) and others in Turkey. The households, services and agriculture sector represents around 40% of the country’s final energy consumption. Despite a drop in 2009, industry (including non-energy uses) accounts for 40% while the transport sector accounts for 20% of final energy consumption[9]. Figure 3 shows that road transportation sector fuel consumption in Turkey. Table 2 shows the overall transportation sector fuel consumption for the years 2010-2025 in Turkey.

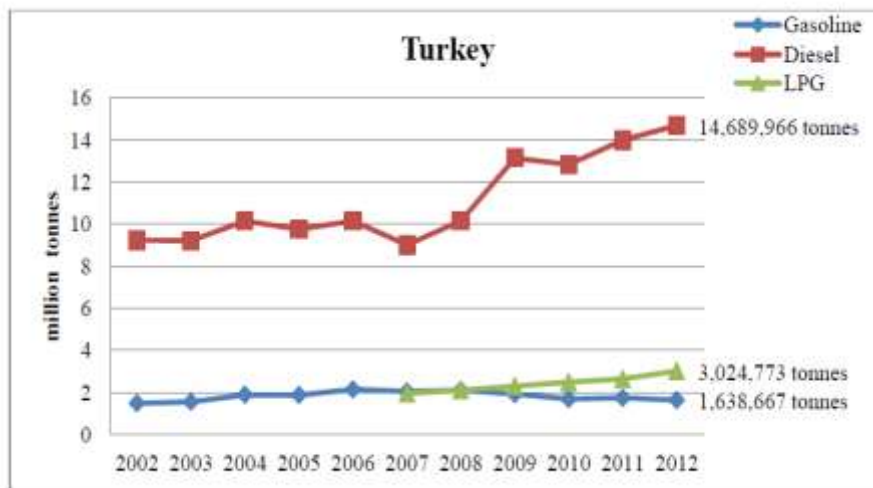


Figure 3 Road transportation sector fuel consumption[11]

Diesel fuel, gasoline and LPG have been using mainly for transportation sector. The transport sector is the third largest energy consumer sector in Turkey. The transportation sector market was dominated by gasoline, diesel, and LPG in Turkey. According to distribution sales of gasoline, diesel fuel and LPG increased by 3.8%, which corresponds to 18.2 million tons in 2012. On the other hand the liquefied petroleum gas(LPG) vehicles have also captured a significant market share of about 16 million vehicles in 2011(mostly in Turkey, South Korea, Poland, Italy, and Australia), which represents about 3% of the global passenger car fleet. Crude oil imports increased by 7% and reached 19.5 million tons in 2012. Turkey is still lagging behind the per capita energy consumption indicator in comparison with the OECD average, which shows that there is still more room for further growth, in alignment with increasing per capita GDP. As of 2012, Turkey is below the OECD average of 62.8 BTU per capita compared to 182 million BTU per capita OECD average[12]. Gasoline, diesel and LPG sales rise in Turkey in 2015, compared to 2014. Diesel sales increased almost 17% for the year compared to 2014 overshadowing sales of gasoline and autogas liquefied petroleum gas (LPG). For the 2015 diesel sales reached 2.05 million cubic meters while gasoline sales rose by 13.08 % to 221,411 cubic meters and autogas LPG increased by 5.84% to 248,706 tonnes. Additionally, gasoline, diesel and autogas LPG sales in Turkey increased in 2015, compared to the same period of the previous year. During the 2015, total diesel sales in the country rose by 13% to reach 21.9 million cubic meters, compared to 19.4 million cubic meters recorded in the same period of 2014. In the January to November period, Turkey's total gasoline sales increased to 2.5 million cubic meters up by 7.69 % compared to 2014. The total autogas LPG sales rose by 5.13 % to reach 2.8 million tonnes, from 2.6 million tonnes last year[13].

Table 2 Distribution of cars registered to the traffic according to fuel type, 2004-2016[8]

| Year | Total | Gasoline | (%) | Diesel | (%) | LPG | (%) | Unknown ⁽²⁾ | (%) |
|---------------------|-----------|-----------|------|-----------|------|-----------|------|------------------------|-----|
| 2004 | 5 400 440 | 4 062 486 | 75,2 | 252 629 | 4,7 | 793 081 | 14,7 | 292 244 | 5,4 |
| 2005 | 5 772 745 | 3 883 101 | 67,3 | 394 617 | 6,8 | 1 259 327 | 21,8 | 235 700 | 4,1 |
| 2006 | 6 140 992 | 3 838 598 | 62,5 | 583 794 | 9,5 | 1 522 790 | 24,8 | 195 810 | 3,2 |
| 2007 | 6 472 156 | 3 714 973 | 57,4 | 763 946 | 11,8 | 1 826 126 | 28,2 | 167 111 | 2,6 |
| 2008 | 6 796 629 | 3 531 763 | 52,0 | 947 727 | 13,9 | 2 214 661 | 32,6 | 102 478 | 1,5 |
| 2009 | 7 093 964 | 3 373 875 | 47,6 | 1 111 822 | 15,7 | 2 525 449 | 35,6 | 82 818 | 1,2 |
| 2010 | 7 544 871 | 3 191 964 | 42,3 | 1 381 631 | 18,3 | 2 900 034 | 38,4 | 71 242 | 0,9 |
| 2011 | 8 113 111 | 3 036 129 | 37,4 | 1 756 034 | 21,6 | 3 259 288 | 40,2 | 61 660 | 0,8 |
| 2012 | 8 648 875 | 2 929 216 | 33,9 | 2 101 206 | 24,3 | 3 569 143 | 41,3 | 49 310 | 0,6 |
| 2013 | 9 283 923 | 2 888 610 | 31,1 | 2 497 209 | 26,9 | 3 852 336 | 41,5 | 45 768 | 0,5 |
| 2014 ⁽¹⁾ | 9 514 881 | 2 871 468 | 30,2 | 2 655 386 | 27,9 | 3 943 147 | 41,4 | 44 880 | 0,5 |

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| | | | | | | | | | |
|--|------------|-----------|------|-----------|------|-----------|------|--------|-----|
| 2014 | 9 857 915 | 2 855 078 | 29,0 | 2 882 885 | 29,2 | 4 076 730 | 41,4 | 43 222 | 0,4 |
| 2015 | 10 589 337 | 2 927 720 | 27,6 | 3 345 951 | 31,6 | 4 272 044 | 40,3 | 43 622 | 0,1 |
| 2016 ⁽¹⁾ | 11 254 357 | 3 025 321 | 26,9 | 3 764 105 | 33,4 | 4 421 974 | 39,3 | 42 957 | 0,1 |
| TurkStat, Road Motor Vehicles, November 2016 Figures in table may not add up to totals due to rounding. (1) Data is by the end of November. (2) Unknown includes the cars that the type of fuel field in the licence is filled incorrectly or left blank and electric cars. | | | | | | | | | |

III. DESCRIPTION OF THE TRANSPORTATION SECTOR

This part of the article is a study of analyzing the transportation sector in Turkey. In 2016, there were about 20,5 billion engine of vehicles are motion in Turkish roads of which 85% of them transportation passenger vehicles. During the last 5 years, a great of developments occurred in the transportation sector, vehicle of number, assortment of vehicles, improvement of motorway and roads. In Turkey, the number of vehicles reached 20,5 billion and Table 2 shows vehicles of classified for fuel types as a 2004- 2016. The gasoline engine and the diesel engine (represent) most of the internal combustion engines for the automobile and as an alternative fuel using LPG is increasing in the last year. The different type diesel engines are commonly using for lorries, trucks, city bus, intercity bus and others. Today, the gasoline and the diesel fuel, LPG are still the main fuels for transportation sector in Turkey and the demand for these types of fuel have been tend increased over the next years. In the other hand, reducing emissions will require some action on the part of the government. The transportation sector has increasing to a great of pollution problems, including air pollution, climate changes, greenhouse effect, healthy, dependence on foreign oil and for solve the pollution problems the need for compulsory choices oil production or protection of environmental security. Table 2 shows that distribution of vehicles registered to the according to fuel type in Turkish roads. [14].

The government has to adopted energy prices and fuel consumption policy; there is no special programs and privilege for inventors and investors to encourage the use of renewable fuels in Turkey. Because of these reasons, the most cost-effective national renewable alternative fuel source is not competitive compared with equivalent conventional fuels systems. So in addition to use of fossil fuel for transportation sector vehicles, renewable alternative fuels should be considered for all transportation sectors, where their financial attractiveness is rising compared with other conventional energy systems. Some approaches has different advantages; such as the diversity of alternative fuels sources, less dependence on imported oil decreases pollution emissions to the environment and help to economy to growing at higher rates. The annual average increase in crude oil and fuel products prices is at least 25% in Turkey. For this reason energy saving is very important and the energy saving ratio can be increase when use of advanced technology engines to overall vehicles. The reasons for the excessive increase in fuel consumption in the transportation sector; in transportation sector, is considered to be relatively increases due to excessive using vehicles and depending on the number of vehicles on the roads.

IV. ALTERNATIVES FUELS IN TRANSPORTATION SECTOR FOR FUTURE.

Turkey is not rich in energy sources and import dependency was about 90% by the year 2012 and energy consumption is constantly increasing year after year. Energy policy very important for determining future national energy needs and Turkey have to developed national energy policy. The main reason behind this is the political, several armed conflicts and war in the Middle East. Currently, it is difficult to make assumptions regarding the future, national energy policy, due to prevailing unstable political conditions, economic development and investment sources to the problem and conditions of region. However, Turkey in general terms national energy policy will continue to be the major policy to future. Future fuels demand can either be closely linked to macroeconomic construction and based on detailed inventories of fossil fuels or alternative on specific fuel technologies for transportation sector. Turkey has plenty of various new and renewable energy sources, such as oil shale, solar, geothermal, wind and biomass energy. Also, Turkey has very rich agricultural products and many opportunities exist to improve the alternative energy resources such as bio mass, and biodiesel and bio oils. By 2030, Turkey can meet almost 50% of its power demand from renewable energy resources; mainly solar, wind and hydropower. A renewables-based energy strategy could be cost-comparable to a coal-based strategy. Moreover, a renewables-based strategy could allow Turkey to anchor its GHG emissions from power generation slightly above current levels and limit the pressure on its foreign trade balance. Because of increasing in energy costs in the supply chain is undertaken by all stakeholders, energy policies are seriously affecting economic and social life all over the world as well as in Turkey. Turkey's primary energy consumption's 13.9 % and primary petroleum consumption's 50.8 % used in transport sector. Almost all of the energy used in the transport sector (97.1%) is petroleum products. Turkey's petroleum production compensate only 7-9 % of consumption and remaining 91-93 % part is compensated with importation, therefore it can be said that energy saving and efficient use of energy in transport sector has a great importance. Energy is not the only factor that affects choosing transport type, but it's an important factor and getting more important. Economic growth,

environmental degradation, energy and transport policies should be recognized in order to improve the energy efficiency in transport sector. All measures that should reduce petroleum consumption and greenhouse gas emissions without affecting economic growth may be undertaken. To evaluate the energy sustainability degree of transport sector, it is necessary to determine the driving factors influencing transport-related energy consumption such as economic growth, energy price, urban population, transport activity, motorization rate, traveling distance, park structure, vehicle types, vehicle age, urbanization, national road network and transport intensity. The main objective was to define cause and effect relationships between these indicators in order to formulate appropriate policies increasing the energy sustainability in the transport sector[15,16].

As a result, it would be reduced demand to imports oil for future years and will be created new industrial sectors for businessmen and workers. In this sector fuel efficiency should be promoted at the highest decision making level in order to meet future-term fuel demands and a comprehensive fuel-thrift policy must be establishment as a main aim in the national fuel program. This program should take into account the conventional fuel, alternative fuel, mix fuel and fuel technologies being employed in the different economic sector. This aim; include periodic cost studies, create incentives to encourage fuel sources conservation programs, improve technical training and public programs for common sense, and participation to invest in fuel and alternative renewable fuels and air pollution policy programs for encourages private sector.

V. THE TRANSPORT SECTOR FUELS AND EMISSIONS ANALYSIS

Industrial production facilities and motor vehicles generate air pollution, triggering and accelerating global warming. Motor vehicles generate the importance of the pollutants on human and environment that stem from vehicles like carbon monoxide (CO), hydrocarbon (HC), nitrogen oxide (NO_x), particle substance (PM), sulphur (S), lead (Pb) and volatile organic compounds (VOCs) increases of the air pollution. It is done that highways have a part over %90 in freight and passenger transportation in Turkey and almost all of the freight and passenger transportation is made by road vehicles[17]. Depending on the vehicle increases in the transportation, the amount of the pollutants resulting from the vehicles is estimated in accordance with changes of the total number of vehicles in Turkey until 2030. According to these estimates, emissions and amounts due to transportation, total number of vehicles in the years 2020 about 25 million and in the year 2030 is about 30 million respectively, and the amount of total exhaust emission (CO, PM, HC, NO_x, SO_x) is 130, and 200 million tons estimating respectively. Total amount of pollutants in 2020 increased %66 compared with 2010 and 2030 increased %64 according to 2020. While number of vehicles increase 116 %, amount of pollutants is estimated to increase 174% in 2030 compared with 2010. An energy-economic model is introduced to find the impacts of practical use of oil fuels vehicles on energy consumption and CO₂ emission effect on the greenhouse in the transportation sector. The first point that requires clarifications is a key in energy change from gasoline to LPG and the second point in this study is seen an economic solution of alternative energy systems for transportation sector. A transportation of vehicles model for evaluating, CO₂ emissions policies should incorporate transportation technologies, economic and environmental impacts. Development technologies and it is efficiency, improvement are factors that should be included for this model as well. Today, CO₂ emission per capita are 2,9 tons/capita in Turkey which is much less than those of the World and OECD averages i.e. 3,87 tons/capita and 11 tons/capita respectively. Due to the inadequacy of carbon emission reduction policies, the upward trend in Turkey's CO₂ emissions is expected to continue up until 2030. CO₂ emissions were about 363 million ton in 2013 and expected to increase to 852 million tons by 2030 under high growth predictions. It is estimated that, total CO₂ emissions to increase at an average rate of 5.8% year and reach 871 million t/year by 2025[17, 18, 19].

It is obvious that gasoline, diesel fuel and LPG are the dominant sources of energy for transportation sector. For example 1995, gasoline sharing ratio, including automobiles vehicles, was about 90% decreasing to 60% and LPG sharing ratio including automobile vehicles was about 10% increasing to reach 40-50% of the total fuel consumption of this sector in 2010. In the past decades, LPG consumption showed a rapid increase, i.e. about 3-4 times of that for same years, while gasoline consumption decreasing about ¼ ratios. This was to most probably due to the increase in gasoline price, and in contrast to LPG prices lower than gasoline and for useful LPG using in order to reduce emissions.(the gasoline engines were modified to for using LPG fuel systems.) It has been estimated that the transportation sector was responsible for about 12% of the national CO₂ emissions during 2010, due to energy use i.e. as a result of burning fossil fuels for various transportation applications. In the future, this ratio will increase following any increase in energy consumption in transportation sector if current conditions and technologies remain unchanged. Meanwhile, with higher gasoline prices and the expansion in, especially low price and low emission values, LPG has seen as a more attractive alternative fuel due to its reliability and clearness compared with gasoline for gasoline engine cars. Due to the reasons attributed to these properties, it constitutes a high proportion of LPG consumption as an alternative fuel in the transport sector. Also, because of the main transportation fuel the diesel fuel compare with other alternative fuels, was has become more popular fuel during the past decade and it can be say that compulsory fuel for all transportation

vehicles. Diesel fuel consumption increased, in based terms part of this increase was due to unsubstitution used fuels and alternative fuel as a diesel using increased on diesel engine automobiles. In 2010, the diesel fuel sharing rate has increased to around 50% of the total consumption in the transport sector and continues to increase annually. Turkey is expected to increase its petroleum demand by 2,7% until 2021, especially for petrol (4.3%), diesel (4.5%) and jet fuel (3.9%). Gasoline demand decreased linearly between the years 2006 and 2012 in, whereas diesel consumption reached to record levels in the same period. There is not a dramatic change in the consumption of LPG. In Figure 2, the shares of types of fuel consumptions are displayed for the years 2006 and 2013[11,20].

In the future, different and renewable alternative fuel surveys should be emphasized and the required energy policies should be planned. At the beginning of these studies, it is expected that many opportunities exist to improve to like this, efficiency vehicles with engine configuration and vehicle dynamic, and with a net fuel saving ratio 15-25% energy policy in Turkey. These include primarily, mainly the improvement of the vehicle chassis, selection of high technology engine, reduce vehicle of weight and improved other subsystems. The advantages of this process, reducing fuel consumption and decreasing emissions, to the environment, and the economic through raising the efficiency, alternative fuels supply projects and creating more jobs for engineers and workers but extra new capital investment being needed for future conventional. At the same time, energy saving programs would increase profitability of transportation facilities due to reduced fuel bills. One of the most crucial objectives of the transportation sector energy survey is that advanced technology vehicles engines, and using of efficiency engine, and high of efficiency engines and subsystems. These kinds of vehicles when employed properly can significantly decrease the fossil fuels use per unit of energy consumed by the user, with consequent reduction emissions of vehicles. For example, vehicles has effective and high technology engine systems are consumption lower fuels and using of environmental technologies to the in the transportation sector.

VI. CONCLUSIONS, RESULTS AND DISCUSSIONS

In this study analyzed the implications of consumption of fuels on transportation sector in Turkey. This study, evaluate the possibilities to fuel and alternative fuels are approaches in transportation sector for Turkey motorway and roads. The total energy consumed by the transportation sector accounted for up to about 20% in year 2010, of the final energy consumption in Turkey. Main fuels are used in this sector diesel, gasoline, LPG and minimum biodiesel and NG. Diesel is the most popular fuel for commercial transportation sector, while gasoline and LPG mainly using for private auto and taxi. In this study, discusses mainly the role of transportation sector in climate change, greenhouse effect, air quality, dependent of oil imports, and oil related national security concerns. In 2016, the transportation sector consumed 33% of primary energy, over percent of total in Turkey energy consumption. Nevertheless, Turkey should develop urgent and alternative policies for fuel security and independence. In Turkey, discusses must be mainly the role of transportation sector in climate change, greenhouse effect, air quality, dependent of oil imports, and oil related national security concerns policies. This study shows that these analyses have required finding new policy, new technology and new fuel sources to transportation sector. It would be helpful not only decision government policies but also for researchers and vehicle manufacturers must be developed new technologies for economic and environmental impacts of which are proposed.

For clean future, today determining current vehicles emissions, making suggestions for future and depending on these suggestions taking measures beforehand to prevent possible problems are quite important. Researchs on the emission of motor vehicle emissions in Turkey is being conducted. In these researchs results, according to current vehicles type and number emissions and according to these findings change of vehicle number and depending on total number of vehicles amount of emissions in Turkey until 2030 are estimated. It is seen that number of vehicles increases rapidly and estimated that number of vehicles 11.657 million in 2010 will reach 25.294 million increasing %116 in 2030. Development of socio-economic structure may be a factor in this increase and decrease of cost and increase of competition may be a factor in the increase of number of vehicles. Results show the sensitivity of national emissions to the assumed economic growth. National CO₂ emissions in 2030 are about 43% higher than 2010. The impact on other pollutants is comparable; that is, NO_x emissions are 40% lower, PM emissions are 39% lower, and SO₂ emissions are 32% lower. As a results suggest that less than 5% and 1% increase in CO₂/GHG emissions, respectively, can be accomplished over the period 2010–2030. The increase in CO₂/GHG emissions exceeds 10% over the period 2000–2020, and the potential may be even more than considered as the analysis only transportation sector for lack of country-specific information.

- Alternative and renewables fuels have to play a role in GHG reduction policy, but development of renewables will need to be selective.

- Also, at the high tax rate, CO₂ not much change occurs in the level of carbon emissions (less than a 1% drop over the planning horizon) so much higher tax rates are likely to be required to bring about substantial reductions in Turkey.
- Each of the options applied individually does not have a major impact on CO₂/GHG emissions.
- With the increase of population, number of vehicles is expected to increase rapidly. Measures should be taken to prevent rapid increase of number of vehicles. Directing people to public transport may be an alternative solution.
- Alternative fuels must be made common to use instead of fuel of petroleum origin seen as the main source for pollution. Moreover, alternative energy resources such as fuel cell, hybrid electric vehicles, solar power, wind power, underground hot water resources must be given much more importance and attention.

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