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Energy Development in Iran and Portugal: Differences in Consumption and Future Prospects

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ABSTRACT: We are surrounds with energy resource. We need energy for basic needs, but now and due to constant economic, social and technological developments in developed countries, it is clear that energy needs are greatest. This leads to an increased use of energy, with the use of fossil fuels or through clean energy designated renewable energy. We all know that sustainable development goes through the efficient use of all resources - renewable and non-renewable and this use has to go to meet what society needs without compromising the future, gas emissions near-zero greenhouse effect, based on the important pillars of an economy that are the planet, people and the economy. This paper show the past, present and future of energy in Iran and Portugal. In addition, we present the difference in the consumption of renewable energy and non-renewable between two countries although geometrically and geographically different has focused on implementing environmental friendly energy.

KEYWORDS: Energy, Fossil Fuels, Renewable Energy, Efficient, Resources, Iran, Portugal.

I.INTRODUCTION

This study needed to increase the awareness of energy conservation and to better the construction practices in both the Iran and Portugal in order to decrease energy consumption. In the Iran, citizens use more than twice as much energy per person. To address this problem, a collaborative effort and will compare and analyze the energy use of residential construction in the Iran and Portugal. The Islamic Republic of Iransituated in the southwestern part of Asia and the far eastern part of the Middle East. The Caspian Sea is in the north and in the south, the Persian Gulf and the sea of Oman, connects the country to the Indian Ocean and international waterways. Iran has a total territorial area of 1,648,000 square kilometers and population of around 63.86 million in the year 2000. Iran is known as an enrich country in terms of hydrocarbon resources. It holds the world's second largest natural gas reserves, and the OPECs second largest supply of oil.

The case study in Europe is Portugal. On the other side, Portugal is located in the southwest of the European continent, on the Western Coast of the Iberian Peninsula and the Atlantic Islands, Portugal has a quick and easy access, not only to Europe but also to the East coast of the United States and the African Continent.The Portuguese territory is the periphery of Europe and a European country with great Atlantic vocation, with borders that covers a territory forming a continental part and an island part which together constitute three unit well individualized: Continental Portugal; Azores and Madeira Islands. Portugal has a total surface of 92 100 km^2 – 89000 km^2 Continental Portugal; 2300 km^2Autonomous Region of Azores and 800 km^2 for the Autonomous Region of Madeira.

II.FOSSIL FUELS

Present lifestyles in the Iran use too much energy per person comparatively. Iran holds approximately 157 billion barrels of proven crude oil (the world's fourth largest reserves). The country's official production capacity is around 4 million barrels per day (mbpd). According to OPEC's secondary sources, Iran's actual production stood a 2.7 mbpd in July 2013, whereas Iran's official statistics suggest a production of 3.7 mbpd.

Dependence on outward-facing Portugal as regards fuel consumption has declined, according to the general direction of energy (DGE), the energy dependency of Portugal went down to 71.5% in 2013, the lowest value since at least 1995.

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Through the graph can show a decrease of consumption of non-renewable sources, such as petroleum. This decrease began in 2005 with a slight increase in 2009. In 2009 was the year that marked the beginning of the financial crisis in Portugal with the coming of the International Monetary Fund. In 2005, the year that marked the turning point for green policies with the requirement of the European Commission in promoting renewable energies.

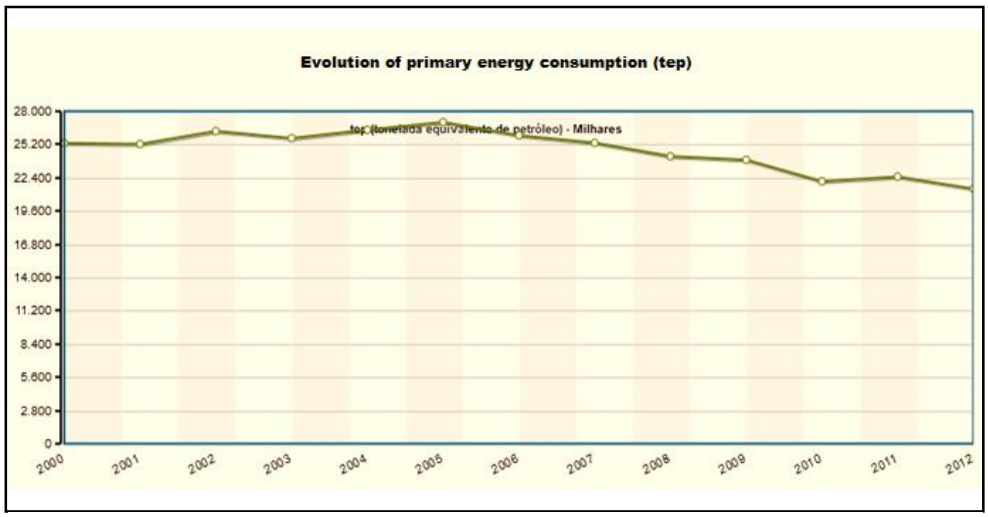

Fig1: Primary energy consumption in Portugal 2000-2012

Portuguese territory in 2000 consumed 15568 toe petroleum (ton oil equivalent) and tep 3813 of coal. Twelve years later, according to the data, there was a strong decrease. Renewable energy in 2000 have not yet assumed great relevance, but throughout the years has examined a greater importance on its implementation until 2012 can be renewable mix 4477 tep.

III.RENEWABLE ENERGY

A. IRAN

Renewable energy is fuelled by a resource that is sustainable in economic, social and environmental terms. It is usually defined by the fuel source, for example geothermal, solar, wind, biomass, tidal, and etc. Renewable energy has the capacity to provide cost-effective energy to remote communities without the added investment of providing fossil generation.

1. HYDRO POWER

In October 2012 , the managing director of Iran Power Development Company said that Iran's national power generation capacity will be boosted by around 4 GW by the 6th calendar month (June 21-July 21) next year.Twenty power plants with the total output of 9.5 GW projected to be built. Some $3.26 billion will be allocated to the projects in the first phase. The projects scheduled to be completed by March 2015. Iran's power generation capacity is currently about 67 GW at the end of the year 2012. By the end of the Year 2016 Economic Development Plan, Iran will boost its electricity generation capacity by 25 GW to reach 73 GW. Iran currently trades power with Turkey, Armenia, Turkmenistan, Azerbaijan, Pakistan, Afghanistan, and Iraq.

2. WIND ENERGY

Iran has a good potential for the production of electricity by the wind energy due to its geographical location. In recent years, various activities have been done to implement wind energy for the electricity generation. Although Iran has large fossil fuel reservoirs such as natural gas and crude oil, due to the limitation of these resources and their environment, the application of wind energy has developed quickly.Wind energy is one of the renewable energies that have attracted great attention. In fact, during the recent years in Iran, very significant progress have done in the manufacturing and the implementation of wind turbines for power generation. The application of wind energy in Iran goes back to 200 years B.C. The Persian windmills with wind-catching surfaces as long as 5 m and as high as 10 m were used for grinding grain in the area known as Nehbandan in the western part of Iran up to a few years ago.

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Iran that is located in a low-pressure area on the one hand, & on the other hand, due to its proximity to high-pressure areas in north & northwest, generally it is affected by 2 kinds of wind:

1. Winds that are blowing in winter from the Atlantic Ocean & Mediterranean sea and also central Asia.
2. Winds that are blowing in summer from Indian Ocean & from northwest.

Iran affected by following atmospheric currents:

1. The main pressure center in the central Asia in winter.
2. The main pressure center in the Pacific Ocean in summer.
3. The west current blowing from the Atlantic Ocean and the Mediterranean especially in winter.
4. The northwest current in summer.

In the year 2002, SUNA organization, started a wind potential assessment project for producing wind atlas of Iran. This project was finished in 2010. In this wind atlas, 26 areas of Iran including 45 sites investigated.

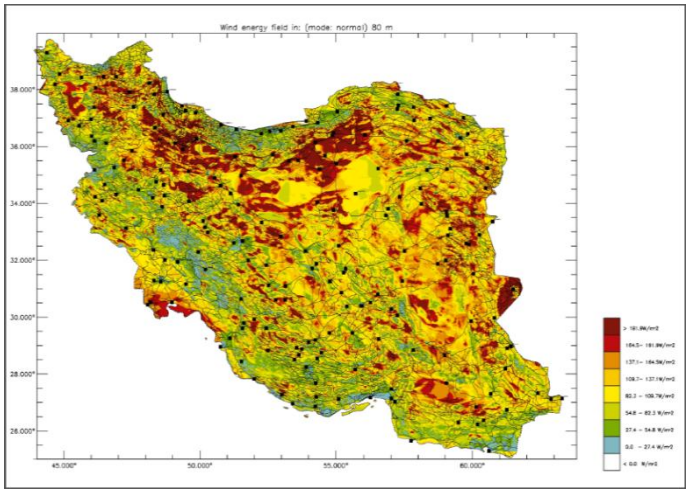

Fig2: Iran Wind Atlas at the height of 80 meters

It been anticipated that Iran's wind atlas will be ready in 2010. These coasts are capable of producing 6,500 megawatts of electricity generated from the wind energy. According to international and local renewable energy experts, Iran possesses wind and other renewable energy resources that may be characterize as "world class", but the Iranian wind resource not yet been mapped out in detail, and existing data is not easily available. During the project preparation, the wind resources in the Manjil area assessed based on existing data from a local meteorology station and found to be in line with Danish Class 1 / good European sites.

Iran's first experience in installing and using modern wind turbines dates back to 1994. Two sets of 500 Kw NORDTANK wind turbines installed in MANJIL and ROODBAR. They produced more than 1.8 million kWh per year. These two sites are in the north of Iran, 250 km from Tehran, the capital of Iran. The average wind speed is 15 m/s for 3700 hours per year in ROODBAR, and 13 m/s for 3400 hours per year in MANJIL. After this successful experience, in 1996, the contract for 27 wind turbines signed and they installed by 1999 in MANJIL, ROODBAR and HARZEVIL. HARZEVIL is the third wind farm site near to MANJIL.

3. SOLAR ENERGY

Solar energy is one of the most important sources of renewable energy. Solar radiation is variable in different parts of the world and in the Earth Sun Belt has the highest value. Iranis located in the area throw this and Studiess how that the use ofsolar equipmentin Iran is very suitable and can be provide partofthe energy that nation's needs.Fig.3.A. showing Iran solar energy potential.

Solar energy radiation onthe surface of Iranisabout4.5kWh/m^2. Iran with having 300 sunny day in a year is one of the best countries in having solar energy potential.The average solar radiation for the whole of Iran is about 19.23 Mega joules per square meter, and it is even higher in the central part of Iran.

Iran has an average solar insulation of 2000 kWh/m^2.yr. The sunny hours which sunshine could be utilized are about 2800 hr/yr. Solar energy has not been formally commercialized yet. Regions having highPotential for solar energy are: Shiraz, Tehran, Khorasan, Yazd, and Semnan (IAEA, 2000).

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4. GEOTHERMAL ENERGY

Amid the 1990s, following a long gap, the growing needs to explore the clean sustainable sources of energy resulted in the setting up of specialized state-run establishments such as Electric Power Research Center (EPRC) and Renewable Energy Organization of Iran (SUNA).

During recent years, the latter as an affiliate of MOE has been effectively engaged in the management and execution of a variety of renewable energy projects including geothermal projects. This company plays a fundamental administrative role in most of the nationwide geothermal projects and turns over jobs to both government and private sectors as its executive arms. Over the past decade, in parallel, SUNA has also conducted a series of countrywide potential investigation studies in order to evaluate appropriate zones for future investment particularly aiming at direct-heat utilizations in the remote areas bearing weaker economies.

In recent years (from 2001 onward), efforts have been made to publicize the concept of direct use for agricultural, fish farming and greenhouse purposes at the level of government authorities in Iran. A project, to publicize geothermal heat pumps, was initiated from 2004 and five geothermal heat pumps were installed in different parts of country for cooling and heating purposes.

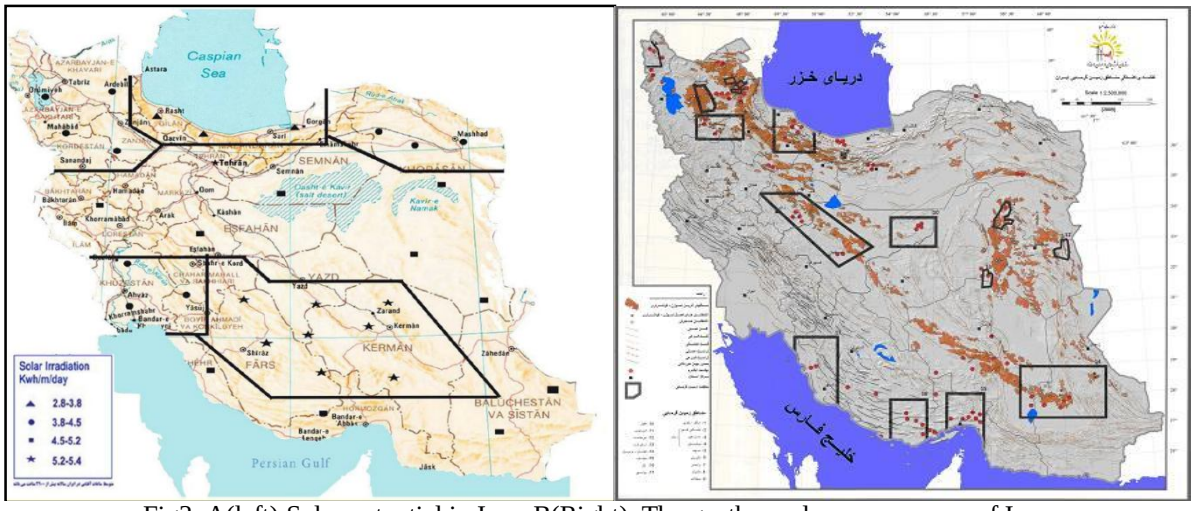

Fig3: A(left):Solar potential in Iran, B(Right): The geothermal resources map of Iran

The idea of power generation from Sabalan Geothermal Prospect (Northwest Sabalan geothermal field) was initially proposed in 1994; thereafter emphasis has been put onto this field as an eminent priority. Upon detailed geo- based survey conducted by the joint collaboration of SUNA of Iran and Sinclari knight Mers Ltd. (SKM) of New Zealand within the time frame of 1998 till 2005, NW Sabalan geothermal field was recognized satisfactorily as a potential reservoir for power generation purposes. The idea of power generation from Sabalan Geothermal Prospect (Northwest Sabalan geothermal field) was initially proposed in 1994; thereafter emphasis has been put onto this field as an eminent priority. Upon detailed geo- based survey conducted by the joint collaboration of SUNA of Iran and Sinclari knight Mers Ltd. (SKM) of New Zealand within the time frame of 1998 2005, NW Sabalan geothermal field was recognized satisfactorily as a potential reservoir for power generation purposes.

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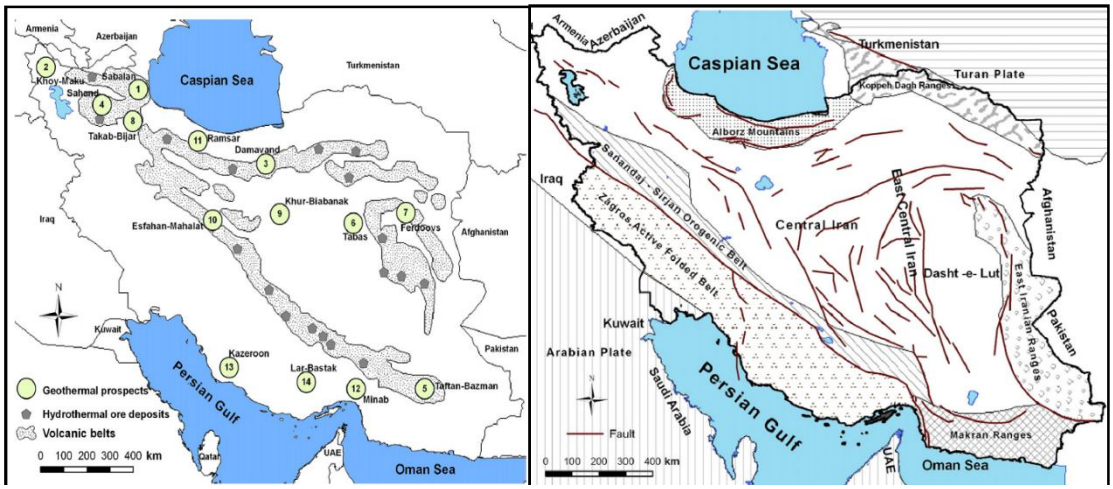

Fig4: Left: Main structural (tectonic) regions of Iran and Right: Geothermal energy resources map of Iran. The 14 geothermal areas are ranked in order of importance (Sabalan the highest rankand Lar-Bastak the lowest)

5. BIOMASS AND BIOGAS

The destruction of fossil fuels, variability of sustainable development energy resources and energy security, ecological problems due to consumption of fossil fuels in one hand, and restoration of new energy resources like the sun, wind, biomass, etc. on the other hand, has caused people to pay closer attention to the development and increase in the use of renewable energies and the increase of share of these resources in the global basket. The significant increase in activities and budget expenditure by the governments for research and study has finally led to total cost of renewable energies to decrease and made them more capable of competing with current traditional systems. This has been carried out in wind energy affairs and some applications of biomass energy and we are witnessing rapid decrease in the prices of other renewable energies.According to available data, in 2005, 13.3 percent of the world's initial energies were supplied from different types of renewable energies the share of which were as follows:

Biomass energy	Water energy	Geothermal energy	Sun energy	Wind energy
79.7 %	**16.5 %**	**3.1 %**	**0.29 %**	**0.48 %**

Based on the studies conducted, almost 64% of primary resources of new energies in the EU is designated to biomass resources. Similarly, around 9% of the generated electrical energy and 98% of the thermal energy, produced by new energy resources, belongs to biomass energy resources (including hydroelectric resources). The nameplate capacity of biogas power plants in Iran is 1860 Kw, the total installed capacity is 1665 Kw and the total Gross generation is 5967 GWh. According to potential evaluations conducted, installablecapacity at the urban solid waste disposal site of Shiraz equals 1060 Kw. However, considering the position and specifications of waste disposal, during past years, the current utilization capacity of the disposal site of Shirazis 450Kw.With regard to the equipment installed, the real rate of electrical energy production from the solid waste disposal site of Mashhad is approximately 654MWh per month. Of course, the obtainable rate of energy will considerably be higher if disposal site is constructed and complete equipment installed. Below Table shows Iran's production capacity and domestic consumption rate of electricity from biogas power plants.

Region	**Total nominal Capacity (MW)**	**Practical Capacity (MW)**	**Gross Electricity Generation (MW)**	**Domestic**
Shiraz biogas power plant	1.2	1.065	2.178	a
Mashhad biogas power plant	0.66	0.6	3.789	a

[a] Domestic consumption rate has not yet been announced by respective companies

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B. PORTUGAL

Also according to ADENE in 2003 the registered energy mix was as follows: hydro (> 10 MW) 15636 GWh; Hydro (<10 MW) 891 GWh; 1663 GWh of biomass (includes vegetable residues/forestry, sulfítivos liqueurs, biogas and municipal solid waste). About 496 GWh of wind power. geothermal energy 90 GWh and 3 GWh in 2003 of PV to total production of renewable energies was 18306 GWh and increased considerably in 2012 to 30896 GWh, noting the following energy consumption: 13701 GWh hydro (> 10 MW); 1167 GWh hydro (< 10 MW); 3337 GWh biomass; 12015 GWh of wind power; 197 GWh in geothermal and 497 GWh of photovoltaic.

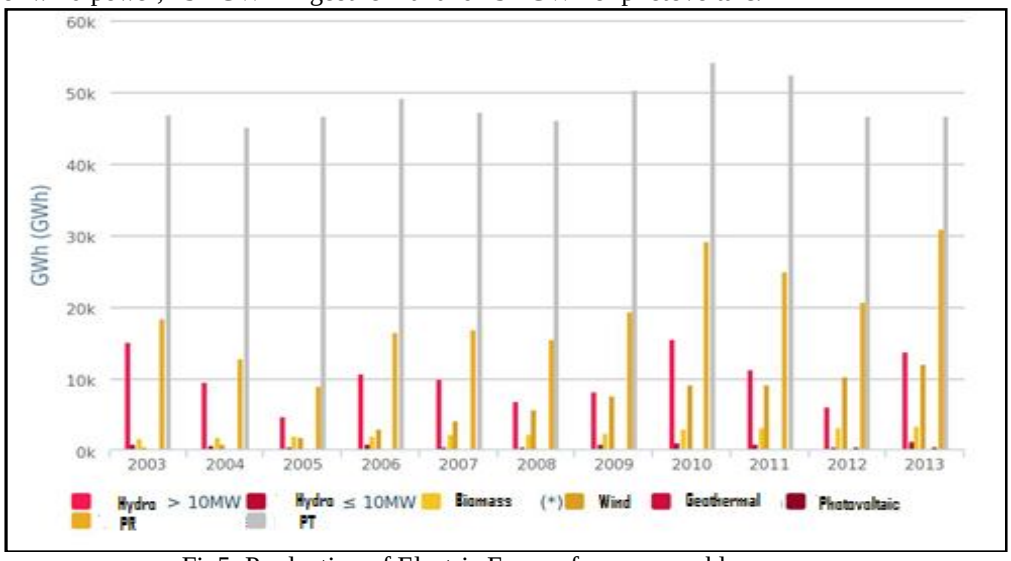

Fig5: Production of Electric Energy from renewable sources

In 2014, the electricity from renewable sources accounted for 62.7% of the total electricity consumed. The Portuguese Renewable Energy Association (APREN) analysed data from REN - National Energy Network on electricity production in 2014 and concluded that "it was the most renewable year" and that without this form to get electricity, "the emissions would reach 26 million tons of CO2 "(carbon dioxide)," double the current, [or] about 40% of total emissions of greenhouse gases" in Portugal (APREN, 2015). According to the graph in 2014, the corresponding share of renewable energies corresponds to 33.3%, while this share 23.7% corresponds to the wind, 3% corresponds to PCH (Small Hydro Central), 1.2% for the sector solar power and biomass corresponds to 5.4%. The large hydropower was the main source of electricity production, contributing 29.4% of electricity consumption, followed by wind with 23.7% and third was coal with 22.2% (APREN, 2015).

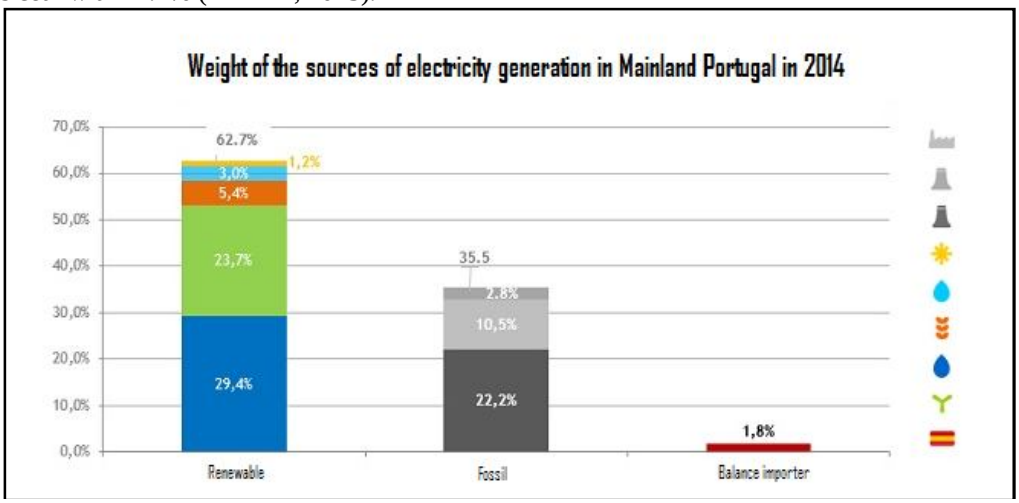

Fig6: Weight of different sources of consumption and electricity in Portugal 2014 (APREN, 2015).

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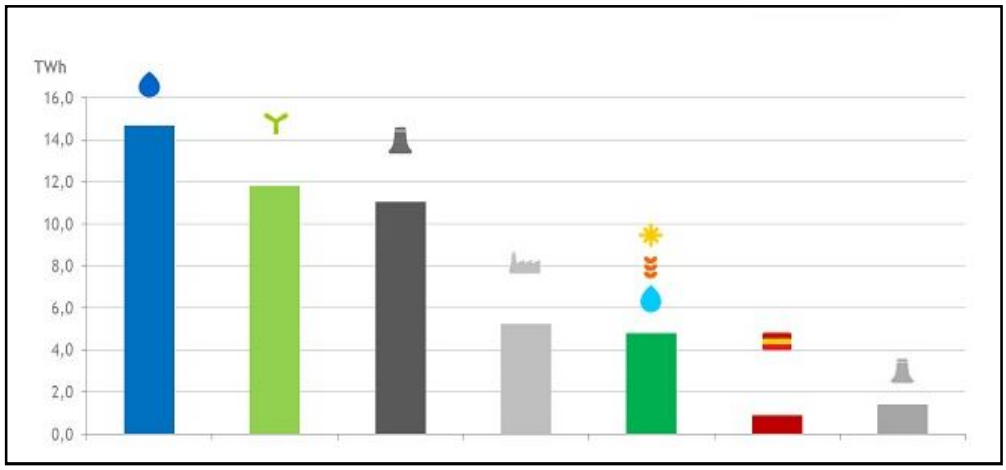

Fig7: Electricity production by source-type year 2014 (APREN, 2015).

The scenario presented by the Portuguese Association of Renewable Energies that appears through the following picture is for there to be an increase of solar energy consumption. This energy has had a greater significance in the production of energy in Portugal, initially with the micro generation and then with the micro production, but then lost relevance due to the prevailing tariff. Currently, the photovoltaic sector has taken on due to policies to encourage consumption.

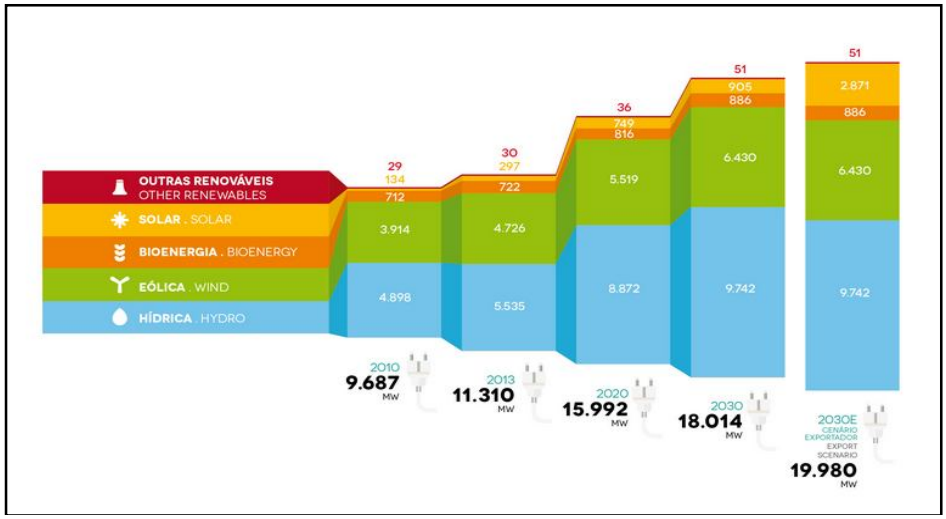

Fig8: Evolution of installed capacity in renewable technology [MW]

In the Autonomous Region of the Azores, as EDA (Electric Company of Azores), there was a decrease of 0.3% in electricity production. The Azores is an insular part of Portuguese territory with a reliance on fossil fuels of Continental Portugal, in particular the main fuel in thermal power stations is the fuel oil.

In relation to renewable production, the Azores is the only region of the country where there is production of geothermal energy (energy from the subsoil). In 2014, has 23% of the total production of the autonomous region of the Azores and 43.7% of São Miguel Island, the only island in the area where this exists, and the only place of Portugal where there is this kind of energy from underground.

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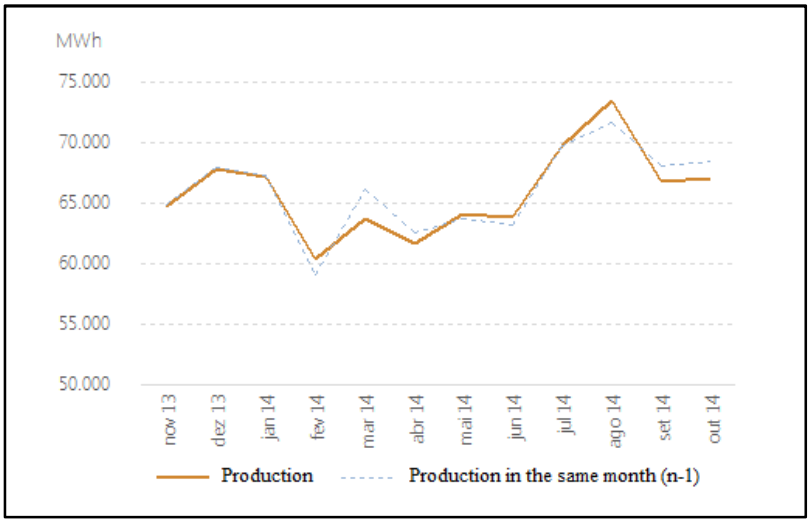

Fig9: Evolution of Energy Production in the Autonomous Region of the Azores

There was also a decrease of 20.4% of hydro production and a growth of 16% of wind energy, with major wind farm fields on the island of São Miguel (wind farm of Graminhais) and of the island of Terceira (Sierra Ridge wind farm). Total energy production in the autonomous region of the Azores ascended the 657,914 MWh, being 35.8% of renewable origin and 64.2% of thermal origin, which, 55.3% was obtained from fuel production and 8.9% diesel production (Electricity Company of Azores, 2015).

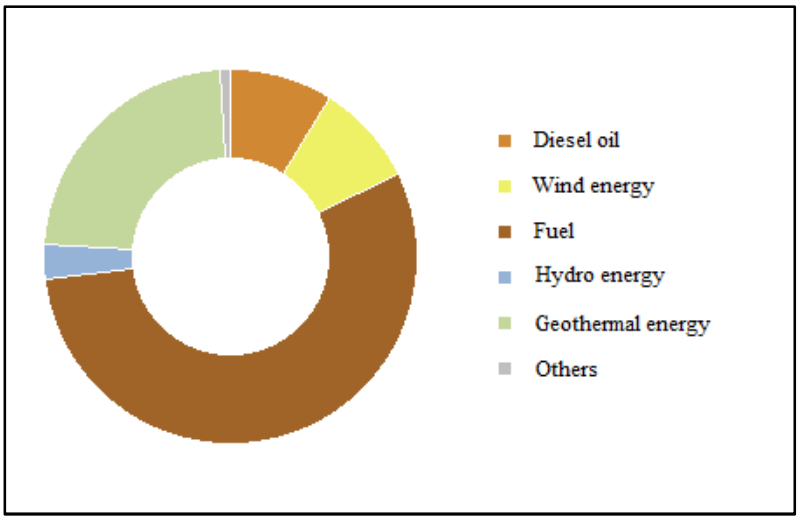

Fig10: Energy Mix in the Autonomous Region of the Azores in the year 2014 (EDA, 2015)

With regard to the emission of carbon dioxide, in 2014 in the autonomous region of the Azores, noted that Corvo Island, Graciosa, Terceira and Santa Maria have registered greater carbon dioxide emissions. The island of São Miguel, the largest island and home to major production sectors, was to have greater CO_2 production, but there was less production and this is due to the production of renewable energy, including geothermal energy.

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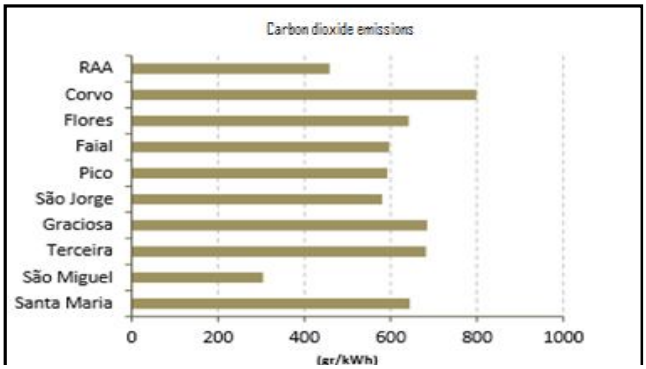

Fig11: Carbon dioxide emission in the Azores

The chart below shows the production of energy by source in the autonomous region of Madeira. In the next chart, you can see that monthly energy production of Madeira is due to thermal energy with 58.1% in that its main fuel is diesel. The other slices of the energy mix of the island of Madeira is due to 11.6% of hydropower; 10.5% of wind power; 3.6% of photovoltaic; 4% of MSW (municipal solid waste) and 12.2% for thermal energy (natural gas). In 2014, the energetic mix of Madeira accounted 830.7 GWh.

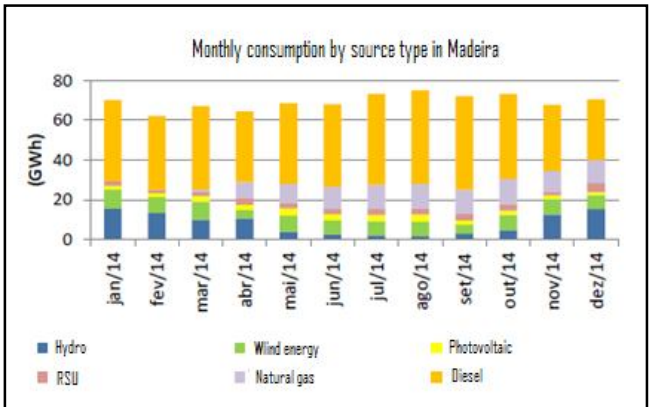

Fig12: Monthly consumption by source type

Also according to the Electricity Company of wood and with regard to the emissions of the gas main contributor to the greenhouse effect, the region has a production of 5652.2 g/kWh of carbon dioxide. The month in which it was observed higher output were the July, August and September with the values of 515.9 g/kWh; 520.4 g/kWh and 541.1 g/kWh, respectively. The month in which found lower CO_2 emission was the December with 398.5 g/kWh.

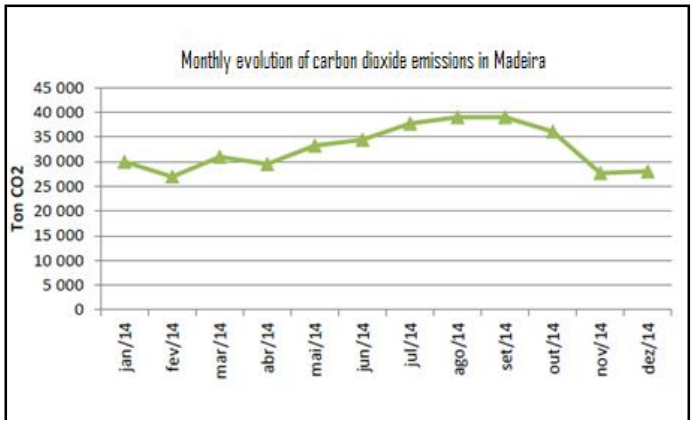

Fig13: Carbon dioxide emission checked in the autonomous region of Madeira in 2014

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IV.CONCLUSION

Totally, the results of this study showed that production in the studied regions show the production in terms of consumer energy, energy efficiency, energy productivity, specific energy and net energy. Although factors such as agricultural sector's overall policies, appropriate market for buying and selling and region's social-economic characteristics have huge impact on farmer's planting program, based on the results of such studies, we cannot make a final decision in relation to the cultivation of different crops. In addition, the current policies of Ministry of Agriculture focus on continuation of Iran and Portugal productions. The last point is that in this study the information related to specific inputs and common operations was examined. Processes such as transport during growing season and other factors exist which were not evaluated due to the lack of appropriate data by the farmers. As a result, values of energy use efficiency and productivity in this study have been estimated somewhat beyond the actual amounts. This paper show this two country can have same goals to produce and share the energy as well.

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BIOGRAPHY

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Catarina Pacheco Vieira is a final year Renewable Energy M.S. student at Department of Electrical Engineering, Faculty of Science and Technology of the New University of Lisbon. Currently it is also trainee at National Energy and Geology Laboratory. The main interests are: renewable energy; electronics; electricity networks; HVAC systems; efficient buildings; facades systems; energy efficiency; instrumentation and monitoring; fauna and Flora; ecosystems; impact assessment environments; environment and waste management.