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The Portuguese Energy Sector: Its Multiple Aspects and Challenges
A Country Study

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Abstract:

Due to the infusion of Foreign Direct Investment (FDI) and European Union policies, Portugal is one of the worlds' leaders in producing clean renewable energy. In the process, Portugal has reduced the use of more traditional forms of energy, such as oil and coal. In addition, Portugal has diversified among types of clean energy it is producing, based on the variety found in Portugal's geography. Regions suited for massive solar farms are complementary to regions suited to wind farms, making it most efficient to pursue both strategies simultaneously depending on the locus of energy production. As a result, Portugal is currently "ahead of the curve" as one of the largest producers of clean energy in the European Union. This paper addresses the origins of Portugal's quest for "clean" energy and the diversification of Portugal's plans to ignite the use of clean energy in the economy.

KEY WORDS: Clean energy; Diversification; Oil and gas; Solar power; Wind power; Hydropower; Foreign Direct Investment; Kyoto Protocol

1. Introduction

From the outset of its membership in the European Union (EU) in 1986, Portugal has benefited greatly. EU membership provided Portugal with access to the global economy, initially based upon increased internal trade between EU member nations. However, the global financial crisis of 2008-2009 changed this relationship (Hagiwara, 2019). The financial crisis caused an economic shockwave that was felt globally. Economies of the world, both weak and strong, fell like dominoes. Portugal was no exception.

Although there was critical damage done to the economies of many EU countries stemming from the financial crisis, not all countries were equally affected. A group of countries referred to as *PIGS* (Portugal, Italy, Greece, and Spain) were impacted by the crisis arguably more than other EU members. The *PIGS*, later known as the *PIIGS* with the inclusion of Ireland (Duman, 2017; Schmidt, 2019), were plagued by rising unemployment, largely owing to their exposure to unsustainable levels of sovereign and private commercial debt (Marron, 2011; Rajan & Santhakumar, 2018; Parker & Tsarouhas (eds.), 2018), and slow growth. Citizens throughout the continent, with the possible exception of Poland, which managed to weather the crisis, maintaining a positive rate of growth in GDP (Reichardt, 2011; Hunter & Ryan, 2012; Gradzewicz, Growiec, Kolasa, Postek, & Strzelecki, 2015; Adamowicz & Adamowicz, 2019), struggled in some cases to afford basic living necessities. Energy prices played a significant part in the crisis, going from “boom to bust” in the process (Bencivenga, d’ecclesia, & Triulzi, 2012).

Over time, the financial crises ebbed and its negative economic impact lessened, but not on an equal basis. Despite the general improvement, a difference in the level of recovery could be ascertained. With the exception of Ireland, which recovered much more quickly (McGowan, 2011; Torok, 2018), the remaining *PIGS* experienced some recovery, but not to the same extent of non-*PIGS*. Several of the *PIGS* continued to experience negative effects of the global financial crisis of the previous decade. For

example, as of May 2019, there is still a relatively higher unemployment rate in the PIGS countries, averaging 12%, as compared to other EU nations who have an average rate of unemployment of 6.5% when examining all EU nations combined (Statista, 2019). [Portugal, 6.6%; Italy, 9.9%; Greece, 18.1%; Spain, 13.6%.]

The situation facing Portugal indicates that it still faces many challenges. Surprisingly, despite largely overcoming an incredibly stressful economic situation, Portugal has been able to develop systemic strategies for dealing with issues relating to energy production and climate change, while at the same time, increasing economic growth.

2. The EU, Portugal, and Energy

Portugal has enjoyed many benefits from its membership in the EU, literally bringing Portugal's economy into the global market. In adopting a set of comprehensive rules for trade, the EU has overcome traditional national barriers to trade found in otherwise uncoordinated and disjointed trade practices between countries. These rules, although targeted in the area of trade, have impacted many aspects of government and politics in member nations— not just strictly those relating to trade. As a result, the EU has also focused its attention on extending the rules of trade to the environmental arena (Delreux, 2004) by incentivizing member nations to invest in renewable and clean energy (Jacobsson, Bergek, Finon, Lauber, Mitchell, Toke, & Verbruggen, 2009; Paramati, Apergis, & Ummalla, 2017; Gokgoz, & Guvercin, 2018; Papiesz, Smiech, & Frodyma, 2018; Miguel, Mendes, & Madeira, 2018).

Delreux and Ohler (2019) note that:

“Despite regular controversies among member states, societal groups, and industries, the EU has managed to be a leader in the adoption of climate policies internally and in the promotion of such policies externally. The main public narrative by the European institutions to justify an ambitious

climate policy is that it is leading to a reduction of greenhouse gas emissions without undermining economic growth in Europe. Internally, the EU has developed the world's most advanced and comprehensive regulatory frameworks, encompassing both EU-wide policies and targets to be achieved by the member states."

2.1. Oil and Coal

Historically, Portugal has relied on oil for meeting its energy needs (e.g., Martins, 2018). Oil was relatively easy to obtain for Portugal, due to historical diplomatic, economic, and political ties with several of its former colonies— most notably Angola (26.6%)—one of the world leading oil exporters (Ferreira, 2006). Portugal also imports oil from Saudi Arabia (12.6%), Algeria (9.9%), and Kazakhstan (9.7%).

However, oil is generally considered as a "dirty form" of energy. Despite its best efforts, Portugal has not been able to completely eliminate the use of oil in its industrial production, although almost all industries have been decreasing their oil usage while also working on adopting cleaner forms of energy. Ultimately, conversion to total clean energy would require an enormous undertaking, accompanied by a massive overhaul of current infrastructure and business practices. In the interim and perhaps for the foreseeable future, some industries may find it necessary to continue to use oil. For example, the forestry (Brouwer, 1993) and agricultural (Serrenho, Warr, Sousa, Ayres, & Domingos, 2016) sectors have seen no appreciable change in their oil usage, as the specialized heavy machinery used in these sectors is difficult to adapt to clean energy alternatives. The specialized heavy machinery used in forestry and agriculture has little has to no manufacturing alternatives, making it both inefficient and cost-prohibitive to switch to a viable clean energy alternative.

Transportation is another sector that has proven problematic in terms of its adaptation to cleaner energy forms. The transportation sector is a massive user of energy,

accounting for 75% of Portugal's oil imports. As with forestry and agriculture (Martinho, 2019), there are few viable and economically practical alternatives for the highly specialized machinery used. A fourth sector that is struggling to adapt is the "non-metallic minerals industry" (Miguel, Mendes, & Madeira, 2018) (involving both cement and glass), once again mainly due to the specialized machinery that is used in this sector. It becomes clear that oil remains crucial to Portugal's growth despite the country's best efforts and intentions to transition to clean energy (Miguel, Mendes, & Madeira, 2018).

However, as with most nations within the EU, while Portugal lacks significant oil reserves, it possesses abundant coal reserves— even though actual coal mining had ceased in 1994 (Murray, 2007; Collins, 2019). While the amount of coal is "negligible when compared to the quantity [of other resources] used for electricity production" (Miguel, Mendes, & Madeira, 2018), Portugal still requires coal to power two power plants located in Sines, completed between 1985-1987, and scheduled to be closed in 2030. and Pego, completed between 1982-1985, and likewise scheduled to be closed in 2022. These power plants are not the main source of energy in Portugal, but "act as a backup system" when other sources of energy productions fail to meet their required quota of energy production (Miguel, Mendes, & Madeira, 2018). The Sines power plant has been identified as "Portugal's worst air polluter" (Shareit, 2016). In order to meet this limited demand for coal, Portugal has resorted to importing coal from foreign countries such as Colombia (88.1%), the United States (6.6%), South Africa (3.5%), and the Ukraine (1.8%). The use of coal, however, is problematic in light of the phase-out policies of the EU (Collins, 2019).

2.2 Can Portugal Eliminate the Use of Oil and Coal in its Economy?

The daunting task of eliminating the use of oil and coal from the Portuguese energy mix will take time. Critical industries that require specialized machinery do not presently have efficient clean energy alternatives to make the transition from "dirty"

energy to “clean” sources. Nevertheless, Portugal and other members of the EU are committed to abandoning “dirty” energy sources and progress towards “clean” energy alternatives (Gromada, Trebska, & Wysokinski, 2019).

In fact, the European Union is in the forefront of the energy revolution by assisting individual countries to create plans to move towards clean energy. The goals that the European Union has established for a “greener clean energy” future can be adapted to best fit the energy requirements and financial limitations of member states. The goal of EU policy is to provide member nations with flexibility in adjusting their domestic policies, rather than creating a ridged “one size fits all” energy policy across multiple member countries. However, one of the major shared goals is the reduction in greenhouse gasses that is evident in all planning.

In 1998, the European Union as an entity became a party to the Kyoto Protocol, an international agreement involving signatory nations and various intergovernmental organizations or IGOs (Gupta & Grubb, 2000; Zakarenia, 2018; Xavier, 2019). In fact, Delreux and Ohler (2019) note that “Desiring to ‘lead by example,’ the EU has been an influential global climate player at important international conferences such as those held in Kyoto (1997), Marrakesh (2001), and Paris (2015)....” Xavier (2019, p. 135) notes that the “EU is pursuing a political climate model and a global governance model.”

The Kyoto Protocol set the goal of a “reduction of greenhouse gases [by] 8%” (Pena, Azevedo, & Ferreira, 2017; Delreux & Ohler, 2019). In turn, the EU advised member nations to translate this global aspirational goal to their own country in order to achieve the most optimal results. In fact, the EU “has overachieved this target by a wide margin: the 15 member states of 1997 (to which the Kyoto target applied) collectively reduced their emissions by approximately 12%, whereas the average emission reduction of the 27 member states of 2012 was around 18%. Hence, from both perspectives, the EU fully complied with its Kyoto targets” (Delreux & Ohler, 2019).

Not surprisingly, however, environmental and clean energy projects were sidelined during the 2008-2009 financial crisis. In order to promote economic growth and reduce the more negative effects of the recession, the EU informed its member countries that they were allowed to “*increase its emissions by 27%*” (Pena, Azevedo, & Ferreira, 2017) until 2012. The EU acted in the belief that if strict environmental goals were still in force, companies would experience a major constraint production and productivity (Pena, Azevedo, & Ferreira, 2017).

2.3 Enter the Wind Option

Being an individual signatory to the Kyoto protocol, Portugal has demonstrated its dedication to the climate change and clean energy policies that the EU had adopted to synchronize its policies with the goals of the Protocol. Portugal began by focusing on developing wind power as an alternative energy source (Carvalho, Rocha, Gomez-Gesteria, & Santos, 2014). As might be expected, however, conversion to wind power would entail a great deal of time, effort, and resources. Portugal would be required to build entirely new infrastructure to support wind energy. To speed up the process, the Portuguese government needed to make it easier to start a wind farm. Portugal accomplished this by changing the method by which the electrical grid could be supplied (Pena, Azevedo, & Ferreira, 2017). Previously, the government tightly controlled who would be permitted to conduct business on the Portuguese power grid. Obtaining permission to operate on the grid was fraught with tremendous bureaucracy. In order to increase the amount of available wind energy, Portugal had to lower the start-up costs associated with building a wind farm, significantly cutting back bureaucratic red tape. Portugal made the process much more streamlined and transparent, so that interested parties would be able to more speedily enter the wind energy sector. Couto,

Simoës, and Estanqueiro (2018, p. 128) report that by 2018, “wind energy covered more than 100% of the electricity demand during certain hours, without and technical problems reported by the Portuguese Transmission System Operator (TSO).”

In addition, the Portuguese government enacted a policy of “feed-in tariffs” (Lesser & Su, 2008). A feed-in tariff (FIT) is designed to increase investments into renewable energy systems (Jenner, Groba, & Indvik, 2013). FITs work by “providing developers long-term purchase agreements for the sale of electricity generated from RE [renewable energy] sources” (Couture, Cory, Kreycik, & Williams, 2010).

Portugal enacted this feed-in tariff by requiring the commercial electricity agency, *Electricidade de Portugal Serviço Universal*, to buy energy from independent power producers at “a rate estimated each month” (Pena, Azevedo, & Ferreira, 2017). This increase in business incentivized additional parties to enter the industry. If the government is required to purchase energy from these independent suppliers, then both the supply and demand for energy would increase. Nevertheless, despite these changes, a few energy companies still dominate the Portuguese market. However, with Portugal rethinking its energy policies and energy needs, many observers believe that the clean energy industry will continue to grow and diversify, encouraging further economic development and investments in clean energy—perhaps most especially in the solar fields (Goncalves, 2019).

2.4 Hydropower

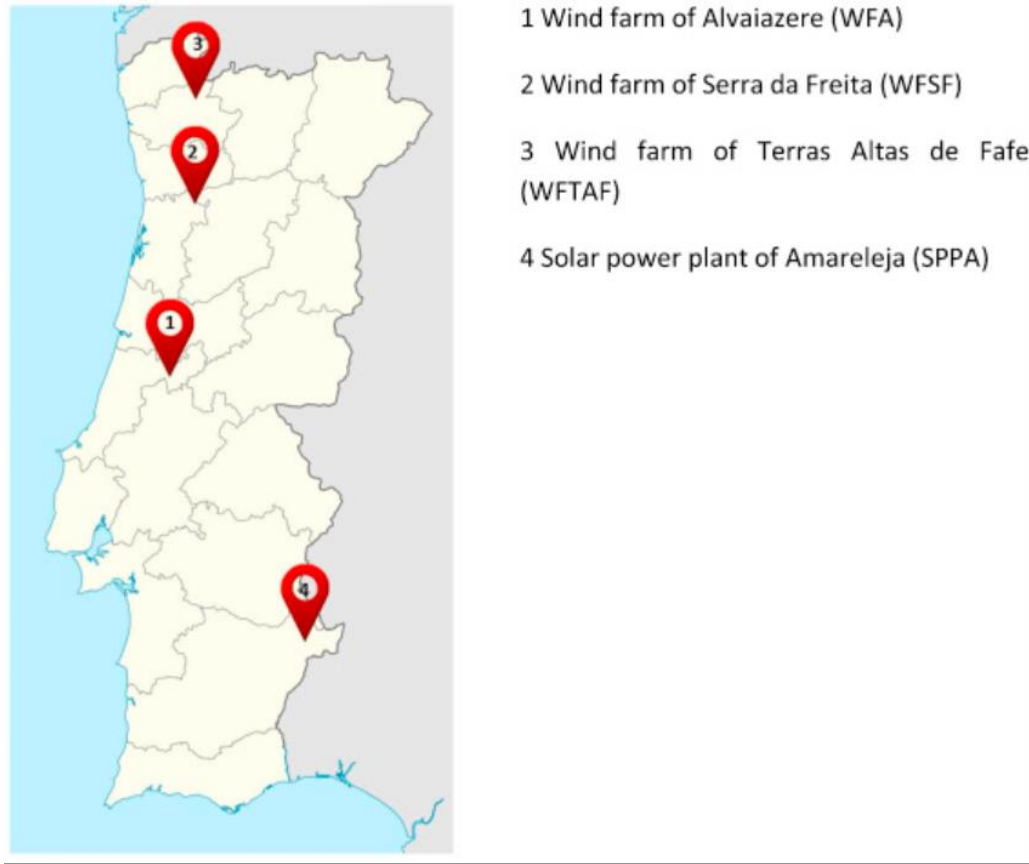
Even prior to the EU’s push towards clean energy, Portugal invested heavily in hydropower (de Almeida, Moura, Marques, & de Almeida, 2005). In the late 1970’s to the 1980’s, the government invested in many hydropower plants that are still in operation today. For that reason, hydropower plays a major part in Portugal’s energy production

mix. However, while hydropower is effective in creating energy, it is potentially an unreliable clean energy source. Teotonío, Fortes, Roebeling, Rodriguez, & Robaina-Alves (2017) discuss the effects that a lower amount of precipitation from climate change would have on hydropower. The authors are concerned that hydropower stations will become less effective because of the effects of climate change. At least for the present, hydropower will remain as *one* of the sources of clean energy in Portugal. The lack of significant startup costs in comparison with other forms of energy makes it an easy and economical source of energy. However, at the same time, climate change threatens the expanded use of hydropower and makes its future problematic.

3. Regional Considerations

Portugal has many diverse geographic regions, which makes it important to adapt different forms of energy to a discreet setting. For example, wind energy requires sustained and powerful winds to assure energy efficiency. Whereas, solar energy requires sustained periods of "open skies" for the sun to shine through (Pacheco, Gorbena, Sequeira, & Jerez, 2017; Pestana, Rodrigues, & Morgado-Dias, 2018)).

The north of Portugal is much more suited for wind energy, where there are more powerful winds and high mountains, making wind energy incredibly efficient (Delicado, Figueredo, & Silva, 2016). The southern region is clearly suited for solar energy. The Alentejo region is known for vast opened fields and an abundance of sun, describing optimal conditions for solar energy. Due to this, the Alentejo region has begun to specialize in solar energy (Delicado, Figueredo, & Silva, 2016). [See Figure 1 below.]



(Delicado, Figueredo, & Silva, 2016).

4. The Role of Foreign Direct Investment

Opportunities aligned with green or renewable energy have opened new avenues for Portugal and the EU. Liedtke (2016) reports that China and the EU have established bilateral investment agreements with the 27 EU member states. Conrad and Kostka (2016, p. 644) have noted that “Since 2011, Europe has witnessed an astonishing surge in Chinese foreign direct investment (FDI), which hit a high in 2015 as Chinese investments totaled more than EUR 20 billion.” A significant amount of the investment in the Portuguese energy sector comes from Foreign Direct Investment (FDI), specifically from China (Haneman & Hotari, 2016). In addition to Portugal’s own domestic investments, China has put a substantial amount of time and money into the renewable

energy sector in Portugal (Liedtke, 2017; Conrad & Kostka, 2016). “China’s significance as an investor in Europe’s energy sector has grown very rapidly in recent years. Chinese companies have invested in every part of the energy market, including power grids in various European countries, traditional generation infrastructure, renewable energy companies, and most recently, Europe’s nuclear power sector” (Conrad & Kostka, 2016, p. 644).

Until recently, China had invested heavily in underdeveloped areas of Africa, but is now moving their investments to Europe, specifically Europe’s energy sector. One of China’s prized target markets has been European countries that are still recovering from the global recession of 2008-2009—for example, the previously mentioned PIGS—in which China has placed 24% of its European energy sector investments (Pareja-Alcaraz, 2017; generally Liedtke, 2017). Countries that are underdeveloped or are recovering from a financial downturn provide more lucrative investment opportunities than those that have been economically stable (Gorynia, Nowak, Howak, & Wolniak, 2007; Hunter & Lozada, 2009), since the overall growth potential is higher in less developed areas or in recovering economies compared to those areas that are already developed (generally, Conrad & Kostka, 2016).

China has evidenced two reasons behind their strategy: diversification of its investment portfolio and purposeful concentration on green technology, which the Chinese foresee as the future (Pareja-Alcaraz, 2017). As part of executing its strategy, China has gained considerable knowledge of new green energy technologies since European countries are considered to be at the forefront of green energy innovation. As a result, China has been able to take what they have learned from their investments in the European energy market and transfer this knowledge to China, which itself will have to transition into cleaner energy in the not-too-distant future (generally, Conrad & Kostka, 2016).

4.1. Concerns Relating to Investments by China

Yet, certain “red flags” or “political and economic concerns” have been raised regarding FDI in the Portuguese energy sector regarding the involvement of China. Conrad and Kostka (2017, pp. 646-647) note:

“First, and most profoundly, Chinese outbound investments are a manifestation of China’s state-led-economic system. A large portion of Chinese investments in Europe comes from state-owned-enterprises. Their motives may not always be guided purely by commercial objectives but are plainly shaped by China’s national interests.”

“Second, Chinese investment activities abroad represent building-blocks of a larger outward policy. Evidence suggests that the state’s industrial policy goals, which aim to win control over the most profitable components or nodes of global supply chains, influence China’s overseas investments. In particular, this pertains to Chinese investments in high-technology companies, for example technology leaders in renewable energy” (see also Wubbeke, Messner, Zenglein, Ives, & Conrad, 2016).

“Third, European decision makers are increasingly concerned that Europe’s commitment to investment openness, which it extends to Chinese investments, is not reciprocated by China. On the contrary, the Chinese government continues to strategically limit access for foreign investments in crucial sectors of the economy” (see also OECD, 2016).

“Fourth, Chinese investments in Europe, in particular in the energy sector, raise concerns over possible infringements of national security.”

“Fifth, given the politically guided nature of at least some of the Chinese investments in Europe, the question of increased political influence arises.”

“Finally, there are concerns in Central Europe about Chinese investors’ non-compliance with international standards” (citing Turcsanyi, 2017; Thomas, 2017).

Some have also expressed concern that some Portuguese politicians might be encouraged into undertaking actions that might be good for Chinese investors rather than for their own citizens. This power that China holds causes concern for some citizens (Delicado, Figueiredo, & Silva, 2016).

4.2 Perception

Surprisingly, some Portuguese citizens appear skeptical about renewable energy initiatives. Delicado, Figueiredo, and Silva (2016) attempted to gauge public opinion on renewable energy by focusing on the impact, “both positive and negative,” in three areas: environmental, landscape, and socioeconomic. They reported on the large number of people who were indifferent or who did not feel strongly about the topic at all. A reoccurring comment was a perception of a lack of transparency and community input surrounding green industry, specifically in building large clean energy power plants. Others commented that renewable energy plants affected the natural landscape of the county. Critics argued that wind turbines and solar panels were destroying the natural beauty of the regions in which they were prominent, potentially damaging the tourism economy. Others commented that the number of jobs created by these power plants were both overly emphasized and greatly exaggerated. They have argued that, in reality, only a very few people were actually working in these clean energy power plants, despite

reports that "thousands" were being employed. Still others have complained about the noise generated by the plants, and assessed that the media only touts the positive aspects of renewable energy and none of the negative aspects (Delicado, Figueiredo, & Silva, 2016).

5. Conclusion

Climate change has shown itself to be a serious threat to the world. Under long-standing policies adopted by the European Union (Gupta & Grubb, 2003; Bohringer, 2014; Delbeke & Vis, 2015), member countries are responding to this threat by investing more into their renewable energy sector. Portugal has excelled in their commitment towards eliminating "dirty" forms of energy, with the help of EU support and foreign direct investment—most notably from China as part of China's "Belt and Road Initiative" (Huang, 2016; Du & Zhang, 2018). By recognizing the unique characteristics of its geographical regions, Portugal has established a diverse portfolio of green and clean energy technology.

Overall, Portugal has shown itself to be one of Europe's leading nations in adapting various sectors of the economy to greener energy sources in order to effectively fight climate change and to be in compliance with international agreements such as the Kyoto Protocol. However, as noted above, the Portuguese government appears to lack the complete support from its population and will need to find a solution to this problem in a relatively short time frame.

There seems to be a pronounced disconnect between politicians and Portuguese citizenry relating to renewable energy. In order to further develop renewable energy sources in Portugal, there needs to be an honest discussion in order to quickly reduce or possibly even eliminate the very skepticism that exists about the topic. For Portugal and the rest of the European Union, the time for action is now, whatever the final choices might be.

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