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Research Article

CAN STRICT INTELLECTUAL PROPERTY LAWS FACILITATE THE RENEWAL OF ENERGY SECTOR GROWTH? THE CASE OF SAUDI ARABIA

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Summary: 1. Introduction. – *1.1 Patent rationales – 1.2 The inventive step – 1.3 Strict patent law – 1.4 Soft patent law – 1.5 Patent law in Saudi Arabia.* – 2. The importance of incentive laws for the renewable energy sector – *2.1 Financial incentives rather than patent laws to develop the renewable energy sector. – 2.1.1 The Renewable Portfolio Standards (RPSs). – 2.1.2 Feed-in Tariff Policy (FIT).* – 3. Lessons for Saudi Arabia. – 4. Conclusion.

Keywords: Intellectual property (IP), renewable energy (RE), feed-in tariff (FIT), renewable portfolio standard (RPS).

ABSTRACT

Background: *Saudi Arabia (KSA) is a global leader in producing fossil fuels and has primarily relied on this energy source for its Gross Domestic Product (GDP). However, after the 2014 oil crash, the country established Vision 2030, intending to shift toward a non-oil dependent economy. Through this vision, Saudi Arabia aims to increase generation of electricity from clean energy sources by 30%. This paper examines the effectiveness of strict intellectual property (IP) regulations aiming to develop the renewable energy (RE) sector.*

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Methods: *In this paper, the author examines the effectiveness of strict intellectual property rights in-depth to develop innovation in the renewable energy sector as mentioned in Saudi Arabia's 2030 Vision. The paper makes a comparison with countries, such as the EU and China, regarding the extent to which strict intellectual rights have improved innovation. The author uses an inductive research approach that relies on qualitative data since it critically analyses regulations and policies in many countries, such as Saudi Arabia, the EU, and China.*

Results and conclusions: The author finds that financial incentives are more effective than in developing innovation in the renewable energy sector. Most importantly, developing countries benefit from financial incentives to increase innovation since many developed countries have adopted a strict IP law after their markets developed.

1 INTRODUCTION

Saudi Arabia has relied heavily on oil in its energy production, but the 2014 oil crash pushed the country to diversify its economy, thus, the government established Vision 2030. Through this vision, the country aims to generate 58 gigawatts from clean sustainable sources. The renewable energy (RE) sector is developing and is not compatible with oil and gas in Saudi Arabia. Therefore, laws have been enacted to develop the new emerging sector by increasing innovation, which aims to increase the new sector's competition and prioritise renewable energy over fossil fuels to address the issue of climate change.

There are many methods of increasing renewable energy innovation. One of which is to enact strong intellectual property (IP) laws to make the new sector more attractive to investors. These investors will not spend time and money on a new sector that cannot protect innovations. Thus, patent laws are designed to encourage businesses to innovate. This motivates investors in the RE sector to create new inventions, obtain patents, and gain the right to sell their products exclusively. Hence, patent laws can be seen as a means of developing the RE sector.

However, others argue that patent laws limit competition by giving confident investors exclusive rights to sell their products, and that financial incentives are more effective than patents to develop the RE sector.[2] Patents work particularly well in mature sectors, but most developed countries rely on financial incentives. Flexible IP laws are introduced in the early stages of developing new sectors; strong IP laws are enacted after achieving certain developmental milestones. Therefore, the paper aims to answer the following questions:

> *1. Do strict IP laws increase innovation in the renewable energy sector?*
>
> *2. Are financial incentives efficient to develop the renewable energy sector in developing countries?*

To answer the research questions, the paper first discusses the impact of IP laws on innovation in the RE sector. It compares many IP laws from developed and developing nations. The second part of the paper sheds light on the role of financial incentives on developing the RE sector, especially for developing nations.

2 Linda Yueh, 'Patent Laws and Innovation in China' (2009) 29 (4) International Review of Law and Economics 304, doi: 10.1016/j.irle.2009.06.001.

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1.1 Patent rationales

The free-market theory has spread across many countries, including the European Union (EU). The TFEU treaty mandates movement of goods and services without restriction, and any country that favours its national companies over other EU companies violates the TFEU.[3] The TFEU aims to increase competition, but a free market does not always increase innovation, so investors may hesitate to invest in markets that do not provide patents for their Research and Development (R&D). This led to the development of patent laws as exceptions to the free-market ideology, aiming to increase innovation and develop the market in the long term. Patents may be likened to rewards given to innovators for their hard work and positive role in development. In addition, patent laws are economically beneficial because knowledge development leads to new products and further innovations. Thus, patents encourage inventors in any market, eventually benefiting the public. There are many examples of patents serving the public interest; for example, pharmaceutical patents led many companies to develop COVID-19 vaccines which protected the public and reduced the death rate from the virus.

Although patents may increase innovation, their widespread use can harm a market by damaging rivals and allowing one individual to monopolise a product while restricting others from competing. In other words, easy patent access can lead to long-term monopolies that undermine free-market systems. Another issue caused by the widespread use of patents is the restriction of consumers' choices when purchasing products. Restricting consumers' options violates the principles of a free-market system that offers diverse goods and services. Succinctly, the extensive use of patents can both increase innovation and harm market competition.

1.2 The inventive step

The concept of invention is a vital step in innovation that most patent laws consider. Many countries require new inventions to be original in the field. Norway, for instance, requires a new invention to be "new," concerning what is already known, and to also differ essentially therefrom.[4] This means that the new invention must not be available to the public in writing, lectures, exploitation, or otherwise previously as that would make it known. Chapter 2 of the Norwegian Patents Act states that patent applications must contain a full invention description, including drawings, where appropriate. The description should enable a skilled person to duplicate the invention. However, the term "skilled person" is only used to ensure that a person can duplicate the invention using the description alone differing from other patent laws which will be explored later. Again, a new invention must only be new in terms of what is already known. In fact, Norwegian patents can be awarded for biological materials when the invention is used for industrial purposes.

Similarly, Denmark seems to have lowered its threshold, in comparison to strict IP countries, such as the U.K, to obtain patents.[5] Article 2(1) of the Consolidate Patents Act states that patents shall be granted for inventions that are new to the state of the art. Section 5 of the Act states that the invention can be patented, even if it is available to the public, if the availability is a

3 Treaty on the Functioning of the European Union (consolidated version) arts 34, 56 <https://www.legislation.gov.uk/eut/teec/contents> accessed 10 May 2023.

4 Norwegian Patents Act No 9 of 15 December 1967 <https://www.patentstyret.no/en/norwegian-patents-act> accessed 10 May 2023.

5 Consolidate Patents Act No 366 of 09 June 1998 (as amended by Act No 412 of 31 May 2000) <https://wipolex-res.wipo.int/edocs/lexdocs/laws/en/dk/dk129en.pdf> accessed 10 May 2023.

consequence of evident abuse concerning the applicant or an officially-recognised international exhibition falling within the terms of the Convention on International Exhibitions.

As it is in Norway, the new invention must be defined with a full description, allowing a person skilled in the art to duplicate the invention. This, again, means that the test for a person skilled in the art aims only to determine whether that person can duplicate the invention, which differs from other patent laws.

1.3 Strict patent law

However, UK patent law takes a different approach to patents. In many EU countries, a patent is awarded when the description of an invention allows a person skilled in the art to duplicate the invention, but the UK adopts a stricter approach, stating that the invention should undoubtedly be novel. The invention must not be clear for the person skilled in art.[6] UK case law has discussed the meaning of "person skilled in the art." Regarding the Technograph Printed Circuits Limited V. Mills and Rockley (Electronics) Limited case, the court held that the skilled person is a theoretical technician who possesses expertise, extensive knowledge, and familiarity with the literature relating to a particular field.[7] This imaginary skilled person has the capability to distinguish between obvious and non-obvious inventions and to see the obvious, but not necessarily the inventive.[8] Courts in the UK went even further to determine the characteristics of a person skilled in the art, showing that the UK threshold for patents is high. This can cause problems because it makes it difficult for small companies to obtain patents.

UK tests of a person skilled in the art have questioned whether the invention was obvious if that person spends as much time as the inventor did to create the new invention. In other words, it is not clear whether, if an invention took five years to invent, it becomes "obvious" only after a further five years. Such questions can be difficult to answer because the characteristics of a person skilled in the art are unrealistic. Judge Hoffman expressed disapproval of the concept of a skilled person, stating that it was a simplistic method of conveying legal concepts to a jury.[9]

However, UK courts seem to have further raised the threshold for patents. In the Medimmune Ltd v Novartis Pharmaceuticals UK Ltd & Ors case, the court stated that the assessment of obviousness means that the invention should not be obvious and that the steps taken to make the invention must also not be obvious.[10] Thus, the invention does not need to be obvious if the steps taken to make the invention are obvious, and therefore, do not pass the obviousness test. So, it is not necessary for a person skilled in the art to assess an invention if the steps used to make it are obvious, even if the invention is not obvious overall. In fact, the court in the Genetech case raised the patent threshold even higher.[11] The court stated that a person skilled in the art is a person who has inventive capacity in the biotechnology field, thus increasing the stringency of the obviousness test to include the complexity of the field. This increase in stringency had dramatic repercussions for many fields, including the pharmaceutical field. Inventors hesitated to invest time and effort in these sectors because the requirement for inventiveness was so high.

6 Paul Torremans, *Holyoak & Torremans: Intellectual Property Law* (8th edn, OUP 2016).

7 *Technograph Printed Circuits Ltd v Mills & Rockley (Electronics) Ltd* [1972] RPC 346 (per Lord Reid).

8 Torremans (n 6).

9 *Société Technique de Publicité v Emerson Europe Ltd* [1993] RPC 513.

10 *Medimmune Ltd v Novartis Pharmaceuticals UK Ltd & Ors* [2012] EWCA Civ 1234.

11 *Hospira UK Ltd v Genentech Inc* [2014] EWHC 1094 (Pat).

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1.4 Soft patent law

Patent law has been scrutinized by the Chinese government since 1984 and amended four times since then to fulfil the requirements of the Trade-Related Aspects of IP Rights (TRIPS) Agreement.[12] This agreement established the minimum requirements for member states regarding IP protection, thus, China needed to amend its patent law in 2000 before becoming a WTO member in 2001. However, the Chinese government continues to try balancing international agreements with public interests to encourage Chinese producers to innovate.[13] For example, China's adoption of public health measures, in its 2008 patent law,[14] exemplifies its attempt to balance international obligations and public interests.

China's approach to IP is lax. The main reason for this is the desire to develop technology through imitation and foster partnerships with Western companies.[15] Such imitation often violates strict patent laws, and China has adopted soft patent laws to allow for smoother technology transfer. Although China's patent laws should provide sufficient protection for IP, the law itself is less stringent and its enforcement is ineffective, revealing China's aim to learn from foreign technologies by maintaining an inadequate IP protection regime.[16]

China has developed a distinct approach to increase innovation—the "open door" policy—resulting in extensive technological development and innovation in China.[17] The policy prefers foreign investment over strict patent laws to increase innovation. This seems successful in China since the country has clearly developed more technologically. Moreover, China's enforcement of patent laws is poor, indicating the country's reluctance to tighten IP laws. These soft patent laws have allowed China to grow technologically while emphasising industrial policy development to utilise foreign technology and direct investment and foster increased spending on R&D.[18]

One of the methods China has adopted to encourage innovation is the establishment of special economic zones (SEZs), from 1979 onward, to attract foreign investment.[19] These are designated export-oriented areas that provide financial incentives for foreign investment. In 1985, China went even further by creating open port cities known as economic and trade development zones (ETDZs).[20] The establishment of SEZs and ETDZs has led to success in attracting high-technology foreign investment. In 1992, China established free trade zones (FTZs), which exempted exports and imports from tariffs.[21] In 1995, the country established high-technology development zones (HTDZs) in almost every province to attract technology and research centres. These efforts have resulted in increasing technological development in China.[22]

12 Monirul Azam, *Intellectual Property and Public Health in the Developing World* (Open Book Publishers 2016) doi: 10.11647/OBP.0093.

13 ibid.

14 Patent Law of the People's Republic of China (amended on 27 December 2008) <https://sipa.sh.gov.cn/patent/20191130/0005-28434.html> accessed 10 May 2023.

15 Noura Humoud Abdulaziz AlZaid, *Saudi Arabia and Intellectual Property: Learning from China's Approach* (KFCRIS 2021) <https://kfcris.com/en/view/post/365> accessed 10 May 2023.

16 ibid.

17 Yueh (n 2).

18 ibid.

19 Jung-Dong Park, *The Special Economic Zones of China and Their Impact on Its Economic Development* (Praeger 1997).

20 Shuang Gao and others, 'Dynamic Evolution of the Operating Efficiency of Development Zones in China' (2021) 13 (18) Sustainability 10395, doi: 10.3390/su131810395.

21 Yueh (n 2).

22 ibid.

Many studies show a relationship between foreign direct investment (FDI) and technological development. It is believed that FDI is vital for "catching up" on technological development and bridging the gap between developing and developed countries.[23] In their 1995–2000 study, Cheung and Lim confirmed the significant impact of foreign investment on patent applications, showing its positive impact on the productivity of local businesses.[24] Since it began attracting increased FDI, China has witnessed burgeoning technological and innovative development in coastal areas permitted to experiment with market-oriented reforms, leading to a significant rise in GDP.[25] Many studies show that FDI is more effective in increasing innovation and technological development than R&D because it creates a competitive environment that easily enhances innovation. The development of local technology benefits per capita GDP as exports increase with innovation increases. This clearly shows the significant impact of FDI on development and innovation.[26]

1.5 Patent law in Saudi Arabia

Patent law in Saudi Arabia has been enacted in cooperation with the GCC. The specific law is called the Gulf Cooperation Council Patent Law (also known as the "GCC Patent Law").[27] According to Article 2(2), a patent may be awarded if the invention is both novel and non-obvious and can be utilised in an industrial setting. The same article explains that the invention is considered new when it has not been anticipated by "prior art," meaning everything disclosed to the public by any means. Article 2(3) specifies that, for an invention to be considered patentable, it must possess an inventive step that a person with average skills and knowledge in the relevant field would not consider obvious, and Article 2(4) states that the invention must be considered industrially applicable. According to the Act, the meaning of "industrially applicable" should be broadly understood to include handicrafts. Article 3 explains what is excluded from patents, such as discoveries, scientific theories, mathematical methods, schemes, rules, methods of doing business, the performance of purely mental acts, and game playing. Finally, the act provides 20 years of protection for an invention, beginning from the patent application's filing date.[28]

Saudi Arabia recognises the importance of IP rights, which led to the 2018 creation of a specialised agency called the Saudi Authority for Intellectual Property (SAIP).[29] The agency introduces policies that tailor the provisions of international agreements to Saudi Arabia's needs, and its strategy was developed by seven public, private, and international entities. The agency stated that the Supreme Committee has approved its strategy for scientific research, development, and innovation, demonstrating the importance of the country's agency based on the belief that IP laws increase innovation.[30] The agency aims to balance encouraging local inventions and attracting international investment and innovation.

23 ibid.

24 Kui-yin Cheung and Ping Lin, Spillover Effects of FDI on Innovation in China: Evidence from Provincial Data (2004) 15 (1) China Economic Review 25, doi: 10.1016/S1043-951X(03)00027-0.

25 Yueh (n 2)

26 ibid.

27 Patent Regulation of the Cooperation Council for the Arab States of the Gulf (amended on November 1999) <https://www.wipo.int/export/sites/www/scp/en/meetings/session_14/ips/gcc_reg_2.pdf> accessed 10 May 2023.

28 ibid.

29 AlZaid (n 15).

30 ibid.

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However, in 2020, Saudi Arabia ranked sixty-sixth worldwide according to the Global Innovation Index (GII).[31] The index stated that Saudi Arabia exhibited limited innovative performance, meeting a below expectations rank for its income level. Many countries in the region have a higher GII ranking, such as the United Arab Emirates, ranked thirty-fourth. The index measures innovation based on seven elements, including knowledge and technology outputs, for which Saudi Arabia is ranked eighty-eighth out of 131 countries. The GII report highlights Saudi Arabia's absorptive capacity for foreign technologies, which is recognised as a limitation in Saudi Arabia's Eighth and Ninth Development Plans,[32] since the country still lacks innovation capabilities.[33]

Limited innovation capacity has reportedly resulted from a lack of human capital investment,[34] although the Saudi government greatly emphasises education. In 2021, the Saudi government allocated 186 billion SAR of funding to education,[35] leading to an increased numbers of students graduating into important fields, such as engineering and science.[36] Nevertheless, the number of qualified engineers who work in R&D is low in Saudi Arabia when compared to industrialised countries.[37] A survey conducted by the General Authority for Statistics (GASTAT) in 2018 examined innovation in Saudi Arabia[38] and reported that there were 5,323 PhD holders in Saudi Arabia, and 4,100 of the holders were foreigners.[39] This deficiency may be related to a lack of incentives for Saudi Arabian nationals to work in these fields. King Abdulaziz City for Science and Technology stated in its annual report that human capital and brain drains are the main challenges Saudi Arabia faces due to poor financial incentives.[40]

Another issue in Saudi Arabia presents in the weak links between academia, policy, and industry.[41] The lack of clear roles for government research entities, such as Taqnia and KACST, can lead to conflicts and coordination issues. According to the GASTAT report, industrial R&D in Saudi Arabia remains low and the private sector spends only 2.74% of its revenues on R&D, which is a low percentage compared to other industrialised economies.[42] This issue is significant as the industry is an important factor in the deployment of new technologies and is uniquely positioned to create innovations in manufacturing processes that escape IP innovation.

31 Soumitra Dutta, Bruno Lanvin and Sacha Wunsch-Vincent (eds), *Global Innovation Index 2020: Who Will Finance Innovation?* (Cornell University; INSEAD; WIPO 2020) doi: 10.34667/tind.42316.

32 Sami Alsodais, 'Science, Technology & Innovation in Saudi Arabia' (*WIPO*, September 2013) <https://www.wipo.int/wipo_magazine/en/2013/05/article_0006.html> accessed 10 May 2023.

33 AlZaid (n 15).

34 ibid.

35 Ministry of Finance of Saudi Arabia, 'Budget 2021' (*KSA*, December 2020) <https://www.mof.gov.sa/en/budget/2021/Documents/Budget2021_EN.pdf > accessed 10 May 2023.

36 AlZaid (n 15).

37 ibid.

38 ibid.

39 General Authority for Statistics, 'Institutional Innovation Survey Bulletin 2018' (General Authority for Statistics, 26 November 2020) <https://www.stats.gov.sa/en/1067> accessed 10 May 2023.

40 'King Abdulaziz City for Science's report' (KACST, 2020) <https://www.kacst.edu.sa/docs/annualrep20arb.pdf> accessed 10 May 2023.

41 AlZaid (n 15).

42 ibid.

2 THE IMPORTANCE OF INCENTIVE LAWS FOR THE RENEWABLE ENERGY SECTOR

Innovation is essential in the renewable energy sector because it increases the sector's efficiency, making it more competitive with the fossil fuel sectors.[43] Boosting innovation and efficiency in the new sector is important to transition from fossil fuels to clean energy. At present, oil and gas are the dominant energy sources due to their efficiency and lower costs, so most countries prefer them to renewable energy sources. This implies that innovation can significantly reduce costs, thus increasing the likelihood of countries relying on clean, sustainable energy rather than non-sustainable sources. The development of this emerging sector requires a special boost in education, research, technology, and finance.[44]

Regulations and policies are often used to develop innovation in the renewable energy sector because they establish frameworks for action and impose sanctions for non-compliance.[45] In environmental law, a special agency or government department is typically responsible for enacting laws due to the complexity of environmental matters.[46] This entity can determine the measures required to achieve specific environmental protection goals and promote clean energy sources. In addition, environmental regulations can drive the private sector to identify problems and help decision-makers improve the regulations. These laws should be efficiently coordinated and employ clear market methods, such as tradable allowances. They should also support innovation by giving economic agents the freedom to use technological solutions to both benefit them and ensure compliance with regulatory stipulations.[47]

Developed countries enforce laws and policies to encourage businesses in the sector to use sustainable energy sources. For instance, the United States (US) enacted the Energy Security Act, the Energy Policy Act, and the American Recovery and Reinvestment Act, aiming to limit the use of oil and gas and encourage the use of clean energy.[48] These laws are necessary for boosting a renewable energy sector that cannot compete with fossil fuels. Fossil fuel sectors have received a significant number of subsidies in the past, driving their competition, but this means that renewable energy laws are needed to provide incentives for the emerging sector.[49] The US's enactment of RE regulations increased the renewable energy use in the country by 92% from 2009 to 2010, with a further increase to 109% from 2011 to 2012.[50] This is an example of the government formulating laws to encourage businesses to invest in generating electricity from sustainable sources.

43 Saidi Magaly Flores Sánchez, Miguel Alejandro Flores Segovia and Luis Carlos Rodríguez López, 'Impact of Public Policies on the Technological Innovation in the Renewable Energy Sector' (2020) 10 (2) International Journal of Energy Economics and Policy 139.

44 Adam Jaffe, Richard G Newell and Robert N Stavins, 'A Tale of Two Market Failures: Technology and Environmental Policy' (2005) 54 (2-3) Ecological Economics 164, doi: 10.1016/j.ecolecon.2004.12.027.

45 Ben Daley and Holly Preston, 'Aviation and Climate Change: Assessment of Policy Options' in S Gossling and P Upham (eds), *Climate Change and Aviation: Issues, Challenges and Solutions* (Routledge 2012) ch 16, 347, doi: 10.4324/9781849770774.

46 Sánchez, Segovia and López (n 43).

47 ibid.

48 Joseph P Tomain and Richard D Cudahy, Energy Law in a Nutshell (3rd edn, West Academic Pub 2016).

49 ibid.

50 Kyle Weismantle, 'Building a Better Solar Energy Framework' (2014) 26 St Thomas Law Review 221.

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2.1 Financial incentives rather than patent laws to develop the renewable energy sector

Financial incentives can develop the renewable energy sector when they are awarded for investments in knowledge and indicate government support for scientific research. Scientific research leads to the generation of marketable products or processes, which can eventually encourage investors to contribute more heavily to the sector. It also increases technology development in the RE sector, encouraging it to compete with oil and gas. In addition, laws and policies can promote measures for increasing innovation in renewable energy, including helping to (a) plan, define the problem, and establish the objectives to be pursued, and (b) establish institutions to design, coordinate, implement, and evaluate the resulting actions. According to the literature, these measures have a long-term positive impact on the RE sector.[51]

Significant empirical evidence has shown the positive impact of financial incentives on the renewable energy sector, demonstrating that financial incentives, such as green taxes and tradable certificates, encourage innovation in the RE sector. The financial incentives increase the number of patents in the sector through an increase in innovation, confirming that the renewable energy sector relies heavily on financial resources.[52]

However, there are many challenges facing the renewable energy sector. First, unlike fossil fuel sources, renewable energy sources are still novel.[53] The percentage of clean energy usage ranges from 0.1% to 10% of total energy use in the premier forum for international economic cooperation, "the Group of Twenty" (G20).[54] Other countries are less likely to use renewable energy sources due to the complexity of clean energy technology. Countries with advanced renewable energy sources, such as the UK and Germany, deployed 68 MW and 9.9 MW of wind energy to 13,183 MW and 588 MW, respectively, from 1990 to 2003.[55] This shows that new renewable energy technologies require considerable amounts of financial investment.

Second, renewable energy sources have high initial capital costs. Generating electricity from renewable energy means installing many high-cost products, such as solar panels and wind turbines, that require relevant connecting equipment and space to operate efficiently.[56] Although the price of renewable energy fuel is almost zero, the initial cost remains high.[57] Therefore, long-term financing and investment must be secured before initiating renewable energy projects.[58] One study showed that without financial incentives, investors hesitate to invest in renewable energy sources, in particular, wind energy.[59] Another study, conducted in India, found that limited financial incentives were the main barrier that deterred investors

51 Sánchez, Segovia and López (n 43).

52 ibid.

53 Taedong Lee, 'Financial Investment for the Development of Renewable Energy Capacity' (2021) 32 (6) Energy & Environment 1103, doi: 10.1177/0958305X19882403.

54 ibid.

55 Catherine Mitchell and Peter Connor, 'Renewable Energy Policy in the UK 1990-2003' (2004) 32 (17) Energy Policy 1935, doi: 10.1016/j.enpol.2004.03.016.

56 Lee (n 53).

57 Anthony Owen, 'Renewable Energy: Externality Costs as Market Barriers' (2006) 34 (5) Energy Policy 632, doi: 10.1016/j.enpol.2005.11.017.

58 John Mathews and others, 'Mobilizing Private Finance to Drive an Energy Industrial Revolution' (2010) 38 (7) Energy Policy 3263, doi: 10.1016/j.enpol.2010.02.030.

59 Sonja Lüthi and Thomas Prässler, 'Analyzing Policy Support Instruments and Regulatory Risk Factors for Wind Energy Deployment—A Developers' Perspective' (2011) 39 (9) Energy Policy 4876, doi: 10.1016/j.enpol.2011.06.029.

from investing in the RE sector.[60] Thus, it is clear that the renewable energy sector is still not competitive with fossil fuels, and financial incentives are needed to develop the emerging sector and attract investors.

Third, the development of the RE sector requires a significant amount of R&D, which can increase the competitiveness of renewable energy through technological development.[61] One study showed a clear relationship between R&D and the reduced costs of low-carbon technology, boosting the use of renewable energy sources.[62] These three reasons explain why the renewable energy sector cannot compete with fossil fuels alone.[63] Instead, financial incentives and R&D are vital methodologies to develop the sector, and countries that provide financial incentives for the RE sector are those most likely to develop this new sector.[64]

2.1.1 The Renewable Portfolio Standards (RPSs)

One of the main initiatives for developing the RE sector is the introduction of renewable portfolio standards (RPSs).[65] RPS stipulate the minimum requirements for renewable energy sources that the electricity grid must meet. For instance, the government may use an RPS to force an electricity grid to generate 15% (or any other percentage) of electricity from RE sources. RPSs aim to establish minimum requirements to increase over time.[66] They also work to increase the energy mix's reliability, diversity, and environmental benefits.[67] One study reported that RPSs are the most common policy instrument used in the US to increase the renewable energy use.[68] This policy is applied in many other countries, such as Sweden, Italy, U.K., Japan, and Australia.[69] This policy was studied and implemented in the 80s in the state of Iowa, which was studied heavily after Rader and Norgaard (1996).[70]

There are two forms of RPSs. The first form is voluntary, which attracts many researchers to examine its effectiveness.[71] This type of RPS provides more flexibility, reduces enforcement costs, and creates cooperative regimes compared to the mandatory form of RPS.[72] Moreover, voluntary RPSs can be seen as political devices for signalling the necessity for clean energy

60 A Mahesh and KS Shoba Jasmin, 'Role of Renewable Energy Investment in India: An Alternative to CO2 Mitigation' (2013) 26 Renewable and Sustainable Energy Reviews 414, doi: 10.1016/j.rser.2013.05.069.

61 Lee (n 53).

62 Tobias Wiesenthal and others, 'A Model-Based Assessment of the Impact of Revitalised R&D investments on the European Power Sector' (2012) 16 (1) Renewable and Sustainable Energy Reviews 105, doi: 10.1016/j.rser.2011.07.139.

63 Lee (n 53).

64 ibid.

65 Haitao Yin and Nicholas Powers, 'Do State Renewable Portfolio Standards Promote In-State Renewable Generation?' (2010) 38 (2) Energy Policy 1140, doi: 10.1016/j.enpol.2009.10.067.

66 ibid.

67 ibid.

68 Barry D Solomon and Shan Zhou, 'Renewable Portfolio Standards: Do Voluntary Goals vs Mandatory Standards Make a Difference?' (2021) 38 (2) Review of Policy Research 146, doi: 10.1111/ropr.12424.

69 Ryan Wiser, Jan Hamrin and Meredith Wingate, 'Renewable Energy Policy Options for China: A Comparison of Renewable Portfolio Standards, Feed-in Tariffs, and Tendering Policies' (*Center for Resource Solutions*, June 2002) <https://resource-solutions.org/document/renewable-energy-policy-options-for-china-a-comparison-of-renewable-portfolio-standards-feed-in-tariffs-and-tendering-policies> accessed 10 May 2023.

70 Nancy Rader and Richard Norgaard, 'Efficiency and Sustainability in Restructured Electricity Markets: The Renewables Portfolio Standard' (1996) 9 (6) The Electricity Journal 37, doi: 10.1016/S1040-6190(96)80262-4.

71 Solomon and Zhou (n 68).

72 Gireesh Shrimali and Joshua Kniefel, 'Are Government Policies Effective in Promoting Deployment of Renewable Electricity Resources?' (2011) 39 (9) Energy Policy 4726, doi: 10.1016/j.enpol.2011.06.055.

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goals,[73] encouraging utility companies to reach agreements with renewable energy producers to fulfil state requirements.

The second form of an RPS is mandatory, in which governments force electricity grids to include renewable energy in their electricity production at rates determined by law.[74] In the US, an estimated three-fourths of all state RPSs are mandatory, and many research studies have shown their positive impact.[75] For instance, Carley, Yin, Powers, Shrimali, Kniefel, and Barbose, et al. provided evidence of the significant impact of mandatory RPSs on developing the RE sector.[76] Moreover, preliminary evidence suggests that mandatory RPSs significantly impact project economics more than voluntary RPSs. In other words, voluntary RPSs may provide more flexibility to allow the private sector to adopt cleaner energy for energy production, but enforcement mechanisms also appear significant when developing the emerging renewable energy sector.[77]

There are many benefits of RPSs, such as reducing greenhouse gas (GHG) emissions by 59 million MT of carbon dioxide (CO2) and reducing construction-related life-cycle emissions from fossil plants.[78] Reducing GHG emissions assist in reducing climate change. According to an IWG central-value SCC estimate, RPSs played the main role in 2013 to reduce future pollution damage by approximately $3.5 billion (2.2 ¢/kWh-RE).[79] Furthermore, reducing GHG emissions improves human health since GHGs harm human health and cause environmental damage.[80] Epidemiological studies prove the relationship between air pollution and increased mortality,[81] showing that more than 3 million deaths annually are caused by air pollution.[82] The EPA stated that its Clean Power Plan (CPP) would provide $14–34 billion by 2030 due to a reduced mortality rate.[83] This evidence clearly shows the positive impact of renewable energy initiatives, such as RPSs, on reducing climate change and improving human health.

2.1.2 Feed-in Tariff Policy (FIT)

Feed-in tariffs (FITs) are a second method used to increase the RE sector. An FIT is a policy aimed at promoting renewable energy generation whereby providers of clean energy receive the price of their energy production from large utility companies.[84] This leads to clean energy producers receiving guarantees from the national grid to purchase their renewable energy

73 Christina Boswell, 'The Double Life of Targets in Public Policy: Disciplining and Signalling in UK Asylum Policy' (2015) 93 (2) Public Administration 490, doi: 10.1111/padm.12134.

74 Solomon and Zhou (n 68).

75 ibid.

76 ibid.

77 ibid.

78 Galen Barbose and others, 'A Retrospective Analysis of Benefits and Impacts of US Renewable Portfolio Standards' (2016) 96 Energy Policy 645, doi: 10.1016/j.enpol.2016.06.035.

79 ibid.

80 Johanna Lepeule and others, 'Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009' (2012) 120 (7) Environ Health Perspect 965, doi: 10.1289/ehp.1104660.

81 ibid.

82 Stephen S Lim and others, 'A Comparative Risk Assessment of Burden of Disease and Injury Attributable to 67 Risk Factors and Risk Factor Clusters in 21 Regions, 1990–2010: A Systematic Analysis for the Global Burden of Disease Study 2010' (2012) 380 The Lancet 2224, doi: 10.1016/S0140-6736(12)61766-8.

83 Environmental Protection Agency, *Regulatory Impact Analysis for the Clean Power Plan Final Rule* (US EPA 2015) 73.

84 United Nations Economic and Social Commission for Asia and the Pacific Fact Sheet, https://www.unescap.org/sites/default/files/26.%20FS-Feed-In-Tariff.pdf

production over a long period, commonly 15–20 years.[85] For example, France fixed the price of wind electricity generation at 8.2 €cents/kW h for 10 years.[86] Portugal also fixed the price of hydropower generation at 5.91 €cents/kW h.[87] Germany has reduced the price of new wind power plant installations by 1% and of photovoltaic (PV) systems by 10%.[88] These examples show that FITs help to increase renewable energy production.

FITs have been widely used to support the RE sector. The US was the first country to adopt FITs to support increased PV systems when the country enacted the Public Utility Regulatory Policies Act in 1978.[89] Most governments recognized FITs in their legislation in the 1980s and early 1990s. For example, Germany introduced an FIT system via the Electricity Feed Law in 1991 and initiated the *1000 Roofs Programme*, which provides compensation for PV systems on small roofs linked to the grid through provision of grants worth 70% of the investment costs.[90] Japan also provided subsidies to PV owners in its *Subsidy Program for Residential PV Systems* in 1994.[91] These financial programs allowed Germany and Japan to become the leading countries in new PV installations in the OECD, reaching 78.5% in 2006.[92]

FITs can play a role in raising the use of RE sources, enhancing their capability to meet new and continuing energy demands. In 2009, the global economy consumed about 11.16 billion tons of equivalent oil.[93] Asia contributed a large share to global energy consumption, accounting for 37% in 2009.[94] By 2035, half of the global energy consumption is expected to come from Asian consumers.[95] FITs can play a significant role in satisfying future energy demand by increasing clean energy generation, but the successful application of FIT policies depends on three components: guaranteed access to the grid (renewable energy producers must ensure that their clean energy will be linked to the grid), a long-term purchase agreement (usually 15–20 years), and a payment level based on the costs of renewable energy generation.[96]

3 LESSONS FOR SAUDI ARABIA

Saudi Arabia cannot apply an unadaptable Chinese model to increase its innovation since it cannot provide companies with the same advantages of colossal market size and low labour costs as China. However, Saudi Arabia can learn from the Chinese model to increase innovation by introducing flexible IP laws for technology transfers, and it can also take advantage of its unique, central location to attract FDI.[97] One study argued that developing countries, including Saudi Arabia, should push for flexible patent laws because developed

85 Toby D Couture and others, *A Policymaker's Guide to Feed-in Tariff Policy Design: Technical Report NREL/TP-6A2-44849 July 2010* (NREL; Golden co 2010) doi: 10.2172/1219187.

86 Ming-Chung Chang, Jin-Li Hu and Tsung-Fu Han, 'An Analysis of a Feed-in Tariff in Taiwan's Electricity Market' (2013) 44 (1) International Journal of Electrical Power & Energy Systems 916, doi: 10.1016/j.ijepes.2012.08.038.

87 ibid.

88 ibid.

89 Elbert Dijkgraaf, Tom P van Dorp and Emiel Maasland, 'On the Effectiveness of Feed-In Tariffs in the Development of Solar Photovoltaics' (2018) 39 (1) The Energy Journal 81, doi: 10.5547/01956574.39.1.edij.

90 ibid.

91 ibid.

92 ibid.

93 United Nations Economic and Social Commission for Asia and the Pacific Fact SheetFact Sheet (n 159).

94 ibid.

95 International Energy Administration, *World Energy Outlook 2011* (OECD/IEA 2011) doi: 10.1787/weo-2011-en.

96 Couture and others (n 85).

97 AlZaid (n 15).

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nations are interested in new markets, not new competitors.[98] Hence, strong IP legislation would force developing countries to navigate uncharted territory.

The need to develop flexible IP laws has been recognised by many conventions, such as the Paris Convention, which allocated for "asymmetries" and allowed countries to adopt different IP protection standards based on their levels of national development.[99] TRIPS has also provided room for flexibility in developing countries by granting them enough flexibility to allow the development of their nation-specific macroeconomic policies, according to TRIPS-compatible norms. Despite efforts to enact international IP laws, national laws are still valid within countries' jurisdictions.[100] Hence, Saudi Arabia should adopt proper IP laws tailored to its economy. As stated previously, many studies show the significant impact of financial incentives on the development of innovation.[101] In fact, financial incentives have been proven to surpass patent laws to develop innovation in the renewable energy sector. A moral argument can be made that developing countries should be given the same flexibility that developed countries once had. There should be no question of *whether* Saudi Arabia should have strong IP laws, but *when*.[102]

4 CONCLUSION

This paper has focused on the role of strong patent laws to increase innovation and, consequently, develop the RE sector. The paper first examined the rationale behind patent laws in market systems, giving examples of patent laws in the EU, the UK, China, and Saudi Arabia, showing that they seem to have increased innovation, but not significantly. The second section of the paper discussed the role of financial incentives in developing the renewable energy sector and innovation, demonstrating that financial incentives increase innovation more dramatically than IP laws. Financial incentives seem more effective than IP laws for developing innovation in the renewable energy sector. Some examples of successful financial incentives for the RE sector have been given, such as RPSs and FITs. In conclusion, Saudi Arabia should adopt flexible IP laws and enact financial incentive legislation to develop its renewable energy sector and achieve this aspect of Vision 2030.

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98 ibid.
99 ibid.
100 ibid.
101 Sánchez, Segovia and López (n 43).
102 ibid.

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