

Drivers and Barriers for Renewable Energy Investments

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Abstract—This article analyses drivers and barriers for renewable energy investments, and provides three suggestions to reduce investment risk.

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I. INTRODUCTION

In the last few decades, studies have shown that the cost of solar power has dropped an amazing 99%. Global new investments in clean energy have surged to \$332 billion in 2018 from \$88 billion in 2005 according to a recent Bloomberg report. According to Octopus, institutional investors plan to double their allocations to renewable energy from 4.4% to 7.1%, which account for \$210 billion estimated inflows over the next five years. As the energy that has recently been recognized as the "mainstream" energy source, renewables are rapidly becoming the preferred choice. Behind the rapid development in the new energy sector, what drives and hinders renewable energy investment? What's the next step for investors?

Over the past 60 years, the average temperature in Alaska has risen by about 3°F. This increase is more than twice as warm as the rest of the United States. The United States Environmental Protection Agency (EPA) states that winter warming has increased by an average of 6°F and has led to changes in ecosystems, such as the early rupture of spring river ice. When people are attracted by the trade war, a threat from global warming is quite close. By simply type "flood news" on google, tremendous flood news will come out. Studies have shown that as sea level begins to inundate coastline over the next decades, \$22 billion worth of commercial real estate properties in Florida is under low to high flood risk. According to NASA, the burning of fossil fuels is one of the main reason causes global warming. Humans began looking for new energy alternatives to traditional energy few decades ago, and the investing trend keeps increasing.

According to the Global Trends in Renewable Energy Investment 2018, the amount of total new investment in renewable energy have surged to \$332 billion in 2018 from \$88 billion in 2005. Solar power and wind power take the lead to get the most investment among all energy sectors. The world's total renewable power capacity has a total of 2195 gigawatts in 2017. Almost half of the total capacity came from BRICs countries. Global new investment in

renewable energy keeps increasing over the past 10 years and most investments were invested in emerging markets.

II. DRIVERS AND BARRIERS FOR RENEWABLE ENERGY INVESTMENTS

A. Drivers for Renewable Energy Investments

Technological innovation is becoming one of the key drivers of renewable energy investment. New technologies involving automation, AI, blockchain, and advanced materials all have accelerated the deployment of renewables. In the last decade, the cost of PV and wind has fallen dramatically. FirstSolar, an American PV manufacturer of solar panels automated its US manufacturing plant in 2017 and tripled the size of its panels at a cost of 30 percent less compared to its competitors according to a report by Deloitte Insights in 2018. The share price of FirstSolar doubled during that year. In the past, availability on demand has become the barrier to widespread sustainable electricity. As the improvement of energy storage technology, it is feasible to reach full penetration of renewables with low cost.

An article issued by Energy & Environmental Science introduced a concept termed thermal energy grid storage, a more efficient and low-cost way to store energy. This approach is achieving significant trade-offs by directly storing heat rather than power, and reducing the cost of round-trip efficiency. Another energy storage tool is lithium-ion batteries. The price of lithium-ion batteries in 2016 was \$273 per kilowatt, a 73% reduction since 2010 according to BloombergNEF. The USA Plug-in Vehicle sales has increased by 81% in 2017, which created demand of market for the lithium-ion batteries. Reduction in cost and new supply chain in EV industry all drive the demand for lithium-ion batteries. Lithium-Ion Battery producer Samsung SDI Co doubled its market capitalization in 2017. The stock price of Albemarle Corporation, an industry leader in lithium and lithium derivatives, tripled in 2017.

Environmental, Social, and Governance, also called ESG investing, has become a new trend of investing in recent years. The increased interest of investors and the possibility of excess returns after risk adjustments have increased the total assets of sustainable investment strategies to \$12 trillion in the US, which accounts for a quarter of all managed professional assets (Brad & David). In the current market, more than 58% of institutional investors are investing in renewable energy to fulfill ESG criteria. Shareholder

pressure and the rising competitiveness have led to increased investment in renewable energy by the fossil fuel industry. In 2016, Large oil corporations more than doubled their number of acquisitions, project investments and venture capital stakes in renewable energy relative to 2015, and 49% of transactions in the past 15 years involved renewable energy, most of which included solar PV.

With the deterioration of environmental pollution and the rapid expansion of population, independence from fossil fuels is a widely-shared goal. The Paris Climate Agreement, which aimed to reduce the emissions of gases that contribute to global warming, has been signed by 197 countries and ratified by 185 as of January 2019 according to Encyclopedia Britannica. Commitments to a climate action plan to meet the goal of limiting the rise in global temperature is another driver for renewable energy investment. To date, over 100 cities worldwide report at least 70% of their energy production is from renewables, and 40 of them are currently operating on 100% renewable electricity. Corporations are also turning their attention to renewable energy, with the likes of Apple, Amazon, Google, Wal-Mart, IKEA, and several major commercial banks and other companies are increasingly moving to 100% renewable energy supplies (Forbes).

Energy access advance drives up the investment in renewable energy in some least developed countries. With the sharp drop in costs and development of the automation process, implementation of solar panel system becomes more viable in developing countries. Many of the world's densely populated coastal areas suffer from severe drought. To provide fresh water to these areas, and also to consider how to use clean energy resources to efficiently produce water, a team of researchers at the Massachusetts Institute of Technology and the University of Hawaii created a detailed analysis of a symbiotic system that combines pumped hydropower energy storage systems and reverse osmosis desalination plants, which can meet these two needs in a large engineering project. The system can economically bring fresh water and renewable energy to the drought-stricken coastal regions of the world. At the meantime, international groups like the World Bank and SEforALL are laying the foundation to help developing countries gain access to renewable energy. The World Bank provided over \$200 millions to help increase access to electricity in West Africa and Sahel Region in 2019 according to The World Bank.

B. Barriers for Renewable Energy Investments

Factors above all promote the increase in renewable energy investment. Now let's move to barriers. Due to unfamiliarity with the technologies or uncertainties over performance, renewable energy projects often require higher transaction cost including assessing resources, permitting, planning, assembling financing packages, and negotiating power-purchase contracts with utilities. With the large scale of infrastructure for the existing energy sector, companies are more willing to retrofit and upgrade current plants instead of switching to renewable technologies to avoid large capital expenditures. In addition, to implement a new energy project, it may need historic weather-related data such as wind, solar radiation, and precipitation records. Such data are often readily available in developed countries, but there is a large gap in the availability of this data in developing countries. As

a result, unavailability of historic weather-related data impedes investors to invest in renewable projects.

Investment risk is another barrier to renewable energy investment. In developing countries, public institutions and legal systems often lack medium and long-term stability, capacity and reliability to implement and enforce general regulation of the law and the private sector, as well as supportive incentives for renewable energy. Unstable politics, risk of expropriation, breach of contract, war, and civil disturbance all impede investors' enthusiasm for renewable energy investment in developing countries. Renewable energy projects generally take a long time, which brings the concern of liquidity, refinancing risk, and currency risk.

From a private sector perspective, decision-making procedures become another barrier in renewable energy investments. When investors try to make investments in the renewable energy project, they are concerned about the return from the project. One of the key performance indicators that investors are concerned with is the net present value. The high unit upfront capital costs and capital-intensity, non-accelerated tax depreciation policies, and a high discount rate will all drag the net present value down. In developing countries, institutions usually don't have the creditworthiness to get loans from banks, and the unattractive risk-return and long time period projects cannot raise capital from secondary markets. As a result, investors may give up making an investment in new energy projects during the decision-making procedure, especially in developing or least developed countries.

Policies have a huge influence on new energy projects. The market size and environment keep changing, and the policies related to renewable energy must keep up with the pace of the rapidly changing environment. However, with exhausting bureaucratic processes, it always takes a long time to establish new policies. The policy inconsistencies have become a barrier for renewable energy investment. For example, the process of wind project approval takes at least one year in China. Also, energy related companies are relatively more sensitive about a country's policy. In 2018, solar related stock fell as China halted building new solar farms. Although cost of generating new energy has significantly dropped in recent years, new energy projects still depend on policies.

III. SUGGESTIONS

Regarding those drivers and barriers for renewable energy investment, I offer three suggestions:

- First, we need to advance renewable energy projects from initiation to full investment maturity. Seek advice from entrepreneurs or business incubator will help improve the quality of project proposals, risk assessment, and technical support. By incorporating technologies such as block chain and AI into new energy projects, it will also be more viable and easy to implement new energy projects.
- Second suggestion is to engage local financial institutions in renewable energy finance. The ESG concept has become a new investing trend for institutional investors. The interaction between the developed technologies and the environment-friendly concept of renewable energy will also help financial

institutions entering renewable energy sector. The local financial institution can help the business to design and plan an effective on-lending facility that will provide various loan sizes for different renewable energy projects.

- Last, we could attract more private investors by leverage risk mitigation tools. For every problem that investors have, there is usually a solution through risk mitigation tool. For example, we can use hedging instruments for currency risk, interest rate swap against interest rate fluctuations, or seek for government guarantees for political risk.

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