



2019

The Dollar is Green, and American Banks Should Be Too; Clean Energy Finance and Its Circulation Through Green Banks

Erin C. Moore
Georgia Southern University

Follow this and additional works at: <https://digitalcommons.georgiasouthern.edu/honors-theses>

 Part of the [Corporate Finance Commons](#), and the [Environmental Studies Commons](#)

Recommended Citation

Moore, Erin C., "The Dollar is Green, and American Banks Should Be Too; Clean Energy Finance and Its Circulation Through Green Banks" (2019). *University Honors Program Theses*. 385.

<https://digitalcommons.georgiasouthern.edu/honors-theses/385>

This thesis (open access) is brought to you for free and open access by Digital Commons@Georgia Southern. It has been accepted for inclusion in University Honors Program Theses by an authorized administrator of Digital Commons@Georgia Southern. For more information, please contact digitalcommons@georgiasouthern.edu.

The Dollar is Green, and American Banks Should Be Too; Clean Energy Finance and Its Circulation Through Green Banks

An Honors Thesis submitted in partial fulfillment of the requirements for Honors in Parker College of Business.

By Erin Moore

Under the mentorship of Dr. Axel Grossmann

The earth is at risk for irreversible damage if the carbon footprint of humans is not drastically reduced immediately. The power of financial institutions to initiate change has been utilized by countries around the world against climate change. Financial systems known as green banks mitigate the risks associated with financing environmental projects. Through an examination of the financial performance of major green banks in the United States and the green energy superpowers, the paper discovers Green Banking is not only socially responsible by supporting a clean environment, but also produces a profitable fiscal environment. In this paper, I will explore the use of financial tools to stimulate the investment of green technology and infrastructure to reduce carbon emissions, its use in China and Germany, and compare it to the status and potential of green banking in the United States.

Thesis Mentor: _____

Dr. Axel Grossmann

Honors Director: _____

Dr. Steven Engel

April 2019

The Parker College of Business

University Honors Program

Georgia Southern University

Acknowledgements

I would like to express my deep gratitude for my professor, Dr. Axel Grossmann for his mentorship during the thesis writing process. His willingness to give his time and expertise has been appreciated.

Introduction

The time is now to act to reduce carbon dioxide emissions and lower the temperature of Earth to a sustainable degree. The U.S. Global Change Research Program concluded that in the last decade the earth has experienced record-shattering weather extremes and climate-related catastrophes that are becoming greater in strength and number. The U.S. Global Change Research Program reported in their 2017 Climate Science Special Report that assessed extreme weather events, “Since 1980, the cost of extreme events for the United States has exceeded \$1.1 trillion. These trends are expected to continue in the future over climate (multidecadal) timescales” (Wuebbles, et al, 2017, p. 18). The United Nations Secretary-General António Guterres’ concluded that economic damage from environmental crises cost \$320 billion dollars around the world in 2017 alone (The United Nations, Office of the Secretary-General, 2018). Climate change is costly for the economy without even taking into consideration the indirect costs associated with public health that could lead to food and water insecurity, disease, and conflict. Many lawmakers and environmental advocates have begun to call for immediate action and have discovered the power of financial institutions to lead the fight to reduce the acceleration of climate change through agreements such as the Equator Principles and Paris Agreement. Countries around the world have embraced financial sustainability and see it as essential for future prosperity.

The purpose of the paper is to explore the economic impact of green banking and recognize the progressive benefits of financing renewable energy projects. The paper will establish a general understanding of the term “Green Banking” by discussing its history and the various approaches to green banking by the main players of public and private green financial institutions. Through an examination of the financial performance of major green banks in the United States and around the world, the paper discovers Green Banking is not only socially responsible by supporting a clean environment, but also a profitable fiscal environment. In this paper, I will explore the use of financial tools to stimulate the investment of green technology and infrastructure to reduce carbon emissions and its use in China and Germany and compare it to the status and potential of green banking in the United States. Figure 1 shows the growing trend of renewable energy investment globally. If renewable energy capital can be harnessed through green banks, it has the potential to reduce climate change and introduce economic prosperity for all shareholders.

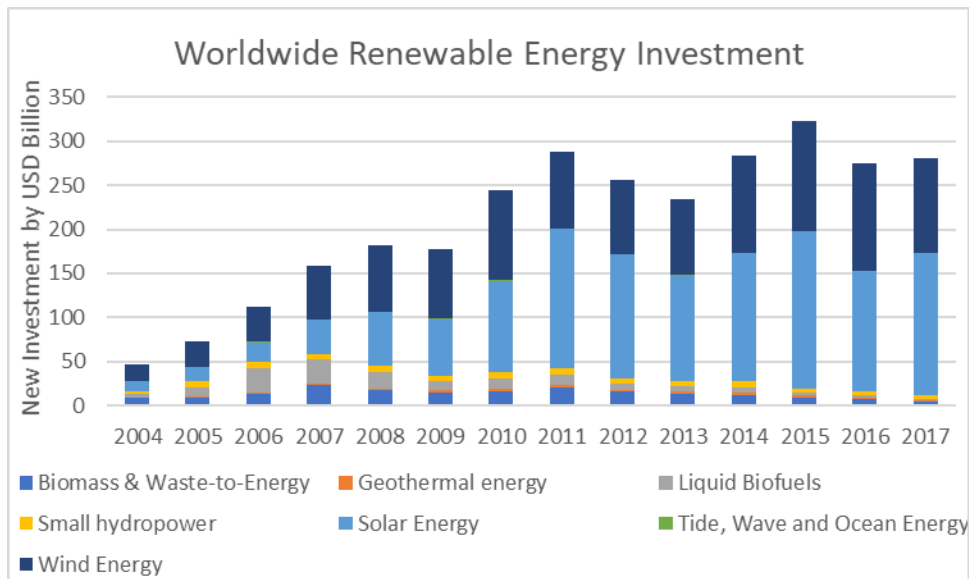


Figure 1: Overview of renewable energy investment by development financial institutions from 2004-2017. Note: Data gathered by Frankfurt School-UNEP Centre/BNEF, 2018.

What is Green Banking?

Financial institutions created or modified to promote environmentally friendly objectives have become broadly known as green banks. Many banks that claim to be green differ in the extent and approach to their sustainability efforts. There are a variety of approaches to green banking practices such as minimizing the environmental footprint of bank operations, offering retail products that promote green home improvements and other small projects or reducing carbon emissions through its bank business. These banking practices are lucrative and help to achieve the goal of a lower carbon footprint. For the purpose of this paper, I will concentrate on the two different types of green banks that focus on financing large-scale clean energy projects. These types of green banks, public green banks and private investment green banks are found in the United States and around the world. The objectives for both public and private green banks are the same, but how their objectives are met differ. First, the green bank must increase the return on invested capital for green ventures which can be done by reducing the financing costs and by making funds more accessible. Second, the bank has to limit the cost of risk and those associated with compliance. The means typically utilized for the first two objectives are discounted interest rates, green bonds, green ratings, green stock indices, and mandatory disclosures. Third, the bank must attract and retain the interest and response of investors and the public. The means typically used for this objective are to implement educational programs, building an investor network, and mandatory disclosures for both the bank and the beneficiary. The response to these objectives also differs on the location of the bank and the availability of policy support as well as financial and legal infrastructure.

Public Green Banks

Environmental projects are limited due to the steep initial cost of implementing green technology and the uncertainty of payback. The public green bank model uses the power of public funds through their relationship with a government entity to entice private investment for renewable energy generation. In the United States, these green banks are quasi-public and are in six different states such as the Connecticut Green Bank and the Green Bank of New York, while seven other states have established green public interest funds (Weiss and Konschnik, 2018). The National Green Banks of China follows a similar model as an American public green bank. The model can be adapted to meet the demands of the local market. The banks are set up to be flexible through their leverage of public funds that are gathered from fees from energy bills, taxes, initiatives, and various other income from federal sources. Through the partnership with the government entity, legislation can be used to achieve the objectives of green banks by offering incentives, such as tax breaks and regulations that increase the demand of clean energy. Although public green banks are a relatively new concept, the Nevada Green Bank Opportunity Assessment found:

As of 2016, the most mature Green Banks in the country, in Connecticut and New York, have collectively invested nearly \$575 billion in total clean energy investment. These investments also mobilize private sector investment into a project by reportedly three to six times the amount of public sector dollars at work (The National Renewable Energy Laboratory, 2017)

Public green banks have been quite successful. For every \$1 spent by state of Connecticut, the Connecticut Green Bank has attracted \$6 of private investment. This effective leverage ratio has allowed the Connecticut Green Bank to mobilize over \$1.3 billion dollars of investment into

their state’s economy since its creation. The bank has also supported nearly 16,000 green jobs in 6 years (Connecticut Green Bank 2018.) Figure 2 shows that the basic public green bank model. The simplified model demonstrates how government entities create a green financial structure to harness public and private investment for sustainable projects using innovative financial mechanisms. The government provides the initial capital to create a public green bank. The public green bank uses the capital to attract more investors and create a channel for those who seek funds for their green projects. The mix of public and private funds mitigates some of the risk involved in investing in clean energy projects. The green bank and the private investors receive a return as the loan is paid with interest.

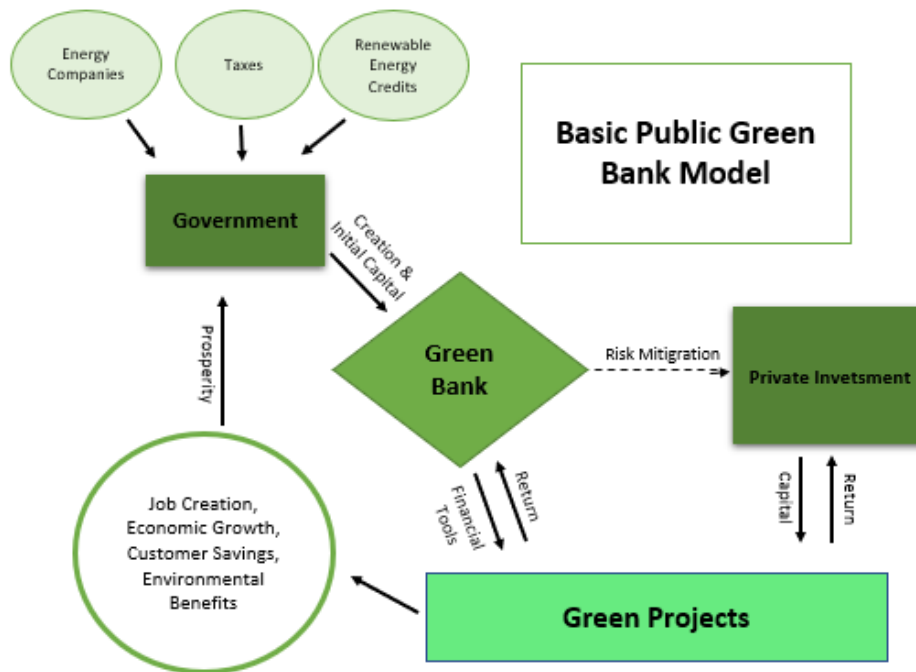


Figure 2: The Basic Public Green Bank Model

Private Green Banking

Many private banks are similar to the public green bank model but do not have relationship with the government. Instead, private financial institutions rely on a mix of financial tools to gather funds for green investments such as bonds and mutual funds. For private investment green banks, I will study those green banks that comply with the Equator Principles. As of April 2018, there are 94 financial institutions in 37 countries that have adopted the Equator Principles. See Appendix A for a complete list of the financial institutions. The Equator Principles Association (2018) defines Equator Principles (EP) as, "...a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence and monitoring to support responsible risk decision-making". EP is applied to four financial tools: Project Finance Advisory Services, Project Finance, Project-Related Corporate Loans, and Bridge Loans. These tools aid the expansion or upgrade of a project that potentially could have a damaging environmental or social impact and instead assist the project in meeting positive standards using outline procedures. The Project Finance Advisory Services and Project Finance apply to projects with total capital costs of \$10 million or more. Project-Related Corporate Loan criteria requires that most of the project is under the control of the client, the total loan amount is over \$100 million, the EP firm's commitment is at least \$50 million, and the loan tenor is at least two years. The fourth EP final product is the bridge loan which has a life span of less than two years and is used to refinance a Project Finance or Project-Related Corporate Loan. While EP has been criticized for not enforcing financing projects that violated its standards, I will utilize the EP classification to narrow the broad spectrum of green banking and sustainable investing. There are five EP members in the USA: Bank of America

Incorporated, Citigroup Inc., Ex-Im Bank, JPMorgan Chase & Co., and Wells Fargo Bank, N.A..

Figure 3 shows the progress as of 2017 of each of the five U.S. EP banks towards their goal of equity and debt capital used for sustainable businesses, environmental projects and developing strategies to address climate change. The banks include all aspects of a low carbon economic in their goals including investing and lending for energy efficient buildings and vehicles as well as green bonds and sustainable infrastructure. Each bank has invested nearly the same dollar amount towards a green economy, yet some have larger goals with only a few years difference in the planned completion date.

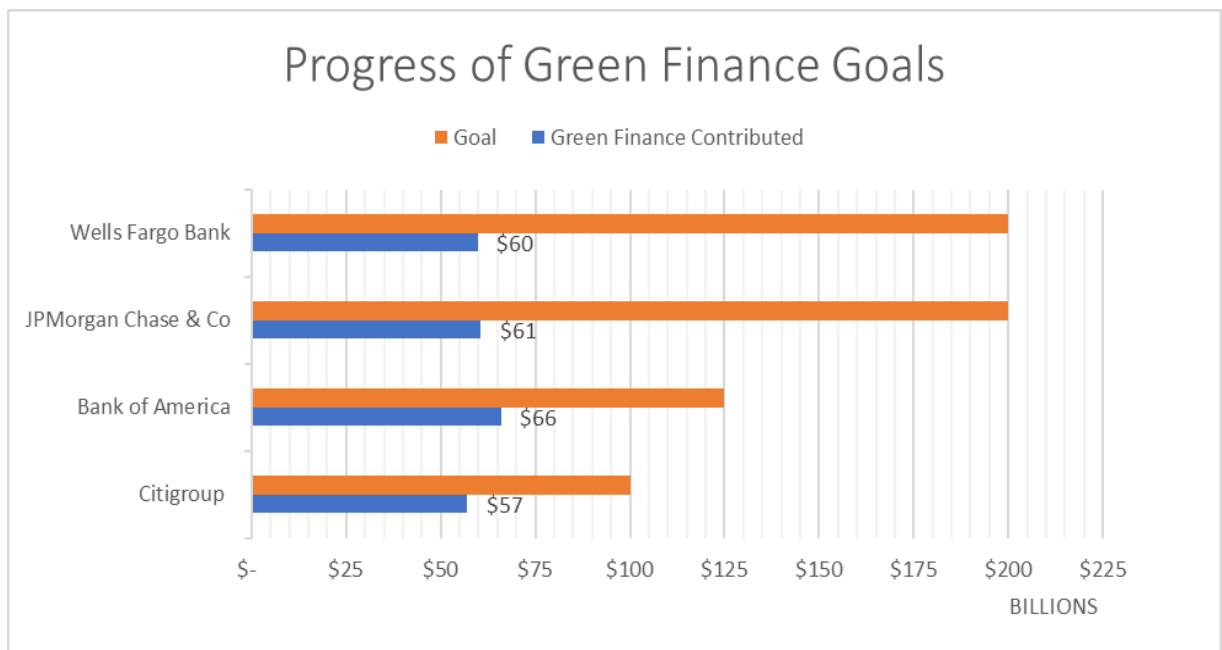


Figure 3: The Progress of Green Finance Goals of five U.S. EP members. Data gathered from Wells Fargo Bank, JP Morgan Chase & Co., Bank of America, and Citigroup, 2019.

History of Green Banking

The idea of financial institutions becoming catalysts for positive environmental change was introduced at the 1992 Earth Summit, which created the United Nations Environment

Programme – Finance Initiative (United Nations 1992). The framework of green banking was established by the Equator Principles, which was created by the International Finance Corporation in 2003 to determine and manage the risks faced by financial institutions in social and environmental projects. To influence the decisions of businesses, lawmakers have recently targeted the financial sector to lead the change for environmental sustainability in business operations. In 2008, a taskforce was created under the Barak Obama presidential administration to promote clean energy development. The concept was introduced as part of the bill known as the American Clean Energy and Security Act. The bill failed to pass the Senate, so advocates turned to the state and local levels (Green Bank Network.) Connecticut established the first state green bank in 2011. Since 2011, six other states have joined the movement to facilitate investment in clean energy technology. The governor of New York, Andrew Cuomo, established a goal for the state’s energy mix to be made of at least 50% of renewable energy by 2030. As part of Cuomo’s Clean Energy Standard, utility companies are required to phase in renewable power and achieve a power mix comprised of 30% renewable energy by 2021. In 2015, the United States signed the Paris Agreement, a pledge to reduce carbon emissions by 2020. The Paris Agreement also called for annual public and private investments of over \$100 billion by 2025 to assist developing countries in their efforts to reduce climate change. As of 2017, the Paris Agreement has raised over \$10 billion dollars. The United States withdrew from the pledge in 2017 with a shift of political power. The withdrawal of the United States sparked greater commitment to the efforts of the Paris Agreement by foreign countries and the American public. Many cities, states, and companies in the United States have individually pledged to the Paris Agreement. The city of San Francisco, California and Vancouver, Canada have even set goals to become 100% powered by renewable energy. The government-supported green banks have

experienced great success, because the government mitigates some of the risk for banks to finance green projects, such as the uncertainty of profitability and expense (Leonard, 2000). Process has been made towards the achievement of these goals through new regulations and public support calling on all companies to do their part. Additionally, investors can benefit from the growth in the clean energy sector by investing in the Dow Jones Sustainability Index (WISGI). The WISGI tracks the success of the top 10% of companies in the Dow Jones with the best environmental sustainability practices and U.S. Environmental Protection Agency EPA Green Power Rank celebrates and tracks companies who are the largest green power users. Figure 4 shows the positive growth of the WISGI and The Dow Jones Sustainability U.S. Composite Index compared to the S&P 500. There may be correlation between the indices as all three indices are made up of constituents primary from the information technology, healthcare, and financial sectors. The Dow Jones U.S. Sustainability Index returns stayed in tow with the S&P 500 returns as the top performing companies of the indices have realized that corporate sustainability is now necessary to compete. Corporations are looking for opportunities to invest in environmental projects and green technologies. With new regulations, demand has grown, and private banks have realized the potential for offering green financial tools. The first American retail bank to be created with the mission of green banking was the First Green Bank in Mount Dora, Florida, which was founded in 2009. The First Green Bank has experienced limited growth over the last ten years with only 6 locations and less than a 1% market share in Orlando (Federal Deposit Insurance Corporation, 2018). Other private banks have had greater success, such as the Bank of America through financial innovation. The Bank of America created the Catalytic Finance Initiative in 2014. The initiative pulled together a dozen partners with an initial investment of \$10 billion dollars to meet the demands for clean energy projects through loans,

bonds, and grants. The many investors involved, and the variety of energy efficiency and renewable energy projects help to mitigate the risk that comes with investing in sustainability projects. The transition to a low carbon society will take more than government intervention but also support from individuals and businesses. Green Banking around the world has taken off as countries adopt climate finance regulations and government sponsored national green banks including China and Germany. Developed countries and even developing countries, have been pioneers in what has become known as green banking. In countries, such as People's Republic Bangladesh, the Constitution was amended to include an article about the protection and improvement of the environment (Roy, Salam Sarker, and Parvez, 2015). Sustainability has become vital to the success of emerging market economies. It is demanded by their stakeholders including NGOs, foreign investors, and shareholders (Roy et al., 2015). This devotion brings new opportunity for economies by pursuing green technology avenues of the energy industry. Green banking is not only good for the environment, but companies are making money off green financial strategies.

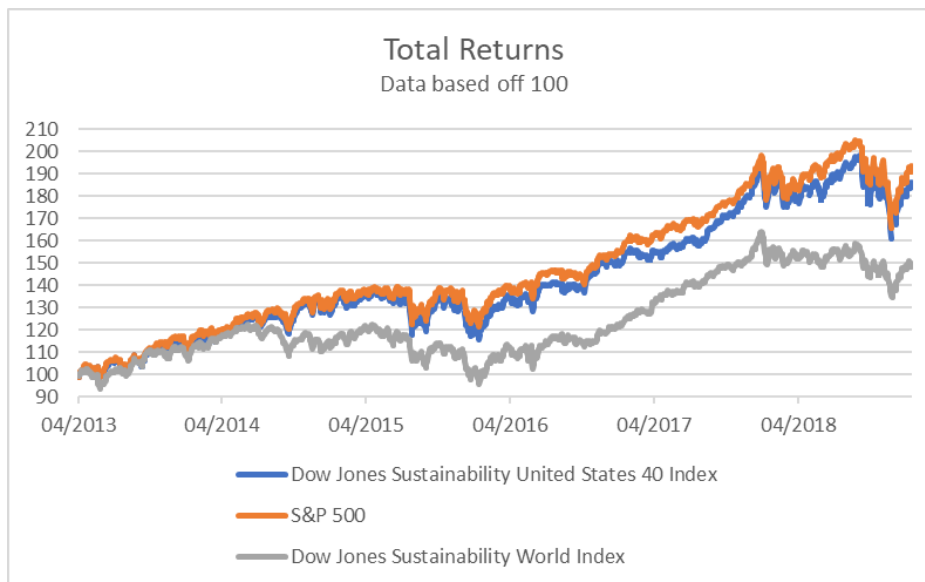


Figure 4: Performance of Dow Jones Sustainability Indexes versus the S&P 500.

Renewable Energy and Economic Development in the United States

In the United States, a shift in political power in 2017 has paused the growth and development of green energy. The current presidential administration favors the promotion and protection of fossil fuel industries such as coal. The potential of renewable energy to replace and outperform coal is not realized. The Wisconsin Energy Bureau wrote:

“Investment in locally available renewable energy generates more jobs, greater earnings, and higher output... than a continued reliance on fossil fuels. Economic impacts are maximized when an ingenious resource or technology can replace an imported fuel at a reasonable price and when a large percentage of inputs can be purchased in the state”

(National Renewable Energy Laboratory, 1997, p.2).

Renewable Energy technology is labor intensive from installation to maintenance, and the United States leads in the innovation of green technology, meaning green energy instruments are readily available for use across the country. A shift to a renewable energy economy could be an enormous success for rural states, such as West Virginia that rely heavily on coal. However, demand for renewable energy is still growing without federal government assistance. In the United States, the energy productivity, which measures the ratio of gross domestic product per unit of energy has steadily grown since 1990 as shown in Figure 5 (Bloomberg New Energy Finance, 2018).

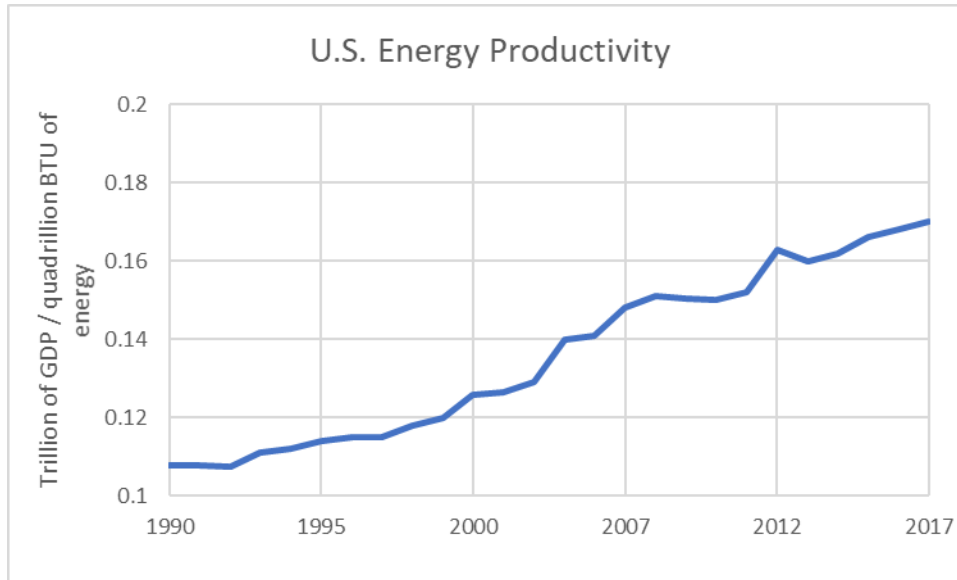


Figure 5: The Energy Productivity of the United States from 1990 to 2017. Data gathered by Bloomberg New Energy Finance, 2018.

Companies are becoming more energy productive by investing in clean energy technology which, in turn will make green technologies more efficient to produce and implement once the initial infrastructure is in place. In 2018, onshore wind became the cheapest unsubsidized source of new electricity generation across the world with the United States enjoying the lowest cost at \$27/MWh (Bloomberg New Energy Finance and The Business Council for Sustainable Energy 2019.) Bloomberg New Energy Finance in partnership with the Business Council for Sustainable Energy found, “Renewable energy provides 18% of total U.S. power generation, up from 11% in 2009” (2019). Sustainable energy jobs make up the bulk of newly created jobs in the American energy industry. Job creation soared from investments in developing the energy efficiency sector creating jobs at a faster pace than any other industry, particularly in solar and wind power. In 2016 alone, nearly 3.3 million sustainable energy jobs were created and continue to expand at a rate of 3% per year (Bloomberg New Energy Finance, 2017).

Renewable Energy Transitions around the World

China, Japan, India, Brazil, and Germany accompany the United States in leading the world in renewable energy job creation as shown in Figure 6. In 2018, over ten thousand new renewable energy jobs were created, and 72% of those jobs were in the five countries previously mentioned. China created 4,191.2 thousand jobs to meet the demands of implementing and maintaining green energy projects. China created nearly 10 times what the other countries did in almost every green energy technology sector, demonstrating their devotion to become the world leader in renewable energy.

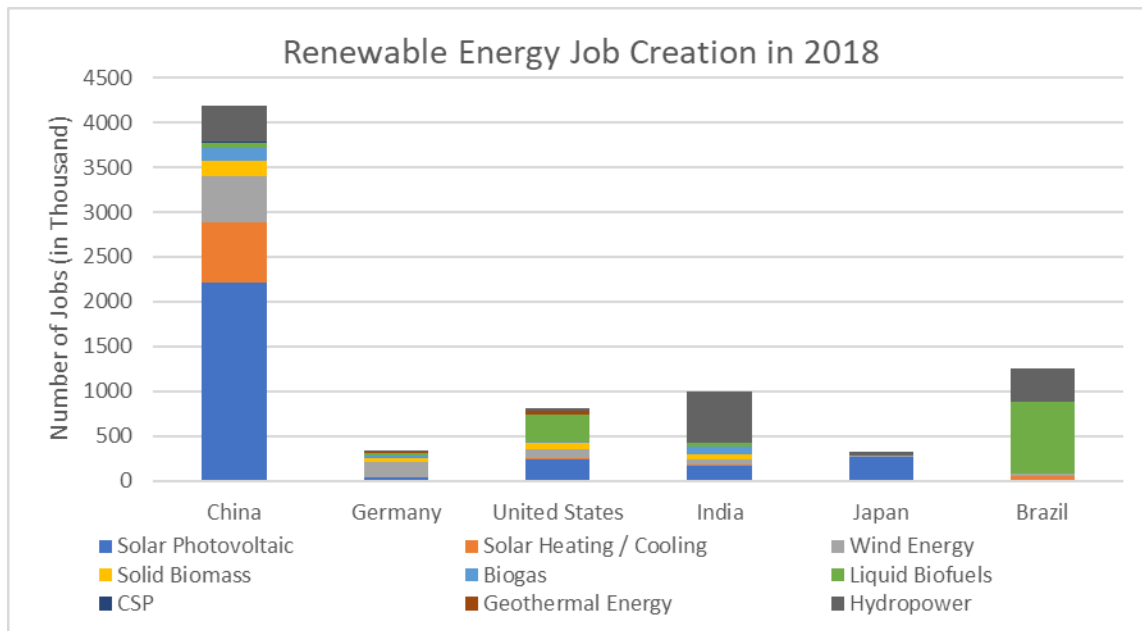


Figure 6: Renewable Energy Job Creation Around the World in 2018. Data gathered by the International Renewable Energy Agency, 2019.

The United Nations Environment Programme (2011) noted what it takes beyond the setup of an effective green financial system for it to be successful with the following comment:

It is clear that across banking, investment and insurance – the core activities of the financial system significant changes in philosophy, culture, strategy and approach, notably the overwhelming dominance of short-termism, will be required if capital and finance is to be reallocated to accelerate the emergence of a green economy (p. 36).

Each country differs on the appropriate structure for their green financial system based on more than the current make-up of their financial ecosystem. The approach must be compatible to the culture of the country. Yet, it is important for each country to observe and note the successes and failures of green finance models around the world. “International collaborations seem necessary to be able to exploit workable proofs of concepts, to share experiences and learnings, to ease and to accelerate actions that reduce greenhouse gas emissions and can turn down the heat from global warming” (UNEP, 2011, p.4). While this paper focuses on the three countries that are the superpowers of renewable energy, developing countries have begun to heavily invest in renewable energy through the guidance and assistance of the developed countries and private institutions.

Germany

Germany became the world’s first major renewable energy economy in the 1950s when the country legislated its first environmental regulations which pertained to potable water. Since the 1950’s, Germany has made massive strides towards sustainability, and in 2014 established the goal of producing more than 80% of their energy consumption with renewable energy by 2050 through the Erneurbare-Energien-Gesetz, or the Renewable Energy Sources Act (Federal Ministry of Food, Agriculture and Consumer Protection, 2012). The Renewable Energy Sources Act of 2014 established the target for the ratio of renewable energy to the gross final electricity consumption with the purpose of:

To enable the energy supply to develop in a sustainable manner in particular in the interest of mitigating climate change and protecting the environment, to reduce the costs to the economy not least by including long-term external effects, to conserve fossil energy resources and to promote the further development of technologies to generate electricity from renewable energy sources (Federal Law Gazette, 2014, p.6).

With this ambitious goal ahead of the German people, it is instrumental to have an effective green financial system. The German green financial system and the process for both demand and supply for capital are complex. It utilizes a variety of financial suppliers and tools to bring together financing channels with distribution channels. Financial institutions known as social or ethical banks have been the major key to facilitate green finance. The first German social bank was Okobank and was founded in the 1980s (Schäfer, 2017). As of 2018, Germany now has 3 banks that operate under the Equator Principles (The Equator Principles Association, 2018). The largest sustainable bank in Germany is the private social bank, GLS Bank. GLS Bank has created its own green financial model (Figure 7) to allow the use of a variety of capital sources and provides flexibility for investors to choose green project portfolios based on their own preferences and risk-aversion (Weber, Remer, 2011).

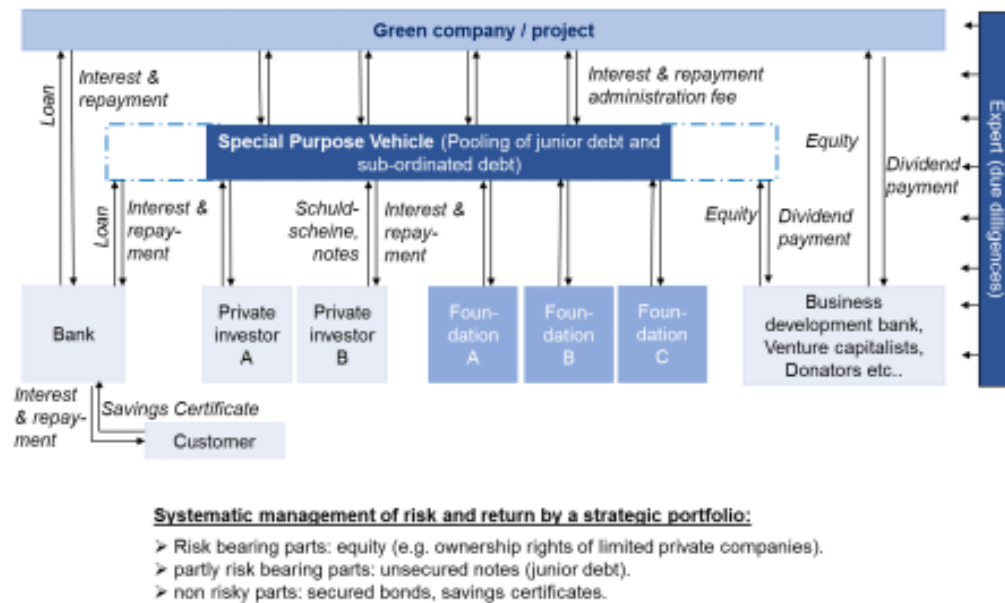


Figure 7: The GLS Bank's Green Finance Model. Diagram created by Dr. Henry Schaefer, 2017.

GLS grew by over 12% in 2018 and finished the year with 5.6 billion euros in assets. Nearly 23 million euros are in green bonds such as the Green Bond of the Dutch Rabobank, which is used to finance solar and wind turbines in Europe. GLS Bank also created the Sustainability Finance Real Economies Investment Fund to provide equity for the creation of small to midsize sustainable banks (GLS Community Bank, 2019). Some of the social banks are state-owned such as the KfW Group, which finances the majority of funds used for environmental projects. Across business sectors, the KfW group committed 33.2 billion Euros to financing climate action and environmental protection. The Mittelstandsbank, member of the KfW group committed 10.2 billion euros to corporate energy efficiency projects and renewable energy programs, such as the Deutsche Bucht offshore windfarm which will supply over 175,000 homes with green energy. Through its energy-efficient construction program and carrying out its Sustainable Development Goals, the KfW group created nearly a million jobs in 2017 (KfW Group, 2017). In 2015,

Germany sponsored 7.4 billion Euros for international climate projects with 4.7 billion coming from the KfW Group (Schäfer, 2017). In recent years, the sustainability efforts have been unable to reach their potential due to limited bank capacities. It is important for conventional banks and companies in Germany to deploy green financial tools in their business model and invest in green projects to reach the goals established by the Renewable Energy Sources Act. Information on the creation of renewable energy jobs in the European Union was last published in 2015. Germany leads the European Union in the wind and solar energy industries. Unfortunately, in 2015 employment in renewable energy decreased across by 6% from 333,700 jobs. The sectors of offshore wind and biomass added jobs, while wind, solar and hydropower jobs decreased or stagnated (O'Sullivan, Edler, and Lehr, 2016). In 2016, it is reported that jobs associated with wind power increased (Ferroukhi, Khalid, Garcia-Banos, and Renner, 2017). From 2006 to 2015, the share of renewable energy of the gross production of power has increased from 11% to 32%, mostly due to major subsidies by the German government. The cost has caused the average cost of electricity to increase by 25% (Böhringer, Landis, Reanos, and Tovar, 2017). It is essential for Germany to reexamine their approach and address shortcomings that have resulted from cost. The country must explore how to make renewable energy more cost efficient by allowing capitalism to be a driving force and convince its population that the benefits outweigh the cost. Still, Germany offers insight and evidence for a strong green financial system to leaders around the world. Germany continues to increase their production and use of renewable energy as shown in Figure 8. In 1990, renewable energy made up 3.6% of Germany's gross power production, and in 2018, renewable energy made up more than 35% of the power production. In less than 30 years, Germany has increased its renewable energy production by 91%.

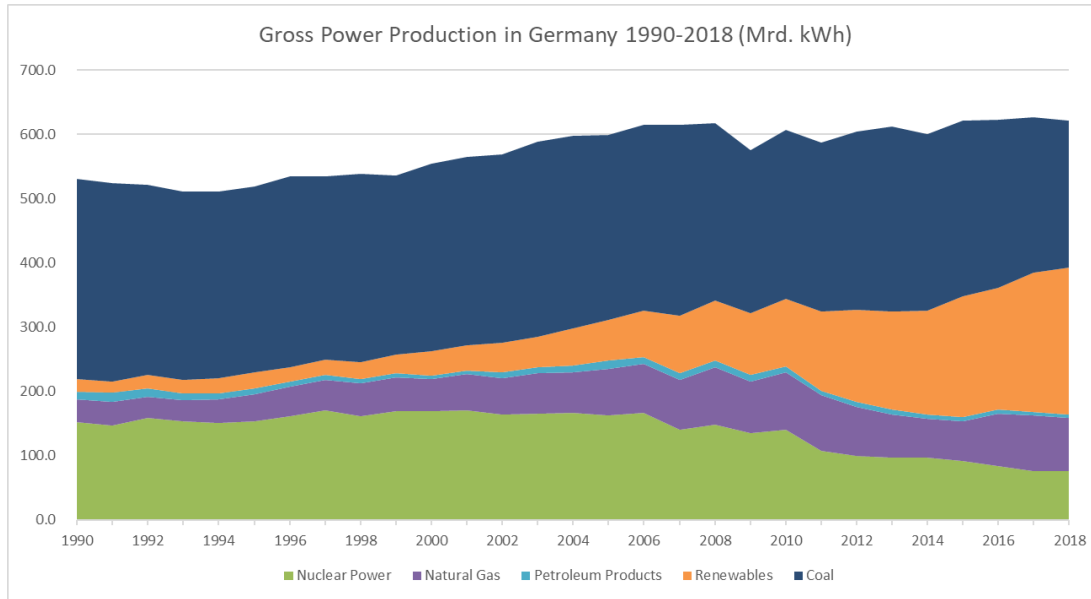


Figure 8: Gross Power Production in Germany 1990-2018 (Mrd. kWh). Data gathered by AG Energiebilanzen, 2019.

China

China has become the second largest economy in the world behind the United States after intense development and growth over the past 30 years. The growth has not come without a cost. The rapid economic development has caused great environmental damage that is greatly restricting the quality and longevity of life. To overcome the damage caused by economic growth, China is pursuing avenues to reduce their carbon emissions and has discovered the goal offered new opportunities to continue to grow in more sustainable ways. With fervor for human health and growth, China has become the leader in renewable energy investment as shown by the worldwide public investment trends. The investment is critical for China for the future success of the country in order to solve environmental issues which have affected air quality, water availability and energy security issues. The investment could be the catalyst to completely change the economy from producer to innovator of science and technology. Dr. Yuan Xu, a

scholar whose research focuses on China's environmental issues wrote, "climate mitigation is heavily innovation-intensive, demanding countless new technologies and rapid industrial learning and upgrading on energy efficiency, renewable energy, energy storage, smart grid, transportation and so on". The clean energy investment stimulates job creation, and in 2016, 3.64 million sustainable energy jobs were created (Ferroukhi, et al, 2017). The National Energy Administration (NEA) of China began in 2017 with even greater aspirations of clean energy investment. China's National Renewable Energy Centre announced that by 2020 the Chinese government will invest 2.5 trillion yuan, which is equivalent to 360 billion U.S. dollars into clean energy generation. With this investment, the National Energy Administration of China expects to create 2.6 million renewable energy jobs each year to meet a goal of 13 million jobs by 2020 (Ferroukhi, et al, 2017). A study from 1978 to 2008 in China found that for every percent increase in the consumption of clean energy the real gross domestic product of the country grew by .120% (Fang, 2011). Clean Energy is boosting the Chinese economy. Further research and development into clean energy will continue to improve the economic, social, environmental, and political wellbeing of the country and has shown its significance in China's 13th Five-Year Plan (Institute for Security & Development Policy, 2018). China creates Five-Year Plans to outline their economic and social goals for that time period. One of the critical focus areas were developing an environmental technology industry and improving the quality of the environment. To achieve their clean energy goals, China has established a Green Finance System based on the Equator Principles. The first steps were taken under the guidance of the People's Bank of China, which established the guidelines and tracking system for green lending, oversaw carbon emission trading programs, and a credit reference center to track the environmental violations of companies (Gongsheng, Jun, Zadek, 2015). Figure 9 shows the new investment in clean energy

from 2010 to 2018 by China, Germany, and the United States. China has supplied the lion's share of new investment into green energy since 2013 which set the country on the course to achieve its clean energy goals. A task force was assembled in 2015 to create a comprehensive green finance system for China and used the examples of green banks in the western world to create the most extensive green financial system in existence. China's green bank model uses green banks, green funds, and green development banks. The Green Bank created was the China Ecological Development Bank with a network of regional banks that deploy private capital and local divisions to leverage the existing financial structure and offer green credits. The banks use Green Funds that leverage the government funding to attract private investors. Green Development Banks are used to spearhead clean energy projects outside of China. The banks offer discounted green loans, green bonds, and green IPOs through the assistance of the financial infrastructure created by carbon markets, green ratings, green stock indices, green database, and green investor networks. The investments are protected through the creation of green insurance, lender liability, and compulsory disclosures (Gongsheng et al, 2015). With the establishment of the Chinese green financial system, China can achieve the green initiatives outlined in its Five-Year Plan and has the potential to become the world leader in the clean energy usage and innovation.

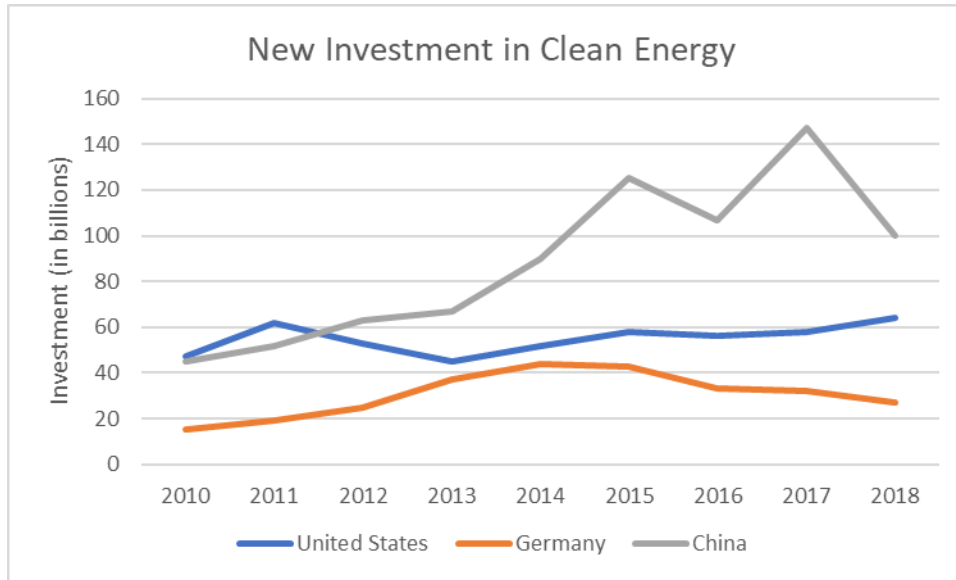


Figure 9: New Investments in Clean Energy in the U.S., Germany, and China. Data gathered by International Renewable Energy Agency, 2019.

Conclusion

For government entities and private companies who want to establish a green financial system, the risk and return associated are examined for their monetary value and does not consider the benefits that arise for society through economic development, scientific innovation, and environmental preservation. As research shows, the initial capital investment is well worth the risk. In the United States, Germany, and China, green financial systems have introduced financial innovation through financial tools such as green bonds, sustainable finance portfolios, and the leverage of public and private funds. Green Banking is one method to address climate change and reduce the environmental impact of society, but it is the most beneficial to influence change across all business industries.

Work Cited

- AG Energiebilanzen. (2019). Primary energy consumption. Retrieved from <https://ag-energiebilanzen.de/6-0-Primaerenergieverbrauch.html>.
- Bank of America Corporation. (2019). Environmental Sustainability and Commitment. Retrieved from <https://about.bankofamerica.com/en-us/what-guides-us/environmental-sustainability.html#fbid=eHfHUYIIvaf>.
- Bloomberg New Energy Finance. (2018). Sustainable Energy in America. Retrieved from <https://www.bcse.org/wp-content/uploads/2018-Sustainable-Energy-in-America-Factbook.pdf>.
- Bloomberg New Energy Finance and The Business Council for Sustainable Energy. (2019). Sustainable Energy in America. Retrieved from <http://www.bcse.org/FACTBOOK/>.
- Böhringer, C., Landis, F., Reanos, M., & Tovar, A. (2017). “Economic Impacts of Renewable Energy Promotion in Germany.”
- Citigroup, Inc. (2019). \$100 Billion Environmental Finance Goal. Retrieved from <https://www.citigroup.com/citi/sustainability/100billion.htm>.
- The Connecticut Green Bank. (2018). Green Bank Impact Report. Retrieved from <https://www.ctgreenbank.com/wp-content/uploads/2019/02/FY18-CGB-Impact-2-11-19.pdf>.
- The Equator Principles Association. (2018). Members & Reporting. Retrieved from <http://equator-principles.com/>.
- Fang, Y.P. (2011). Economic welfare impacts from renewable energy consumption: The China experience. *Renewable and Sustainable Energy Reviews*, 15, (9), 5120-5128
- Federal Deposit Insurance Corporation. (2018). Deposit Market Share Report. Retrieved from <https://www5.fdic.gov/sod/sodMarketRpt.asp?barItem=2>.
- Federal Law Gazette. (2014). Act on the Development of Renewable Energy Sources-Unofficial translation. Retrieved from https://www.clearingstelleeegkwkg.de/files/node/8/EEG_2014_Englische_Version.pdf.
- Ferroukhi, R., Khalid, A., Garcia-Banos, C., & Renner M. (2017). Renewable Energy and Jobs - Annual Review 2017. Retrieved from https://www.irena.org/documentdownloads/publications/irena_re_jobs_annual_review_2017.pdf.
- Frankfurt School-UNEP Centre/BNEF. (2018). Global Trends in Renewable Energy Investment 2018. Retrieved from <http://www.fs-unep-centre.org>.
- GLS Community Bank. (2019). The bank in numbers. Retrieved from <https://www.gls.de/privatkunden/gls-bank/zahlen-fakten/>.

- Gongsheng, P., Jun, M., & Zadek, S. (2015). Establishing China's Green Financial System. Retrieved from <https://www.cbd.int/financial/privatesector/china-Green%20Task%20Force%20Report.pdf>.
- Institute for Security & Development Policy. (2018). Made in China 2025. Retrieved from https://www.uschamber.com/sites/default/files/final_made_in_china_2025_report_full.pdf.
- JP Morgan Chase & Co. (2017). Environmental Social Governance Report. Retrieved from <https://www.jpmorganchase.com/corporate/Corporate-Responsibility/environment>.
- KfW Group. (2017). Sustainability Report 2017. Retrieved from <https://www.kfw.de/nachhaltigkeit/KfW-Group/Sustainability/>.
- The National Renewable Energy Laboratory. (2017). Green Banks. Retrieved from <https://www.nrel.gov/state-local-tribal/basics-green-banks.html>.
- O'Sullivan, M., Edler, D., & Lehr, U. (2016). Gross employment through renewable energies in Germany and reduced fossil fuel imports through renewable energies and energy efficiency - results for 2015. Retrieved from <https://www.bmwi.de/Redaktion/DE/Downloads/S-T/bruttobeschaeftigung-erneuerbare-energien-monitoringbericht-2015.html>.
- Roy, M.K., Salam Sarker, M.A., & Parvez, S. (2015). Sustainability in Banking Industry: Which way to move? *ASA University Review*, 9(2), 53.
- Schäfer, H. (2017). Green Finance and the German banking system. Retrieved from https://www.bwi.uni-stuttgart.de/abt3/files/forschung/BF7_GreenFinance_Banks_Germany_2017.pdf.
- UNEP. (2011). Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication - A Synthesis for Policy Makers. Retrieved from www.unep.org/greeneconomy. Federal Ministry of Food, Agriculture and Consumer Protection. (2012). The Renewable Energy Sources Act. Retrieved from https://www.bmel.de/SharedDocs/Downloads/EN/Publications/EEG-Amendment2012.pdf?__blob=publicationFile.
- United Nations. (1992). UN Conference on Environment and Development. Retrieved from <http://www.un.org/geninfo/bp/enviro.html>. National Renewable Energy Laboratory. (1997). "Dollars from Sense, The Economic Benefits of Renewable Energy." Retrieved from <https://www.nrel.gov/docs/legosti/fy97/20505.pdf>.
- The United Nations, Office of the Secretary-General. (2018, September 26). Planet at Risk for Irreversible Damage If World Does Not Act Fast to Implement Paris Commitments, Secretary-General Warns during Climate Change. Retrieved from <https://www.un.org/press/en/2018/sgsm19245.doc.htm>.
- Weber, O. & Remer, S. (2011). Social Banks and the Future of Sustainable Finance.

Weiss, J. & Konschnik, K. (2018). Beyond Financing: A Guide to Green Bank Design in the Southeast. Retrieved from <https://nicholasinstitute.duke.edu/sites/default/files/publications>. Wells Fargo. (2019). Environmental Sustainability. Retrieved from <https://www.wellsfargo.com/about/corporate-responsibility/environment/>.

Wuebbles, D.J., Fahey D.W., Hibbard, K.A., Dokken, D.J., Stewart, B.C., & Maycock T.K.,... (2017). Climate Science Special Report: Fourth National Climate Assessment. Retrieved from https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf.

Appendix A

Countries of the Equator Principles:

Institution	Country	Region
Arab African International Bank	Egypt	Africa
Mauritius Commercial Bank Ltd.	Mauritius	Africa
BMCE Bank	Morocco	Africa
Access Bank Plc	Nigeria	Africa
Fidelity Bank Plc	Nigeria	Africa
Absa Group Limited	South Africa	Africa
FirstRand Limited	South Africa	Africa
Nedbank Limited	South Africa	Africa
Standard Bank of South Africa Limited	South Africa	Africa
Ecobank Transnational Incorporated	Togo	Africa
Bank of Jiangsu	China	Asia
Industrial Bank Co., Ltd	China	Asia
IDFC Bank	India	Asia
Mizuho Bank, Ltd.	Japan	Asia
MUFG Bank, Ltd	Japan	Asia
Sumitomo Mitsui Banking Corporation	Japan	Asia
Sumitomo Mitsui Trust Bank, Limited	Japan	Asia
The Norinchukin Bank	Japan	Asia
Korea Development Bank	South Korea	Asia
Cathay United Bank Co., Ltd	Taiwan R.O.C.	Asia
CTBC Bank Co., Ltd	Taiwan R.O.C.	Asia
E.SUN Commercial Bank, LTD	Taiwan R.O.C.	Asia
Taipei Fubon Commercial Bank	Taiwan R.O.C.	Asia
KBC Group N.V.	Belgium	Europe
Eksport Kredit Fonden	Denmark	Europe

OP Financial Group	Finland	Europe
BNP Paribas	France	Europe
Crédit Agricole Corporate and Investment Bank	France	Europe
Natixis	France	Europe
Société Générale	France	Europe
DekaBank Deutsche Girozentrale	Germany	Europe
DZ Bank AG	Germany	Europe
KfW IPEX-Bank GmbH	Germany	Europe
Intesa Sanpaolo SpA	Italy	Europe
UniCredit SpA	Italy	Europe
DNB	Norway	Europe
Export Credit Norway	Norway	Europe
Royal Bank of Scotland	Scotland	Europe
Banco Bilbao Vizcaya Argentaria, S.A. (BBVA)	Spain	Europe
Banco Sabadell	Spain	Europe
Banco Santander S.A.	Spain	Europe
Bankia	Spain	Europe
Bankinter	Spain	Europe
CaixaBank	Spain	Europe
Instituto de Crédito Oficial (ICO)	Spain	Europe
Nordea Bank AB (publ)	Sweden	Europe
Skandinaviska Enskilda Banken AB	Sweden	Europe
Svenska Handelsbanken AB (publ)	Sweden	Europe
Swedish Export Credit Corporation (SEK)	Sweden	Europe
Credit Suisse Group	Switzerland	Europe
ABN Amro	The Netherlands	Europe
ASN Bank N.V.	The Netherlands	Europe
Coöperatieve Rabobank U.A.	The Netherlands	Europe
FMO (Netherlands Development Finance Company)	The Netherlands	Europe
ING Bank N.V.	The Netherlands	Europe
NIBC Bank N.V.	The Netherlands	Europe
Barclays plc	UK	Europe
Green Investment Group Limited	UK	Europe
HSBC Holdings plc	UK	Europe
Lloyds Banking Group Plc	UK	Europe
Standard Chartered PLC	UK	Europe
UK Export Finance	UK	Europe
Banco de Galicia y Buenos Aires S.A.	Argentina	Latin America

Banco Bradesco, S.A.	Brazil	Latin America
Banco do Brasil	Brazil	Latin America
Banco Votorantim SA	Brazil	Latin America
CAIXA Econômica Federal	Brazil	Latin America
Itaú Unibanco S.A.	Brazil	Latin America
Bancolombia S.A.	Colombia	Latin America
CIFI (Corporacion Interamericana Para El Financiamiento de Infraestructura S.A.)	Panama	Latin America
Banco de Crédito	Peru	Latin America
Banco de la República Oriental del Uruguay	Uruguay	Latin America
Ahli United Bank B.S.C.	Kingdom of Bahrain	Middle East
Bank Muscat S.A.O.G.	Sultanate of Oman	Middle East
First Abu Dhabi Bank (FAB)	United Arab Emirates	Middle East
Bank of Montreal	Canada	North America
Bank of Nova Scotia	Canada	North America
Canadian Imperial Bank of Commerce (CIBC)	Canada	North America
Export Development Canada	Canada	North America
Manulife	Canada	North America
Royal Bank of Canada	Canada	North America
TD Bank Financial Group	Canada	North America
Banco Mercantil del Norte S.A.	Mexico	North America
CIBanco S.A.	Mexico	North America
Bank of America Corporation	USA	North America
Citigroup Inc.	USA	North America

Ex-Im Bank	USA	North America
JPMorgan Chase & Co.	USA	North America
Wells Fargo Bank, N.A.	USA	North America
Australia and New Zealand Banking Group Limited (ANZ)	Australia	Oceania
Commonwealth Bank of Australia	Australia	Oceania
Efic	Australia	Oceania
National Australia Bank Limited	Australia	Oceania
Westpac Banking Corporation	Australia	Oceania