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EVALUATION OF IFC RELATED GREEN FINANCE AND EFFECT ON REDUCED GREENHOUSE GAS EMISSIONS

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ABSTRACT
The significance of green finance cannot be overlooked in achieving an inclusive, sustainable and cleaner growth of economy by generating environmental benefits. It helps in increasing the supply of finance from the public, private and not-for-profit sectors for the growth of sustainable development aspects. UN Environment encourages in the alignment of the financial system of different countries to streamline the financial flows for the attainment of sustainable development goals for 2030. In the current study, green finance activities of International Finance Corporation have been evaluated to check if the same is helpful in controlling the global warming as decided upon in Paris agreement. In addition, the effect of issue of green finance on the reduction in greenhouse gas emissions have been analyzed and evaluated.

INTRODUCTION
In this study, the investments made by International Finance Corporation or IFC and especially their grant of loans or issue of bonds have been studied into the projects which help in protecting the environment. These include, apart from other things, grant of loans or issue of bonds for solar projects, wind projects, biomass projects and green buildings. The reason for selecting only these types of projects is because these projects involve creation of annual energy and they also help in construction or rehabilitation of renewable energy projects apart from being effective in reducing greenhouse gas emissions. All the relevant data has been taken from the IFC Green Bond Impact Report released in the year 2018 to 2021. A multiple linear regression model has been applied and reduction in greenhouse gas emissions has been considered as a dependent variable while the variables of value of loans granted, annual energy produced and renewable energy capacity constructed are considered as independent or predictor variables. All the assumptions of linear regression have been tested before application of the test. The significances of various predictor variables have been studied. The study also focused on the impact they have on the dependent variable if they are changed by a single unit keeping all other variables as constant. In addition, adequacy of loans granted by IFC was also analyzed.

LITERATURE REVIEW
Robson (2014) elaborated that Australia's energy saving policies, especially subsidies, were faulty as the net effect reduced revenues to the exchequer and not diminished harmful emissions. Schneider and Goulder (1997) identified the importance of carbon tax as an effective government instrument which has more potential positive benefits than revenue reducing subsidies. Still, they have noted carbon tax to be unpopular pointing towards other such aspects which restrict implementation of punitive measures. Bye and Jacobsen (2011) have promoted tax imposition as an effective government tool of restricting harmful gas emissions. There is an implication that promoting self-measures and granting positive benefits is less impactful. Moreover, there is an inherent flaw in the model that assumes environmental quality to be a constant factor. Nicholls (2021) identified the importance of study of assessment of impact of sustainable finance for efficient allocation. Zhang, Zhang and Managi (2019) have highlighted that it is necessary to study green finance from financial viewpoints as in cost and benefit analysis. Zhou, Tang and Zhang (2020) have panel data from provinces of China and concluded that although green finance has positive effects on environmental quality, the impact differs according to economic development levels and prevalent levels of green finance development. As per the research of Shao, Zhong and Ren (2020), despite of best efforts, carbon intensity only changed slightly over a period in China. All these literatures highlight the fact that companies may be just willing to receive funds while contributing less to the environment. Bai, Chen, Yan and Zhang (2022) concluded that green finance had a significant impact on the reduction in carbon emissions but the same was different amongst different regions. Mngumi, Shaorong, Shair and Waqas (2022) have identified few research gaps in green finance studies. They identified that the dynamics of the relationship between impact and green finance needs to be investigated as the nature and volume of green finance is changing. Hence, study needs to be done which establishes an optimum level of positive environmental effect to be created in order to receive the benefits of such green finance or other such benefits.
Shishlov, Morel and Cochran (2016) have highlighted the need to focus on environmental integrity of green bonds and

the need to adequately define green bonds. The need to closely monitor transparency is also highlighted. Rose (2021) has suggested that green or climate finance should be limited unless investments are found to be reliable in being environmentally protective and providing good returns. Xu, Mei, Shahzad, Liu, Long and Zhang (2020) have concluded that regulations for green finance and green financial products are still in their nascent stage. This accompanied by environment impact disclosure being not mandatory adds to the complications. Muganyi, Yan and Sun (2021) revealed that the impact of green finance was impressive and it should be actively promoted but also identified the need for more research on risk free implementation of green finance products. Wang and Zhi (2016) identified the importance of regulations of grant of green finance. It was concluded that funds should match with the term structure of environmentally protective projects. There was an identified need for the investments in those projects to be made more liquid. Hence, there is an identified need for research to be done which prescribe or suggest regulations to be made for the grant and monitoring of green finance.

Maltais and Nykvist (2021) highlighted that business related incentives are more prominent for green finance than financial ones. There is an inherent implication that present green finance does not provide suitable financial incentives. As per report published by PWC (2021), cross border financial market infrastructure-based approach would lead to lower cost of issue, greater investor due diligence, greater trust by higher transparency, equal access and convergence of sustainable finance with mainstream one. Azhgaliyeva and Liddle (2020) have revealed in their study that global investments in renewable energy have increased since 2007 on an average level and financing costs are an important component in tariff decisions. There is an inherent implication that global investments are leading to reduction in finance costs. Afzal, Rasoulinezhad and Malik (2022) revealed that strong institutions and green finance policies should be combined to lower long term negative effects of financial development on the environment. Wang and Wang (2021) identified that the tertiary industry had the maximum impact of green finance. All these studies indirectly support the fact that International Finance Corporation is an ideal institution to play its role in grant of green finance. It would grant suitable financial incentives. It is cross border in nature and would lower cost of issue. Furthermore, it is an effectively strong institution which can carry out proper due diligence and also invest heavily in tertiary industries.

Fthenakis and Kim (2007) have identified that greenhouse gas emissions of solar power and nuclear technologies vary depending upon various factors. Moreover, it was revealed that previous studies giving advantage to nuclear power over photovoltaic were outdated. Fearnside (2003) has shown that renewable energy resources like hydroelectric dams are too complicated when their role in generating greenhouse gases needs to be studied. They do not reduce greenhouse gases in a straight forward manner. Ahiduzzaman and Islam (2011) have discussed in length about the need to generate more energy and also reduce greenhouse gases to a greater extent as the concerned country Bangladesh is deeply impacted by climate change. Guo, Geng, Dong and Liu (2016) have identified that energy production and greenhouse gas emissions have a complicated relationship. There have been phases when greenhouse emissions remained constant and phases where they increased rapidly. Hence, research needs to be done to adequately identify the relationship between clean annual energy production and greenhouse gas emissions so that better decisions can be taken with regards to such technologies.

Jiguang and Zhiqun (2011) have highlighted the role played by IFC is grant of green loans to China of about 2.8 billion yuan till September 2008 which can save 10,821,800 tons of carbon dioxide emissions. Still, implied doubts are being raised on whether it would be sufficient. Kerr and Avendano (2020) have identified that IFC had a very important role in defining green loans. However, there are still implied doubts over the total quantum of green loans granted by IFC and other institutions which would be adequate. Gilchrist, Yu and Zhong (2021) have noted that IFC follows a structured methodology in grant of green loans. Still, only 15 percent of green loans were accounted for by clean energy sector. Park and Kim (2020) noted that IFC has estimated that green loans amounted to only 7% of total loans in the private sector in 2018. The current system was blamed for this scenario. Hence, all these studies point to the fact that study needs to be done on the quantum of green loans granted by IFC so as to analyze whether they are environmentally adequate or not.
Chen, Yang, Zhao and Wang (2011) found that solar towers can reduce more greenhouse gas emissions than solar thermal plants. They have supported studies on the relationship between renewable energy cost and reduction in greenhouse gas emissions and quantification of further factors. Amponsah, Troldborg, Kington, Aalders and Hough (2014) identified the fact that different renewable energy method produces different greenhouse gas emissions. The paper has identified a need for further research on standardization. Lima, Mendes, Mothe, Linhares, de Castro, da Silva and Sthel (2020) talks about increasing renewable energy production in Brazil and accomplishing the Paris climate target. It is implied that research needs to be done so that both renewable energy production and environmental protection is maximized. Gunkel (2009) have busted the myth that hydroelectric power has a role to play in reducing greenhouse gas emissions. It was shown that

sometimes greenhouse gas emisisons even exceeded the traditional emissions from coal thermal power plants. Yang, Zhou, Zhang, Nielson, Li, Lu, Yanga and Chen (2018) studied a typical biomass gasification power plant in China and concluded that it reduces greenhouse gas emissions on a considerable level. It also identifies the need for further studies in improvements and standardization of the model. Khondaker, Hasan, Rahman, Malik, Shafiullah and Muhyedeen (2016) identified that 90% of the energy produced in UAE produce greenhouse gases. Stress has been given on research to produce more by renewable energy while minimizing greenhouse gas emissions. All these studies highlight the fact that there needs to be a research to identify a relationship between renewable energy production or establishment and consequent reduction in greenhouse gases so that a standard can be set for renewable energy production.

Research gaps identified by the study are: -

1. There is a need to establish an optimum level of positive environmental effect to be generated so that the benefits of green finance can be continued.
2. Research needs to be done which prescribe or suggest regulations to be made for the grant and monitoring of green finance.
3. IFC plays an important part in having a positive impact on the environment through the grant of green loans. The adequacy of grant of such green loans needs to be studied.
4. There is a need to study the relationship between produced energy and the reduction in greenhouse gas emissions.
5. There is a need to study the relationship between establishment of renewable energy producing plant and reduction in greenhouse gas emissions.

OBJECTIVES

The various objectives of the study are as listed under: -

1. To establish the optimum level of positive environmental effect to be generated for the benefits of green finance to continue.
2. To prescribe or suggest regulations to be made for grant and monitoring of green finance.
3. To check the adequacy of loans granted by IFC in meeting the environmental needs of the earth.
4. To analyze the effect of increase on annual energy produced on the reduction in GHG emissions.
5. To analyze the effect of increase in Renewable Energy Capacity constructed or rehabilitated on reduction in GHG emissions.

RESEARCH METHODOLOGY

The study proceeds by collection of values of few selected variables from the IFC Green Bond Impact Report Financial Year 2021, 2020, 2019 and 2018. A total of 48 values of observations where loans have been granted and subsequent effects estimated have been considered for the study. The selected independent or predictor variables were "Climate Loan committed" in USD Millions, "Annual Energy produced" in MWh, "Renewable Energy Capacity constructed/rehabilitated" in MW and the dependent variable was "Expected Annual Reduction in GHG emissions" in tCO_2eq/year. The variables were first tested for stationarity. Augmented Dickey Fuller Test was applied to check their stationarity. Karl Pearson correlation test was then applied on the above variables to test their correlation. Thereafter, Multiple Linear regression was envisaged to be applied on the above variables. All the assumptions of multiple linear regression were first checked using the relevant tests. On the basis of inference that the assumptions of normality are not satisfied, the study progresses by application of robust regression which is not dependent on assumptions of normality and heteroscadasticity. The significant inferences from the robust regression model were further studied and conclusions drawn.

The various assumptions for Multiple Linear Regression are as given under: -

1. Normality – The residuals of multiple linear regression are all normally distributed
2. Homoscedasticity – The variance of residuals remains the same for every value of independent variable.
3. Linearity – The relationship between independent variables and the mean of dependent variable is linear.
4. Independence – Observations are independent of each other.
5. No Autocorrelation – The error terms must not be auto correlated.
6. Multicollinearity – The independent variables have no relationships with each other.

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DATA ANALYSIS

The analysis starts by going for a stationarity tests of all the concerned variables. The null and alternative hypothesis for the tests are as give below:-

Null Hypothesis 1:- One of the concerned variables have a unit root present in them. Alternative Hypothesis 1:- None of the concerned variables have unit root present in them.

ADF test is applied on all the concerned variables. The results are as displayed in Figure 1a. of Figure 1. As seen in Figure 1a of Figure 1, ADF tests rejects the null hypothesis 1 and it can be concluded that there is no unit root present in any of the variables. The study progresses by going for Karl Pearson tests of correlation. The null hypothesis for the tests as displayed below:- Null Hypothesis 2:- None of the concerned variables are correlated with any other concerned variable.

Alternative Hypothesis 2:- At least, one of the concerned variable is significantly correlated with any other concerned variable.

The results are as displayed in Figure 1b of Figure 1. As displayed in the figure, the null hypothesis 2 is rejected and all the concerned variables are significantly correlated with each other. The study progresses by checking for normality of residuals of multiple regressions where reduction in GHG emissions is the dependent variable and all other independent. The null hypothesis for the test are as displayed below:-

Null Hypothesis 3:- The residuals of linear regression are normally distributed. Alternative Hypothesis 3:- The residuals of linear regression are not normaly distributed.

The test results are displayed in Figure 1 c of Figure 1. As seen in the figure, null hypothesis is rejected and we conclude that the residuals are not normal. The study progresses by going for tests of heteroscedasticity. White test is applied for the same. The null hypothesis for the same is as displayed under:-

Null Hypothesis 4:- The values of the errors do not depend on the values of the independent variables.

Alternative Hypothesis 4:- The values of the errors depend on the values of independent variables. The test results are as displayed in Figure 1d of Figure 1. As see in the figure, White test rejects the null hypothesis 4. Hence, as both assumptions of normality and homoscedasticity are not applicable, we cannot proceed with linear regressions and instead proceed with robust regression. Wilcox and Keselman (2004) have highlighted that robust regression is useful when heteroscedasticity is present. Alma (2011) have concluded that robust regressions work well whenever there are any violations of normality assumption of linear regressions.

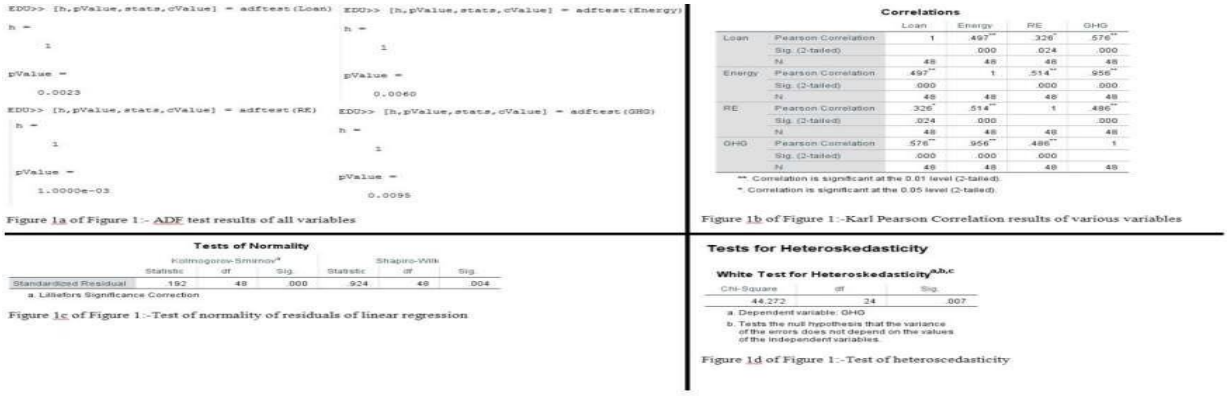

Figure 1:- Results of Unit Root tests, Correlation, Normality and Heteroscedasticity

The study proceeds by going ahead for tests of linearity. The analysis starts by checking for linearity assumption of Multiple Linear Regression. The null hypothesis for the assumption of linearity is as mentioned below:-

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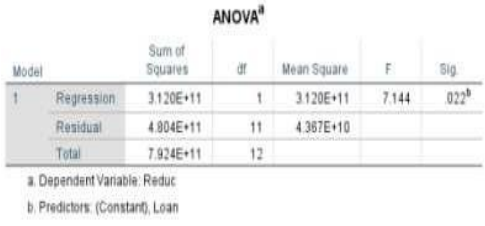
Null Hypothesis 5:- None of the concerned variables have a linear relationship with any other concerned variable.
Alternative Hypothesis 5:- At least, one of the concerned variables have a linear relationship with one other concerned variable

The first two variables to be checked for linear regression are “Expected Annual Reduction in GHG emissions” and “Climate Loan committed”. Applying ANOVA test on them yielded the results as shown in Figure 1a of Figure 2: -

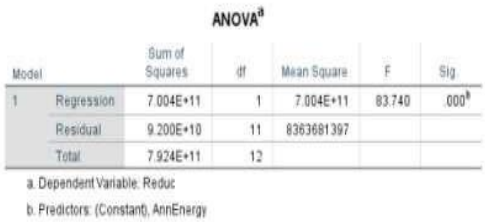


ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.120E+11	1	3.120E+11	7.144	.022[b]
	Residual	4.804E+11	11	4.367E+10		
	Total	7.924E+11	12			

a. Dependent Variable: Reduc
b. Predictors: (Constant), Loan

Figure 1a of Figure 2: - Anova Test Results for check of linearity between “Expected Annual Reduction in GHG emissions” and “Climate Loan committed”

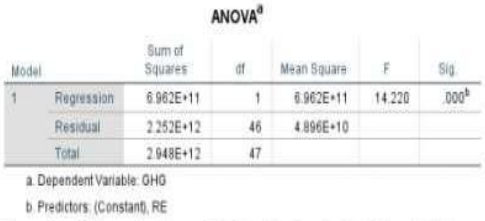


ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.004E+11	1	7.004E+11	83.740	.000[b]
	Residual	9.200E+10	11	8363681397		
	Total	7.924E+11	12			

a. Dependent Variable: Reduc
b. Predictors: (Constant), AnnEnergy

Figure 1b of Figure 2: - Anova Test Results for check of linearity between “Expected Annual Reduction in GHG emissions” and “Annual Energy produced”



ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.962E+11	1	6.962E+11	14.220	.000[b]
	Residual	2.252E+12	46	4.896E+10		
	Total	2.948E+12	47			

a. Dependent Variable: GHG
b. Predictors: (Constant), RE

Figure 1c of Figure 2:- Anova Test Results for check of linearity between “Expected Annual Reduction in GHG emissions” and “Renewable Energy Capacity constructed/rehabilitated”

Figure 2: - Anova Test Results for check of linearity between “Expected Annual Reduction in GHG emissions” and independent variables

As seen in the concerned figure, Anova test confirms the linearity relationship between the two variables. The p value of 0.022 confirms that the null hypothesis of the coefficient being zero in a linear relation between the variables is not zero. Hence, there is a linear relationship. Hence, we can conclude that “Climate Loan committed” and “Expected Annual Reduction in GHG emissions” are linearly related to each other. The study proceeds by comparing variables of Expected Annual Reduction in GHG emissions” and “Annual Energy produced”. The results of Anova are as shown in Figure 1b of Figure 2.

As seen in the concerned figure, it is not possible to reject the hypothesis of relationship of linearity between the two variables. The p value of 0.000 confirms that the null hypothesis of the coefficient being zero in a linear relation between the variables is not zero. Hence, there is a linear relationship. Hence, we can conclude that “Expected Annual Reduction in GHG emissions” and “Annual Energy produced” are linearly related to each other. The study proceeds by comparing variables of Expected Annual Reduction in GHG emissions” and “Renewable Energy Capacity constructed/rehabilitated”. The Anova test results are as displayed in Figure 1c of Figure 2.

As seen in the concerned figure, Anova test confirms the linearity relationship between the two variables. The p value of 0.000 confirms that the null hypothesis of the coefficient being zero in a linear relation between the variables is not zero. Hence, there is a linear relationship. Hence, we can conclude that “Expected Annual Reduction in GHG emissions” and “Renewable Energy Capacity constructed/rehabilitated” are linearly related to each other. Hence, we can conclude that all the concerned variables have a linear relationship with each other as explained before.

The study proceeds by consideration of the next assumption which is independence of observations. As the projects under consideration are completely independent of each other, we can make a fair assumption that observations are independent

of each other. Hence, no hypotheses were made and discussed in this regards.

The analysis proceeds by checking for autocorrelation of error terms in the regression process. This is done by application of Durbin Watson test. The null hypothesis of the test is as displayed below:-

Null Hypothesis 6:- The error terms or residuals are uncorrelated. Alternative Hypothesis 6:-

The error terms or residuals are auto correlated.
Application of Durbin Watson test on regression yielded the results as shown in Figure 3a of Figure 3. As seen in the concerned figure, Durbin Watson test yields a value of 1.5086 for the autocorrelation. As per Field (2009), Durbin Watson test values of 1.5 to 2.5 should be generally accepted. It was suggested by him that Durbin Watson values of less than 1 and more than 3 should be a cause of concern. As the concerned value is within acceptable range, we can fairly conclude that there is no autocorrelation present in the residuals. Hence, we fail to reject null hypothesis 6 on the basis of this test.

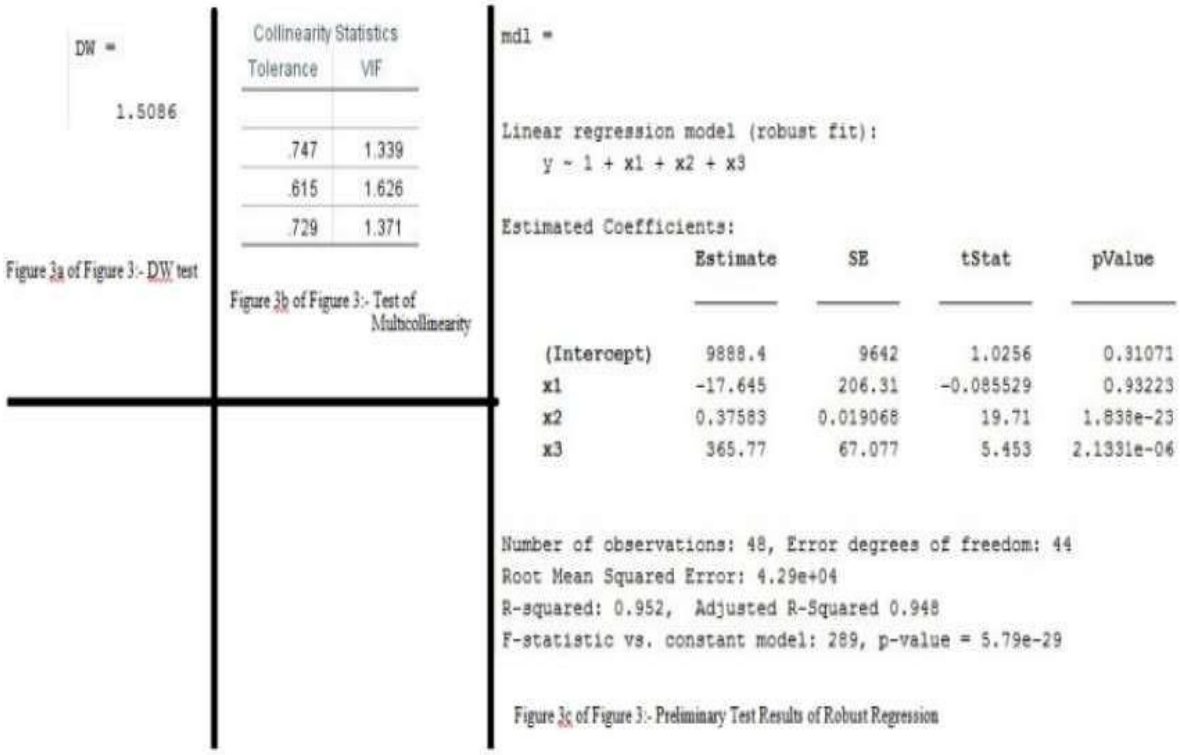


Figure 3:- DW Test, Multicollinearity Test and Preliminary Test Results of Robust Regression The study proceeds by checking for multicollinearity. The null hypothesis for the test is as

displayed below:-
Null Hypothesis 7:- There is no presence of multicollinearity amongst the concerned variables. Alternative Hypothesis 7 :- There is presence of multicollinearity amongst the concerned variables.

Application of Variance Inflation Factor (VIF) values for testing of multicollinearity yielded the results as shown in Figure 3b of Figure 3. As seen in the concerned figure, Variance Inflation Factors of all variables are less than 10. As per (Salmeron Gomez, Garcia-Garcia and Garcia- Perez, 2020), a value of VIF less than 10 has traditionally been used as an indicator of lesser troubling presence of multicollinearity. Hence, we can conclude that multicollinearity is not present and fail to reject the null hypothesis 7. We proceed towards running of the robust regression on MATLAB. The respective null hypotheses are as displayed below:-

Null Hypothesis 8:- The reduction in greenhouse gas emissions is not dependent on the amount of loans granted by IFC.

Alternative Hypothesis 8:- The reduction in greenhouse gas emissions is dependent on the amount of loans granted by IFC.

Null Hypothesis 9:- The :- The reduction in greenhouse gas emissions is not dependent on the amount of energy generated under various projects.

Alternative Hypothesis 8:- The reduction in greenhouse gas emissions is dependent on the amount of energy generated under various projects.

Null Hypothesis 10:- The reduction in greenhouse gas emissions is not dependent on the amount of renewable energy constructed or rehabilitated under various projects.

Alternative Hypothesis 10:- The reduction in greenhouse gas emissions is dependent on the amount of renewable energy constructed or rehabilitated under various projects.

We proceed by looking at the values of coefficients of independent variables and their significance after running the robust regression on MATLAB. The first parts of results of robust regression are as displayed in Figure 3c of Figure 3. As seen in the concerned figure, Adjusted R Square value is 0.948. This implies that 94.8% of the variance in dependent variable is explained by the variance in the independent variables. The value is cross checked again by running the robust regression again and carefully checking all the values. The significance of the entire set of coefficients of the robust regression model is depicted in the same Figure 3c of Figure 3. x1 is the independent variable of granted loans, x2 is the independent variable of annual energy and x3 is the independent variable of renewable energy constructed while y is the dependent variable of reduction in GHG emissions.

As seen in concerned figure, the p-value for the entire model is 5.79e-29. This implies that the likelihood of coefficient values all being zero is very less and that the model is significant. The coefficient values of individual independent variables of the robust regression model and their significance is as displayed in the same figure.

As seen in the concerned figure, the significance values for “Climate Loan committed” is 0.93223. This implies that the amount of loans granted by IFC is not significant in reducing greenhouse gas emissions. The significance of “Annual Energy produced” variable is 1.838e-23 which is very less than 0.05. This implies that annual energy produced is significant for the prediction of the dependent variable “Expected Annual Reduction in GHG emissions”. The variable of “Renewable Energy Capacity constructed/rehabilitated” is also significant in prediction of the dependent variable as the p value is 2.1331e-06 which is very less than 0.05. In a nutshell, the robust regression model can be presented as: -

Reduc = 9888.4 - 17.645*Loan + 0.37583*AnnEnergy + 365.77*RECap --- Equation 1
Where Reduc = “Expected Annual Reduction in GHG emissions” in tCO_2eq/year
Loan = “Climate Loan committed” in USD Millions AnnEnergy = “Annual Energy produced” in MWh
RECap = “Renewable Energy Capacity constructed/rehabilitated” in MW

As the “Climate Loan committed” is an insignificant variable, we remove it from the model and run the robust regression test again. The results are as displayed in Figure 4a of Figure 4. X1 is annual energy produced variable while x2 is renewable energy constructed variable.

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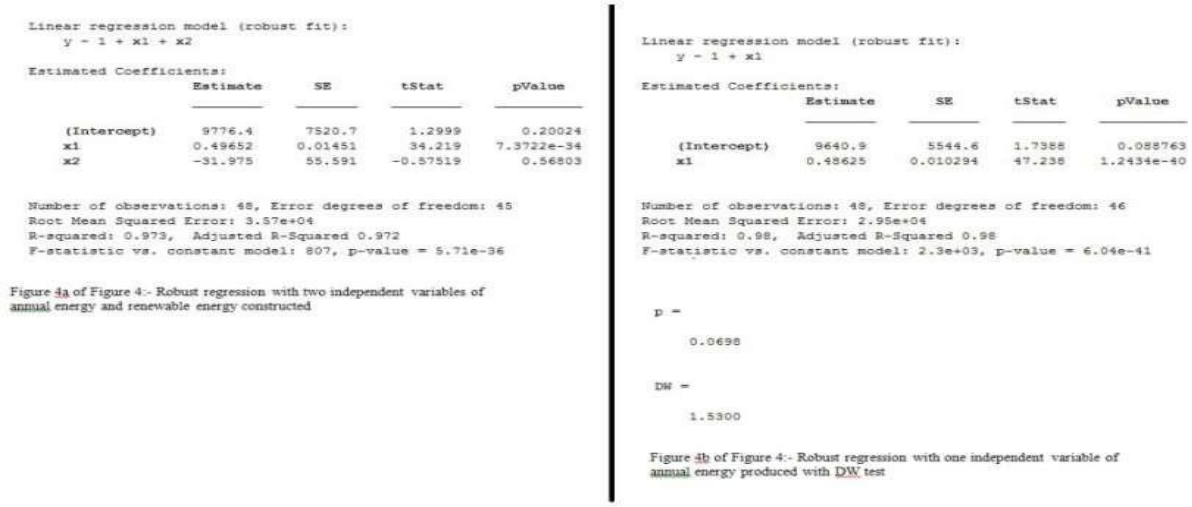

Linear regression model (robust fit):
y ~ 1 + x1 + x2

Estimated Coefficients:

	Estimate	SE	tStat	pValue
(Intercept)	9776.4	7520.7	1.2999	0.20024
x1	0.49652	0.01451	34.219	7.3722e-34
x2	-31.975	55.591	-0.57519	0.56803

Number of observations: 48, Error degrees of freedom: 45
Root Mean Squared Error: 3.57e+04
R-squared: 0.973, Adjusted R-Squared 0.972
F-statistic vs. constant model: 807, p-value = 5.71e-36

Figure 4a of Figure 4:- Robust regression with two independent variables of annual energy and renewable energy constructed

Linear regression model (robust fit):
y ~ 1 + x1

Estimated Coefficients:

	Estimate	SE	tStat	pValue
(Intercept)	9640.9	5544.6	1.7388	0.088763
x1	0.48625	0.010294	47.238	1.2434e-40

Number of observations: 48, Error degrees of freedom: 46
Root Mean Squared Error: 2.95e+04
R-squared: 0.98, Adjusted R-Squared 0.98
F-statistic vs. constant model: 2.3e+03, p-value = 6.04e-41

p =

0.0698

DW =

1.5300

Figure 4b of Figure 4:- Robust regression with one independent variable of annual energy produced with DW test

Figure 4:- Improved Robust Regression Results with insignificant variables removed from study

As seen in Figure 4 a of Figure 4, the results show that renewable energy constructed or rehabilitated is insignificant as the p value is 0.56083 which is more than 0.05. Removing the variable of renewable energy constructed or rehabilitated from the study and running the robust regression test again, we get the results as seen in Figure 4b of Figure 4. As seen in Figure 4b of Figure 4, the p value for the significance of annual energy produced variable is 1.2434e-40 which is very less than 0.05. The adjusted R squared value is pretty high at 0.98 or 98% which is cross checked once again. The Durbin Watson test gives a value of 1.53 which is acceptable as discussed previously. As we have only one independent variable, multicollinearity is not an issue. Hence, the final model including only the significant variables is as displayed below:-

Reduc = 9640.9 + 0.48625*AnnEnergy --- Equation 2

Where the units are the same as explained before

As we can see from Equation 2, the annual energy produced is the only significant variable concluded from the study taking almost everything into consideration. The study progresses by changing the values of the variable of annual energy produced and seeing the effect on the reduction in greenhouse gas emissions. The results are as displayed in Figure 5 which is a table represented in the form of a figure.

ΔReduction in GHG emissions (tCo2eq/year)	ΔAnnual Energy produced (MWh)
48.625	100
97.25	200
145.875	300
194.5	400
243.125	500
291.75	600
340.375	700
389	800
437.625	900
486.25	1000

Figure 5:- Change in reduction in GHG emissions by changes in Annual Energy produced The study proceeds by analyzing the adequacy of loans granted by IFC in terms of adequate

reduction in GHG emissions. As per (UN report, 2019), GHG emissions have to be cut by 7.6 percent every year for the next 10 years to meet the set target of average temperatures not exceeding by 1.5 degree Celsius in the Paris summit. In other words, annual GHG emissions need to be reduced by 32 Gigatons CO2 equivalents every year to meet the ambitious 1.5 degree Celsius threshold target set in the Paris summit.

The total annual energy produced by loans granted by IFC in the year 2021 is 898844 MWh. Considering equation 2 and putting this value of annual energy produced by projects under loans granted by IFC, we get the value of reduction in GHG emissions as 0.447 Megatons CO2 equivalent per year. Comparing this value of 0.447 Megatons CO2 equivalent per year with the required value of 32 Gigatons CO2 equivalents, a very low adequate investment on part of IFC is reflected.

FINDINGS AND DISCUSSIONS

The various findings of the study are as listed and discussed here: -

1. The loans granted by International Finance Corporation have been identified as not sufficient enough. With the current levels of loans granted by the IFC, it would not be possible and in fact grossly inadequate to keep the global warming below the 1.5 degree Celsius threshold level as agreed by almost everyone in the Paris agreement. Global warming rising by more than 1.5 degree Celsius would bring with them unbearable changes into our world. As per the report from IPCC (2019), the human adaptation would be very difficult and the occurrence of extreme events would rise apart from adverse effects on food security and biodiversity.
2. Although Loans granted by IFC has been found to be significantly correlated with reduction in greenhouse gas emissions, robust regression has deemed the variable of loans granted as insignificant. A possible explanation for the condition is that loans may have been granted to projects which do not produce sufficient annual energy or cause a significant reduction in greenhouse gas emissions.
3. Annual energy produced has been found to be a significant variable having a substantial impact on the reduction in greenhouse gas emissions. This may be possibly explained by the fact that the annual energy which has been produced is mostly renewable energy or a type of energy which does not increase greenhouse gas emissions. Hence, the more renewable energy or such type of energy is being produced, more reduction in greenhouse gas emissions are carried out.
4. Renewable Energy constructed or rehabilitated was found to be significantly correlated with reduction in greenhouse gas emissions but revealed to be not too much of a significant variable in robust regressions. A possible explanation would be that the project may already have a large portion of functioning renewable energy and only a small new portion of renewable energy is rehabilitated. Hence, the considered variable was not appropriate to study the relationship between renewable energy constructed and reduction in GHG emissions. A data providing total renewable energy in each project would be more apt.
5. On closer observations of individual grant of loans as per all mentioned IFC reports and comparing with the final result of the study, it was revealed that there are situations in which a large amount of loan granted is invested in a project which produces comparatively smaller amount of energy. This may happen for projects where a large fund is needed to build the infrastructure which would eventually generate only a small amount of electricity. One of the examples of such a project is hydroelectric energy. A large amount of funds has to be invested in building infrastructure for hydroelectric energy. Still, whether the plant would generate electric energy or not depends upon the volume of rains and water supply at the dams.

RECOMMENDATIONS

The recommendations of the study are as listed below: -

1. IFC should monitor the value of loans granted which are actually going into projects which help cut carbon dioxide emissions. There would be many companies which would take up loans from IFC but a major portion of those loans would be invested in projects which may not be suitable for the environment. A proper due diligence would ensure that the mere taking up green loans would not remain an eyewash. The amount of annual energy generated can be taken as a benchmark. On the basis of the present study, any project reducing lesser than 0.48625 tCO2 equivalent per year of GHG emissions on every extra 1 MWh annual energy produced should be discouraged. This would enable more GHG reducing technologies to come up. Moreover, any worthy project deteriorating in standard of reducing suitable GHG emissions as discussed before should be closely monitored. The concerned project should be pressed to be discontinued if things do not change after a long time. The first two objectives of the study are being taken care of by

subscribing to the above mentioned standards.

2. International Finance Corporation should think of granting substantially higher amount of loans as compared to the one they are granting now. The increase in the grant of loans should be done in a way so that greenhouse gas emissions are reduced in line with keeping the global warming below 1.5 degree Celsius as compared the pre industrial levels. In other words, IFC should grant loans so that carbon dioxide emissions are kept below 32 Gigatons carbon dioxide equivalent per year. On the basis of the present study, a total of 65,809,748,810.5 MWh of annual energy needs to be produced by IFC green loan funded projects so as to accomplish the target. Even if IFC is not able to grant such high amount of loans or be skeptical about few projects, it should see to it that there are other institutions which are able to fill the gap.
3. IFC should make it very sure that a majority of the granted green loans should go to projects which generate a large amount of energy in totality. As per the study, a smaller amount of energy produced corresponds to a smaller reduction in greenhouse gas emissions which is not a good idea.

CONCLUSION

The world desperately needs an urgent intervention to drastically control the process of global warming. International Finance Corporation is helping the world by granting loans to companies to invest in projects which help in reducing greenhouse gas emissions. It has been revealed in the study that the grant of loans is highly inadequate with respect to the ability to control the process of global warming. It would be highly advisable that IFC should enhance the grant of green loans and monitor them thoroughly with regards to annual energy produced and reduction in greenhouse gas emissions such that global warming is effectively controlled. It has also been found that there is a considerable impact of annual energy produced in reduction of greenhouse gas emissions. Hence, green finance should be majorly targeted towards higher levels of annual energy producing projects. IFC should also increase the process of due diligence and should see that the green loans granted are only utilized in projects which are especially focused on reduction of greenhouse gas emissions and control of global warming. This would reduce the misuse of green finance.

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