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RETURN ON INVESTMENT ANALYSIS OF UNLICENSED SOLAR ENERGY PROJECTS IN TURKEY

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ABSTRACT

First of all, this study aims to show how the power size and currency affect the return on investment percentages of unlicensed solar energy projects in Turkey. Commonly, the investors have confusions on their minds while taking investment decisions. Particularly, there are definite variables which may affect a solar energy project's return on investment percentage and so the research question of how a multiple regression model can represent this percentage comes back to minds too. In order to simulate investment scenarios, this study is designed by using the sample of unlicensed solar energy installations which have the capacity of 250 KW, 500 KW and 1000 KW. According to the cash flow analyses for these samples the effects of power size and currency variables to return on investment percentages are observed. Therefore, the multiple regression model of return on investment percentages is offered by taking into account the power capacity and currency as independent variables to estimate the future cash flows by comparing each cases. As a result, the correlations are observed between dependent variable and independent variables. Especially, the power capacity has significant effect on return on investment rates of projects in accordance with the fundamental rule of risk-reward relation in finance. Also, the share of currency risk is calculated to prove how the volatility in currency index may affect the return on investment rates.

Keywords: *Renewable Energy Industry, Solar Energy, Unlicensed Solar Energy Projects in Turkey, Return On Investment Rates*

Jel Codes: *G30, G32*

TÜRKİYE'DEKİ LİSANSLI OLMAYAN GÜNEŞ ENERJİSİ PROJESİ YATIRIMLARININ GETİRİ ORANLARININ ANALİZİ

ÖZ

Bu çalışma, öncelikle, Türkiye'deki lisanslı olmayan güneş enerji projesi yatırımlarının getiri yüzdelerine güç hacminin ve döviz kurunun etkisinin hangi seviyelerde olduğunu göstermeyi amaçlamaktadır. Genellikle, yatırımcılar yatırım kararlarını alırlarken zihinlerinde karışıklık yaşarlar. Bilhassa, bir güneş enerjisi projesi yatırımının getiri yüzdesine tesir edebilecek belirli değişkenler bulunmakla beraber, getiri oranını temsil edebilecek bir çoklu regresyon modeli nasıl oluşturulabilir sorusu da akıllara gelmektedir. Bu çalışma, 250 KW, 500 KW ve 1000 KW kapasiteye sahip lisanslı olmayan güneş enerjisi kurulumlarının örneklem olarak kullanılması ile elde edilen yatırım senaryolarını simüle etmeyi hedeflemiştir. Bu yüzden, yatırımların getiri yüzdelerini öngören çoklu regresyon modeli ile, güç kapasitesi ve döviz kuru bağımsız değişkenleri hesaba katılarak, her vaka için gelecek nakit akımlarını karşılaştırmak amaçlanmıştır. Sonuç olarak, bağımlı ve bağımsız değişkenler arasındaki korelasyonlar incelenmiştir. Özellikle, finansmanın temel prensibi olan risk ve getiri ilişkisine uyumlu bir şekilde, güç kapasitesinin, projelerin getiri oranlarına önemli miktarda etkisinin olduğu gözlemlenmiştir. Ayrıca, döviz kuru riskinin payı hesaplanarak kurdaki dalgalanmaların yatırımların getiri oranlarını nasıl etkileyebileceği ispatlanmıştır.

Anahtar Kelimeler: *Yenilenebilir Enerji Endüstrisi, Güneş Enerjisi, Türkiye'deki Lisanslı Olmayan Güneş Enerjisi Projeleri, Yatırımın Getiri Oranları*

Jel Kodları: *G30, G32*

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1. INTRODUCTION

Across the globe, energy demands are growing cumulatively, therefore, the countries are challenging to expand domestic renewable energy production to increase energy efficiency and provide greener growth which has economically advantages in relation to energy exportations and importations. However, there are currently one billion people who live without electricity and three billion people consume contaminative fuels to satisfy their basic living requirements which have adversely impacts on health conditions. (The Worldbank) Furthermore, over four billion people are dying as a result of relying pollutant fuels which cause indoor air pollution. In developing countries such as Turkey, the deficit between supply and demand results as bottlenecks in electricity procurement because of the conventional investments. Theoretically, electricity production can be operated in equilibrium with environmentally transformable energy. By carrying out the business models which rely on renewable energy investments, future return of electricity generating plans can be both applicable and feasible.

In Turkey's situation, being dependent on imported fuel energy sources causes country to be vulnerable both economically and socially. As a result, a policy framework is proposed by the government to attract alternative investments in the energy sector.

With the developing country status of Turkey, energy demand is normally increasing by the time. Due to this reason, Turkey's energy policies and strategies should be formed by the parameters of alternative energy resources, liberalization in energy markets and performance in efficiency. Dependent on these parameters, utilization of local and renewable energy resources are needed.

Urbanization, demographic trends, economic growth rate and income per capita are the key indicators which affect the energy demand of a country. According to the both side of the equation, the data of Global Energy Statistical Yearbook demonstrates Turkey's total energy production as 43 Mtoe in 2017 with total energy consumption as 152 Mtoe in the same year. Therefore, there should be new ways of attracting the foreign investors to energy sector in Turkey to close the deficit between two parameters.

In past 20 years, with government incentives in the world, alternative energy sources(renewables) have major role, because of both environmental concerns and the competition between nations in global energy industry. Due to the both cost benefit analysis and sustainable responsibility principles, renewable energy investments have strategic advantages in comparison with coal, fuel oil and partially nuclear. Also, the countries and companies, which aim to transform their energy generation strategies into renewables, can both reduce the carbon emission and energy costs by providing social responsibility reflections to investors.

In the long run, there is interaction and relationship between financial incentives to renewable energy transformations and return on investment rates. In scientific literature, the studies about examinations of risk and return analyses demonstrate that investments to renewable energy sources can be evaluated in both macro and micro environment. However, the expected returns of renewable energy investments are still a question mark on the investors' minds according to the governmental policies. From the financial point of view, the applications of state policies can propose the clear risk management strategies for both corporate and individual investors. Due to the general law of economics, if the expected reward of an investment decision increases, probability of fiancial loss raises. Therefore, risk management of renewable energy investments should be executed proactively, before taking an investing decision such in general.

Financial analyses for renewable energy projects are applicable to measure the efficiency of investments. Simple payback period, return on investment and equity, internal rate of return, net present value and discounted cash flows are mostly used techniques while making analyses.

Fundamentally, payback period is the necessary time to cover the cost of an investment. Mainly, this indicator shows how long the return of an investment takes. Much of corporate finance is about capital budgeting and in this sense, the time value of money is ignored unlike the other methods.

By computing as a valuation metric of return on an investment rate is effective while comparing the efficiency of diversified investments. Return on investment (ROI) basically measures the relative return and cost of an investment.

ROI= (Earning of investment-Cost of investment) / Cost of investment

Moreover, there other factors such transaction cost, taxes, time, inflation and opportunity cost which affect return on investment rates indirectly.

Expected profitability of potential investments in capital budgeting can be gauged by internal rate of return (IRR). Basically, this indicator is for understanding the rate of net cash inflow during a time period relative to total initial investment cost by applying a discount rate.

$$IRR = \sum_{t=1}^{T} [Ct/(1+r)^{t}] - Co$$

Ct= net cash inflow during the time period

Co= total initial investment cost

r1= discount rate

t= number of time periods

Net present value (NPV) is a kind of method used in investment planning to valuate a project by calculating the difference between the present value of cash inflows and the present value of cash outflows over a period of time.

$$NPV = \sum_{t=0}^{n} [Rt/(1+i)^{t}]$$

Rt= net cash inflow-outflows during a time period

i= discount rate or return that could be earned in alternative investments

t= number of time periods

Basically, following formula shows the net present value as;

NPV=(Present value of the expected cash flows)-(Present value of invested cash)

Forecasting the return of an investment relative to its' future cash flows is named as discounted cash flow (DCF) valuation method. DCF formula is represented as;

$$DCF = \sum_{n=1}^{N} [CFn/(1+r)^{n}]$$

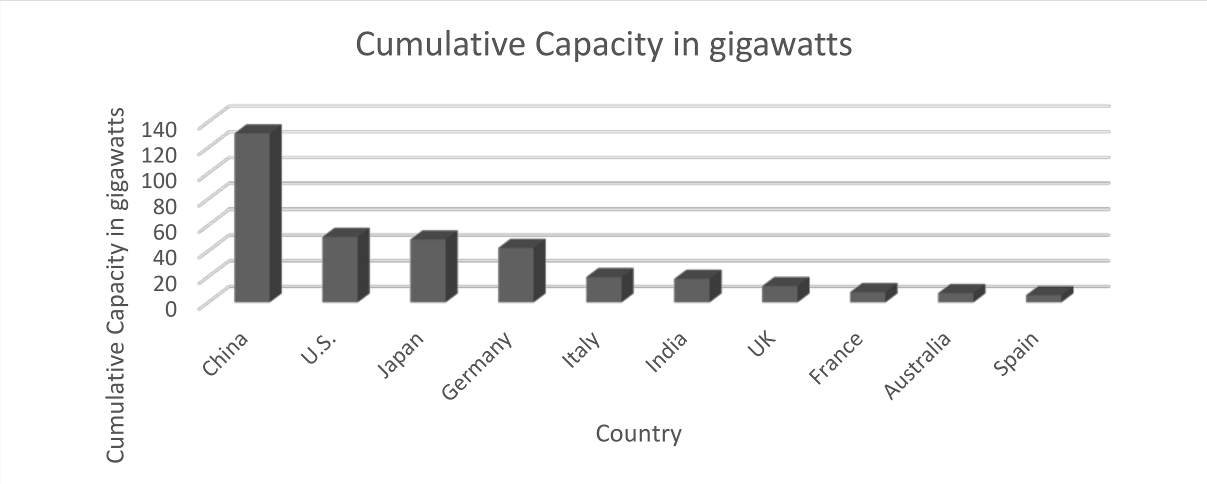
CF= Cash Flow

r= discount rate

The investment amount of emerging economies into renewable energies exceeded developed countries in 2015 and extended their lead in 2017, accounting for a record 63% of global total, due mostly to China.

Basically, solar energy system is installed to gather energy from the sun. It eliminates the environmental issues which are the results of greenhouse gas emmissions by using the power of solar sources in efficient ways.

Solar power focus investments in renewable energy sector strengthened its lead in 2017. Projects like solar parks and wind farms reached USD 216.1 billion. Less than 1 MW PV installations named as small scale solar energy achieved an investment rise of 15% to USD 49.4 billion.



Graph 1. Globally Solar PV capacity in year of 2017

Source: Statista

Because of the mentioned reasons, in this paper, return on investment rates of solar energy projects are examined from Turkey's perspective supported by cash flow analyses. Also, the main goal of this study is to show the feasibility of unlicensed solar energy investments relative to their power size in Turkey. Moreover, in practice, this study offers a multiple regression model that is used to discuss the relationships between the main parameters which can affect the return on investment rates of unlicensed solar energy investments in Turkey. What if analyses are applied for three different unlicensed solar energy investments relative to their power (250KW, 500KW and 1000KW) by showing cash flow analyses. Then, payback periods and ROI rates are calculated according to cash flow analyses. Finally, the relationship between ROI percentages, power size and USD/TRY currency are observed through multiple regression analysis and then a return on investment model is offered due to these parameters.

2. LITERATURE REVIEW

The results of the academic studies made in globe is briefly discussed in order to demonstrate the general subjects of financing renewable energy.

Table 1. Past Studies

Author	The Name of Article	The Scope	Result
Christa N. Brunnschweiler	Finance for renewable energy: an empirical analysis of developing and transition economies	Exploring the role of financial industry in renewable energy developments.	Commercial banking has huge impact on renewable energy investments.
Jyoti Prasad Painuly and Norbert Wohlgemuth	Renewable energy financing: what can we learn from experience in developing countries?	Considering the problems which are related to finance renewable energy technology.	The availability of financial sources may accelerate renewable energy technology.
Pacudan R.	The clean development mechanism: new instrument in financing renewable energy technologies	Proving the clean development mechanism stimulates investments on renewable energy projects in emerging economies.	Leverage equity and debt financing are the funds to develop the renewable energy projects in emerging economies.
Marc Jean Bürer and Rolf Wüstenhagen	Which renewable energy policy is a venture capitalist's best friend? Empirical evidence from a survey of international cleantech investors.	Investment experts from European and North American venture capital and private equity funds were interviewed.	Policy preferences of private investors in innovative clean energy technology firms shows the targets of governments.
Ryan H. Wiser and Steven J. Pickle	Financing investments in renewable energy: the impacts of policy design	Financing processes of power plants for renewable energy projects are examined.	Renewable policy design may reduce renewable energy costs by providing revenue certainty.
F. Cucchiella, M. Gastaldi and M. Trosini	Investments and cleaner energy production: a portfolio analysis in the Italian electricity market.	Representing an economic analysis to valuate the profitability of renewable energy investments.	Each renewable energy source has unique return in relation to a several factors.
Sezi Çevik Onar and Tuba Nur Kılavuz	Risk analysis of wind energy investments in Turkey	Monte Carlo simulation and real option models are proposed to evaluate risks and compensations in investments as wind energy.	The proposed models shows significant evidence for both costs and benefits.
Özgür Yıldız	Financing renewable energy infrastructures via financial citizen participation: The Case of Germany	Demonstration of financial citizen participation model in German renewable energy sector.	Financial citizen particiapation is an alternative way to invest in renewable energy sources.
Vedat Kıray and Lütfü Şağbanşua	Barriers in front of solar energy plants in Turkey and investment analysis of solution scenarios-case study on a 10 MW system.	The importance of solar energy applications in Turkey is considered.	Because of the payback period, it is not as much as attractive for investors with large capital.

3. RESEARCH METHODOLOGY

Observing ROI analyses of unlicensed solar energy investments in Turkey by using cash flows according to their power size and examining the factors which affect the ROI percentages quantitatively by using multiple regression analysis to show the statistical relations between variables.

This study aims to represent how return on investment rates of the unlicensed solar energy projects in Turkey can be transformed to a mathematical model according to the parameters of power size and currency.

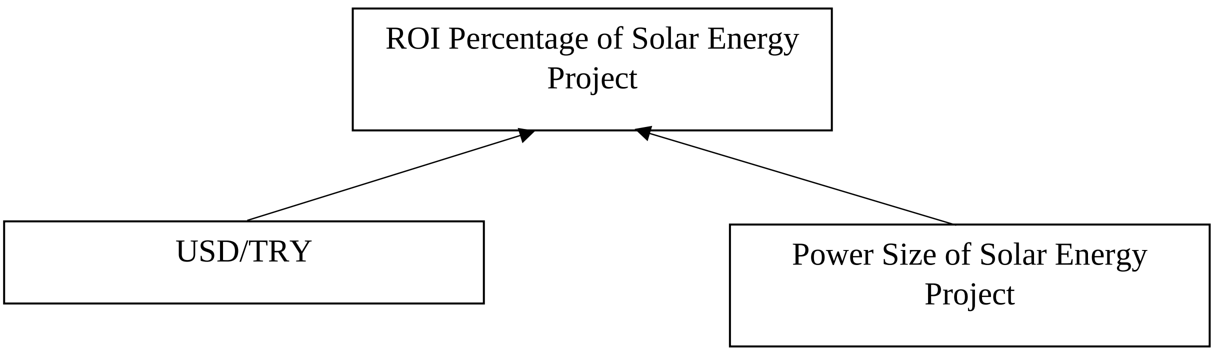
It is always a main challenge for investors to take the most optimal decision for a project. Therefore, this study is an important indicator for the investors who wish to invest their capital to unlicensed solar energy projects in Turkey, because this research contains both financial and statistical part of the cases.

ROI percentages, power size of solar energy project and USD/TRY currency are the core variables for solar energy investments. So, the model is designed according to these variables.

Basically, conceptual model of the research can be shown as;

Outcome variable: ROI percentage of solar energy project

Predictor variables: USD/TRY and Power size of solar energy project



This study is structured to multiple regression model.

H0(Null): Variables in the model do not improve the fit

H1(Alternative): Variables in the model improve the fit

This study just contains the unlicensed solar energy projects in Turkey as 250 KW, 500 KW and 1000 KW due to the power size with analysing USD/TRY currency between 3.5 and 4.4 range. Annual system operating costs are excluded while doing cash flow analyses.

In this study, both primary and secondary data collection methods are used relative to quantitative and qualitative data types. Documental revision which involves the use of previously existing and reliable informations as a source of data to be used in this study. Qualitatively, case studies are investigated in order to gather secondary data due to the main goal of the study.

According to the law Numbered 5346 which contains the electricity production of renewable energy sources is supported by state for unlicensed solar energy projects to 1MW(1000 KW).

Table 2. State Incentives

Incentive (State)	USD Cent/kwh
Produced Energy based on Solar Energy Production Facility	13.3
Construction (If native)	0.8
PV modules (If native)	1.3
Cells which forms PV modules (If native)	3.5
Invertor (If native)	0.6
Solar radiation focusing device on PV module (If native)	0.5

Source: TEDAŞ (according to the law numbered 5346)

Table 3. Cluster of Unlicensed solar energy projects from 250KW to 1MW

Installation Costs (Euro)				
The Cost Factors	Unit Price per 1 Watt	250KW	500KW	1 MW (1000KW)
Solar panel	0.54-0.64	135000-160000	270000-320000	540000-640000
Invertor	0.20-0.25	50000-62500	100000-125000	200000-250000
Construction	0.07-0.08	17500-20000	35000-40000	70000-80000
Wiring DC-AC	0.05-0.07	12500-17500	25000-35000	50000-70000
Protection equipment	0.02-0.03	5000-7500	10000-15000	20000-30000
Transformer	0.02-0.03	5000-7500	10000-15000	20000-30000
Other	0.06-0.07	15000-17500	30000-35000	60000-70000
Labor and Shipping	0.06-0.07	15000-17500	30000-35000	60000-70000
Total (Without Tax)	1.02-1.24	255000-310000	510000-620000	1020000-1240000
Total in USD	1.352836	338209	676418	1352836

Source: TEDAŞ

Table 4. Distribution Tariffs

Distribution Tariffs			
Year	2016	2017	2018
Unit Price(kr/kWh)	0.7597	2.5628	2.8276
USD Currency End of Year (Central Bank)	3	3.5255	3.7719
Unit Price (Dolarcent/kWh)	0.26	0.73	0.75

Source: TEDAŞ

Economic life of solar energy central is approximately 25 years. In Turkey, according to the code of 5346 which is stated under renewable energy law, the state guarantees to purchase the electricity which is produced by solar energy for 10 years in determined prices. Moreover, the amount of energy which is purchased by the state is made over dollars. The selling price of electricity which is produced by solar energy is 13.3 cent $/kwh. There are extra incentives if the local PV modules are used.

Table 5. Power Metrics

Watt=A unit of power
Kilowatt (KW)=1000watts
Kilowatt hour(kWh)=Kilowatts multiplied by the number of hours of draw. This is the unit of measurement that utility companies bill electricity in.
1KW= Average 1500kwh/year electricity production

Source: TEDAŞ

Hierarchical regression method is used for analyses because it is based on theory testing.

Table 6. Cost Model

Cost of Production Model for Unlicensed Solar Energy Projects in Turkey	
Unit Price(kr/kwh)	p
Annualy Production(kWh)	x
Payable Distribution Fee (TL)	p*x
Annual System Operating Cost (GTŞ)(TL)	y
Annual System Operating Cost (EDAŞ)(TL)	z
Total (TL)	p*x+y+z
Dollar Currency (End of Previous Year)	c
Total (U.S. Dollar)	p*(x+y+z)/c

Table 7. Cash Flow Model

General Cash Flow Model of Solar Energy Investment in Turkey	
The Reduction of Electricty Production Rate	%r
Net Annual Electricity Production(kWh)*Unit Selling Price (USD/kWh)	x*0.133
Maintenance Cost (USD)	m
Distribution Cost (USD)	d
Total Investment Amount (USD)	ı
Return	[x*0.133-(m+d)]-ı
Time Period of Return (Year)	1

Table 8. Case for 250 KW Solar Energy Project

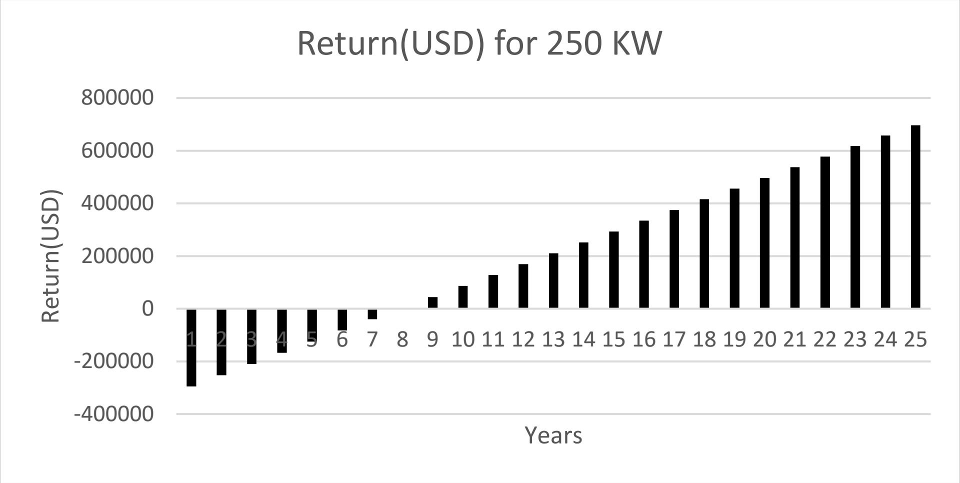
Year	1	2	3	4	5	6	7	8
The Reduction of Electricity Production Rate (Assumption)	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%
Net Annual Electricity Production(kWh)*Unit Selling Price (USD/kWh)	49875	49725.38	49576.2	49427.47	49279.18787	49131.35	48983.96	48837
Maintenance Cost (USD)	4000	4000	4000	4000	4000	4000	4000	4000
Distribution Cost (USD)	2812.599469	2804.162	2795.749	2787.362	2778.999853	2770.663	2762.351	2754.064
Return (USD)	-295146.5995	-252225	-209445	-166805	-124304.6401	-81944	-39722.3	2360.593

Total Investment (USD) = 338209$

Return On Investment Rate For 25 Years= 206.07%

USD/TRY=3.77

Payback Period= 7 or 8 years



Graph 2: Return On Investment For 250 KW Solar Energy Project

Table 9. Case for 500 KW Solar Energy Project

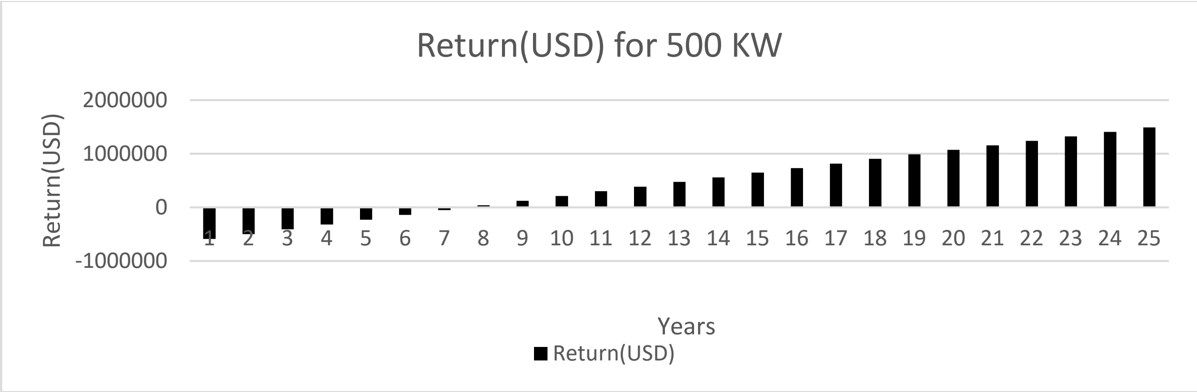
Year	1	2	3	4	5	6	7	8
The Reduction of Electricity Production Rate (Assumption)	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%
Net Annual Electricity Production(kWh)*Unit Selling Price (USD/kWh)	99750	99450.75	99152.4	98854.94	98558.37574	98262.7	97967.91	97674.01
Maintenance Cost (USD)	4000	4000	4000	4000	4000	4000	4000	4000
Distribution Cost (USD)	5625.198939	5608.323	5591.498	5574.724	5557.999705	5541.326	5524.702	5508.128
Return (USD)	- 586293.1989	-496451	-406890	-317610	- 228609.2802	-139888	-51444.7	36721.19

Total Investment (USD) = 676418$

Return On Investment Rate For 25 Years= 220.85%

USD/TRY=3.77

Payback Period= 7 or 8 years



Graph 3. Return On Investment For 500 KW Solar Energy Project

Table 10. Case for 1000 KW Solar Energy Project

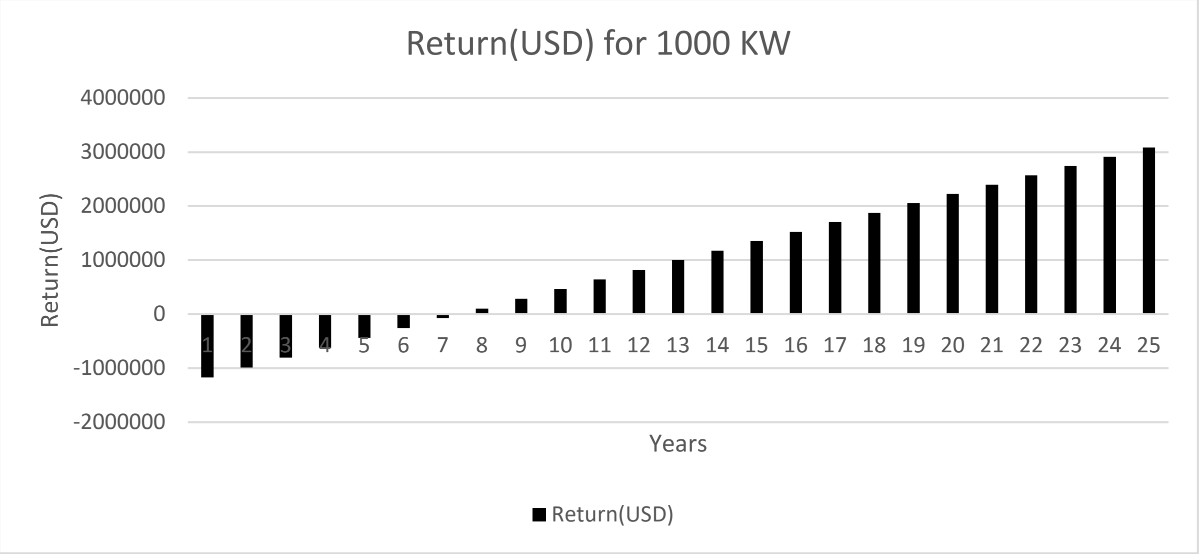
Year	1	2	3	4	5	6	7	8
The Reduction of Electricity Production Rate (Assumption)	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%
Net Annual Electricity Production(kWh)*Unit Selling Price (USD/kWh)	199500	198901.5	198304.8	197709.9	197116.7515	196525.4	195935.8	195348
Maintenance Cost (USD)	4000	4000	4000	4000	4000	4000	4000	4000
Distribution Cost (USD)	11250.39788	11216.65	11183	11149.45	11115.99941	11082.65	11049.4	11016.26
Return (USD)	-1168586.398	-984902	-801780	-619219	-437218.5604	-255776	-74889.4	105442.4

Total Investment (USD) = 1352836$

Return On Investment Rate For 25 Years= 228.25%

USD/TRY= 3.77

Payback Period= 7 or 8 years



Graph 4. Return On Investment For 1000 KW Solar Energy Project

Table 11. Sample of Model

Power Size (KW)	USD/TRY	ROI(Percentage) For 25 Years
250	3.5	204.524341
250	3.6	205.1245153
250	3.7	205.6922477
250	3.8	206.2300994
250	3.9	206.7403691
250	4	207.2251252
250	4.1	207.6862347
250	4.2	208.1253866
250	4.3	208.5441128
250	4.4	208.9438061
500	3.5	219.308099
500	3.6	219.9082732
500	3.7	220.4760057
500	3.8	221.0138574
500	3.9	221.524127
500	4	222.0088832
500	4.1	222.4699927
500	4.2	222.9091446
500	4.3	223.3278708
500	4.4	223.727564
1000	3.5	226.699978
1000	3.6	227.3001522
1000	3.7	227.8678846
1000	3.8	228.4057364
1000	3.9	228.916006
1000	4	229.4007622
1000	4.1	229.8618717
1000	4.2	230.3010236
1000	4.3	230.7197498
1000	4.4	231.119443

Table 12. Correlational Relationships

Correlations

		ROIPercentage	Powersize	USDTRYCUR
Pearson Correlation	ROIPercentage	1.000	.918	.151
	Powersize	.918	1.000	.000
	USDTRYCUR	.151	.000	1.000
Sig. (1-tailed)	ROIPercentage	.	.000	.213
	Powersize	.000	.	.500
	USDTRYCUR	.213	.500	.
N	ROIPercentage	30	30	30
	Powersize	30	30	30
	USDTRYCUR	30	30	30

Strong correlation between power size and return on investment percentage is observed, although the same condition is not valid for currency and there is weak correlation between currency and return on investment rate.

Table 13. Inputs of the Model

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Powersize	.	Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).
2	USDTRYCUR	.	Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).

a. Dependent Variable: ROIPercentage

Table 14. Anova Test

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2198.604	1	2198.604	149.874	.000[b]
	Residual	410.752	28	14.670		
	Total	2609.357	29			
2	Regression	2257.855	2	1128.927	86.717	.000[c]
	Residual	351.502	27	13.019		
	Total	2609.357	29			

a. Dependent Variable: ROIPercentage

b. Predictors: (Constant), Powersize

c. Predictors: (Constant), Powersize, USDTRYCUR

Anova table proves that the two models which are offered have significant values below 0.05, therefore the data sample in this research is fit to both of the two models.

Table 15. Collinearity Tests

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions		
				(Constant)	Powersize	USDTRYCUR
1	1	1.882	1.000	.06	.06	
	2	.118	3.992	.94	.94	
2	1	2.840	1.000	.00	.02	.00
	2	.157	4.253	.01	.97	.01
	3	.003	32.919	.99	.00	.99

a. Dependent Variable: ROIPercentage

Collinearity statistics prove that there is no correlational relationship between independent variables. Therefore, multicollinearity does not exist for these cases.

Table 16. Residual Statistics

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	207.8498	232.8450	219.2034	8.82366	30
Residual	-3.32547	4.85331	.00000	3.48149	30
Std. Predicted Value	-1.287	1.546	.000	1.000	30
Std. Residual	-.922	1.345	.000	.965	30

a. Dependent Variable: ROIPercentage

According to the analyses, there is a strong positive correlation (approximately 0.918) between power size and ROI percentage of investment. Also there is a weak correlation (approximately 0.151) between USD/TRY currency and ROI percentage of investment. But due to the two models which are offered by SPSS in analysis of variance (ANOVA); variance explained by the model is significantly greater than the error within the model. So, using regression model is significantly better at predicting values of the outcome than using the mean.

Multiple regression model is constructed as;

ROI Percantage=183.861+0.027*(Power Size)+4.893*(USD/TRY)

This formulation gives the results approximately. There may be deviations in comparison with real observed values.

Table 17. Actual and Predicted Percentages

Power Size (KW)	USD/TRY	ROI(Percentage) For 25 Years in Cash Flow	Predicted According To The Model	Deviation
250	3.5	204.524341	207.7365	3.212159
250	3.6	205.1245153	208.2258	3.101285
250	3.7	205.6922477	208.7151	3.022852
250	3.8	206.2300994	209.2044	2.974301
250	3.9	206.7403691	209.6937	2.953331
250	4	207.2251252	210.183	2.957875
250	4.1	207.6862347	210.6723	2.986065
250	4.2	208.1253866	211.1616	3.036213
250	4.3	208.5441128	211.6509	3.106787
250	4.4	208.9438061	212.1402	3.196394
500	3.5	219.308099	214.4865	-4.8216
500	3.6	219.9082732	214.9758	-4.93247
500	3.7	220.4760057	215.4651	-5.01091
500	3.8	221.0138574	215.9544	-5.05946
500	3.9	221.524127	216.4437	-5.08043
500	4	222.0088832	216.933	-5.07588
500	4.1	222.4699927	217.4223	-5.04769
500	4.2	222.9091446	217.9116	-4.99754
500	4.3	223.3278708	218.4009	-4.92697
500	4.4	223.727564	218.8902	-4.83736
1000	3.5	226.699978	227.9865	1.286522
1000	3.6	227.3001522	228.4758	1.175648
1000	3.7	227.8678846	228.9651	1.097215
1000	3.8	228.4057364	229.4544	1.048664
1000	3.9	228.916006	229.9437	1.027694
1000	4	229.4007622	230.433	1.032238
1000	4.1	229.8618717	230.9223	1.060428
1000	4.2	230.3010236	231.4116	1.110576
1000	4.3	230.7197498	231.9009	1.18115
1000	4.4	231.119443	232.3902	1.270757

Due to the F test the variance explained by the model is significantly greater than the error in model.

4. FINDINGS AND RECOMMENDATIONS

As a result, the proposed conceptual model is assumed in the beginning of the research partially validated by the data sample operated in multiple regression analysis. Especially, 0.918 correlation level between power size and return on invesment rate shows that intrinsic value of unlicensed solar energy investments is an hidden indicator of power size and venture capital.

However, concerning to 0.151 correlation degree between USD/TRY currency and return on investment rate, the consistency does not exist for claiming the familiar argument as the power size. Following the similar logic, root cause of this case is explained as 13.3 cent selling price of electricity is produced by solar energy centrals for their first 10 years since their installation is not optimally defined according to the cost and benefit analyses from the cost of goods sold item. Therefore, the state incentives for solar energy projects should be reviewed by deeply investigations and observations through empirical studies.

For further studies, there are varied unpredictable factors which have effects to the return on investment rates of unlicensed solar energy projects in Turkey. Technically, solar period of regions where the photovoltaics will be installed can be integrated to the multiple regression model for improving the validity, because in that case there will be differences between Konya and Artvin according to their position for sun. Basically, the sample range of both power size and currency variables can be extended to improve the significance level of outputs.

Moreover, SPSS program is used for analyses and tests in this study, but to get better performance SAS, R or minitab programs can be used because there are some limits in SPSS program for financial and economics studies especially for a researcher who aims to focus on multiple regression model.

Feasibly, this study can be strengthened by adding the sample of licensed solar energy installations which has a capacity over 1 MW to make comparisons between the benefit-costs of unlicensed and licensed projects in Turkey.

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