

Economical Evaluation of Subsidy Omitting Effect on the Renewable Energy Position in Power Generation in Iran

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ABSTRACT

According to Reforms in electricity industry and privatization in Iran, "financial provision sources" is introduced as the most important barrier in enhancing electricity production through renewable energy.

In this article by measuring and comparing Marginal Cost and electricity production through every renewable: Solar Thermal - 30MW, Wind -12.5MW and Small Hydropower -1MW with fossilized technology: Steam Power Plant -400MW, Large Gas -300MW, Small Gas Power Plant -50MW and Combined cycle -400MW, suggested tariffs in buying electricity by economical study (providing financial resources – Loan from internal banks). All of the measurements are done in two scenarios: The present position in free mood and the result of directed subsidy and each of these two scenarios is studied through by considering social cost in electricity production.

Finally, for supporting the sustainable energy and Sustainable Development in Iran and also for increasing the renewable energy quota in energy basket, the Government is proposed to encourage private investor for investment in renewable energy production in Iran. All of the measuring in this research is done through **COMFAR** software.

1. Introduction

Electrical energy is one of the important resources of energy in production line, the growth of economy, social progress and public welfare. Since the main amount of its production is from Power Plants, in which a great amount of fossil fuel is consumed, these resources not only create a large amount of environmental pollution but also are limited and some time in future the earth will be emptied from these resources. Because of limitations in transferring electricity to remote areas and villages and also for malting job opportunities, there has been a great attention to renewable energies (Solar energy, Wind energy and Small Hydropower, Biomass and Geothermal energy) for substituting as an alternative and having variety in basic energy, electrical energy production with an achievement to sustainable development as a goal was in priority. Off course using these kind of energies have some barriers and limitations which need great amount of study. One of the important barriers for enhancing using these resources to produce electrical energy is the limitation of providing financial

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resources for this case, which is caused by weak economy structure, financial and fundamental structures of countries and it will just be solved by proper Governmental policies and strong support from the private investor share or company.

In this Article, the **Benefit-Cost analyze** is used to measure and compare Marginal Cost of electricity production through every renewable (Solar Thermal, Wind and Small Hydropower) and fossilized technology (Steam Power Plant (400MW), Large Gas (300MW), Small Gas Power Plant (50MW) and Combined cycle (400MW) and renewable technology: Solar Thermal (30MW), Wind (12.5MW) and Small Hydropower (1MW) the recommended tariffs of guaranteed electricity and the respect of B/C ratio.

For Sustainable Development approach all of the measurements are done in two scenarios: The present position in free mood and the result of directed subsidy and each of these two scenarios is studied through two moods: by considering social cost and by ignoring social cost in electricity production. Finally, for supporting the sustainable energy and Sustainable Development in Iran and also for increasing the renewable energy quota in energy basket, the Government is proposed to encourage private investor for investment in renewable energy production in Iran.

2. Materials and Methods

For analyzing and as simulating the data in this study the Benefit-Cost analyze is used. It is a usual method in evaluating the plants of economy, for measuring the Marginal Cost of producing unit or cost of electricity production unit which is the specifying factor for tariffs recommended for guaranteed electricity buying and finally the equality of B/C for comparing.

The Equivalent Uniform Annual Cost (EUAC) and in this case Levelized Cost of Energy (LCOE) is used.

$$\mathbf{B/C = EUA_B / EUA_C} \quad (1)$$

If it is $B/C \geq 1$, it is justifiable for private investor and

If $B/C < 1$ it is not justifiable for private investor [1].

In this method all the Marginal Cost annually are measured with discounting rate ($i=10$) to the reference year and then it is distributed during the project life time [2].

The interest rate of Loan is the most important factor in making decision of financial cases, all the measurements and comparisons and as simulations in different interest rates of loan (7% interest from Foreign Exchange Saving of Iran, 12% and 17% interest from Governmental Banks in Iran and also 25% interest loan from private Banks [3]) has been done, also, all the indexes in this research are measured with the aim of studying the suitable plants for investors in private sector with $IRRE = 20\%$ [4]. All the measurements in this research are done through **COMFAR software** (Computer Model for Feasibility Analysis and Reporting) which is a flexible program for economical evaluation of the industrial projects based on national and international standards [5].

The properties and technical information of technologies in selecting the kind of every technology by considering experts and professionals in electricity industry and Iran New Energy Organization-SUNA [6] and assistance professor, we select the fossilized technology: Steam Power Plant, Large Gas, Small Gas Power Plant and Combined cycle and renewable technology: Solar Thermal, Wind and Small Hydropower.

The technical properties and information of the fossilized technology are measured according to the TAVANIR organization in Iran in 2006 with the discount rate of 15% Rials and also 2.5% stock was adjusted by the researcher to the year 2011 [7] and the technical properties and information of renewable technology also have been added to the Appendix of the research from the strategic and economical studies office of renewable Energy Organization of Iran-SUNA (refer to the Appendix).

According to the important event in omitting the subsidy in Iran since 2011, all of the measurements and comparisons in this research are done in two scenarios: The present position in free mood and the result of directed subsidy and each of them are measured in two moods: by considering social cost and by ignoring social cost in electricity production.

In measurements related to fossilized technology, we assume that the fuel for fossilized station is Natural Gas and the price of Natural Gas in present position in free mood is $6.81 \text{ €}/\text{m}^3$ and by programming subsidy 75% price average for importing price of gas which is $18.93 \text{ €}/\text{m}^3$ is measured and determined [8].

3. The measurements related to technologies

3.1. The First Scenario

The present position in free mood

The price of the Natural Gas is measured based on budget law of 2011, $6.81 \text{ €}/\text{m}^3$

In measurement related to renewable technologies by considering the Social Costs of electricity production as unimportant case the measuring of monotonous Marginal Cost of electricity production, the tariffs for guaranteed electricity shopping and the proportions in Cost-Benefit ratio are as the following:

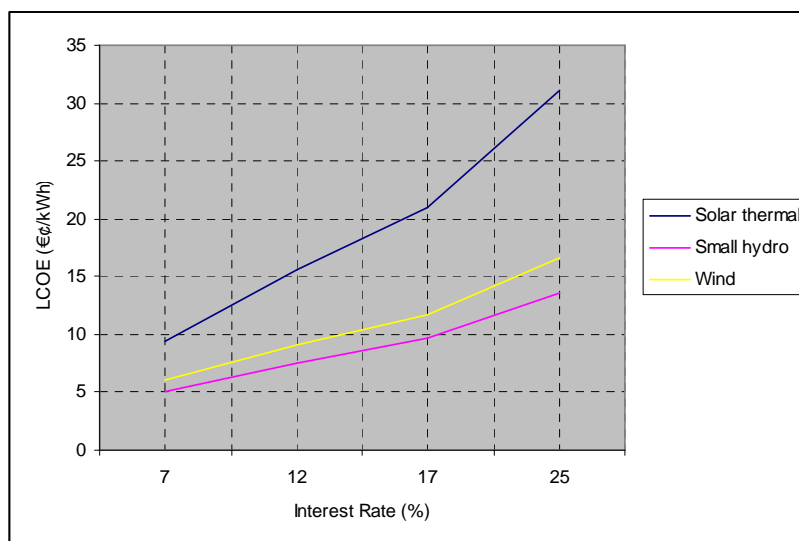


Figure1. LCOE vs. Interest Rates - Renewable Technologies

	Solar thermal	Small hydro	Wind
7	9.44	5.06	6.03
12	15.61	7.52	9.05
17	21.01	9.67	11.69
25	31.04	13.66	16.61

Figure 1 shows that for every amount of interest rates, the Marginal Cost of electricity production through Small Hydropower is lower than the Marginal Cost of wind with longer gap; it is less than the electricity cost which was produced through solar thermal power plant. This difference at the time of interest rate is equal to 7% which is the least Marginal Cost and with the interest rate of 25% which is the maximum amount. The three Marginal Costs in producing electricity have an increasing trend.

According to granted purchases of renewable energy electricity tariff in 2011, 9.34 €/Kwh. (average weight: 9.84 €/Kwh for pick load hours and average load 20 hours are 6.81 €/Kwh for low load hours-4 hours) the ratio of B/C for this technology in different interests of loan are as follow measurements (Figure 2).

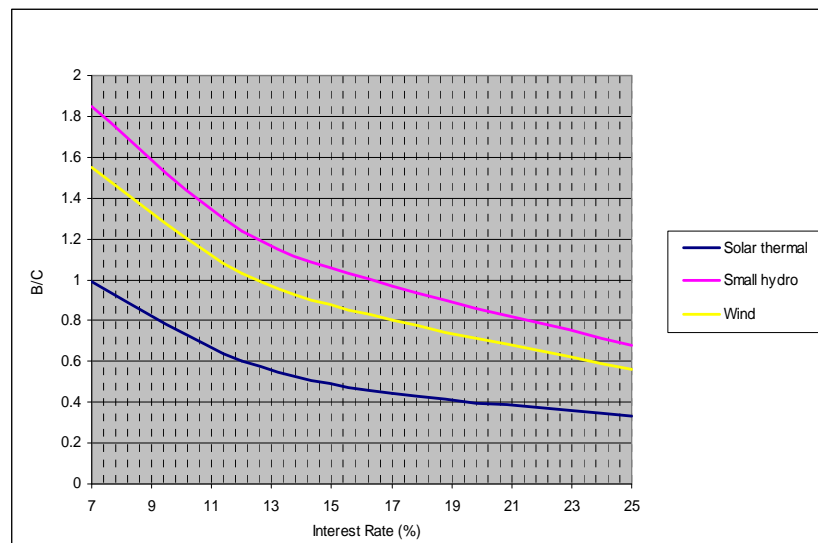


Figure 2. B/C Ratios vs. Interest Rates - Renewable Technologies

	Solar thermal	Small hydro	Wind
7	0.99	1.85	1.55
12	0.60	1.24	1.03
17	0.44	0.97	0.80
25	0.30	0.68	0.56

The measured ratio of B/C, electricity production through Solar thermal power plant in different interests of loan show this reality that, the electricity production through Solar

thermal power plant in Iran at the present time is not justifiable ($B/C < 1$) for private investors (economical justification). And electricity production through Wind energy in different interests of loan shows this reality that, the electricity production through Wind energy in Iran through interest rate more than 12% is not justifiable for private investors (economical justification) and it has an increasing trend by investment for private section in interest less than 7%. and electricity production through Small Hydropower in different interests of loan shows this reality that, the electricity production through Small Hydropower plant in Iran in interest rate more than 16% is not justifiable for private investors (economical justification) and it has an increasing trend for private section investment by less than 9%.

By considering the advantages of this technology and the necessity for developing this technology in Iran from different encouraging support of government, the researcher recommends the tariff policy; in this way it is recommended the guaranteed purchase of electricity in order to encourage private investor in this technology.

The researcher consider $IREE = 20\%$ for creating attraction of investment and encouraging investor in this technology and in this condition the guaranteed tariffs of electricity purchase are as follows (Figure.3) compared with renewable technology in terms of economy with the fossilized technology, the three indexes for fossilized technology the two condition are considered separately; without measuring Social Costs in producing electricity and by measuring the Social Costs separately are considered.

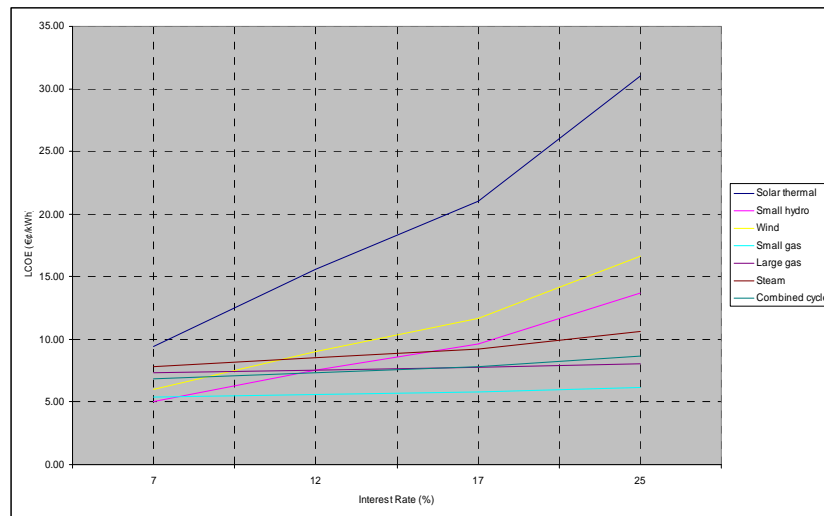


Figure 3. LCOE vs. Interest Rates without Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	9.44	5.06	6.03	2.44	4.85	4.48	4.20
12	15.61	7.52	9.05	2.45	5.03	5.20	4.68
17	21.01	9.67	11.69	2.64	5.21	5.88	5.13
25	31.04	13.66	16.61	3.00	5.54	7.28	6.02

Figure 3 shows the comparison between Marginal Cost of electricity production through renewable technology (Solar Thermal, Wind and Small Hydro) and fossilized technology (Large Gas, Small Gas, Steam and Combined cycle) without considering Social Costs.

The explanations for renewable technology and fossilized technology have been given separately before and we have just compared them with each other.

It is observed that, by interest rate of 7% the whole Marginal Cost of electricity production except Solar Thermal and Small Gas Power Plants are similar to one another. The cheapest produced electricity is related to Small Gas Power Plant. The cheapest electricity through renewable technology is from Small Hydropower station that is very close to interest rate of 7% and a little more than Marginal Cost of produced electricity in Large Gas Power Plant (the most expensive electricity through fossilized energy resources) but by increasing interest rate, this gap can have high increasing speed.

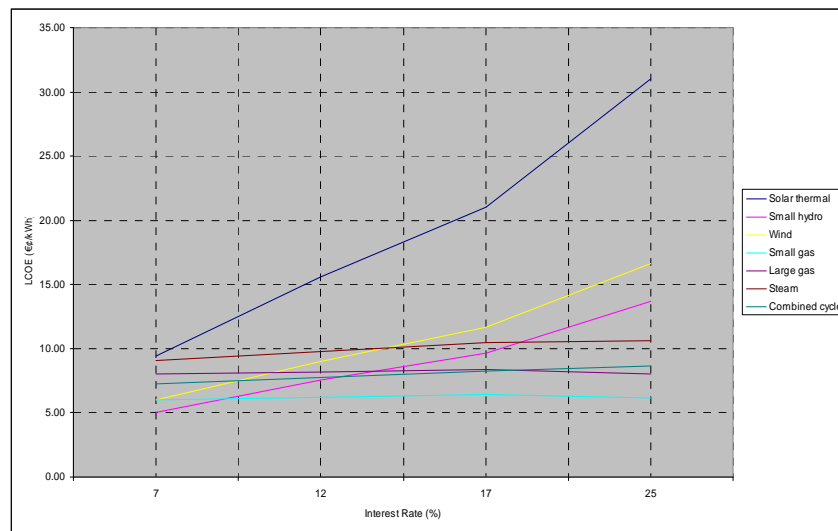


Figure 4. LCOE vs. Interest Rates with Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	9.44	5.06	6.03	2.87	5.48	5.73	4.62
12	15.61	7.52	9.05	3.09	5.67	6.44	5.10
17	21.01	9.67	11.69	3.28	5.84	7.12	5.55
25	31.04	13.66	16.61	3.63	6.17	8.52	6.44

Figure 4 shows the comparison of Marginal Cost in electricity production through renewable technology (Solar Thermal, Wind and Small Hydro) and fossilized technology (Large Gas, Small Gas, Steam and Combined cycle) by considering Social Costs. The explanation related to every renewable technology and fossilized technology is separately presented before and now we compare them together.

It is observed that, with interest rate of 7% all the Cost for electricity production except Solar technology and Thermal and Small Gas are similar to each other. The cheapest electricity is for Small Gas Power Plant and the most expensive one is from Solar Thermal Power Plants.

The cheapest renewable energy is Small Hydro power, which in 7% interest rate is lower than Marginal Costs in Steam Power Plants (the most expensive electricity from fossilized energy) and Large Gas, but is equal with 8% interest rate with Costs in Large Gas Power Plants and in 9% interest rate is equal with Steam Power Plants. By increasing the interest rate, this Cost is more than the Cost in the above Power Plants and by increasing the interest rate, it gets increasing speed. The second rate for the cheapest electricity from renewable technology is related to Wind a Power Plant which is equal to Marginal Cost of electricity in interest rate 7% in Steam Power Plants (the most expensive electricity from fossilized technology) but by increasing interest rate, this gap has increasing speed.

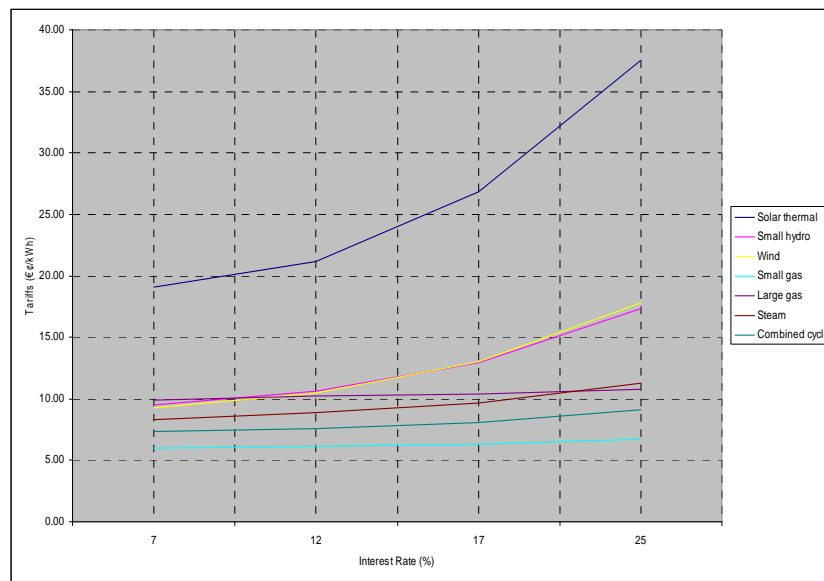


Figure 5. Tariffs vs. Interest Rates without Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	19.06	9.52	9.27	2.63	6.49	5.20	4.88
12	21.17	10.61	10.46	2.72	6.73	5.27	5.12
17	26.85	12.95	13.00	2.92	6.95	6.33	5.60
25	37.52	17.35	17.78	3.30	7.37	7.95	6.55

Figure 5 shows the comparison of guaranteed electricity shopping Tariff form renewable technology (Solar Thermal, Wind, and Small Hydro) and fossilized technology (Large Gas, Small Gas, Steam and Combined cycle).

The related explanations to every renewable and fossilized resource have been presented separately before and now we just compare them together.

It is observed that for every interest rate, the electricity Tariffs for guaranteed shopping from renewable technology is upper than 7.57 €/Kwh, however up to interest rate between 23% to 24% the Tariff is 7.57 €/Kwh and just for 23% and more than that, the Tariffs in Steam Power Plants are a little more than 7.57 €/Kwh.

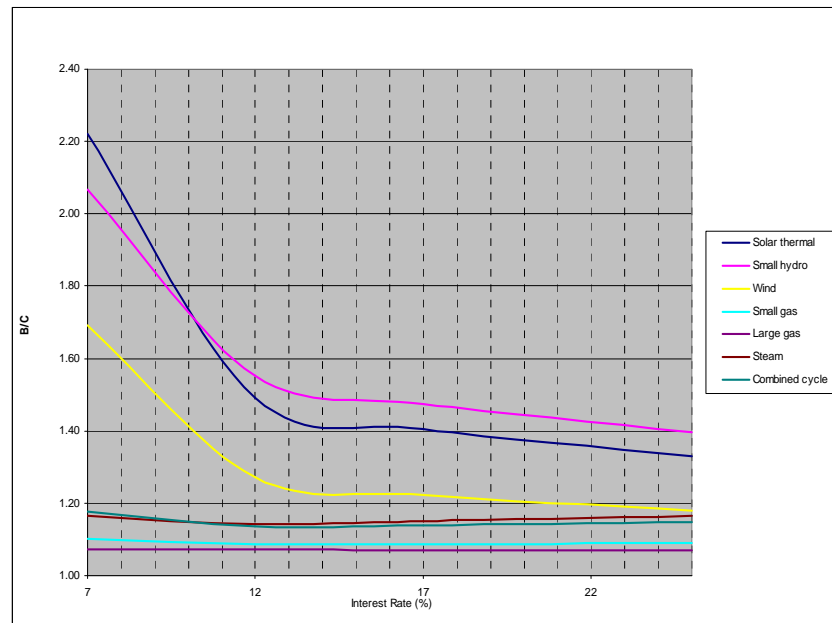


Figure 6. B/C Ratios vs. Interest Rates without Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	2.22	2.07	1.69	1.17	1.06	1.28	1.28
12	1.49	1.55	1.27	1.10	1.06	1.18	1.20
17	1.41	1.47	1.22	1.09	1.06	1.18	1.20
25	1.33	1.40	1.18	1.09	1.06	1.20	1.20

Figure 6 shows the comparison of the Cost_Benefit ratio in electricity production through renewable technology (Solar Thermal, Wind and Small Hydro) and though fossilized fuel resources without considering the Social Cost.

The related explanations for every renewable technology and fossilized one have been presented before and now we just compare them with each other. This proportion is considered one of the indexes. The higher this index is, the more benefit this choice has.

It is obvious from the Figure that, the renewable technology as a whole is the highest in profit for electricity production in respect to fossilized energy except from interest rate higher than 21% that the profit in Wind Power Plants is lower than Combined cycle ones. There should be paid serious attention to the mentioned fact about Steam power plant. Totally, the highest profit is related to Thermal Solar Power Plants (up to interest rate lower than 10%) and in higher profit related to Small Hydropower. The least amounts of profit are owned by Large Gas Power Plants.

So, the best Thermal Power Plant in terms of profit is the Combined cycle and the worst in term of profit is Large Gas Power Plant and also the best renewable Power Plant in terms of profit is the Small Hydropower.

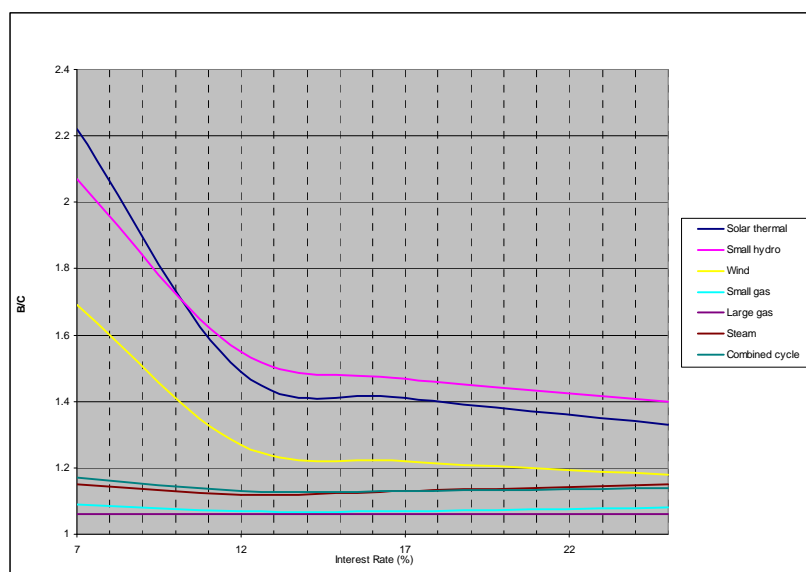


Figure 7. B/C Ratios vs. Interest Rates with Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	2.22	2.07	1.69	1.13	1.05	1.24	1.26
12	1.49	1.55	1.27	1.07	1.05	1.15	1.19
17	1.41	1.47	1.22	1.07	1.05	1.16	1.19
25	1.33	1.40	1.18	1.07	1.05	1.18	1.19

Figure 7 shows the comparison of Cost_Benefit ratio in electricity production through renewable technology and through fossilized fuel technology by considering Social Costs. The explanations related to every renewable resources and fossilized fuel separately have been presented before, now they are just going to be compared together. This proportion is one of the profitable indexes. The higher this proportion is, the more profitable this choice will be.

The effect on Social Cost in decreasing the Cost_Benefit ratio for electricity production from technology is fossilized energy. It is obvious from the Figure that, the renewable technology totally has the highest profit in Wind Power Plants which is less than Combined cycle Power Plants.

There should be paid serious attention to the mentioned fact about Steam Power Plants.

Totally, the highest rate of profit is related to Solar Thermal Power Plants (the interest rate a little more than 10%) and the higher interest rate is related to Small Hydropower.

The least rate of profit is also related to big Gas Power Plants.

So, the best Thermal Power Plant in terms of profit is the Combined cycle and the worst in Thermal, Large Gas Power Plant and also the best renewable Power Plant in terms of profit is the Small Hydropower.

3.2.The Second Scenario

The result of directed subsidy

The price of the Natural Gas price is measured, 18.93 €/m³

In comparison between renewable technology and fossil one in terms of economy, two conditions are considered separately; first without Social Costs in producing electricity and second with measuring the Social Costs.

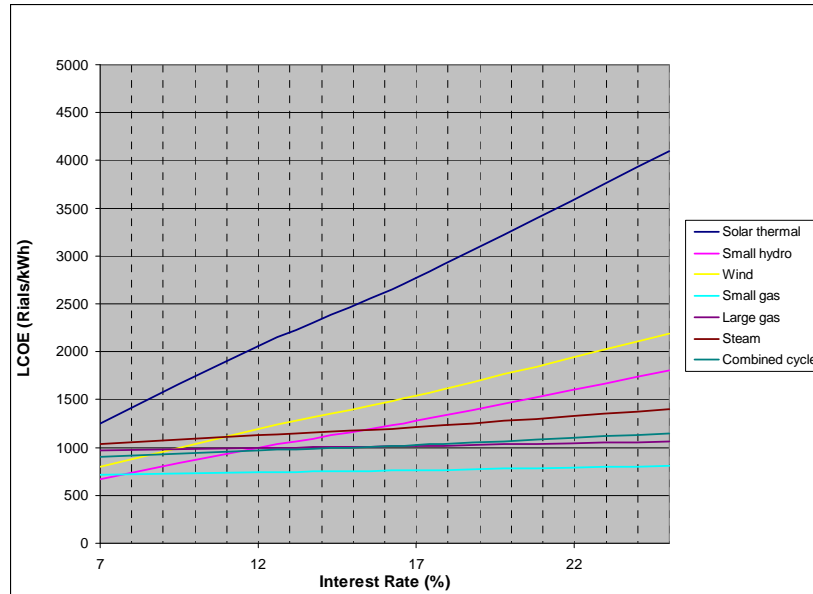


Figure 8. LCOE vs. Interest Rates without Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	9.44	5.06	6.03	5.39	7.36	7.81	6.86
12	15.61	7.52	9.05	5.60	7.55	8.52	7.35
17	21.01	9.67	11.69	5.79	7.72	9.21	7.80
25	31.04	13.66	16.61	6.14	8.05	10.61	8.69

Figure 8 shows the comparison of Marginal Cost in electricity production through renewable technology (Solar Thermal, Wind, and Small Hydro) and fossilized technology (Large Gas, Small Gas, Steam and Combined cycle) by considering Social Costs. The explanations related to every renewable technology and fossilized are separately presented before and now we just compare them with each other.

It is observed that, with the 7% interest rate, the Marginal Cost of electricity production through Small Hydropower and Wind Power Plants are cheaper than Costs for producing electricity through Large Gas, Steam, and Combined cycle Power Plants, in such a way that, the cheapest choices of electricity production are the Small Hydro, Small Gas and Wind Power Plant. After these choices, the Combined cycle, Large Gas, Steam and Solar are at the next places. With low interest rate, less than 8% the Marginal Costs in Hydropower and

Small Gas Power Plant are equal and after that the Small Gas Power Plant is the cheapest position for producing electricity.

The increasing trend of Marginal Cost for Small Hydropower causes that, in the interest rate between 17% to 12% with the electricity Cost in Combined cycle Power Plant and in interest rate of 12% with the electricity production in Large Gas Power Plant and in interest rate of 15% to 16% with electricity production is equal in Steam Power Plant.

The Marginal Cost of electricity through Wind which was in third position with interest rate 7%, the increasing trend leads to the fact that in interest rate 8% to 9%, in Combined cycle Power Plant and 9% to 10% in Large Gas Power Plant and 11% in Steam Power Plant are equal.

It is observed that, in interest rate territory, the Cost increase steep of electricity production through renewable technology is more than its fossilized counterparts. One of the reasons is that the rate of investment is high, in such a way that the share of loan is incredible in respect to interest rate.

The government can support and pay attention to the Wind and Small Hydropower choices from the renewable and Small Gas groups and the fossilized ones if the interest rate is up to 8%.

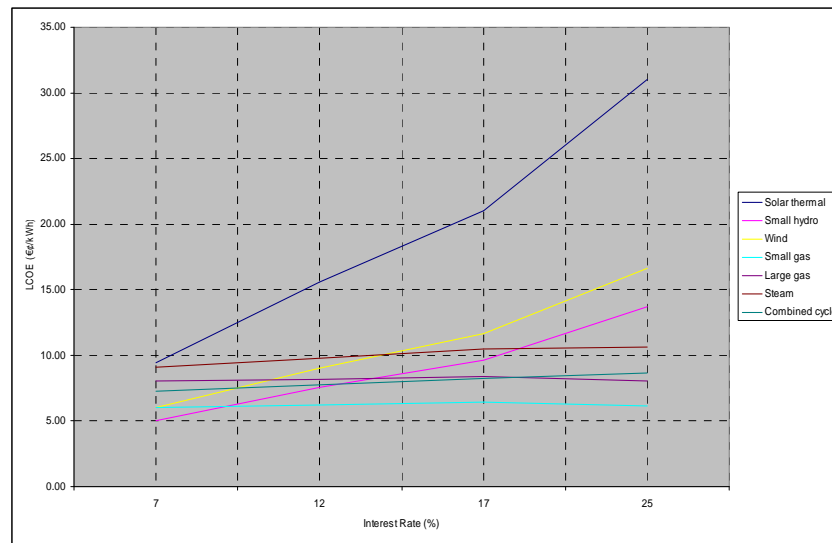


Figure 9. LCOE vs. Interest Rates with Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	9.44	5.06	6.03	6.02	8.00	9.06	7.29
12	15.61	7.52	9.05	6.23	8.18	9.77	7.77
17	21.01	9.67	11.69	6.42	8.36	10.45	8.21
25	31.04	13.66	16.61	6.14	8.05	10.61	8.69

Figure 9 shows the comparing of Marginal Cost in electricity production through renewable technology (Solar Thermal, Wind and Small Hydro) and fossilized technology (Large Gas, Small Gas, Steam and Combined cycle) by considering Social Costs. The explanations related to every renewable technology and fossilized are separately presented before and now we compare them together.

It is observed that, the interest rate of 7%, the Marginal Cost of Small Hydropower and Wind is cheaper than Large Gas Power Plants, Steam and Combined cycle in such away that, the cheapest choices of electricity production, Small Hydropower, Small Gas and Wind (are equal to each other). The choices like Combined cycle, Large Gas, Steam and Solar Thermal are in other positions. With the interest rate of 9% the Marginal Cost is equal; the Marginal Cost of electricity production through Small Hydropower and Small Gas and after that Small Gas Power Plant choice has the cheapest electricity position. The Marginal Cost of electricity with a trend of increasing Cost in Small Hydropower cause that in interest rate of 13% it is equal with Marginal Cost of electricity production in Combined cycle Power Plant and in interest rate of 13% to 14% it become equal with the Cost of electricity production in Large Gas Power Plant and in interest rate of 19% to 20% it is equal with the electricity Cost in Steam Power Plant.

The Marginal Cost of Wind Power Plant which is at the same position (second position) as Small Gas Power Plant in interest rate of 7%, It's increasing trend causes that in interest rate 9% to 10% it is equal with Marginal Cost of electricity produced in Combined cycle Power Plant and in interest rate 10% to 11% it is equal with electricity production in Large Gas Power Plant and in interest rate of 14% is equal with electricity production in Steam Power Plants.

It is observed that in interest rate environment, the increasing steep of electricity produced through renewable energy technology is more than its fossilized counterparts.

One of the reasons is that, it has high investment which is necessary, in such a way that the loan share is incredible and is sensitive about interest rate.

The government can support and pay attention to Small Hydropower and Wind electricity production through renewable groups and Small Gas from fossilized group, up to 9% of course as it is observed, for every interest rate of 7%, the Marginal Costs in Solar Thermal Power Plant for electricity production is very similar with Cost of electricity production in Steam Power Plants.

It is recommended that, this choice in renewable group should be paid attention so that, by increasing the installed capacity of this Power Plant and its growth, the investment Costs also decreases in future, was presented as a candidate for cheap electricity production.

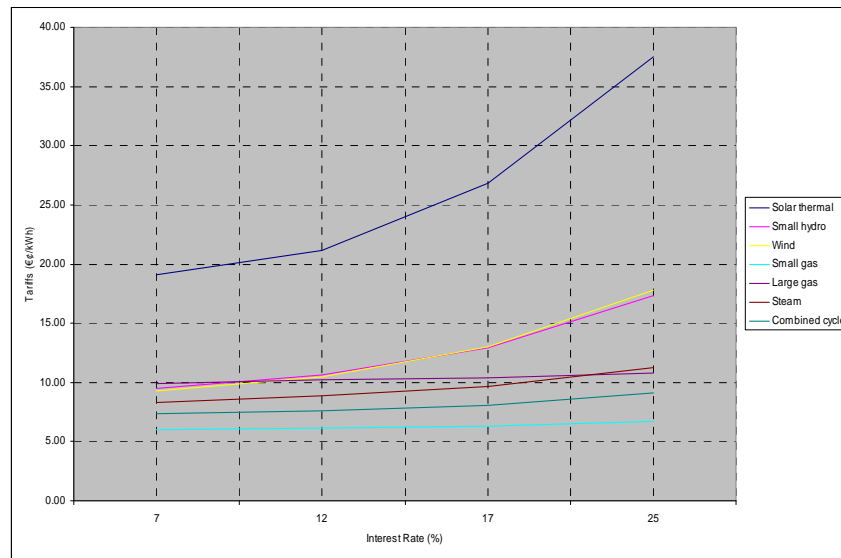


Figure 10. Tariffs vs. Interest Rates without Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	19.06	9.52	9.27	5.97	9.94	8.27	7.34
12	21.17	10.61	10.46	6.13	10.18	8.85	7.58
17	26.85	12.95	13.00	6.33	10.40	9.64	8.06
25	37.52	17.35	17.78	6.73	10.82	11.24	9.07

Figure 10 shows the comparison of guaranteed electricity shopping Tariff through renewable technology (Solar Thermal, Wind and Small Hydro) and fossilized technology (Large Gas Small Gas, Steam and Combined cycle).

The related explanations to every renewable and fossilized resource have been presented separately before and now we just compare them together.

It is observed that, for every interest rate of 9%, the guaranteed electricity shopping Tariff through Small Hydropower resources and Wind ones is lower than the Tariff for guaranteed electricity shopping from Large Gas Power Plant. Although in interest rate of about 10% the Tariffs for shopping electricity from the mentioned resources are equal to each other, and then for Tariffs higher than 10% the electricity production Tariffs through renewable energy technology is more that their fossilized counterpart Tariffs.

For every amount in interest rate, the lowest Tariff is related to Small Gas Power Plants (lower than 7.57 €/Kwh) and the highest Tariff is related to Thermal Solar Power Plants (higher than 18.93 €/Kwh).

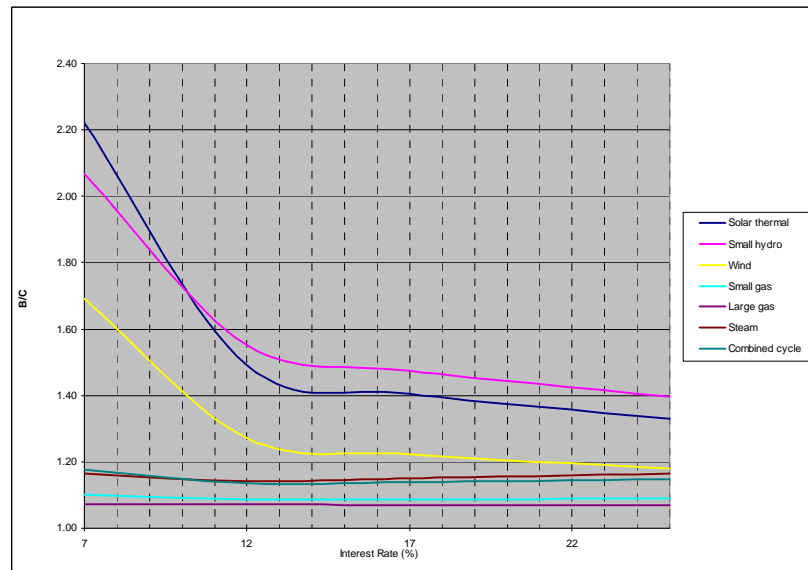


Figure 11. B/C Ratios vs. Interest Rates without Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	2.22	2.07	1.69	1.10	1.07	1.16	1.18
12	1.49	1.55	1.27	1.09	1.07	1.14	1.14
17	1.41	1.47	1.22	1.09	1.07	1.15	1.14
25	1.33	1.40	1.18	1.09	1.07	1.17	1.15

Figure 11 shows the comparing of Benefit-Cost ratio in electricity production through renewable technology (Solar Thermal, Wind and Small Hydro) and from fossilized fuel technology (Large Gas, Small Gas, Steam and Combined cycle) by considering Social Costs. The explanations rated to every renewable resources and fossilized fuel separately have been presented before, now we only compare them together. This proportion is one of the profitable indexes. The higher this proportion is the more profitable this choice will be. It is obvious that, as the Figure shows, the renewable technology as a whole is the highest interest rate for electricity production in respect to fossilized energy.

Totally, the highest profit is related to Thermal Solar Power Plants (up to interest rate lower than 10%) and in higher interest rate related to Small Hydropower. The least amount of profit is owned by Large Gas Power Plants.

So, the best Thermal Power Plant in terms of profit is the Combined cycle and the worst in Thermal Large Gas Power Plant and also the best renewable Power Plant in terms of profit is the Small Hydropower.

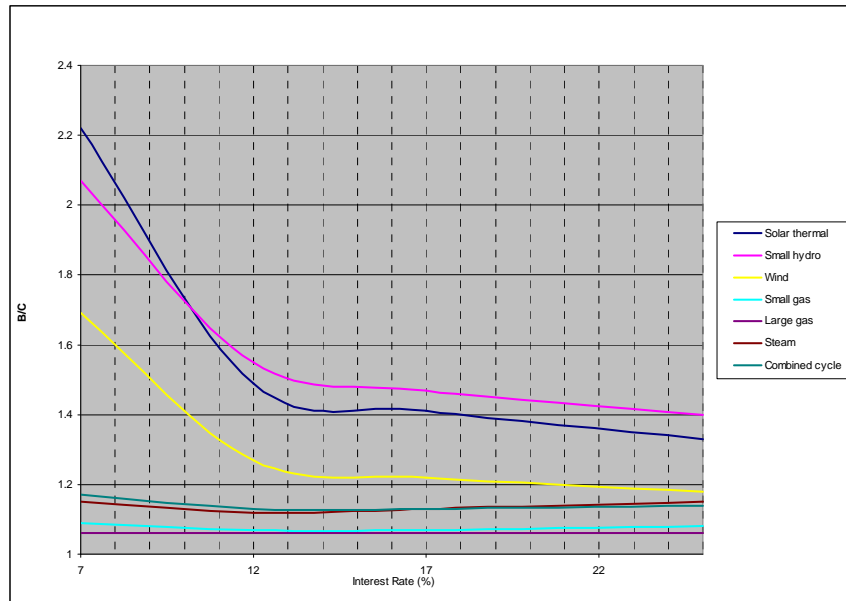


Figure 12. B/C Ratios vs. Interest Rates with Social Cost / comparing

	Solar thermal	Small hydro	Wind	Small gas	Large gas	Steam	Combined cycle
7	2.22	2.07	1.69	1.09	1.06	1.15	1.17
12	1.49	1.55	1.27	1.07	1.06	1.12	1.13
17	1.41	1.47	1.22	1.07	1.06	1.13	1.13
25	1.33	1.40	1.18	1.06	1.06	1.15	1.14

Figure 12 shows the comparison of the Cost_ Benefit ratio in electricity production through renewable technology (Solar Thermal, Wind and Small Hydro) and the fossilized fuel resources (Large Gas, Small Gas, Steam and Combined cycle) without considering the Social Costs.

The related explanations for every renewable technology and fossilized one have been presented before and now we use compare them with each other.

This proportion is considered one of the interests. The higher this index is the more profit this choice has.

It is obvious from the Figure that, the renewable technology as a whole is the highest in profit for electricity production in respect to fossilized energy.

The point about Steam Power Plants is that, totally the highest profit is related to Solar Thermal Power Plants (up to interest rate lower than 10%) and in higher profits is related to Small Hydropower. The least amount of profit is owned by Large Gas Power Plants.

So, the best Thermal Power Plant in terms of profit is the Combined cycle and the worst is Thermal, Large Gas Power Plant and also the best renewable Power Plant in terms of profit is the Small Hydropower.

4. Conclusions

4.1. The comparison of the Renewable Technology with Fossilized Technology

According to the Figures 6,7,11, and 12 comparison of the ratio of Cost_Benefit between electricity produced from renewable energy technology and fossil fuel technology show that. The former is profitable and more attractive to private investor except from $r > 21\%$ without social cost and $r < 22\%$ with social cost. So, Wind energy is less profitable than Combined cycle Power Plant. The private investor meets the most profit in interest between 10% and 12%.

The private investor tendency toward renewable technology with interest lower than 10% are hierarchically; Solar Thermal Power Plant, Small Hydropower and Wind energy, and for interest higher than 10% are; Small Hydropower, Solar and Wind energy.

As Figures 3,4,5,19,20, and 21 shows, the average Cost of electricity production and recommended Tariff of Solar Power Plant is more than two other renewable technologies but according to the Figures 6 and 7, it is shown that this kind of technology is more profitable in comparison with the two other ones.

It is recommended that this kind of technology should be supported more by government in other to increase the capacity which causes development in this industry. Therefore, the exposes will be decreased and it will be a candidate for producing inexpensive electricity in the future.

According to high potential of wind and our knowledge about it and also its value chain in Iran, it is recommended that the government should support it in order to attract private investor. The loan interest rates should definitely be less than 10% otherwise fossil technology could be a serious rival.

5. Recommendation

Clause "A" of the Article-44, the Iranian Constitutional Law [9] emphasizes the development of Governmental sector and lack of the development of governmental establishments. According to this clause, the Government does not have the right to perform new economic activity exterior to the items on the top of the Article-44 and is required to grant any activities (Including continuation of previous activities and utilizing it) which is not included in the titles on the top of the Article 44 to the private sector. It generally points to the discussion of private investor.

Hence, the Government should provide the necessary conditions to the development of usage of renewable energy in Iran energy basket through participation of private sector by removing obstacles and providing conditions for investment, subjecting policies, and setting proper requirements (market-oriented), realization of Electricity tariffs and contracting long-term agreements of guaranteed purchasing electricity.

The Marginal Cost, Guaranteed purchase Tariffs of electricity and Cost_Benefit ratio of the electricity production through renewable technology (Solar Thermal, Wind and Small Hydro) and the Considering of three Hypothesis in this research show that, the proportion of Cost_Benefit ratio through Small Hydropower and Wind energy in low interests, are higher than one, but for private investor the investment in electricity production through renewable energy does not have economical justification and they are not attractive for investment, this discovery has connection with other last discoveries in previous researches.

Due to the advantages of renewable technology and the necessity for enhancing this technology in Iran from different encouraging support of Government, **the researcher recommends the Tariff policy**, in this way he recommends the guaranteed purchase of electricity in order to create attraction in investment and encouraging private investor. The reality is that unfortunately purchasing Tariff for guaranteed purchase of electricity production through renewable in Iran is measured based on electricity production through Wind energy and without considering the justification, and encouraging the cooperation of private investment for all renewable energy technologies. But in this research, **the researcher measured and recommended the Tariff for each of these technologies** separately with the goal of encouraging private investment (at IRRE=20%), in this way, by applying these Tariffs, the electricity production through renewable technology will be justified and attractive (refer to the Figures 6 and 7). of course it is very obvious in condition of directed subsidy, Also the **Social Cost** effects on this competition have been shown in **‘Measurements and the Comparison of the Renewable Technology with Fossilized Technology in two scenarios’** too, (refer to the Figures 11 and 12).

Following the calculations and comparisons, two factors of "**Subsidy**" and "**Interest rates of loan**" have been recognized and introduced as the most effective factors and "**Social Cost**" has also been considered and introduced as an effective factor on compatibility and enhancing of power generation through renewable energy. The effect of these three factors have been calculated in two different Scenarios and presented in different tables in Chapter two.

The researcher puts forward the following Suggestions to encourage private sector to participation in investment for power generation through renewable energy having the aim to achieve the sustainable energy and Sustainable Development in Iran:

- Complete execution of **the Eliminating Directed Subsidy Law**.
- **Applying the guaranteed Tariffs** of electricity purchase which are recommended in Figure 10.
- It is recommended that for attracting private investor in **Wind energy** and its enhancement, due to high potential and knowing this technology and its chain of value in Iran, the Wind Power Plant technology should be supported more by government. The loan interest rates should definitely be less than 10% otherwise fossil technologies could be a serious rival.
- It is recommended that the **Solar thermal** is supported more by government so that by increasing the capacity set up in this Power Plant and industry growth, the investment Costs also decrease in future and become a candidate for cheap electricity production.
- **Presenting loan facilities just with nominal interest rate** for the investment of private sector to generate **power through fossilized energies**.
- **Presenting loan facilities with 7% interest rate** and lower for investment of private sector to **generate power through renewable energy**.
- **Applying the Environmental Criteria** (Pollution Taxes for Fossilized Fuel Power Plants).

Finally it is recommended to use **TIF** whose measurements are done, and it will be presented in next study.

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