Economic Analysis of Geothermal Power Generation in Iran for Private Sectors

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ABSTRACT

Based on the abundant resources of geothermal, Iran is attractive for geothermal development. A feed-in tariff is a policy mechanism designed to accelerate investment in renewable energy technologies. This policy seems to be unfavorable to attract private sector participation in Iran for geothermal energy projects. This is evident in the presence of no field developers since geothermal exploration began in Iran. This study gives an overview of the current conditions and procedural steps for different geothermal power plants. The costs of a geothermal projects are examined, including the exploration, drilling and construction of a power plant. The state-sponsored government policies and regulations to enable private companies are investigated. To be attractive for the private sector to participate in geothermal projects, the price of electricity in Iran would need to increase, or drilling costs to be lowered and thereby be comparable to costs elsewhere in the world.

1. INTRODUCTION

Iran is one of the biggest owners of fossil fuel reserves in the whole world. These big reserves of fossil fuels are exceptional as the country is the largest owner of oil and gas resources worldwide. Despite their advantages, such as short-term energy security, they might prove to be insecure and unstable in the long run.

Figure 1 indicates the share of different energy resources in primary energy consumption in Iran in 2018. As is shown, the majority of primary energy is supplied by fossil fuels (around 98.5% percent). The remaining 1.5% percent comes from a combination of hydropower, nuclear, biofuels and other renewable sources (BP, 2019).

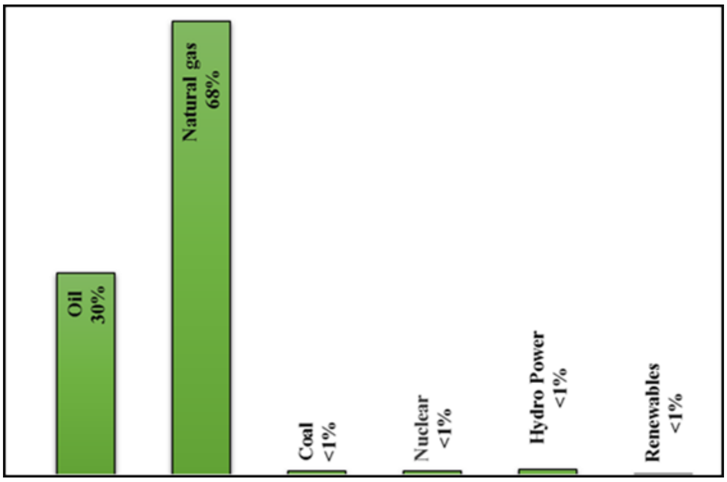

Figure 1: Iran's total primary energy consumption (BP, 2019).

Iran's wealth of hydrocarbons has led the government to heavily subsidize fuel for individual energy consumption (MEI, 2016). The average price of gasoline around the world is 1.11 USD per litre, while in Iran the price of gasoline is 0.29 USD per litre which is close to the price of a bottle of mineral water (Globalpetrolprices.com, 2019). Iran's average wholesale electricity tariff is 0.03 USD per kWh and electricity tariffs in Iran are among the lowest in the world, compared with 0.15 USD per kWh in Iceland or 0.36 USD per kWh in Germany (Globalpetrolprices.com, 2019)

Iran will experience two major benefits by transitioning to a more diverse energy mix. Firstly, a reduced domestic demand for fossil fuels will yield in an increased competitiveness in global energy markets. Put differently, reduced domestic demand will allow Iran to export more of its immense reserves of oil and natural gas to client states abroad. Secondly, reducing domestic fuel use will allow the government to ease its costly subsidies while simultaneously meeting growing electrical demand through more sustainable and cost-effective renewable energy sources (MEI, 2016).

The Iranian government has paid considerable attention to the utilization of renewable energies. Among the renewable sources, Iran has geothermal energy potential. The exploitable potential of geothermal energy for electricity generation is 5000-6000 MW (Energypedia, 2016). Iran has also begun development on the Middle East's first geothermal power plant. This "pilot" station in the northwest Iranian province of Ardabil is expected to have an installed capacity of 50 MW.

To increase incentives for investing in renewable energy, Iran amended its laws in 2015. Pursuant to the new laws, a new system of feed-in tariffs differentiating by type of technology has been implemented. The present policy seems to be unfavourable to attract private sector participation. This is evident by the presence of no field developers since geothermal exploration began in the Iran. The current fiscal incentives being enjoyed by these developers are not enough to warrant continuous sustainable exploration and development of this resource. Our present system is obviously not very attractive to prospective investors basically due to the unfavourable rate of return on their investments. To hasten the exploration and development of our geothermal resources, we need to improve the regulation so that it will attract investments.

2. INVESTMENTS IN RENEWABLE ENERGY IN IRAN

2.1 Feed-in tariffs

Iranian feed-in-tariffs have remained unchanged since 2016. On the implementation of the legal obligations of Iran's Ministry of Energy, the guaranteed electricity purchase feed-in tariff for types of renewable and clean energy are notified as follows (Table 1):

Table 1: The guaranteed electricity purchase tariff for renewable and clean energy (SATBA, 2019)

Technology type		Guaranteed purchase tariff (IRRs/kWh)	Guaranteed purchase tariff (U.S.cents/kWh)-2016	Guaranteed purchase tariff (U.S.cents/kWh)-2019
Biomass	landfill	2700	9	6
	The anaerobic digestion of manure, sewage and agriculture	3500	11	8
	incineration and waste gas storage	3700	12	9
Wind farm	> 50 MW capacity	3400	11	8
	≤ 50 MW capacity	4200	13	10
Solar farm	> 30 MW capacity	3200	10	8
	≤ 30 MW capacity	4000	13	10
	≤ 10 MW capacity	4900	16	12
Geothermal (including excavation and equipment)		4900	16	12
Waste recycling in industrial processes		2900	9	7
Small hydropower (with the capacity of 10 MW and less)	Installation on the rivers and side facility of dams	2100	7	5
	Installation on the pipelines	1500	5	4
Fuel cell systems		4948	-	12
Turbo expanders		1600	-	4

The currency of payment under the guaranteed power purchase agreement (PPA) is the Iranian Rial, where the power price in Rial has remained unchanged since 2016 but has depreciated in value against the dollar in the last years (WFW, 2018). This PPA agreement is for a 20 years' period with the specified tariffs. Tariffs will be multiplied by 0.7 after adjustment of Article 3 of the Economic Council Directive starting from the first day of the second of 10 years until the end of the contract. The power plant for different types of biomass and small hydro power has to be constructed and operated within 30 months since the notification of the contract. Tariffs will be proportionately increased up to 30% in accordance with the instructions under Article 6 of Economic Council Directive, for power plants constructed using local equipment, technologies know-how, design and manufacturing (SATBA, 2019).

2.2 Statistics of renewable power plants

The Iranian Renewable Energy and Energy Efficiency Organization announced that it had, by October 2017, issued permits for the construction of approximately 8,000 MWe of installed power from renewable sources and entered, by January 2018, into PPA with a total capacity of around 2,840 MWe. Moreover, the Organization for Investment, Economic and Technical Assistance of Iran ("OIETA") has reportedly received until October 2017 applications for licenses under the Iranian Foreign Investment Promotion and Protection Act ("FIPPA") covering circa €4bn worth of investments. Also, in 2016/2017, solar projects with capacities of 21 MWe in Hamadan province, 20 MWe in Kerman province and 10 MWe in Esfahan province were successfully commissioned (WFW, 2018). Table 2 shows the share of each renewable energy source in the generation of electricity. As mentioned before, there are currently no non-governmental geothermal power plants in Iran.

Table 2: Installed renewable energy power plants situation up to end of June, 2019 in Iran (SATBA, 2019)

Power plant	Capacity (MW)
Wind	297
Solar (PV)	330
Biomass	11
Small Hydropower	88
Waste heat recovery	13
Total	739

2.3 Procedural steps

Workflow for a proposed project is as follows (Figure 2):

Phase 1: Registration and issuance of construction permit

Phase 2: Obtaining required permits to conclude the contract

Phase 3: Project execution period and construction of power plant (After signing the contract).

Phase 4: Operating period

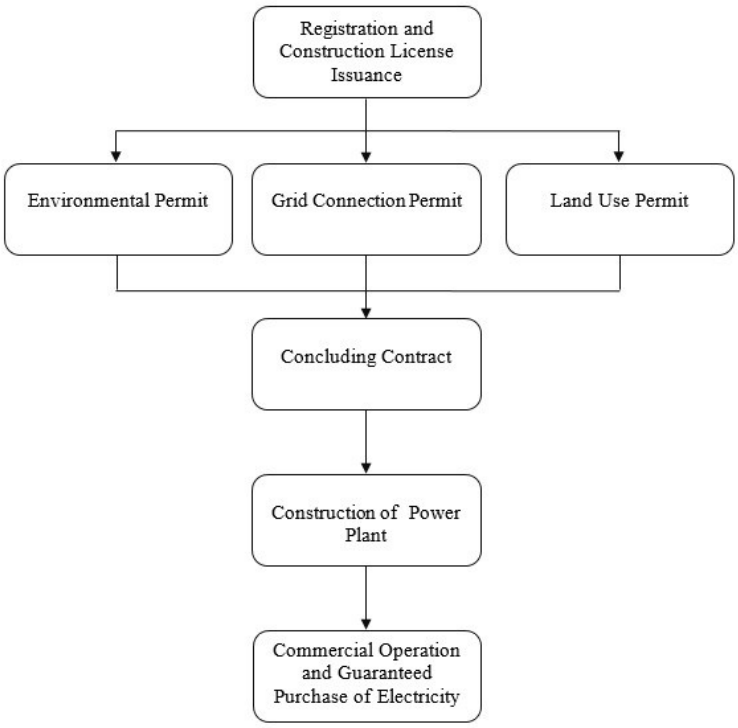

Figure 2: Steps of implementing projects (SATBA, 2019)

In order to start constructing a renewable energy power plant in Iran, an application must be submitted to SATBA containing details of the project, such as location and estimated capacity of the plant. Upon verification of the aforementioned requirements, and on the condition that no overlap exists with the sites of previously registered projects, SATBA will issue a construction permit to the applicant.

Following the issuance of the construction permit, the applicant shall obtain other necessary permits such as environment preservation, grid connection and land permits. Thereafter, a power purchase agreement can be entered into with SATBA and the construction of the power plant can commence. During the construction period, the project company is required to periodically submit progress reports to SATBA. SATBA controls and supervises the construction, and coordinates the grid connection tests and inspections through the Iran Grid Management Company. The plant must be commissioned within 18 months of the conclusion of the power purchase agreement, otherwise the tariff in force at the time of commissioning will be applied, rather than the tariff in force at the conclusion of the power purchase agreement (WFW, 2016).

3. COST ESTIMATION OF BUILDING A GEOTHERMAL POWER PLANT

The primary stages of a geothermal developmental cycle are exploration, resource confirmation, drilling and reservoir development, plant construction and power production. So, these four phases of a geothermal energy project will be used as a baseline plan for the feasibility models presented in this study:

1- Exploration and confirmation cost

2- Drilling cost

3- Power plant cost

4- Operation and maintenance cost

The capital cost for geothermal power plants are different from plant to plant and are depending on the resource chemistry, technology, and temperature employed. The majority of the overall cost is typically attributed to construction of the power plant, due to the high cost of raw materials including steel (46.6% of the total cost). The second highest cost intensive processes are the exploratory and production drilling stages, which together comprise 42.1% of the total cost. Low-temperature reservoirs typically use binary power plants, while moderate- to high-temperature reservoirs employ dry steam or flash steam plants, based on whether the production wells produce primarily steam or water, respectively (Cross and Freeman, 2008).

4. FINANCIAL FEASIBILITY ASSESSMENTS

Before an investment decision is made it is necessary to determine whether or not the planned investment idea is feasible. A financial feasibility analysis is an effective analytical tool that can be used to evaluate investments (Björnsdóttir, 2010).

The finances used to make an investment must be paid out right away, while benefits accrue over time. Benefits are based on future events and the ability to predict the future is imperfect; therefore, it is crucial to carefully evaluate investment alternatives (Salas, 2012).

The model used in this study is a mathematical model which makes it easier and less time consuming to update the analysis. It is designed for Microsoft Excel in a spreadsheet form. In this model the Net Present Value (NPV) and Internal Rate of Return (IRR) are used as profitability criteria for a geothermal development projects. Both of them (NPV and IRR) are calculated with Excel’s built-in functions (Jensson, 2006). The “pilot” station in the northwest Iranian province of Ardabil is expected to have an installed capacity of 55 MW in two phases: 5 MW and 50 MW. So, two scenarios need to be calculated for profitability in order to figure out the viability of a given project:

- Scenario 1: 5 MW geothermal power plant
- Scenario 2: 50 MW geothermal power plant

4.1 Net Present Value

Net Present Value (NPV) is the difference between the present value of all cash inflows and cash outflows associated with an investment project.

The formula for NPV is (Park, 2002):

$$NPV(i) = \frac{A_0}{(1+i)^0} + \frac{A_1}{(1+i)^1} + \ldots + \frac{A_N}{(1+i)^N} = \sum_{n=0}^{N} \frac{A_n}{(1+i)^n} \tag{1}$$

where A_n = Net cash flow at the end of period n;

i = MARR (Minimum Acceptable Rate of Return);

N = Lifetime of the project;

If the NPV(i) is positive for a single project, the project is financially feasible, since a positive NPV means that the project has greater equivalent value of inflows than outflows and therefore makes a profit (Björnsdóttir, 2010).

The calculation of the NPV requires a value for the MARR and its selection is the main difficulty for this method. MARR value selection is essentially a strategic function and is done from the viewpoint of the entire organization; and the value of MARR that is used can be based on the financial cost of capital and the risk adjusted MARR (Salas, 2012).

4.2 Internal Rate of Return

Internal Rate of Return (IRR) is defined as the compound rate of return i^* that makes the NPV equal to zero (Salas, 2012), which is expressed as:

$$NPV(i^*) = \sum_{n=0}^{N} \frac{A_n}{(1+i^*)^n} = 0 \qquad (2)$$

Investors usually want to do better than breaking even in their investments. Their investment policy usually defines a minimum acceptable rate of return (MARR), in which case the IRR and the MARR can be used to decide whether a project is feasible or not. The decision rule for a simple project is as follows (Björnsdóttir, 2010):

If *IRR* > *MARR*, accept the project;

If *IRR* = *MARR*, remain indifferent;

If *IRR* < *MARR*, reject the project.

4.3 Model inputs and assumptions

As with any model calculations, some assumptions regarding the model have to be made. The assumptions made for the financial model are stated here:

Planning Horizon

The planning horizon is the amount of time an organization will look into the future when preparing a strategic plan. This is set at 20 years in this study based on the contract terms of feed-in tariffs. This study was conducted in 2016, and in the sensitivity analysis section its results will be reviewed for 2019. The construction time of the power plant is assumed to be 1 year (2016) for scenario 1 and 7 years for scenario 2 (2016 to 2022).

Capital Cost

The total cost in this model is divided into three categories: Buildings costs, Equipment costs and other costs.

Working capital

Working capital which is the capital needed to pay short-term debts and continue operations is assumed to be 0 MUSD for scenario 1 and 36 MUSD for scenario 2.

Financials

The financial inputs and assumptions include requirements of the owners, tax and accounting regulations of the respective country, etc. (Björnsdóttir, 2010). Following are the required inputs regarding the project's financials which are based on Iran's laws and regulations (listed in Table 3):

Table 3: Financials inputs used in the study

Input	Value
MARR for the total capital	17%
MARR for the Equity	24%
Equity part of financing	25%
Loan part of financing	75%
Loan Repayments	5
Loan Interest	6%
Debtors (Accounts receivable)	10%
Creditors (Accounts payable)	10%
Dividend	30%
Depreciation Buildings	4%
Depreciation Equipment.	10%
Depreciation Other	20%
Loan Management Fees	2%
Income Tax	25%

- MARR: the minimum acceptable rate of return for both project and equity needs to be determined by the project owners.
- Equity percentage: the part of the project's capital cost that will be paid with equity from owners. The financing for both scenarios in this project is considered to be 25% equity and 75% loan.

- Dividend percentage: the proportion of profits that will be paid to owners in the form of dividends.
- Income (corporation) tax: determined in compliance with the respective country's laws and regulations.
- Depreciation: determined in compliance with the respective country's laws and regulations. Depreciation categories may have to be defined as applicable for each project, e.g. buildings, equipment and other investment.
- Loan interests: different interests are available for different projects, depending on the project's estimated return and risk, as well as conditions on financial markets. If the project owners plan to refinance the project after some time, the refinancing interests also need to be determined.
- Loan life: the time from when repayments of a loan start until the loan is fully paid.

5. RESULTS

5.1 Financial feasibility assessments in Iran

Capital Cost

Capital cost for a geothermal power plant includes exploration and confirmation, drilling and power plant costs. Most of the estimations are based on related literature, which present average cost figures. Table 4 shows a summary of costs for Scenario 1 (5MW) and Scenario 2 (50MW) in 2016. The estimated capital costs will be used as input in the financial modelling. Figure 3 illustrates the breakdown of the total capital cost for Scenario 1 and 2. This includes all the costs associated with total investment where drilling cost is approximately 50%, drilling cost in Iran case is the dominant factor. Since the bigger power plant is cheaper, the share of power plant cost for 50 MW is smaller than for 5 MW, therefore share of drilling cost for 50 MW will be bigger than for 5 MW.

Table 4: Estimated cost of geothermal power plant in 2016

Power plant capacity (MW)	category	Cost (million USD)
5	Exploration and Confirmation	1.73
	Drilling	12
	Power Plant	15.72
	Capital cost	29.45
	Capital cost per MW	5.89
	Operation and maintenance (every year)	0.39
50	Exploration and Confirmation	17.3
	Drilling	144
	Power Plant	124.86
	Capital cost	286.16
	Capital cost per MW	5.72
	Operation and maintenance (every year)	3.94

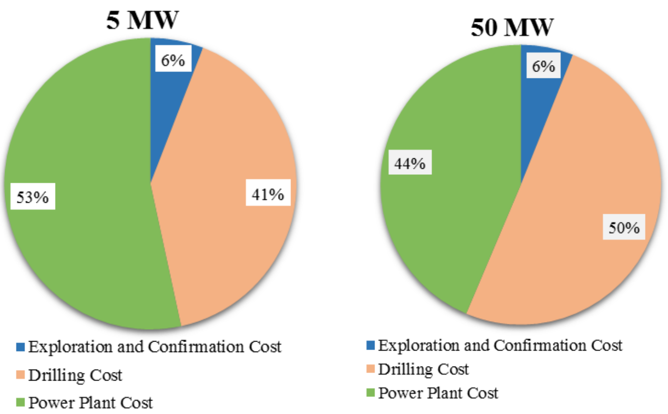

Figure 3: Breakdown of the total capital cost in 2016

SCENARIO 1: 5 MW geothermal power plant

The cash flows of the investment project for 5MW are illustrated in Figure 4. The chart shows two cash flows, one for capital investment and the other for equity. As seen from the chart, there is outflow of cash during the construction of the project, i.e. in the first year (2016). When the construction is finished, the project starts to generate income but just for one year (2017) because after a year loan received must be paid. The loan received, which is for 75% of the investment cost and working capital, is paid over 5 years after a year of start-up in 2018, so this is the reason why there is a dip in the net cash flow and equity from 2018 to 2022. After that the power plant begins cash flows in as revenues from sales. Tariffs will be multiplied by 0.7 from the first day of the second 10 years until the end of the contract which shows the dip in net cash flow and equity from 2027 to 2028.

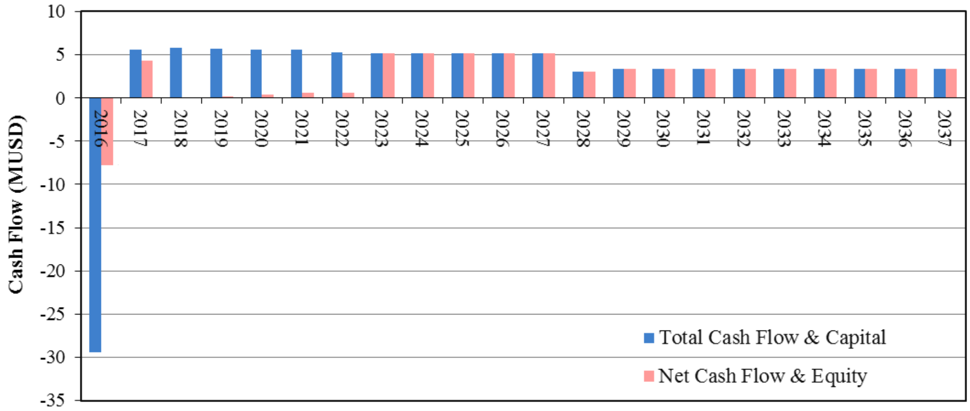

Figure 4: The cash flows of the project for 5MW

Figure 5 shows the accumulated NPV over the planning horizon. The NPV of net cash flow reaches to positive side over the planning horizon but the NPV of total cash flow increases over the planning horizon without ever reaching the positive side. Since the NPV of total cash flow is zero, we remain indifferent to the project. The necessary payback period for recovering investments is higher for the project (end of year contract) than for the equity investors but still payback period for the equity is high (10 years after operation begins).

The IRR is of much interest to the investors. Figure 6 shows how the IRR rises throughout the planning horizon for 5MW. The IRR for Net Cash Flow is higher than 24% and the IRR for Total Cash Flow is 17%. Since the IRR of Net Cash Flow is higher than the MARR, this project can be considered a profitable project for the equity investors. However, since the IRR of total Cash Flow is equal to the MARR, we remain indifferent to the project. By comparing Figure 5 and Figure 6 it can be seen that the NPV of net cash flow reaches zero at the same time as the IRR reaches the MARR.

Both cash flow ratios and financial ratios for 5MW show that based on these results there is not much foundation for investment and we remain indifferent to the project.

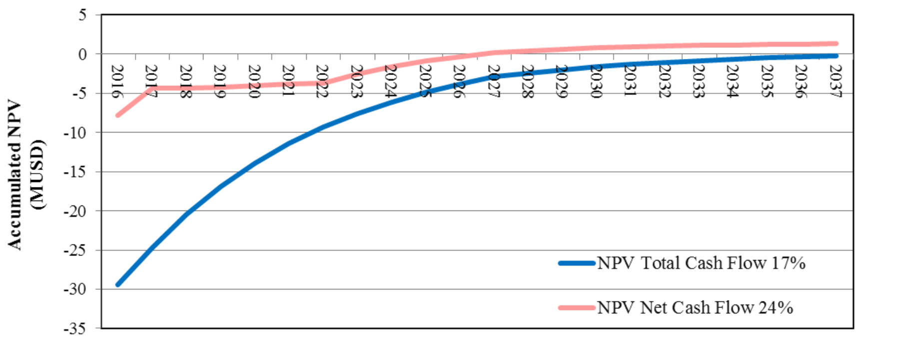

Figure 5: Accumulated NPV over the planning horizon for 5MW

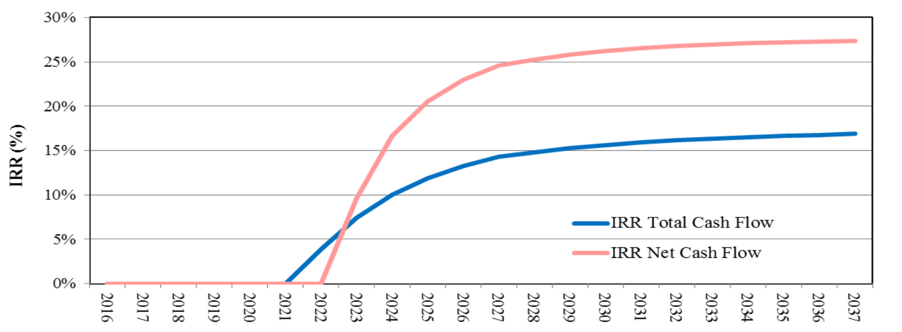

Figure 6: Internal Rate of Return for 5MW

SCENARIO 2: 50 MW geothermal power plant

The cash flows of the investment project for 50MW are illustrated in Figure 7. The chart shows two cash flows, one for the total capital investment and the other for equity. As seen from the chart, there is outflow of cash during the construction of the project, i.e. in the first seven years (2016 to 2022). The loan received, which is for 75% of the investment cost and working capital, is paid over 5 years after a year of start-up in 2024, so this is the reason why there is a dip in the net cash flow and equity from 2024 to 2028. When the construction is finished, the project starts to generate income but just for one year (2023) because after a year loan received must be paid. The project does not start to generate net profits from 2024 until 2026 but due to the accumulated losses the project is still in the red at the end of the planning horizon. Tariffs will be multiplied by 0.7 from the first day of the second 10 years until the end of the contract which shows the dip in net cash flow and equity from 2032 to 2033.

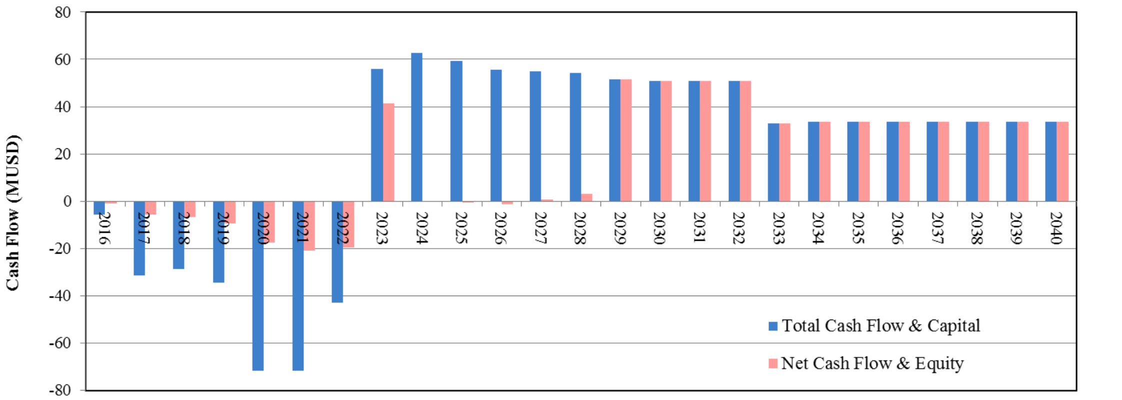

Figure 7: The cash flows of the project for 50MW

Figure 8 shows the accumulated NPV of the project over the planning horizon. The graph shows how the project increases its NPV over the planning horizon without ever reaching the positive side. At the end of the period the NPV of total capital is -48 MUSD and NPV of equity is -12 MUSD.

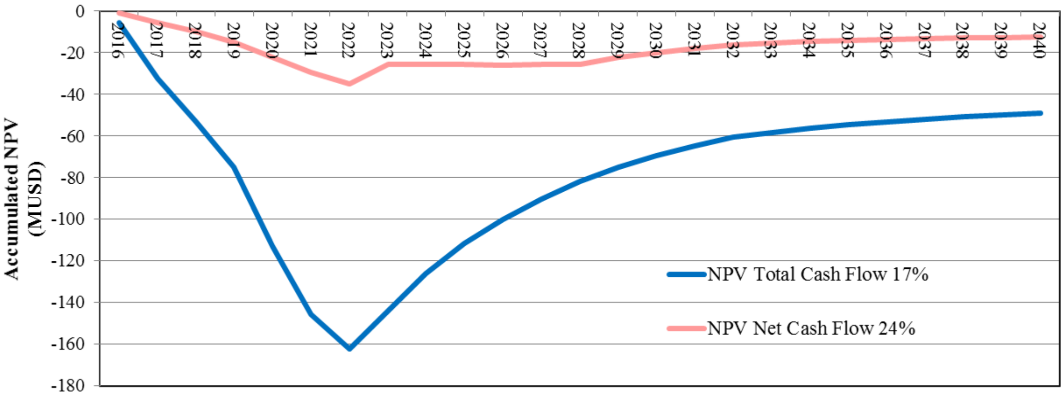

Figure 8: Accumulated NPV over the planning horizon for 50MW

The IRR is of much interest to the investors. Figure 9 shows how the IRR rises throughout the planning horizon for 50MW. The IRR for Net Cash Flow is 18% and the IRR for Total Cash Flow is 12%. Since the IRR of Total Cash Flow and Net Cash Flow are lower than the MARR (for equity and total capital are 24% and 17%, respectively), this project can't be considered a profitable project.

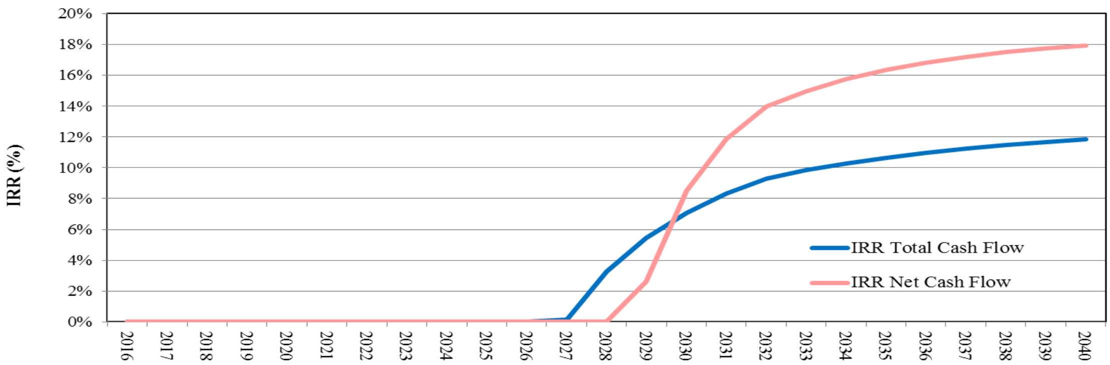

Figure 9: Internal Rate of Return for 50MW

Both cash flow ratios and financial ratios for 50MW show that based on these results there is not much foundation for investment for the given conditions. The ratios are all lower than the present acceptable minimum (17% for project and 24% for equity) and therefore indicate that the project would have difficulty meeting its obligations with regard to repayment of loans and other financial obligations.

5.2 Comparing financial feasibility study in Iran with other countries

Drilling cost in the Middle East is more expensive because the demand is very high compared to other countries and also there is competition from oil and gas. Drilling cost in Iran is around 5000$ per meter, while this cost is not so high in other countries. Based on information from industrial partners, the drilling cost in other countries is around 1300$ to 3500$ per meter. This is the reason why geothermal power plant construction is too expensive in Iran. In addition to drilling cost some financial parameters are also different, which affect the results. For example, discounting rates for project and equity in some countries are 10% while in Iran it is much higher. Also, loan repayments in Iran is just 5 years while in some countries is more than 10 years. Furthermore, electricity tariffs in Iran are among the lowest in the world, compared with other countries.

Given the current situation, our present system is not very attractive to prospective investors basically due to the unfavourable rate of return on their investments. To hasten the exploration and development of our geothermal resources, we need to provide an environment that will attract investments, thus the proposed legislative measure offers a package of incentives, both in fiscal and contractual arrangements.

5.3 Sensitivity analysis

The most effective way to present the results of a sensitivity analysis is plotting sensitivity graphs. All variables are then plotted on the same graph, each as a separate line. The slopes of the lines show how sensitive the output is to a change in each variable; the steeper the slope is the more sensitive the outcome is to a change in a particular variable. It is therefore very good for the decision maker to take the results of the sensitivity analysis into account in the decision-making process, and if possible arrange to mitigate risk associated with changes in key parameters. (Björnsdóttir, 2010).

Figure 10 shows a sensitivity graph for Scenario 2 (50 MW). Input parameters that are known to affect the outcome of a geothermal project the most were selected for the analysis. As seen from the graph, the IRR of this project is most sensitive to changes in electricity price, and buildings costs, which includes drilling cost. These parameters affect the outcome in a different way, as an increase in electricity price increases the IRR, but an increase in drilling cost decreases the IRR.

As seen from sensitivity analysis in Figure 10, small changes in input values can affect the outcome of the analysis significantly. If the electricity price or drilling cost changes for geothermal, the project can be profitable. The sensitivity analysis in Figure 10 for the electricity price and drilling cost shows that a relatively modest increase in price of electricity or decrease in drilling cost can change the financial side of the project. So if the price of electricity can be raised from the current 16 U.S.cents/kWh to 24 U.S.cents/kWh (1.5 times) or if the drilling cost can be decreased from 5000 $/m to 1600 $/m, the economics of the project will change significantly. Table 8 and Table 9 show a summary for a sensitivity analysis of this project.

Also since loan repayment is important in financial analysis, if it is assumed that the government gives loan for renewable energy projects with longer repayment period (for example 10 years), that will not affect the result a lot in this case.

As mentioned in previous sections the MARR for Net Cash Flow is 24% and the MARR for Total Cash Flow is 17%. Since the IRR of Total Cash Flow and Net Cash Flow after changing the price of electricity or drilling cost are higher than the MARR, this project can be considered a profitable project with at least 24 U.S.cents/kWh or with 1600$/m for drilling cost.

The Iranian currency has been steadily losing its value against the US dollar. Iran is now attempting to set an official exchange rate of 42,000 Rials to the dollar. Iranian feed-in-tariffs have remained unchanged since 2016, which has depreciated in value against the dollar in the last three years. The price of electricity has decreased from 16 U.S.cents/kWh in 2016 to 12 U.S.cents/kWh at present (2019). Assuming that the price of the power plant is constant since 2016, the project is still not profitable.

Table 5: Summary for a sensitivity analysis for 50MW by changing the electricity price

Electricity Price (U.S.cents/kWh)	NPV Total Cash Flow	NPV Net Cash Flow	IRR Total Cash Flow	IRR Net Cash Flow
16 (in 2016)	-48 MUSD	-12 MUSD	12%	18%
24	6 MUSD	16 MUSD	18%	31%

Table 6: Summary for a sensitivity analysis for 50MW by changing the drilling cost

Drilling Cost ($/m)	NPV Total Cash Flow	NPV Net Cash Flow	IRR Total Cash Flow	IRR Net Cash Flow
5000	-48 MUSD	-12 MUSD	12%	18%
1600	4 MUSD	13 MUSD	18%	34%

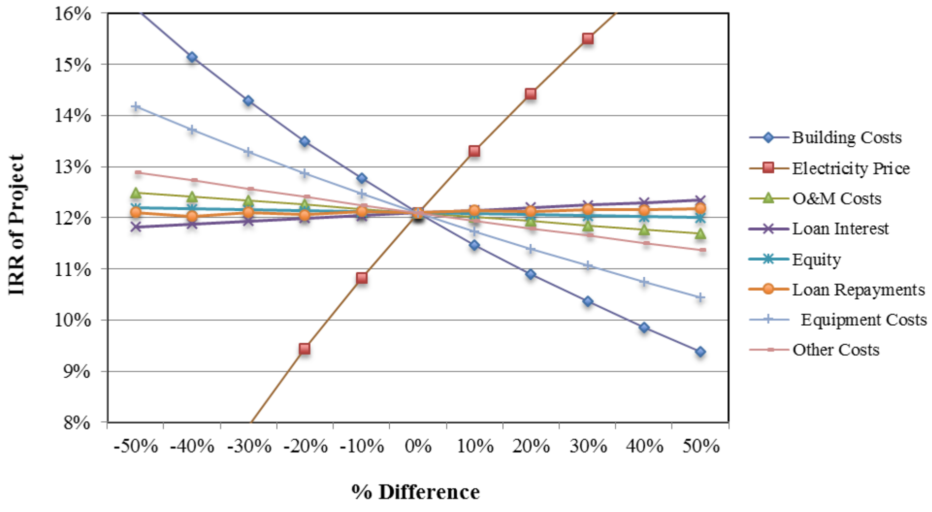

Figure 10: Sensitivity graph for case study for 50MW

6. CONCLUSIONS

Based on the abundant resources of geothermal energy, Iran is attractive for geothermal business. The government has implemented laws guaranteeing power purchase for a period of up to 20 years but it seems to be unfavourable to attract private sector participation. In addition to ensuring the purchase of electricity, financing the initial investment is one of the main obstacles. The main goal of this paper was to find out whether or not there is a financial foundation for the private sector's participation in geothermal power generation in Iran.

The results of this paper show that geothermal power development projects in Iran are not very attractive for private investors when the project considers the cost of exploration and confirmation, drilling an unknown field, and power plant with current electricity tariffs.

The profitability model came up with an indifferent result for Scenario 1 (5 MW geothermal power plant) and an infeasible result for Scenario 2 (50 MW geothermal power plant). Risk analysis suggests that the most important financial factors that affect project profitability are the energy price and drilling costs.

In order for scenarios to be successful in the real world, the price of electricity in Iran would have to increase at least to 24 U.S.cents/kWh or drilling cost would have to be comparative to costs elsewhere in the world. Drilling cost would have to decrease at least to 1600$ per meter. In addition, that bigger power plants can be more economic since the highest value of the scale exponent could be selected for scaling.

These are some problems, which could be solved with some determination and the will of the Government in Iran. Important factors where the government could help to generate a positive impact on profitability and risk of the investment are: energy price, taxes, and reducing drilling costs. Numerous alternatives could be evaluated such as: improved tax incentive laws, large period energy contracts, public funds for exploration and confirmation phases, and doing the exploration and well field development by the government. The decision-making process for large projects is very complicated and obviously all aspects could not be covered in this paper and many assumptions have been made, some based on little information available. However, this study gives an indication of the feasibility for the private sector to enter geothermal projects at current conditions in Iran.

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