# CHAPTER V

# CONCLUSION AND RECOMMENDATION

## Conclusion

This research provides techno-economic assessment of future perspectives of the CSP plant in Mongolia. The technical evaluation of CSP plant was analyzed and estimated in terms of solar resource, land topography, land space, power grid availability, water resources, and infrastructure. The cities name Sainshand and Dalanzadgad in Gobi desert were site selected for this research. DNI evaluation was done by three sources of data; measuring on ground data, data taken from NASA and predicted data by theory. The result from ground measuring showed that the average annual DNI was 1898.13 $kWh/m^2/a$ for Sainshand while the DNI in Dalanzadgad was 1650.67 $kWh/m^2/a$. This data was less than the data from NASA and predicted data. It can be seen that the measured data from both sites is closed to nominal one, 1800 $kWh/m^2/a$. In order to evaluate economic part, electricity generation from both CSP plants was calculated base on measured DNI value. In the future, the accurate DNI data need to be measured on sites and the pre-engineering part should be performed before project initiation.

The land topography showed that the slope of both cities was less than 1%. This can be accepted for land leveling. And these two cities have available land space for 5 MW parabolic trough power plants. For the sufficient provided resource which is one important key factor for CSP plant, the both sites show effective potential of underground water. In case of Power Grid availability, Sainshand had already developed infrastructure such as the 110 kV power line connected with CES. And also, there are Trans-Mongolian Railway and main convenient road passing through the city that is effective for power plant construction material transportation. But Dalanzadgad is the city in remote area; the infrastructure has not been developed well yet. It has regional off-grid CHP system of 6 MW supplied heat and electricity for 7 districts.

The meteorological data for last 10 years analysis indicated that the average ambient temperature in Dalanzadgad is about 23.6 °C during summer, −13.7 °C during winter, and annual mean temperature of around 5.8 °C, whereas average ambient temperature in the Sainshand is about 25.0 °C during summer, −17.1°C during winter, and annual mean ambient temperature of around 5.1 °C. The annual average wind speed in both sites are similar and quite low with only 2.3 - 5.1 m/s in Dalanzadgad and 3.6 – 5.7 m/s in Sainshand.

Base on regional electricity demand, 5 MW parabolic trough solar thermal power plant was designed for each selected site. Dalanzadgad off-grid 5 MW parabolic trough solar thermal power plant required about 36,924.59 $m^2$ area of parabolic collector field whereas Sainshand grid connected 5 MW solar thermal power plant required 36,938.36 $m^2$.

The technical evaluation results showed that Dalanzadgad, Sainshand sites can be recommended to install the Parabolic Trough Solar Thermal Power plant.

The economic evaluation was performed in terms of the comparison between 5 MW off-grid and grid connected parabolic trough solar thermal power plants in case of FIT and Tax Incentive. It showed that both CSP projects would not be economically viable at 8 % discount rate and project investment of 13.7 million Euro in Dalanzadgad and 13.9 million Euro in Sainshand. From the government FIT policy which has already announced to the investors as maximum FIT of c€ 14/kWh, the results from this research showed that the NPV of Dalanzadgad off-grid CSP power plant is 12.69 million Euro while the BCR is 1.38, IRR is 7.04% and PBP is 8.26 years. NPV of Sainshand grid connected CSP plant is 12.66 million Euro, the BCR is 1.35, IRR is 6.8% and PBP is 8.4 years. The conclusion of this research can be proposed to Mongolian Government to consider the new term which can be similar to "Adder", subsidy scheme in case of Thailand. This means regular consumer energy price (5 c€/kWh) plus FIT (13.7 c€/kWh). For an example, Government may recommend about c€ 19/kWh to the investors.

However, the Government should consider carefully in a financial model before the Government offers the new subsidy policy to the entrepreneurs CSP projects. If the Government revised Renewable Energy Law adding new policy, CSP

projects such as off-grid and grid connected would be economically viable at 8 % discount rate, FIT and Tax Incentive.

**Recommendation**

1. The simulation for electricity production from the CSP plants should be performed to obtain more accurate results.

2. The appropriate DNI data should be collected steadily for the whole year.

3. Due to many types of working fluid that can be used with parabolic trough technology, the detail of working fluid should be taken into account in the research.

4. In order to receive better effective proposal for the government, the financial model should be also investigated.