CHAPTER V

CONCLUSION AND RECOMMENDATION

Technical aspects

The technology is available to create very small scale solar thermal power plants. The radiation is strong enough for the use of solar parabolic installations for the energy supply even in rural areas in Southeast Asia. The climate conditions shown in the show cases have demonstrated that the use of solar thermal power plants is possible.

The use of turbines in solar thermal power plants is necessary to reach acceptable economical results. In individual and very small scale installations (class 2 and 3) ORC systems can be acceptable too, if the system is not grid connected. For household applications not suitable technical solution, except photovoltaic, is available. If suitable engines will become available, than small scale solar trough installations are going to be seen in larger numbers in sunny regions around the world.

A turbine of 2 MW size may reach 19 % efficiency, while a 5 MW turbine already reaches up to 26 % and 50 MW units may reach nearly 40 %. If these efficiency are calculated into the whole process, the solar-electric efficiency is between 14 and 28 %.

All the above mentioned aspects, where integrated into the SOLAR A equation and take into consideration the technical character of a system. To define factors for validation of the technology, classes for small power plants have been developed in this thesis. Also efficiencies are brought to factors as well as prices per kW electric installed. These criteria in addition to economical impact criteria are shown in the result.

Economical aspects

The construction of small scale solar thermal power units can not be compared to large scale installations in regard to possible financial impacts. Nevertheless the adaptation of construction by making use of a broader amount of locally produced parts as steel structures and common installation measures allows small power plants to be economical useful as large scale installations. Small scale as defined in this thesis and very small scale units seem to be useful, when all criteria together are taken into consideration.

If the design allows to work with low pressure as well and to integrate a self-securing operation, then necessary price levels can be met. This may lead to the fact that the total project investment could be limited within budgets of 2,000 to 4,000 Euros for turn-key technical installations. Large scale units are reaching prices between 2,800 and 3,800 Euros per kW depending on local conditions today. This price is suitable for present adder conditions in Thailand and other South East Asian states.

The payback period for a 5 MW solar power plant can reach nowadays 8.6 years without financing. In the future this period may be reduced to 6 years, when prices are down to 2,800 Euro per kW. Until 2020 prices below 2,000 Euro should be reached and allow adequate economics without state support. A prolongation of the adder contract period now to 15 to 20 years instead of 10, would be useful not only to promote and support the solar technology but to allow the creation of local solar thermal industry and to speed up the climate protection speed regarding saving of CO_2.

Such a price development may look like the following graph, which is based on necessary market developments:

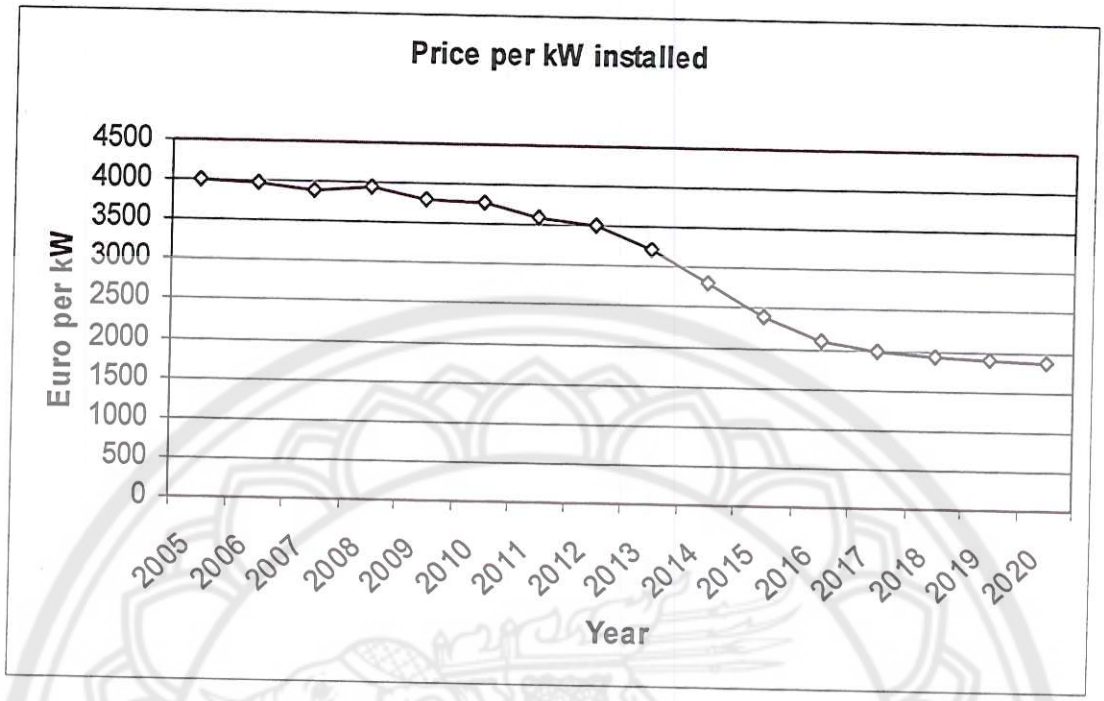

Figure 50 The development of solar thermal power plant pricing

Source: Solarlite GmbH, 2009

A larger scale system achieves other economical results as the efficiency of the converting unit – turbine instead of steam screw – is much higher. A 5 MW unit in Thailand may be able to produce 9 million kWh per year on pure solar mode without using co-generated thermal energy. The CO_2 saving in this size will reach 5,200 tons per year.

Conclusion

The economical use of appropriate solar thermal technology in Thailand is possible. The case studies and the SOLAR A equation have shown in comparism, if the right criteria are met, economical valuable projects can be done even under limited conditions.

The SOLAR A equation is working and the developed factors are suitable and show the reality of today solar technology. The factor catalogues as well as the classification need to be surveyed and accepted by a broader audit, but they can be used as a basis to identify on short term basis a value of a project.

Solar attractiveness = climate + investment + technical character + public impacts

The results shown in the validation studies of several projects in comparison with commonly used LCOE calculations, come to the result that the SOLAR A figure needs to be higher than 4. A project with SOLAR A = 4 would describe a non-profit, but balanced project like a pilot or demonstration plant. If SOLAR A > 5, commercial status of the projects is reached. It might still be necessary to support the technology in those projects by using feed-in-tariff systems as a public impact.

The factors are a major result of this thesis and are based on long-term experience – in future they may help to identify suitable projects faster or to identify not suitable projects to investors or authorities.

Some changes in the factor definitions may become necessary especially, when co-generation needs to be validated as well. In Southeast Asia this might become important on short term basis, as there are still more opportunities to be followed and examined for renewable energy technologies, as well as their use in typical applications such as cooling and food processing facilities. The use of solar thermal technologies in combination with adsorption or absorption chillers can replace other cooling or air conditioning technologies and would help in reducing the bottleneck of electrical energy as thermal energy is demanded only. More electrical energy would then be available for small and medium size industries or craft companies like the OTOP promoting measure.

Investment costs are still high and need to be subsidized by state supporting systems, but in future the cost will come down and allow suitable prices for electricity production. Small scale systems need high financial support as their electricity production cost may reach 0.46 Euro per kWh. At sites with good direct solar irradiation conditions and 5 MW size of the turbines minimum, the price per kWh may drop from 0.11 to 0.19 Euro today to 0.05 to 0.08 Euro in 2020.

The protection of the climate can be supported with the described technology in terms of the CO_2 savings achieved as well as the ecological balances of the used parts which are worthy amounts.