

Figure 2-33: Absorber of PTC systems .....	77
Figure 2-34: Components and typical arrangement of Fresnel collector system.....	79
Figure 2-35: Two receiver arrangements for Linear Fresnel Collectors (LFC).....	79
Figure 2-36: Main components of Stirling Dish technology .....	80
Figure 2-37: Classifications of Thermal Energy Storage systems.....	84
Figure 2-38: Schematic of generalized thermochemical storage cycle for CSP technologies.....	86
Figure 2-39: Full load hours for CSP as a function of Direct Normal Irradiation (DNI) and the solar multiple (SM) .....	88
Figure 2-40: Cost indicators and boundaries .....	89
Figure 2-41: A typical Rankine cycle system .....	90
Figure 2-42: Typical arrangement of an Integrated Solar Combined Cycle System (ISCCS) .....	92
Figure 2-43: Solar Energy Enhanced Combustion Turbine (SEECOT) .....	93
Figure 2-44: Function process of the Stirling motor.....	94
Figure 4-1: LCOE and different collectors in the SAM library .....	101
Figure 4-2: Levelized cost (real) vs run (combination) which gives positive net present value – Case 1 .....	103
Figure 4-3: Levelized cost (real) vs run (combination) which gives positive net present value – Case 2 .....	103
Figure 4-4: Net capital cost per watt – Case 1 .....	104
Figure 4-5: Net capital cost per watt – Case 2 .....	105
Figure 4-6: Beam normal irradiance - (SWERA and actual solar data) .....	106
Figure 4-7: System power generated (kW) of Case 1 at TES(hr)=0.....	107
Figure 4-8: System power generated (kW) of Case 2 at TES(hr)=0.....	107
Figure 4-9: System power generated (kW) of Case 1 at TES(hr)=4.....	108
Figure 4-10: System power generated (kW) of Case 2 at TES(hr)=4 .....	108
Figure 4-11: System power generated (kW) of Case 1 at TES(hr)=8 .....	109
Figure 4-12: System power generated (kW) of Case 2 at TES(hr)=8 .....	109
Figure 4-13: System power generated (kW) of Case 1 at TES(hr)=12 .....	110
Figure 4-14: System power generated (kW) of Case 2 at TES(hr)=12 .....	110
Figure 4-15: System power generated (kW) of Case 1 at TES(hr)=16 .....	111
Figure 4-16: System power generated (kW) of Case 2 at TES(hr)=16 .....	111
Figure 4-17: System power generated (kW) of Case 1 at TES(hr)=20 .....	112
Figure 4-18: System power generated (kW) of Case 2 at TES(hr)=20 .....	112
Figure 4-19: Standard deviation for each parameter combination analyzed above...113	
Figure 4-20: Annual energy generation ( kWh) of Case 1.....	114
Figure 4-21: Annual energy generation ( kWh) of Case 2.....	114

## **LIST OF TABLES**

Table 2-1: Summary of solar angles .....	30
Table 2-2: Coefficients $a$ and $b$ for the Angstrom regression Equation .....	42
Table 2-3: Monthly average daily extraterrestrial insolation on horizontal surface (MJ/m <sup>2</sup> ) .....	44
Table 2-4: Day number and recommended average day for each month .....	44
Table 2-5: Classification of the days according to the clearness index .....	45
Table 2-6: Land use of Solar Tower .....	73
Table 4-1: Summary of worldwide CSP projects by numbers .....	99
Table 4-2: Summary of worldwide CSP projects by capacities .....	100