Background:

- The current world record for solar thermal to electric efficiency is 18%.
- The amount of solar energy received in one hour is more than the world’s population uses in one year.
- The ability to efficiently harness solar energy will provide a viable replacement to fossil fuel based power.

Objectives:

- Design of a thermodynamic cycle that will achieve high efficiency for solar power generation.
- Design of an Einstein Cycle suitable for air conditioning.

Solar Technology:

- Parabolic Solar Troughs concentrate the sun’s heat on an evacuated tube and can reach temperatures of up to 390 °C.

Solar Power Generation:

- By integrating parabolic solar troughs as the source of heat, vapor is generated in the boiler and is expanded in a turbine, producing power.
- The vapor is condensed using the ambient air.
- Through the use of regeneration, cascaded cycles, and alternative working fluids, the cycle’s efficiency was increased to 35%.

Einstein Air Conditioning:

- Albert Einstein and Leo Szilard patented a single pressure refrigeration cycle in 1930 which eliminated the need for a pump.
- The cycle utilized Butane (the refrigerant), ammonia (pressure equalizing fluid), and water (the absorbent) as working fluids.
- Low grade heat such as solar power or waste heat can be used solely to run the cycle.
- The typical COP of the cycle was 0.17 for refrigeration, however, the overall COP was increased to 0.5 if used for air conditioning.