



# Findings for Session 3: Heat recovery

- ISIS: Example of existing machine where increase in electricity prices have triggered a study of how electricity can be saved. All sub systems have been analysed and the biggest culprits (ancillary system and RF systems) identified.
- MAX and ESS studies: Energy balance and energy mapping done for both facilities. The aim for ESS is to recycle 60% of the energy. Multiple cooling circuits at different temperatures are planned for both facilities with the hot circuits coming close to 100 degree. Alternatives to district heating studied e.g. Stirling motors and in-house heating.
- Concentrating solar powers using traditional cycles for electricity production: Linear concentrating systems: Parabolic Through, Linear Fresnel. Point concentration: Dish engine, Central receiver. Thermal storage in e.g. molten salt, over come 2000 hour available classically. Leads to overall better economy of plant. 600 GWh produced in three plants in Spain with linear through, 3 sqkm each plant
- Second law of thermodynamics: Exergy analyses shows that the efficiency is very low for producing work (electricity) from low temperature. However, every work cycle needs a heat sink and a heat point and it will be more efficient the bigger the difference is between these two temperatures.

- Thermodynamics tells us that we **first** should assure better efficiency and **second** that it is most efficient to recycle energy as heat (housing, water). If high temperatures can be recovered it opens possibilities for e.g. electricity production
- It is very costly and labor demanding to re-fit an existing facility
- Including efficiency and recycling requirements at the design stage opens many possibilities e.g. manufacturers have seldom been asked if high temperature cooling water can be recovered.
- Concentrated solar power could be an answer to Europe's (the world's) energy needs if solar rich regions are interested to invest and export electricity, possible hydrogen. Storage systems help to make it economic, maybe even in Sweden.