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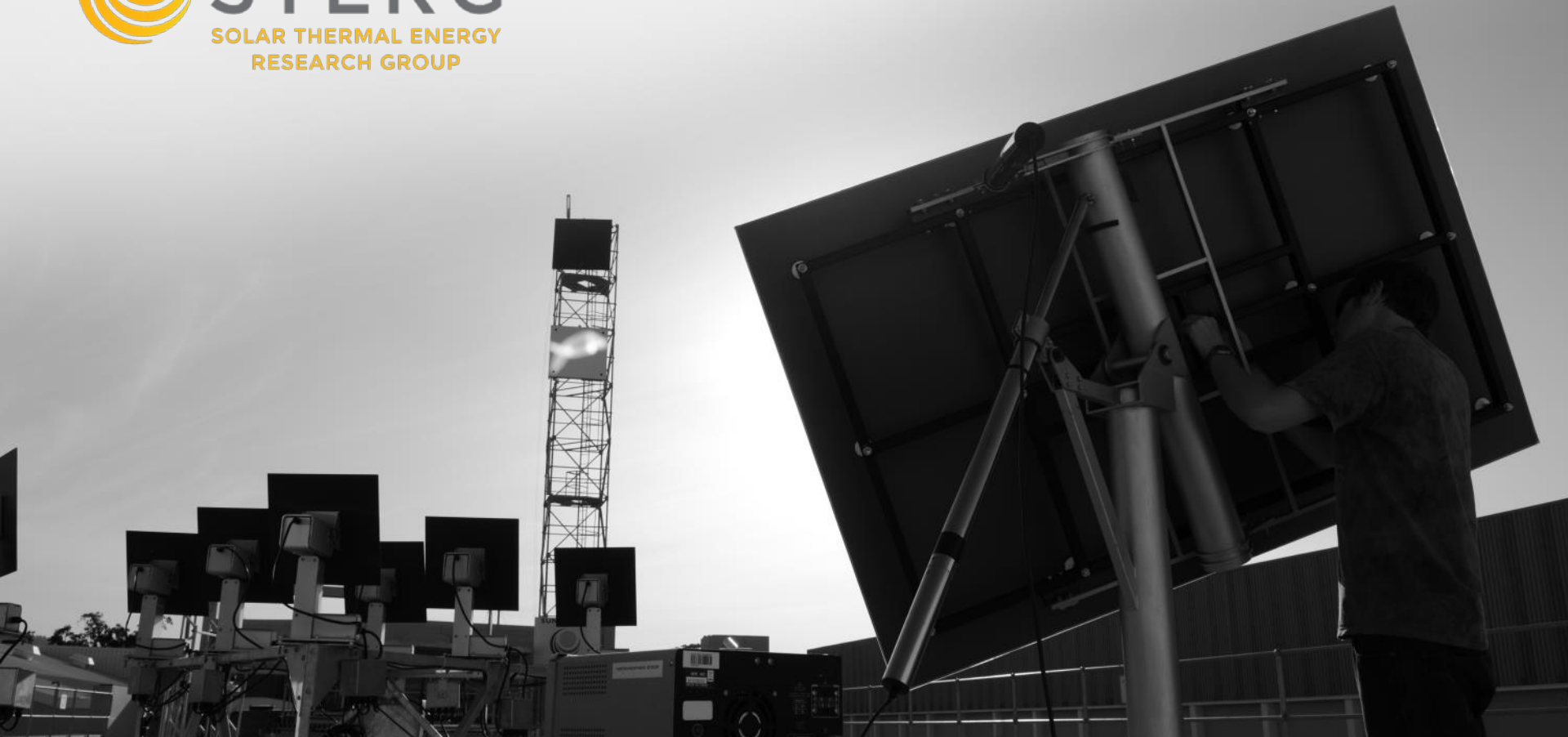

An Organic Rankine Cycle as technology for Smaller Concentrated Solar Powered Systems

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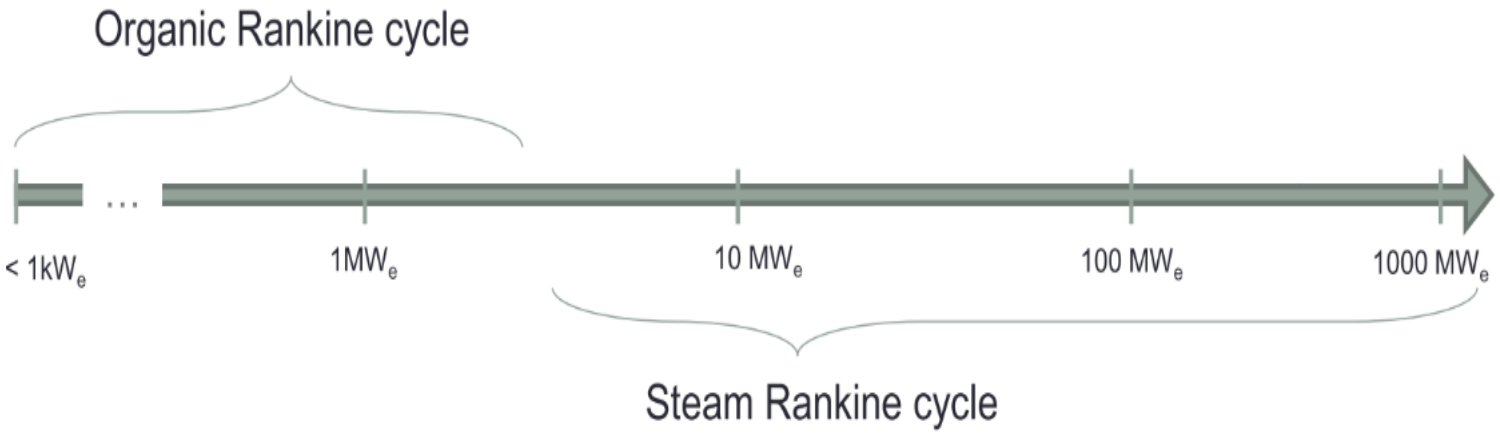
Introduction

- Motivation
- Objectives
- ORC maturity in CSP
- Specific site in SA
- Simulation
- Conclusion

Motivation

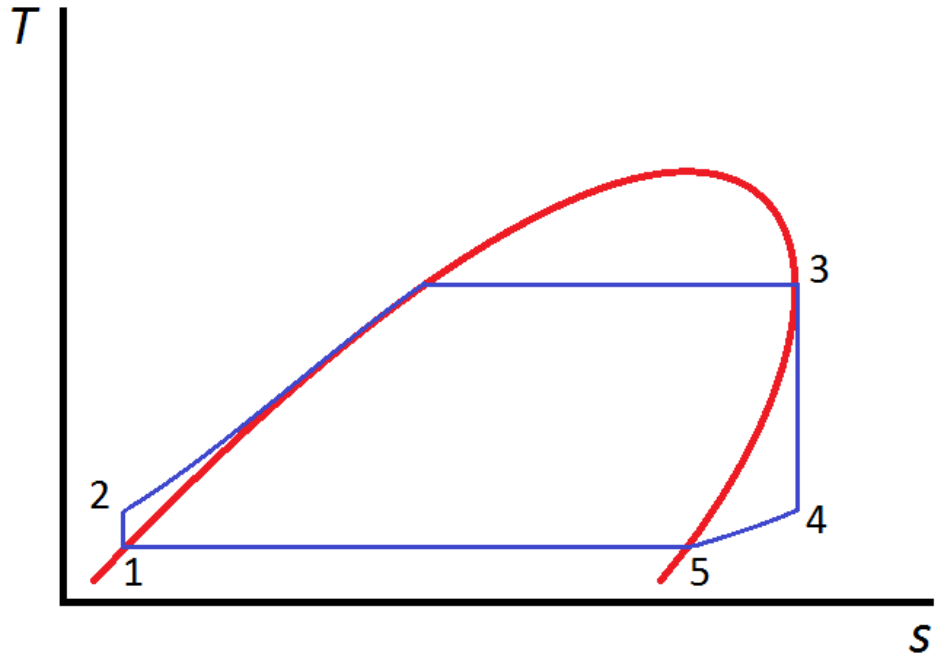
- The real value of CSP
- Economic competiveness of CSP
- Why ORC?

Motivation



Proposed Thermal range of Rankine Cycles
(Dickes, 2016)

Typical ORC



Motivation

- Advantages of ORC
  - Turbine simplicity
  - No condensation on turbine blades
  - Reduced maintenance
  - Cheaper plant with less components
- Disadvantage
  - Low efficiency

Objectives

- Determine the technological maturity
- Identify an industry and site in Southern Africa
- Analyse and simulate an ORC with CSP
- Perform an over-head economic analysis

ORC Maturity in CSP

- 1 MW APS Saguaro PT plant in Arizona, USA in 2006

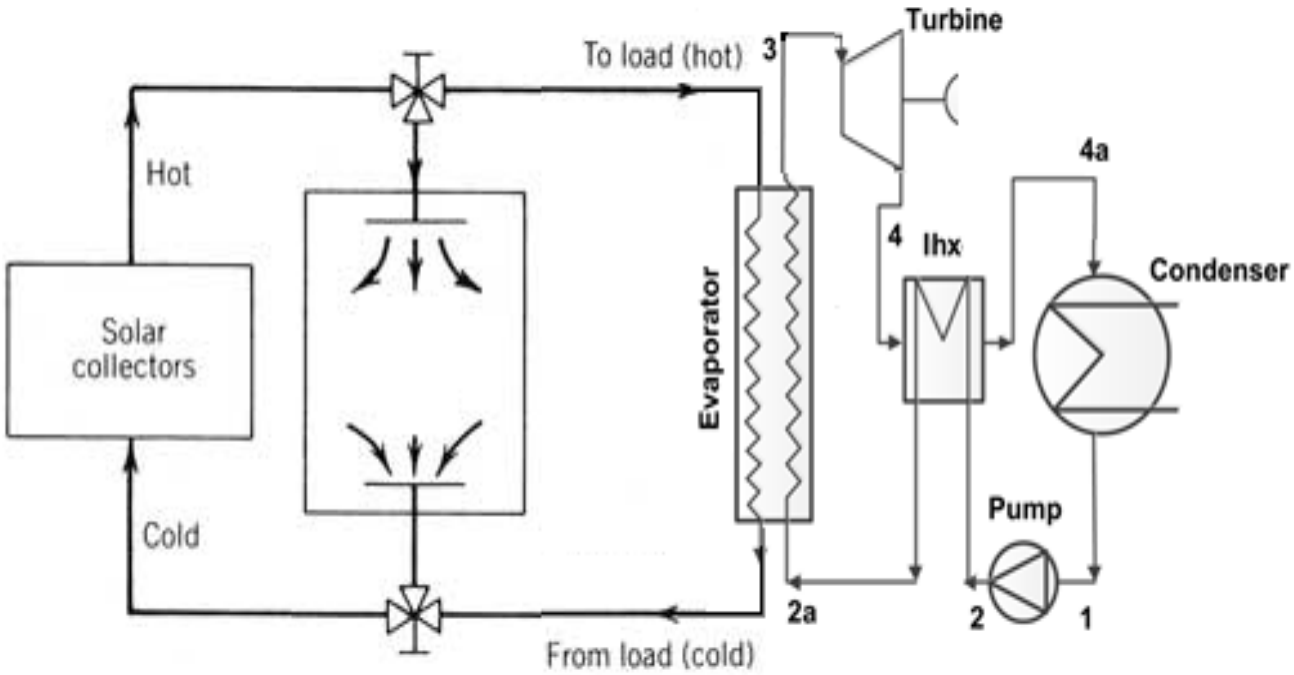
- Smaller developments and other industries

Site in Southern Africa

- Possible industries
  - o Industrial
  - o Residential off-grid
- United Manganese of the Kalahari (UMK)

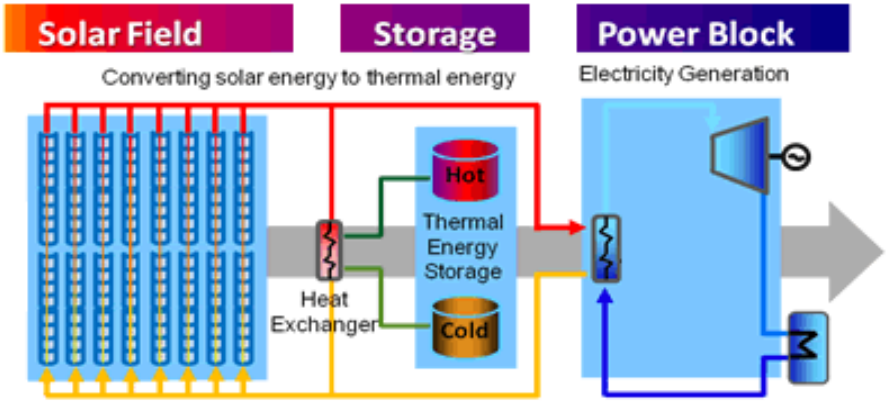
Site (Google maps, 2017)

Simulation: ORC Plant



Simulation: Approach

- Model functional blocks
  - o Solar field
  - o Storage
  - o Power block

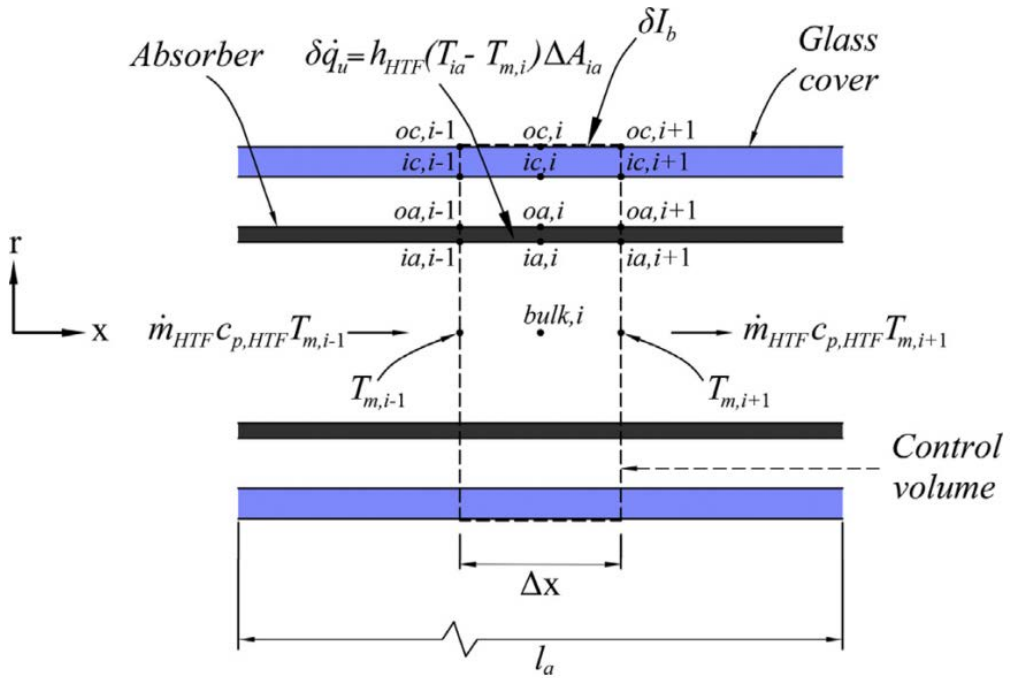


- Steady state and transient model

Simulation: Approach

- Steady state model
  - Specify output (500kWe – 5MWe)
  - Neglect storage
  - Solar field analysis
  - Power block

Simulation Approach …



Simulation: Approach

- Transient simulation
  - Specify output (500kWe – 5MWe)
  - Incorporate storage
  - Simulate over TMY
  - Calculate LCOE

Conclusion

- The technology is very immature
- Mining site will be considered
- The future of ORC with CSP

References

- Dickes, R. (2016). Solar-based ORC power systems. In *ORC-Plus Workshop*.
- Google maps, (2017). https://www.google.de/maps/place/Umk+Mine+Hotazel/

The End Thank You

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