LICENSING OPPORTUNITY

ETH transfer – Linking Science and Business

Concentrated solar power via a reciprocating piston engine

Keywords

Solar, Solar-thermal, Concentrating solar power, Non-stationary, Engine, Reciprocating, Volumetric absorber, Pulsed radiation, Transient heat transfer

Summary

This novel reciprocating piston engine converts solar irradiation into electrical power. A concentrated solar beam is redirected between the engine's cylinders and absorbed in an efficient porous receiver in the cylinder heads (Fig. 1). Due to the moving beam, thermal load on the components is reduced compared to stationary solar receivers.

Invention

The presented concentrating solar power (CSP) technology has the potential for reaching very high solar-to-electricity efficiencies. In particular, it enables to take advantage of the very high top temperatures (>2000°C) that can be reached with today's solar concentration systems within a solar-thermal power cycle. The technology can be very cost effective: with similar investment costs compared to the solar Brayton/Rankine-based systems, it is expected to reach significantly higher solar-to-electricity efficiencies. The engine is suitable for decentralized medium-scale power plants as well as centralized large-scale plants in regions with high solar density and low cloud coverage. Typical electrical power output of one engine unit is in the range of 0.1 - 1 MW. In order to further increase the thermal efficiency of the method it can be combined with a bottoming steam power cycle and take advantage

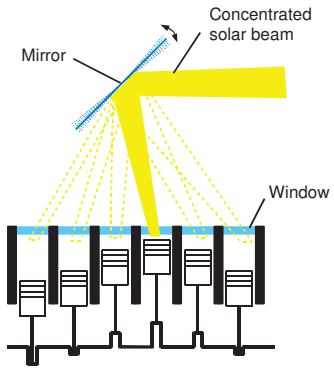

Fig. 1: General concept of a solar driven reciprocating piston engine

of its high off-gas temperatures, as secondary energy source (Fig. 2). Based on the very high solar-to-electricity efficiency it is expected to become competitive with fossil fuel-based electricity in the near future.

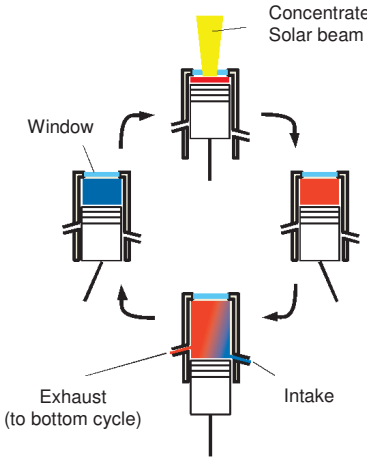

Fig. 2: Illustration of a complete engine cycle for one cylinder

Patent Status

- Patent pending

Features & Benefits

- Very high solar-to-electricity efficiency
- A peak solar-to-electricity efficiency of around 30-35% is expected, including bottoming cycle
- Cost of electricity is expected to become competitive with fossil fuel-based electricity
- Operates at very high top temperatures (>2000°C)
- Completely new, efficient type of solar-power system

Field of Application

- Electricity generation based on solar power
- Medium scale solar power plants
- Large scale solar power plants

References

- Wurzbacher, J., Steinfeld, A., Boulouchos, K., Hörler, H.U., A non-stationary solar thermal power cycle, in progress

Ref. No. T 09-067

ETH Zurich
ETH transfer
Zurich, Switzerland

+41 44 632 23 82
transfer@sl.ethz.ch
www.transfer.ethz.ch

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich