Solar@UP: Solar-dish Brayton cycle

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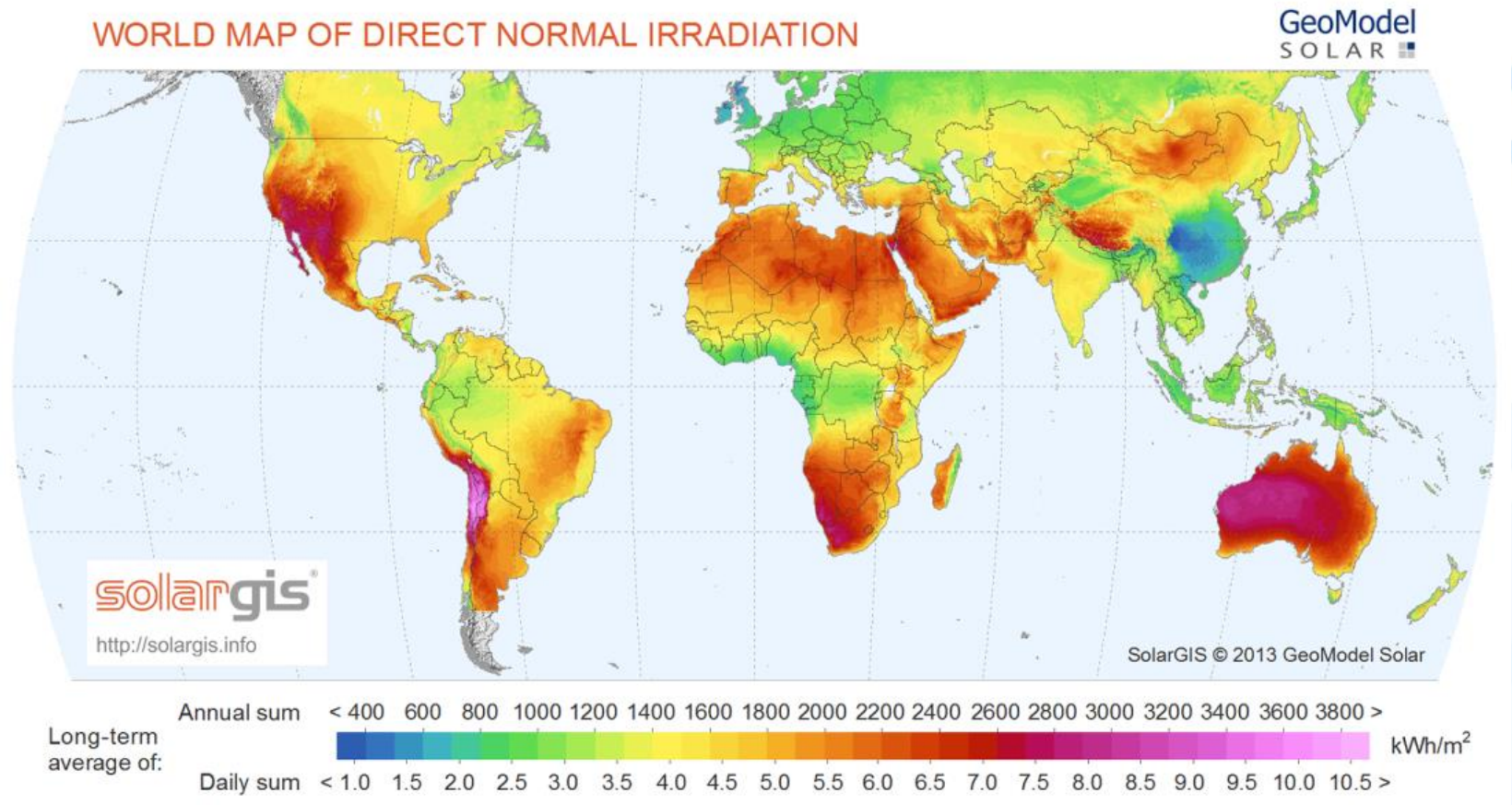
Background



Long-term average of direct normal solar irradiance on a world map showing the potential of solar power generation in southern Africa (GeoModel Solar, 2014)

Background

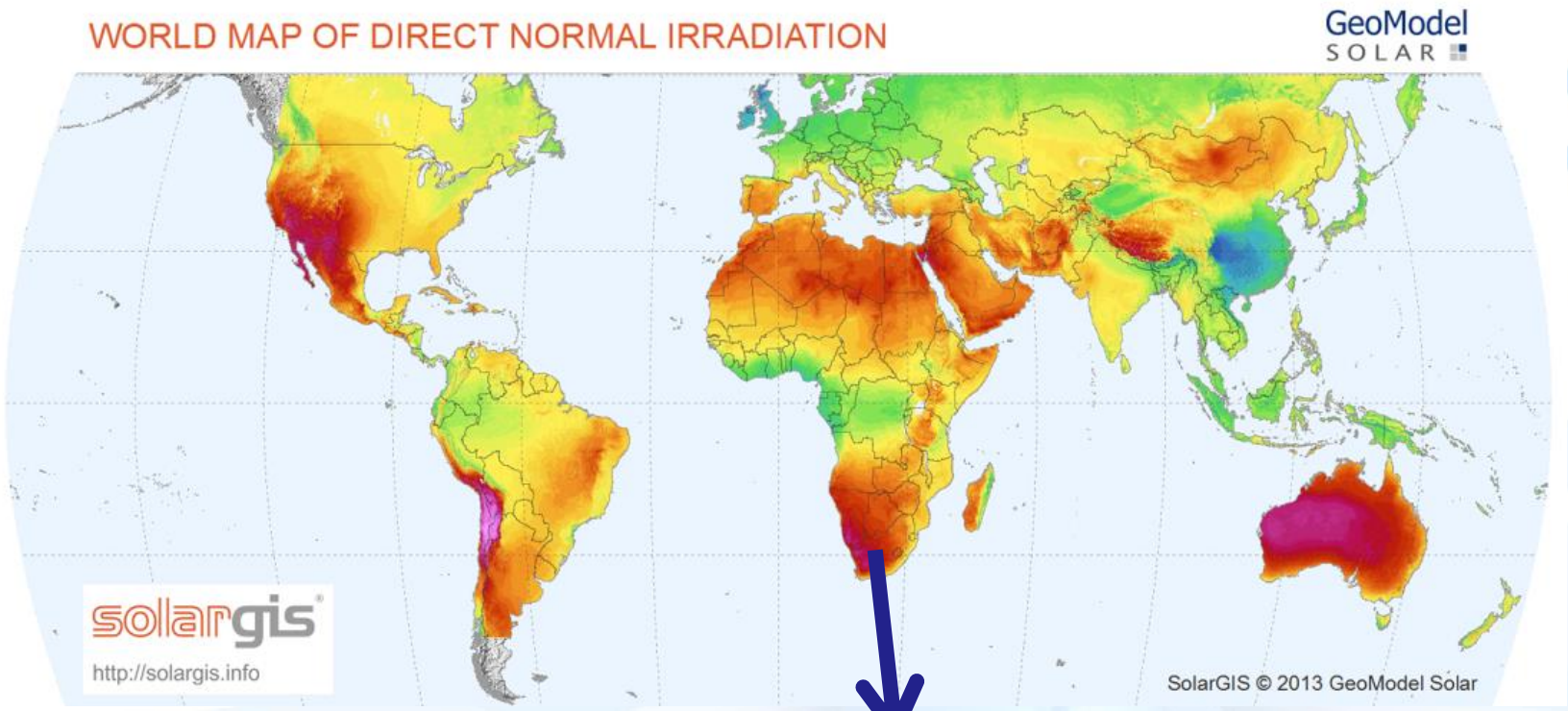
*South Africa has one of the **best solar resources in the world** and this resource is free to use and study for all South Africans, who should take the lead in this field in terms of*

- *skills development,*
- *training and*
- *product manufacturing.*

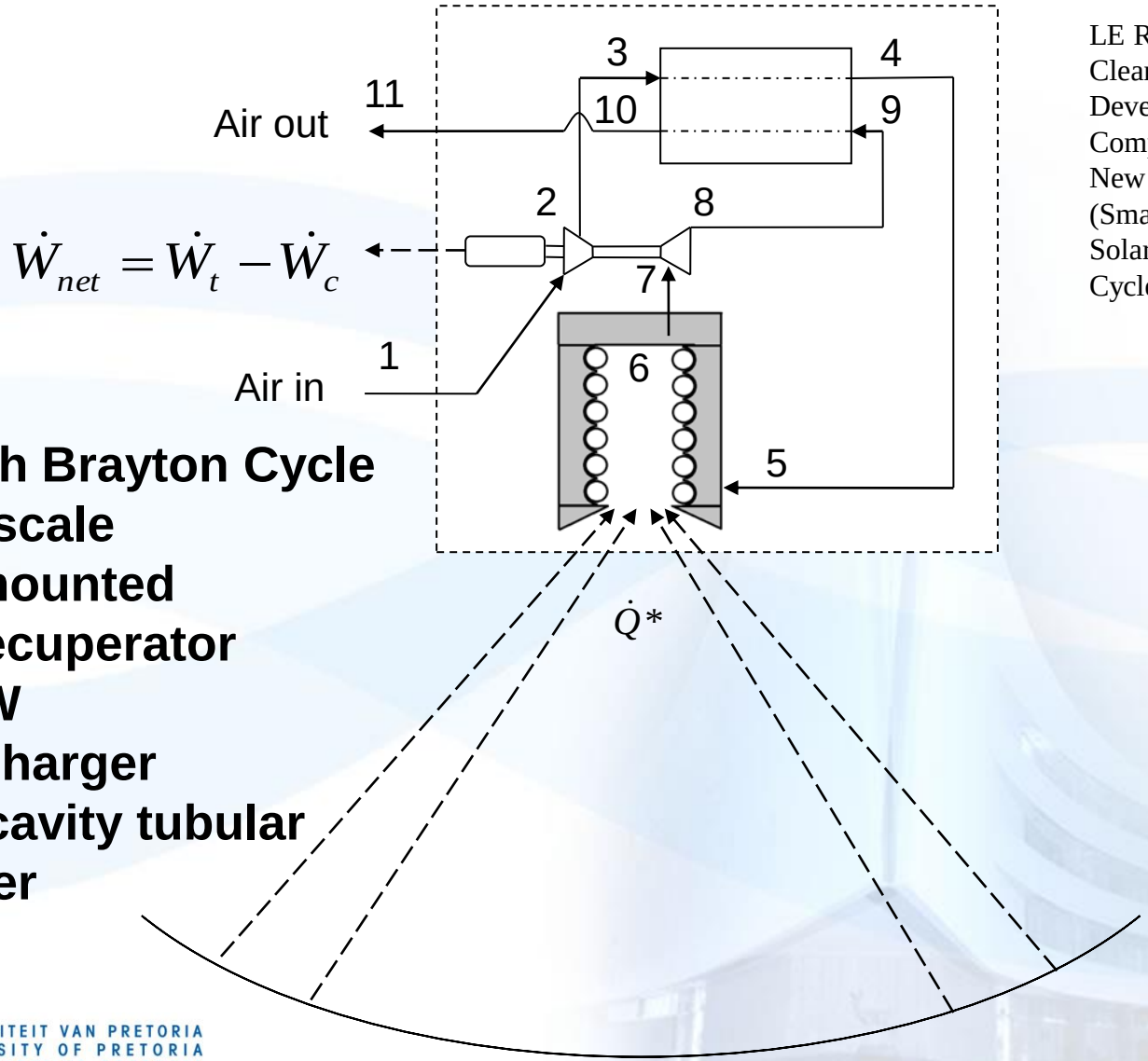
*The research and development of **solar dish technologies** **is a new and exciting research field** in which all South African researchers of all age, race and gender can take the lead.*

- Dr WG le Roux

Background



1. **Power generation**
2. **Water purification**
3. **Fuel production**

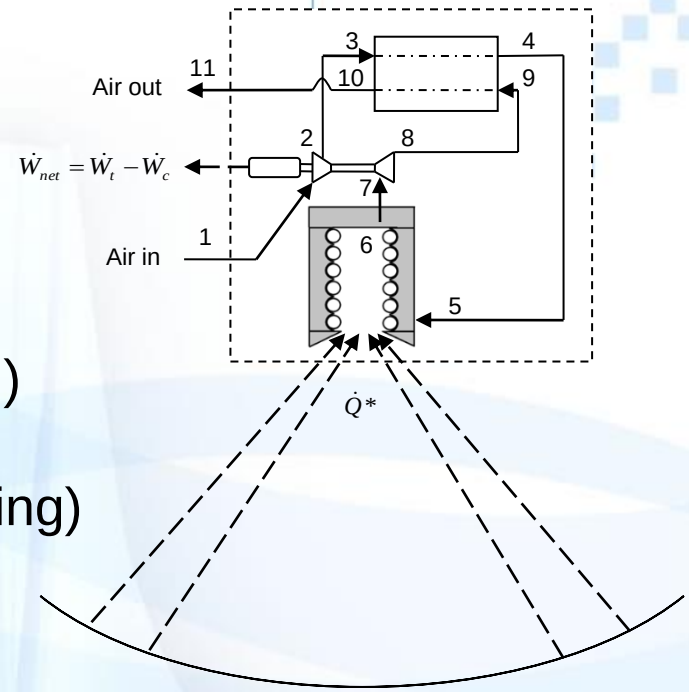


LE ROUX WG, MEYER JP; Clean Energy for Sustainable Development, 1st Edition: Comparisons and Contrasts of New Approaches, Chapter 6 (Small-scale Dish-Mounted Solar Thermal Brayton Cycle), pp. 167–190, 2017.

Solar-Dish Brayton Cycle

- **small-scale**
- **dish-mounted**
- **with recuperator**
- **1-20kW**
- **turbocharger**
- **open-cavity tubular receiver**

Solar thermal Brayton cycle advantages



- Air as working fluid
- Turbocharger as micro-turbine
- Can also be powered with gas (hybrid system)
- Water heating (cogeneration)
- High efficiency potential (reheat and intercooling)
- Mobility
- Cost benefits (bulk manufacturing)
- Thermal storage

- Quicker to commercialise (prototyping is quicker and cheaper)
- Large-scale local manufacturing – good for the economy (good for South Africa)
- Micro-grids

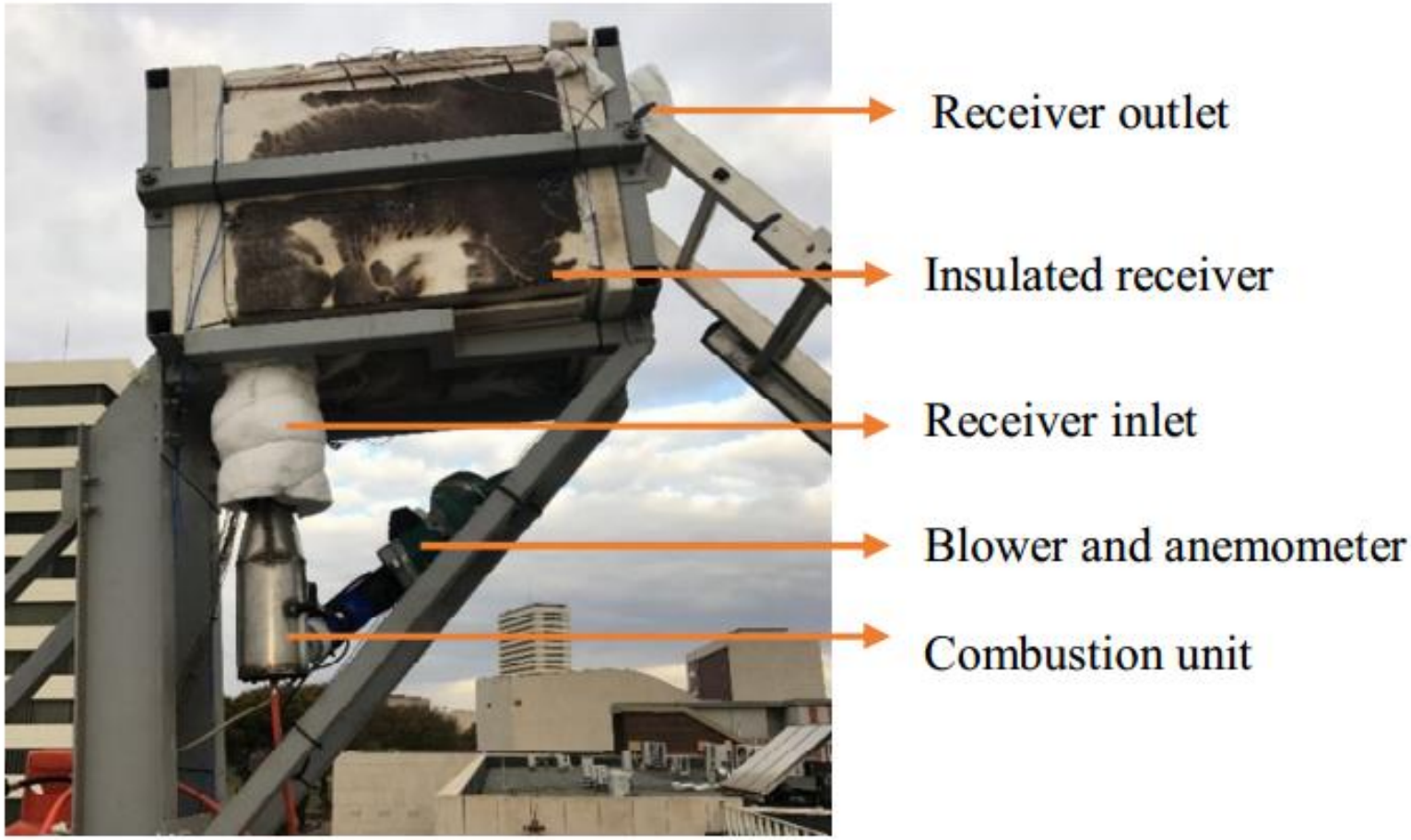
Open cavity tubular receiver

Receiver dimensions optimised in a previous work (Le Roux et al., 2014)

LE ROUX WG, BELLO-OCHENDE T and MEYER JP; The efficiency of an open-cavity tubular solar receiver for a small-scale solar thermal Brayton cycle, Energy Conversion and Management 84: 457-470, 2014.

Solar @ UP – Solar dish

Solar receiver testing

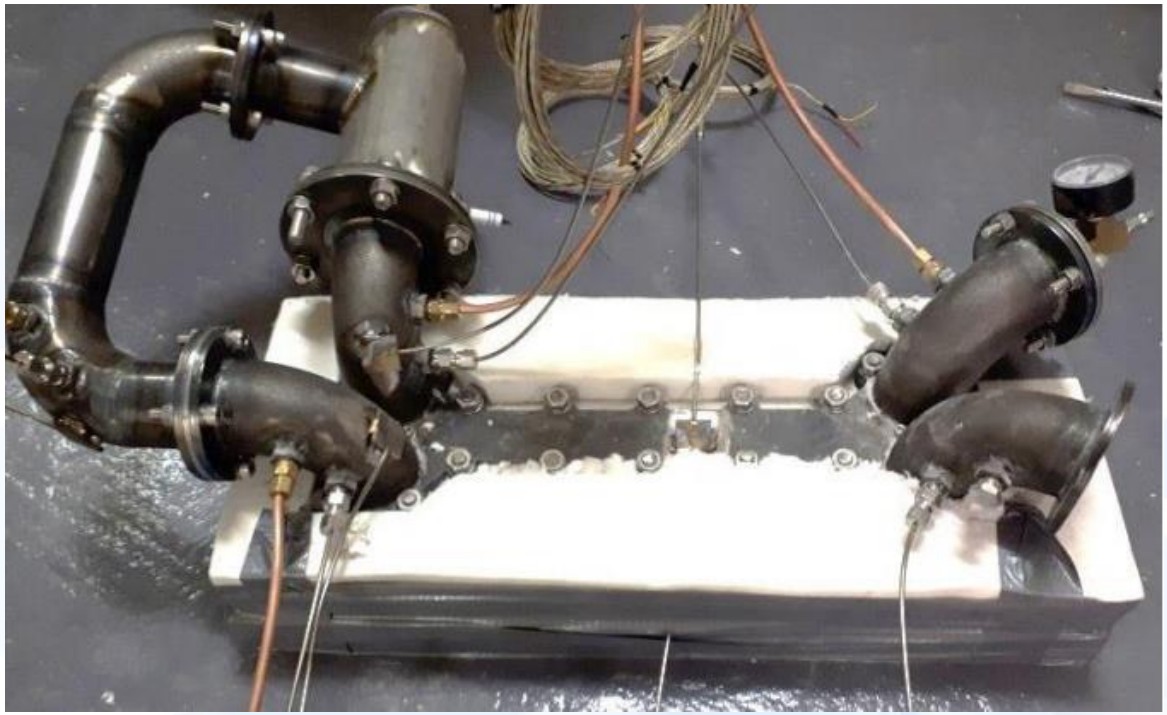


WOLFF TM, LE ROUX WG and MEYER JP; Heat loss analysis for a cavity solar receiver, 16th International Heat Transfer Conference (IHTC-16), Beijing, China, 10-15 August, 2018.

Moonlight testing for flux mapping

WOLFF TM, LE ROUX WG and MEYER JP; Analysis of a parabolic dish solar collector via lunar flux mapping, 5th Southern African Solar Energy Conference (SASEC2018), Durban, 25-27 June, 2018.

Recuperator testing



DELLAR K, LE ROUX WG and MEYER JP; Experimental testing of a small-scale solar thermal Brayton cycle recuperator, 16th International Heat Transfer Conference (IHTC-16), Beijing, China, 10-15 August, 2018.

DELLAR K, LE ROUX WG and MEYER JP; Small-scale solar thermal Brayton cycle recuperator: Experimental testing and heat loss analysis, 5th Southern African Solar Energy Conference (SASEC2018), Durban, 25-27 June, 2018.

Acknowledgement

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Thank you

Questions?

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