Australian
Solar Energy Society
Tasmanian Branch

A SOLAR ATLAS FOR TASMANIA

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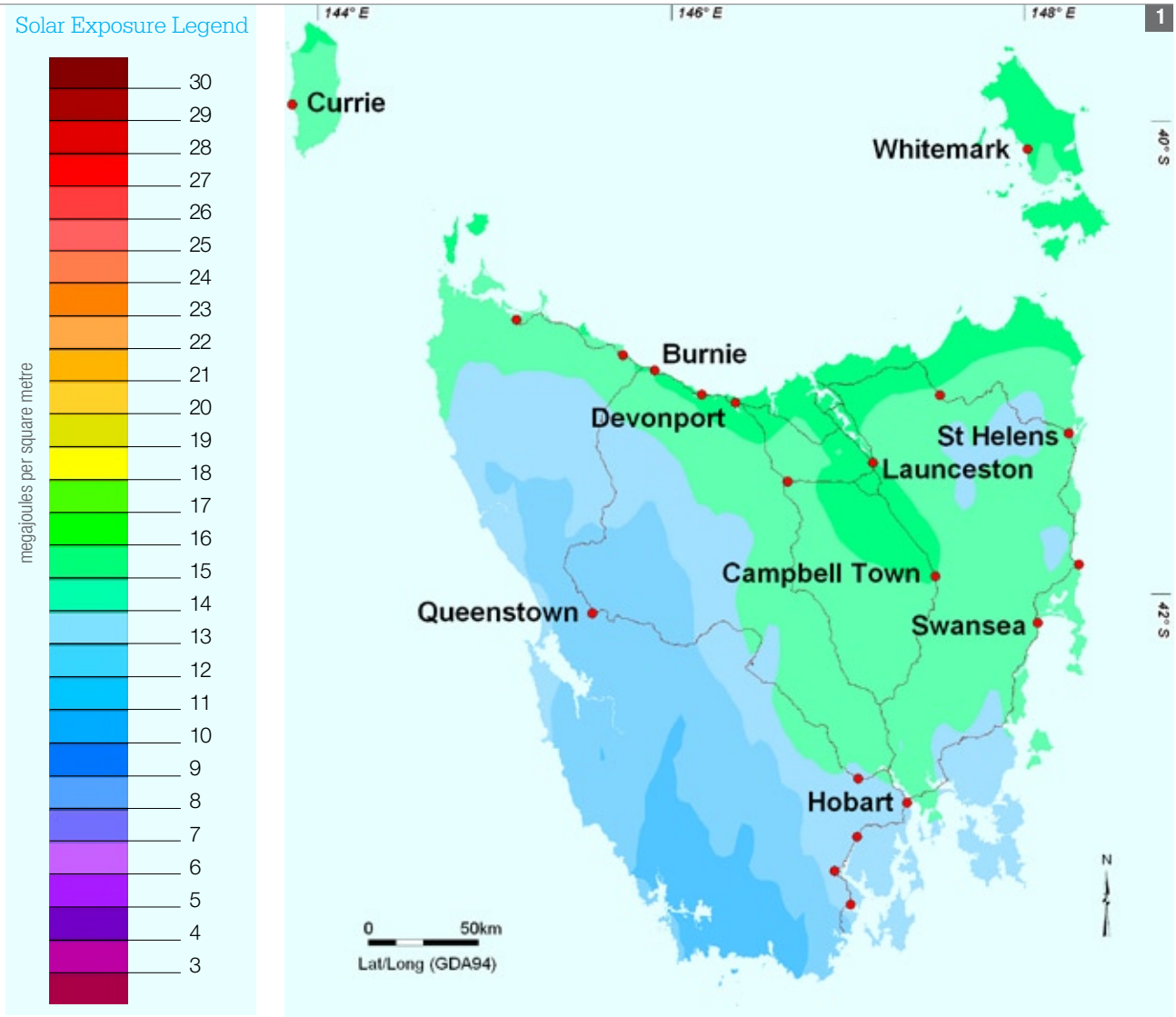
Fig.1 Annual Average

Annual mean solar radiation (2000 to 2010)



Reading this Atlas

This atlas presents measurements of total solar energy reaching a horizontal surface (insolation or solar exposure) in units of megajoules per square metre per day (MJ/m²/day) derived from satellite-borne instruments, accounting for both the amount of solar radiation reaching the top of the atmosphere and the amount of cloud. In the absence of cloud, insolation closely follows the sun's motion, with a maximum at the summer solstice and a minimum at the winter solstice. Extremes of mean temperature occur about a month later.

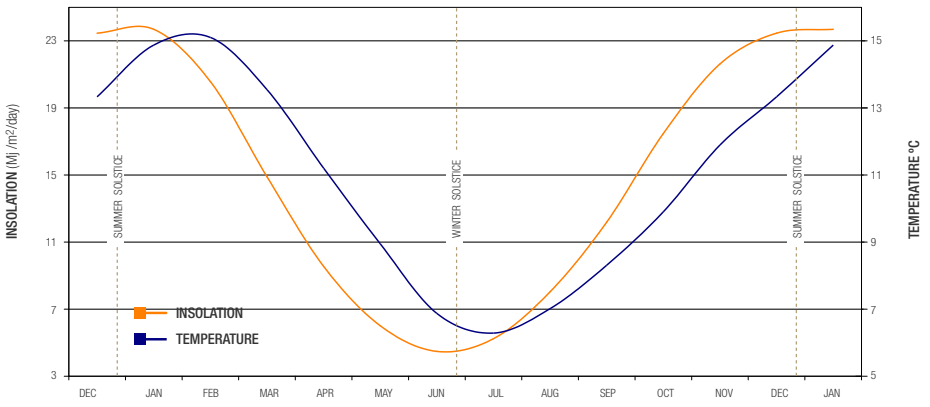


Fig.2 Annual cycle of insolation and temperature

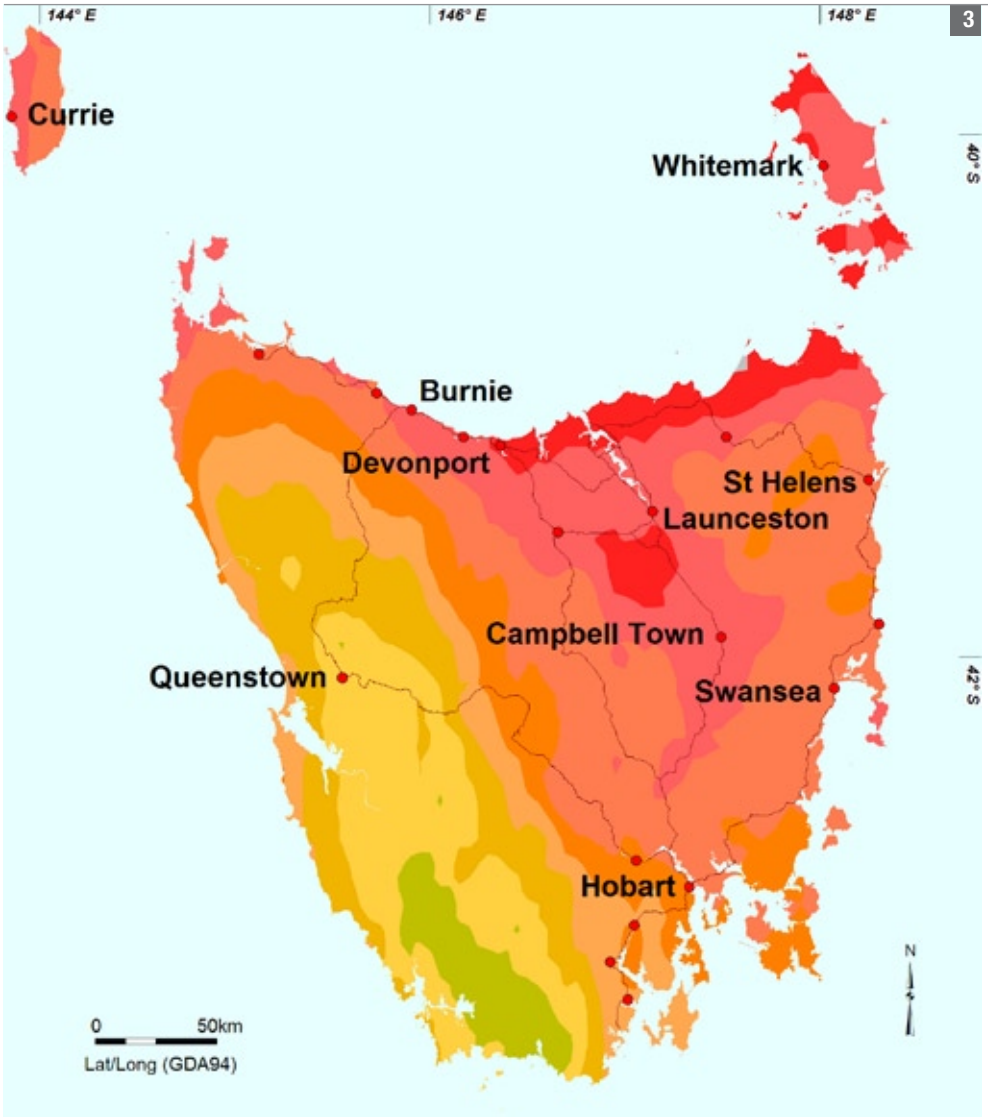
Averaged over Tasmania. Insolation data from 2000 to 2010, temperature data from 1981 to 2010

SOLAR EXPOSURE IN TASMANIA

Variations in Solar Exposure in Tasmania are mostly controlled by cloudiness and the time of year. Over a year, the relatively sunny northern Midlands gains about one and a half times as much solar energy as the cloudy southwest highlands. Typical daily solar exposure in summer can be four or five times that received in winter. Cloudiness over Tasmania follows rainfall, and is governed by the interaction of air-stream and topography. The prevailing westerly winds bring moist air from across the Southern Ocean onto the state's west coast. The air is forced to rise over the mountainous terrain, cooling as it does so. The cooler air holds less moisture, so clouds form (and eventually rain falls). As the air continues eastwards, it has not only lost moisture but also descends and warms, leading to less cloud. Cold fronts embedded in the general westerly flow can bring more cloud for short periods, and extend that cloud across the whole state (and especially to the northwest).

Not all cloud comes with westerly winds. Easterly winds bring considerable moisture off the warm Tasman Sea. This is one of the causes of a maximum in cloudiness – and a consequent minimum in solar exposure – in the northeast highlands. Onshore winds also enhance cloudiness in coastal areas and the nearby hills, including those of the southeast.

Areas closer to the equator generally have higher annual solar exposure than those closer to the pole, but in Tasmania this effect is swamped by the variation in cloudiness. Summer, when the sun is above the horizon for a long time each day and reaches high angles in the sky, brings significantly higher solar exposure than winter with its short days and low sun angles.



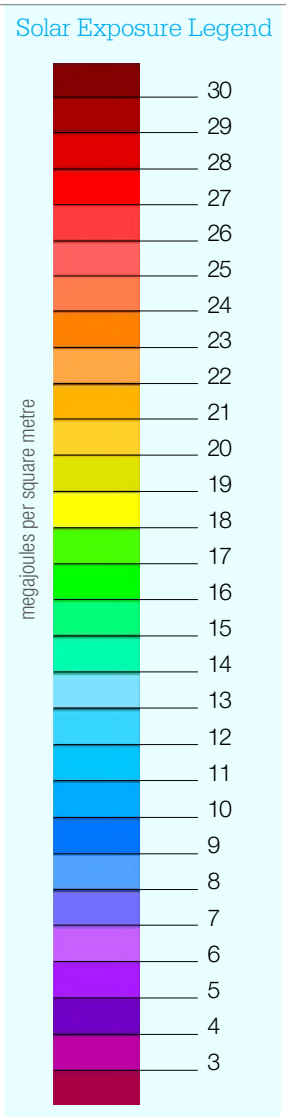
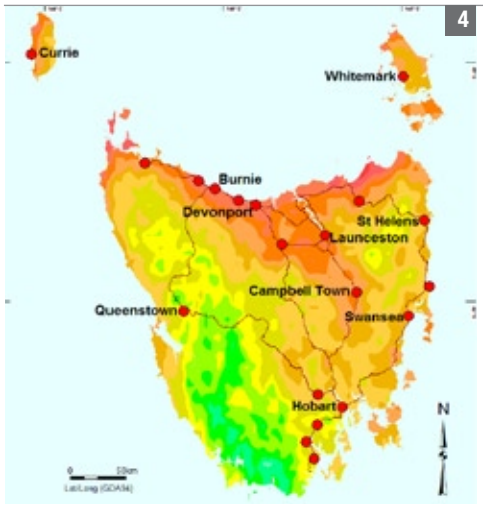


Fig. 3
December average solar radiation
(2000 to 2010)



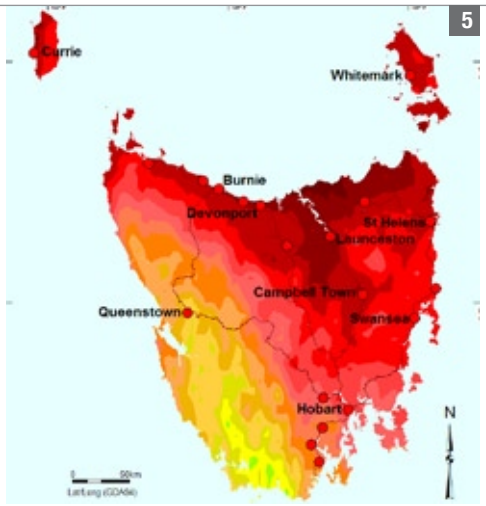


Fig. 4
December 2001
(a December with low insolation)

Fig. 5
December 2000
(a December with high insolation)

Individual months or seasons can be markedly cloudier – and hence receive less solar exposure – than the long-term average. A cloudy summer month will still lead to relatively high exposure, but a cloudy winter month can yield very low values indeed. This needs to be taken into consideration when designing a system, as the average daily value will not be obtained on every day, and will be exceeded on some days.

Weather events can make it cloudy for several days at a stretch, so systems must allow for periods of limited solar input. These cloudy periods are often associated with low air temperatures, rain and wind, all of which may impact on the demands made of a solar energy system.

Climate Projection Modelling shows changes overall by the end of the 21st century are generally less than 5%, which is small compared to the variations that already exist across the state and negligible when compared to the annual cycle. These projections are in the publication *Climate Futures for Tasmania* which may be downloaded from *www.climatechange.tas.au*

Ian Barnes-Keoghan, Climatologist
Bureau of Meteorology

DETAILED SOLAR RADIATION DATA

The Australian Solar Radiation Data CD and Handbook provides insolation data for 28 locations around Australia, including Hobart and Launceston. The AUSOLRAD software allows the user to generate their own tables for conditions of their choice for eaves overhang, orientation, ground reflectance and tilt. The handbook provides data tables for the 28 locations, maps, appendices on the science of irradiation and a section suggesting how data could be used for designing in different situations.

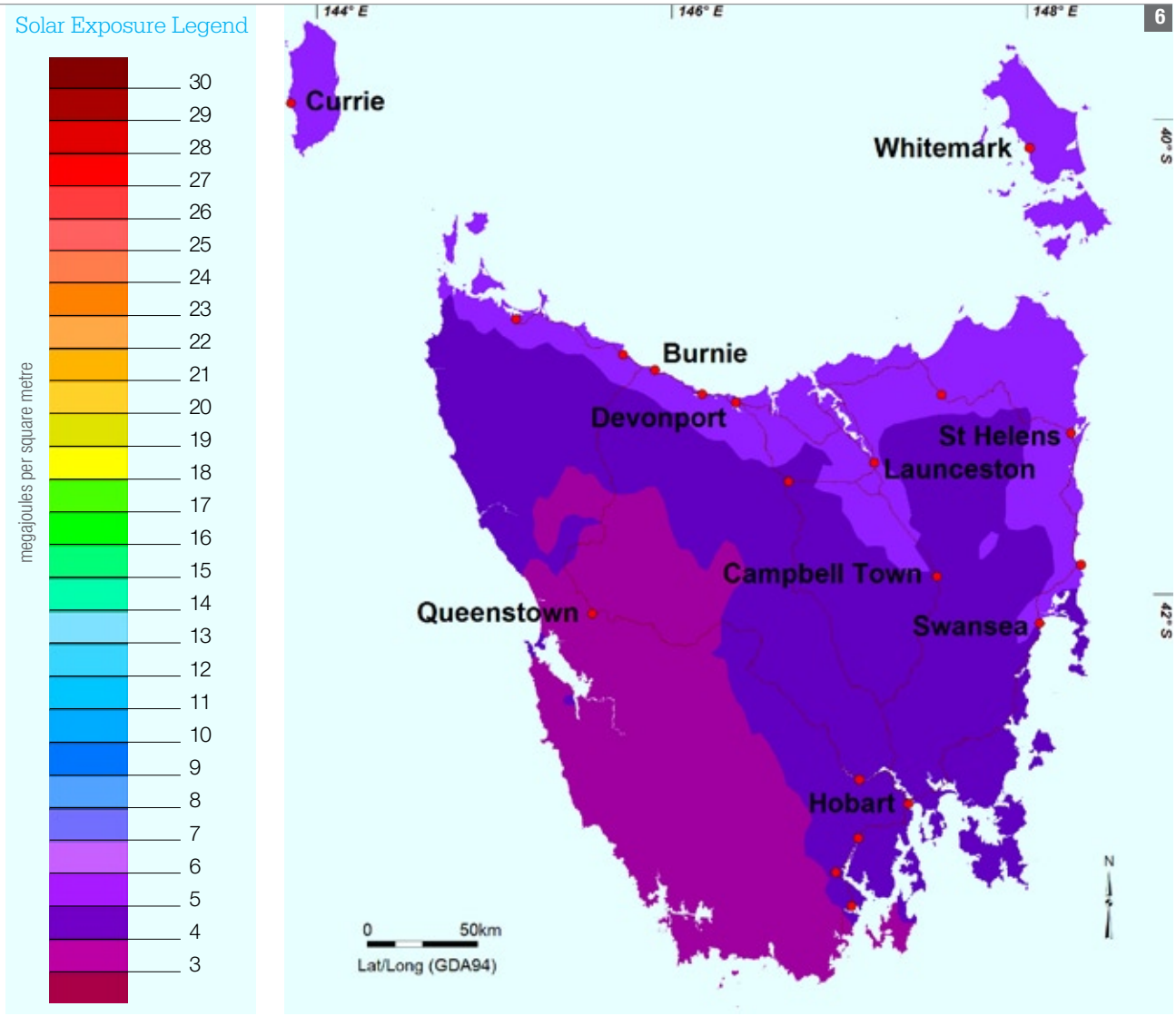


Fig. 6
June average solar radiation
(2000 to 2010)

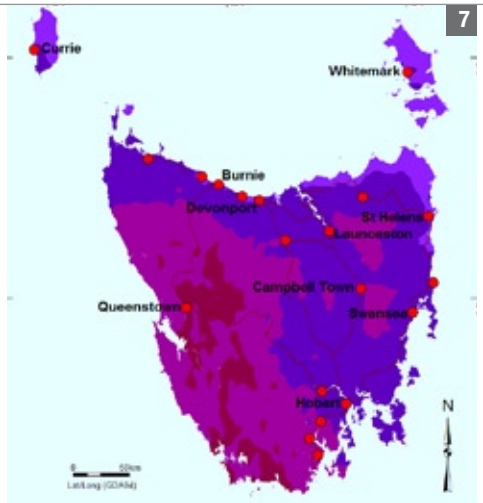


Fig. 7
June 2001
(a June with low insolation)

Fig. 8
June 2007
(a June with high insolation)

DESIGN OF SOLAR SYSTEMS

The maps show the total solar energy (sum of the direct beam and the diffuse radiation) striking horizontal ground expressed as megajoules per square metre per day (MJ/m^2/day). Definitions of all terms are explained at *www.bom.gov.au/climate/austmaps/solar-radiation-glossary.shtml#globalexposure* The maps are useful for comparing solar energy in different regions of the State but they must be adjusted before using them to calculate the solar energy falling on your roof or walls. For example if you have a north facing roof at an angle of 40 to 43 degrees (the optimum angle for annual solar radiation in Tasmania) you will receive about 27% more energy per square metre averaged over a whole year. In the case of a vertical north facing wall you will receive about 18% less energy per square metre of wall averaged over the whole year, but the north wall receives twice the energy per square metre in winter compared to the horizontal surface. Local shading from trees, buildings and hills must also be taken into account when estimating how much solar energy is available. Use the AUSOLRAD software described previously for accurate calculations of solar radiation.

Dr John Todd, Physicist, Eco-Energy Options

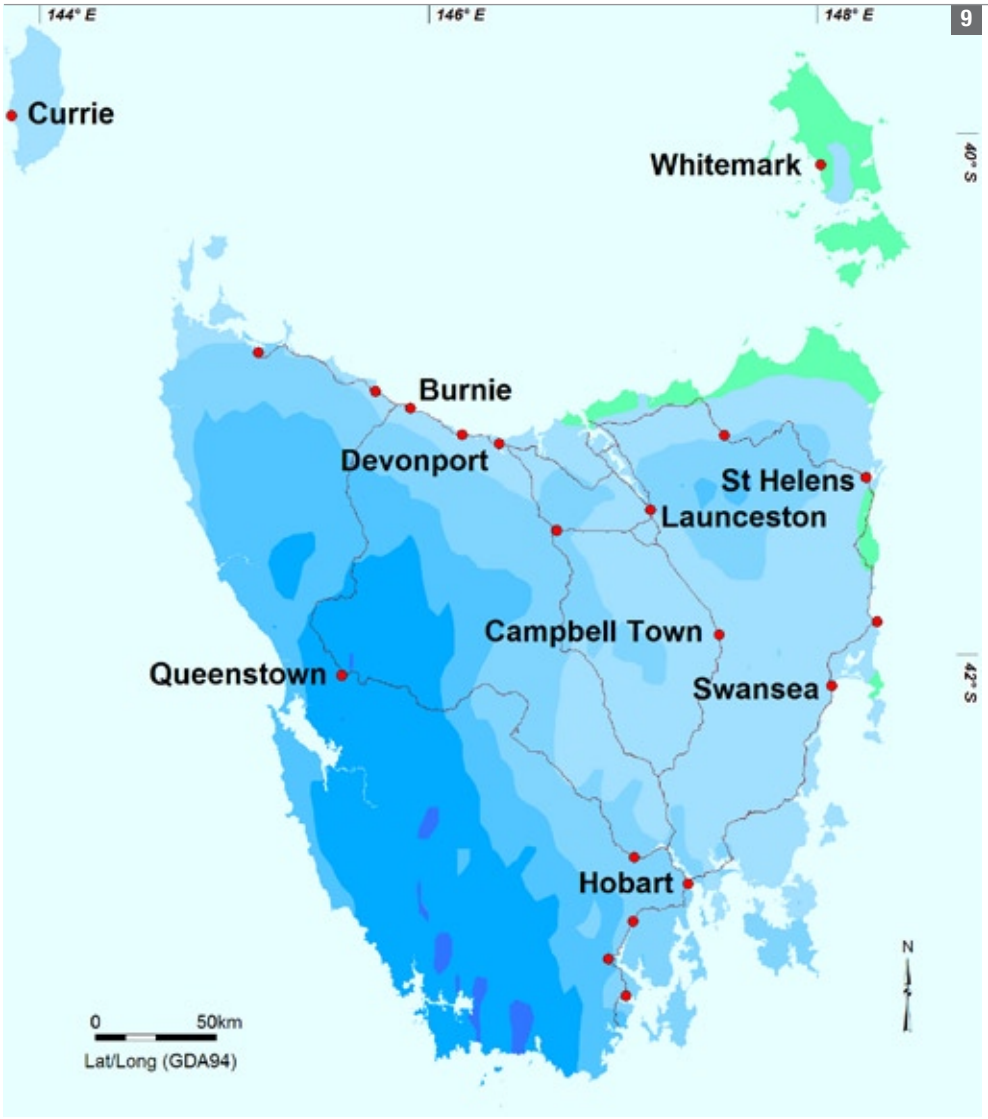
Further Information

Insolation in this atlas is Australian Isorad data. For more meteorological data visit **www.bom.gov.au** or email: climatedata@bom.gov.au

3.6MJ = 1kWh

Cartography: **DH Geodata Services**
Email: dawn_hendrick@hotmail.com

Copies of the atlas may be downloaded from: **www.rjmcgregor.iinet.net.au** **www.hobartcity.com.au** and **www.slt.org.au**



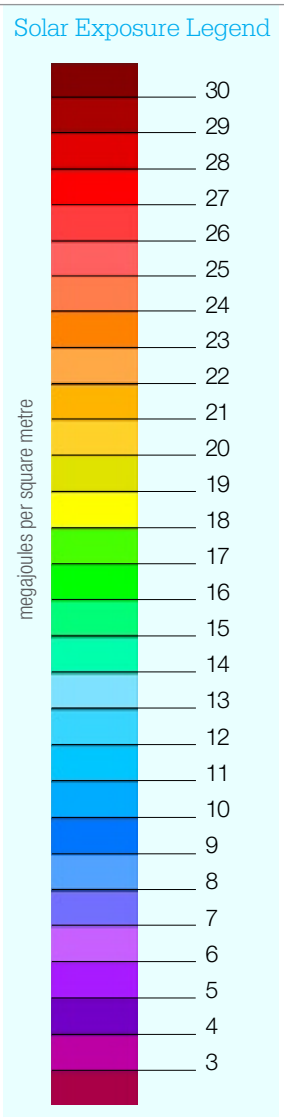
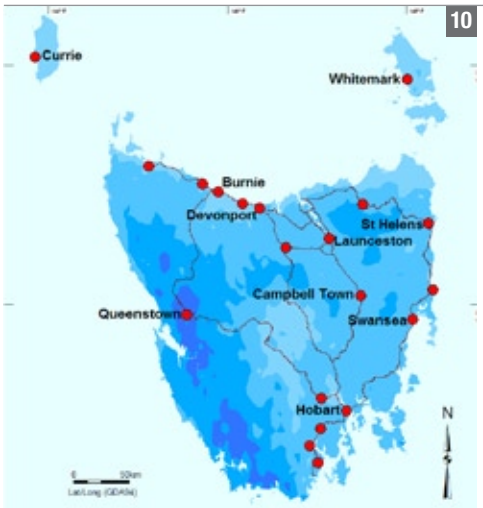


Fig.9 September mean solar radiation (2000 to 2010)



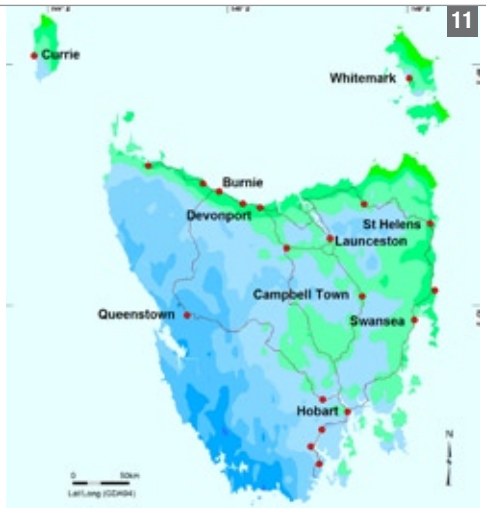


Fig. 10 September 2009 (a September with low insolation)

Fig. 11 September 2006 (a September with high insolation)

Produced by

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