SVPro sizing and system specification

Introduction

The SVPro range of commercial ventilation, heating and cooling solutions consist of three key components. It's important to size the solar air collectors, airflow distribution and optional control accessories to suit the intended purpose of the installation. This document provides some guidelines.

Design factors

Every installation is different, and must be designed to suit its intended purpose. Key design requirements include:

- location and orientation of solar collectors
- heating and cooling loads
- air flow and air exchange rates required
- air temperature management
- humidity management
- air pressure requirements
- air tightness of building space
- efficiency losses in all system components
- sizing of ducting and distribution
- location of air distribution
- location and sizing of air extraction vents

Solar air collector

All SVPro solutions are based on the award winning SolarVenti solar air collectors, designed and built in Denmark. SolarVenti has European Keymark and DIN Certo certifications, with test performance verifications from Fraunhofer test labs in Germany.

The Solar Air Collector is heated by the solar radiation when the sun shines, there is also ambient heat and good drying on overcast days. The energy, heat and drying converted by the black filtration mat via the solar radiation will be transferred into the building as fresh, low humidity, preheated air.

The air enters the collector through a patented perforated rear wall into a plenum. The air then passes through the absorber filter, made of a black technical material, which is resistant to high temperatures. The material is also the effective air filter.

Solar collectors are individual modules of approximately $2m^2$

Dimension in mm: (L x W x D) 1004 x 1970 x 300
Weight per module in kg: 10
Filter – Absorber, 1.25 m^2 absorber felt per m^2 collector:

2 mm black polyester
Cover: 10 mm Polycarbonate (UV and hail resistant)

Pressure drop:
25 Pa / 50 m^3/m^2 collector,
75 Pa / 100 m^3/m^2 collector,
175 Pa / 150 m^3/m^2 collector

Efficiency: 70% at an air flow of 125m^3/m^2 collector
Max. energy output: Approx. 842 W/m^2 collector
Average energy output:
500 – 800 kWh/m^2 (depends on type of control system)

The maximum recommended length per row of collectors is 20 meters. For large air volumes, more rows of solar collectors are suggested.

Airflow and distribution

Fan sizing and air distribution needs to be designed appropriate to the output characteristics desired.

At recommended flow rates of between 100 and 150 m^3/h per m^2 for general commercial and industrial applications, fan sizing and positioning must consider collected air, system pressure drops at all points of movement and distribution, efficiency losses at distribution points, the required rates of space air exchange, and any heating, humidity, or moisture drying demands.

As a rule of thumb, use 1m^2 of air collector for each 100m^3/h of air flow.

Careful design, specification, and airflow routing is critical to ensuring the greatest efficiency of designed solutions. Consider:

- Installation near Ventilation intake units
- SVPro solar air collectors are designed for roofs (or ground) with little or no slope.
- SVPro solar air collectors are optimally installed facing as close to due North as possible.
- A deviation of up to 45 degrees from due North is possible, by simply increasing the area of solar collectors.

Heated Air Drying Requires Higher Rates of Air Flow for Two Reasons:

1. Water is evaporated faster and more air is needed to carry it away, and
2. The higher the rate of air flow, the more uniformly there is in the drying of upper and lower layers of seed. Moreover, drying proceeds considerably faster at recommended temperatures at higher rates of air flow. Sometimes the drying time can be halved by doubling the air flow.

Integration with HVAC

SVPro systems can be integrated with existing air handling systems (**HVAC**: *Heating, Ventilation, and Air Conditioning*) or designed specifically to optimize the HVAC requirements of a new build. They can be incorporated into drying or aeration systems for agricultural grain drying, bio-waste facilities and processing, library air humidity balancing, industrial paint drying, warehouse workplace health and safety ventilation.

Key references, formulas and parameters

An excellent resource for design formulas is located at *The Engineering Toolbox* here

Humidity:

Specific humidity of a kilogram of air (at average sea level pressure)

Temp. (°C)	Temp. (°F)	Grams of water vapor per kg of air (g/kg)
-40	-40	0.1
-35	-31	0.2
-30	-22	0.3
-25	-13	0.51
-20	-4	0.75
-10	14	1.8
0	32	3.8
5	41	5
10	50	7.8
15	59	10
20	68	15
25	77	20
30	86	27.7
35	95	35
40	104	49.8

For initial system modelling, excluding system inefficiencies, use:

airflow required (m^3/min) = 0.05 H/delta T

where H is heat dissipation in Watts,

delta T is the temperature change required from inlet to outlet

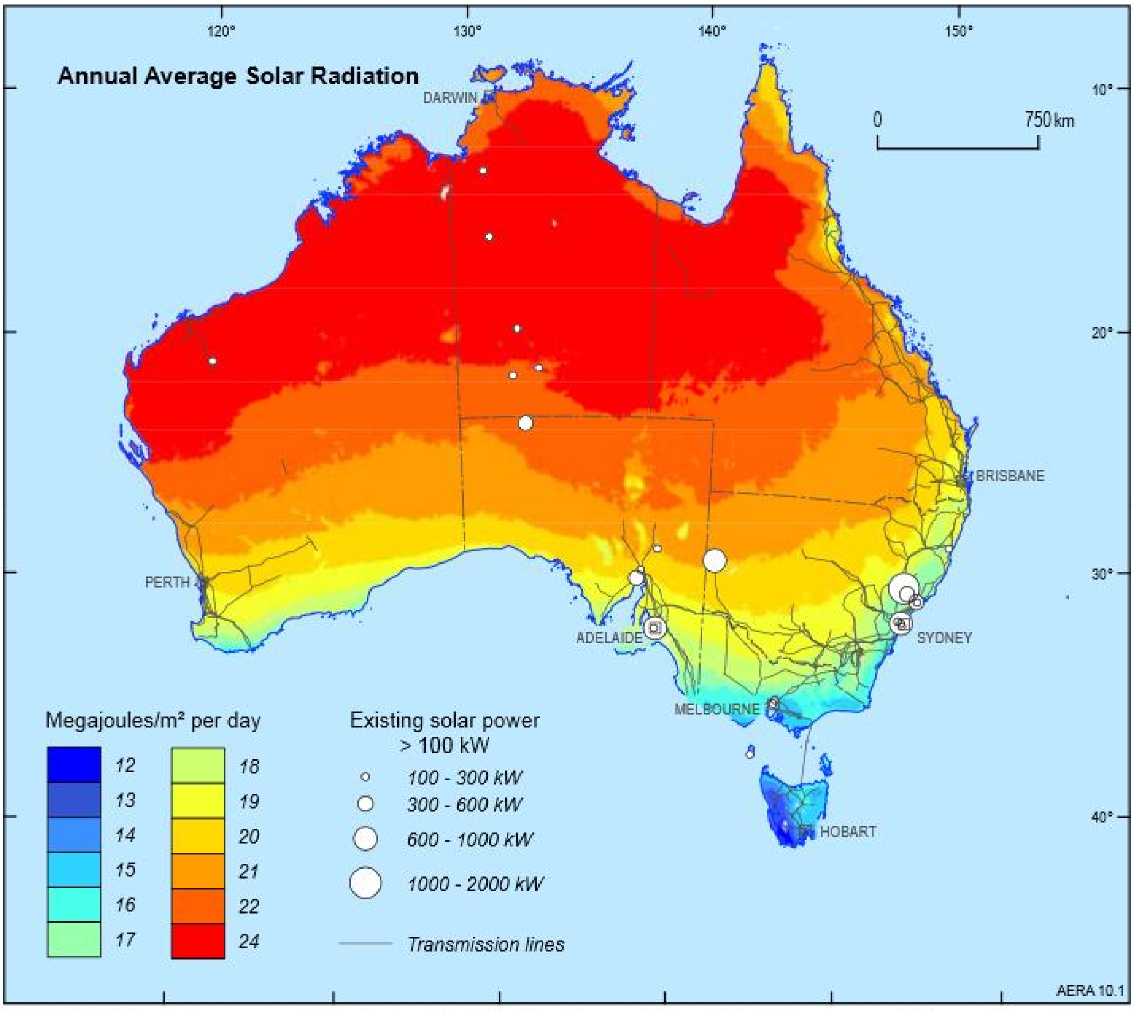

Figure 10.1 Annual average solar radiation (in MJ/m²) and currently installed solar power stations with a capacity of more than 10 kW

Source: Bureau of Meteorology 2009; Geoscience Australia

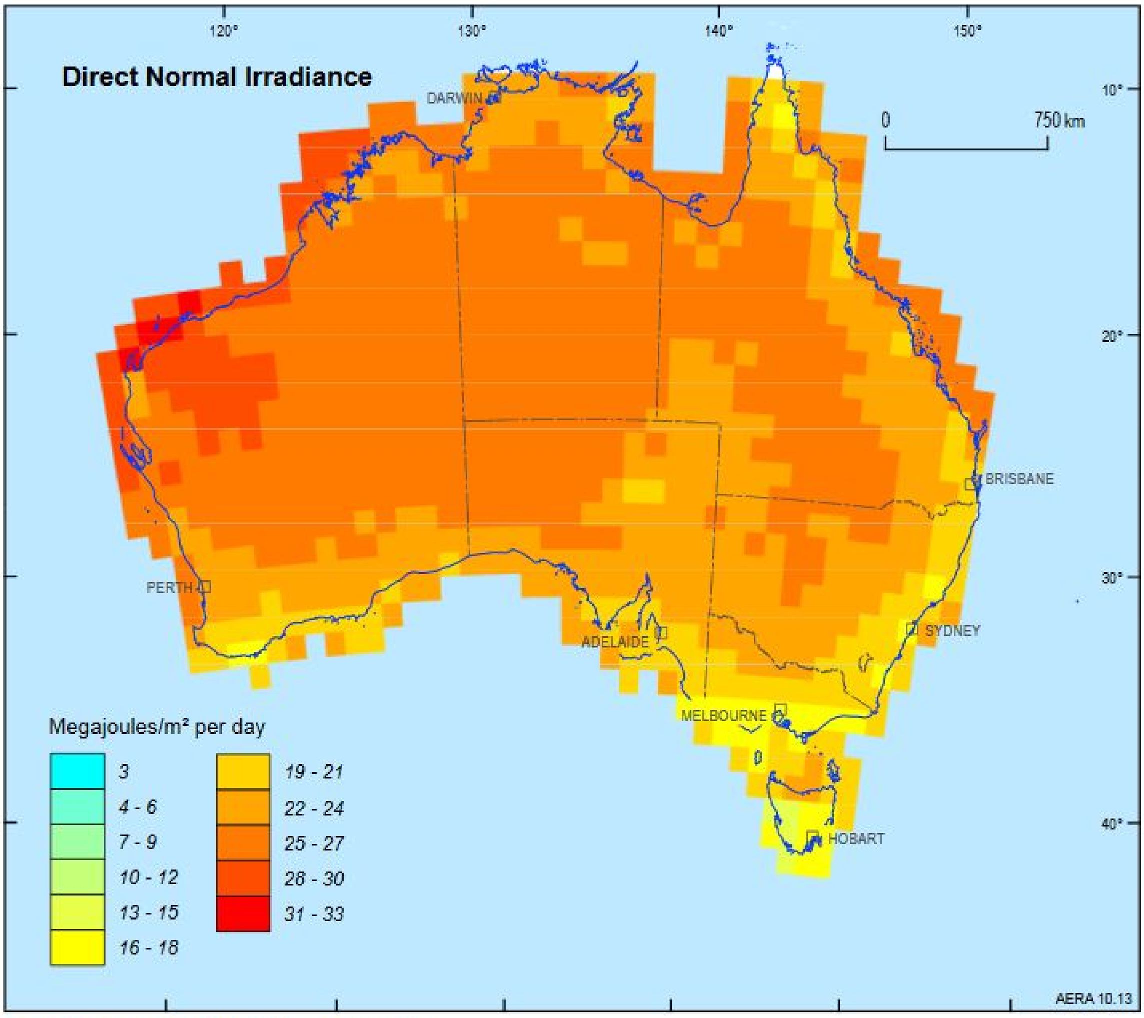

Figure 10.13 Direct Normal Solar Irradiance

Source: NASA 2009

Sources of data

Excellent data is available from a number of sources, including from these Australian government entities from where the above diagrams were sourced:

ARENA

Australian Bureau of Meteorology

Geoscience Australia