Solar Dryer Collector Area

Collector area of a solar air dryer for a batch of product, from the water to remove, drying days, daily solar radiation and collector and dryer efficiencies.

Method: Energy balance of solar air dryers

Input parameters

Unit system: SI

Parameter	Value	Unit
Fresh product per batch	500.00	kg
Initial moisture (wet basis)	80.000	%
Final moisture (wet basis)	15.000	%
Drying days per batch	3.0000	
Daily solar radiation on the collector	18.000	MJ/m²
Collector efficiency	40.000	%
Dryer utilisation of collected heat	50.000	%
Latent heat	2,400.0	kJ/kg

Calculated results

Parameter	Value	Unit
Water to remove	382.35	kg
Heat needed per batch	0.91765	GJ
Collector area	84.967	m²
Collector area per kg of fresh product	0.16993	m²/kg

Notes for this case

• The heat to evaporate the water must come from the sun over the drying days: area = m_w λ /(n_d H η_c η_d), where H is the daily radiation on the collector plane. Flat-plate air collectors deliver 30–50 % of the incident energy; the dryer uses about half of that, the rest leaving with the warm exhaust. Size for the month with least sun, or add a back-up heater for cloudy days.

Formula and method

$$m_w = m_f \frac{w_0 - w_1}{1 - w_1}, \quad A = \frac{m_w \lambda}{n_d H \eta_c \eta_d}$$

Variables

m_f	Fresh product per batch	kg
w_0	Initial moisture (wet basis)	-
w_1	Final moisture (wet basis)	-
n_d	Drying days per batch	-
H	Daily solar radiation on the collector	J/m²
η_c	Collector efficiency	-
η_d	Dryer utilisation of collected heat	-
λ	Latent heat	J/kg
m_w	Water to remove	kg
Q	Heat needed per batch	J
A	Collector area	m²
A/m_f	Collector area per kg of fresh product	m²/kg

Method and standards

Solar dryer.

Assumptions and limits

- Average daily radiation; constant efficiencies.

References

Energy balance of solar air dryers

Report details

Report reference	FCC-PRQP-ZDPP (the same inputs always give the same reference)
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Calculator	Solar Dryer Collector Area
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/drying/solar-dryer-collector-area

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.