Air-Side Economiser: Free-Cooling Hours from Weather Bins

Hours of full and partial free cooling with an air-side economiser from six weather bins of temperature and hours, the supply temperature and changeover limit.

Method: Bin method on dry-bulb temperature (ASHRAE Handbook—HVAC Applications, economisers)

Input parameters

Unit system: SI

Parameter	Value	Unit
Bin 1: mean outdoor temperature	8.0000	°C
Bin 1: hours	600.00	h
Bin 2: mean outdoor temperature	14.000	°C
Bin 2: hours	1,300.0	h
Bin 3: mean outdoor temperature	19.000	°C
Bin 3: hours	1,700.0	h
Bin 4: mean outdoor temperature	24.000	°C
Bin 4: hours	2,000.0	h
Bin 5: mean outdoor temperature	29.000	°C
Bin 5: hours	2,100.0	h
Bin 6: mean outdoor temperature	34.000	°C
Bin 6: hours	1,060.0	h
Supply air temperature	13.000	°C
Changeover limit (outdoor air no warmer than this)	24.000	°C

Calculated results

Parameter	Value	Unit
Full free cooling (outdoor at or below supply)	600.00	h
Partial free cooling (between supply and changeover)	5,000.0	h
Total hours in the bins	8,760.0	h
Share of hours with some free cooling	63.927	%

Notes for this case

- Dry-bulb changeover; in humid climates an enthalpy limit cuts the partial hours. Bins from your weather file.

Formula and method

$$t_f = \sum_{T_i \le T_s} t_i, \quad t_p = \sum_{T_s < T_i \le T_{co}} t_i$$

Variables

T_1	Bin 1: mean outdoor temperature	K
t_1	Bin 1: hours	s
T_2	Bin 2: mean outdoor temperature	K
t_2	Bin 2: hours	s
T_3	Bin 3: mean outdoor temperature	K
t_3	Bin 3: hours	s
T_4	Bin 4: mean outdoor temperature	K

t_4	Bin 4: hours	s
T_5	Bin 5: mean outdoor temperature	K
t_5	Bin 5: hours	s
T_6	Bin 6: mean outdoor temperature	K
t_6	Bin 6: hours	s
T_s	Supply air temperature	K
T_{co}	Changeover limit (outdoor air no warmer than this)	K
t_f	Full free cooling (outdoor at or below supply)	s
t_p	Partial free cooling (between supply and changeover)	s
t	Total hours in the bins	s
x	Share of hours with some free cooling	-

Method and standards

Bin counting.

Assumptions and limits

- Bin mean temperatures; bins that add up to more than a year are flagged.

References

• Bin method on dry-bulb temperature (ASHRAE Handbook—HVAC Applications, economisers)

Report details

Report reference	FCC-KG1S-MX8W (the same inputs always give the same reference)
Generated	17 November 2026, 19:37 UTC
Calculator	Air-Side Economiser: Free-Cooling Hours from Weather Bins
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	2 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/hvac/psychrometry/economiser-free-cooling-hours

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.