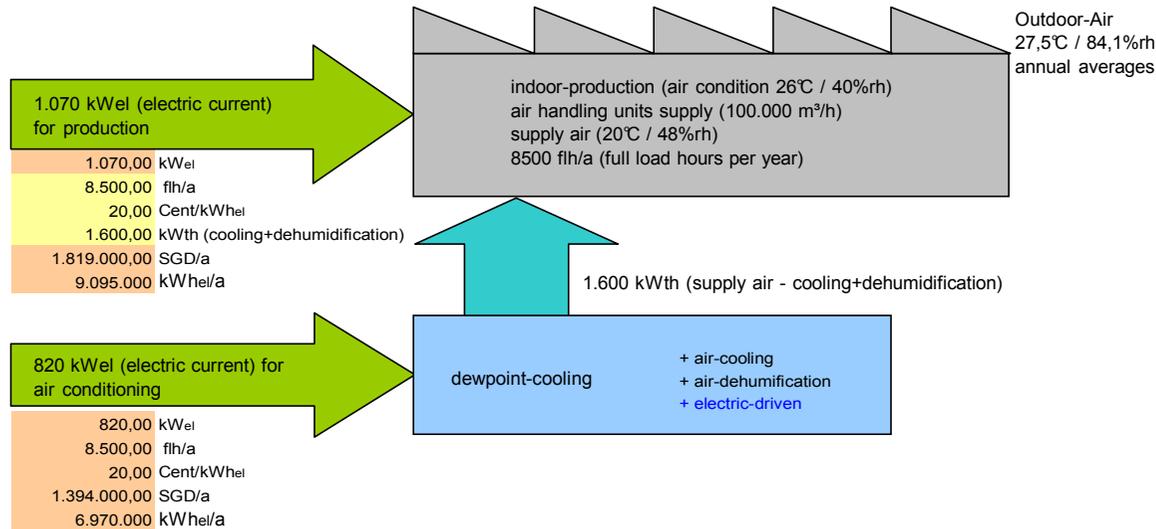


LiTherm-TEK - Air conditioning cost savings for cooling + dehumidification - Calculation of profitability

actual thermal energy and electric power balance with conventional dewpoint-cooling-system



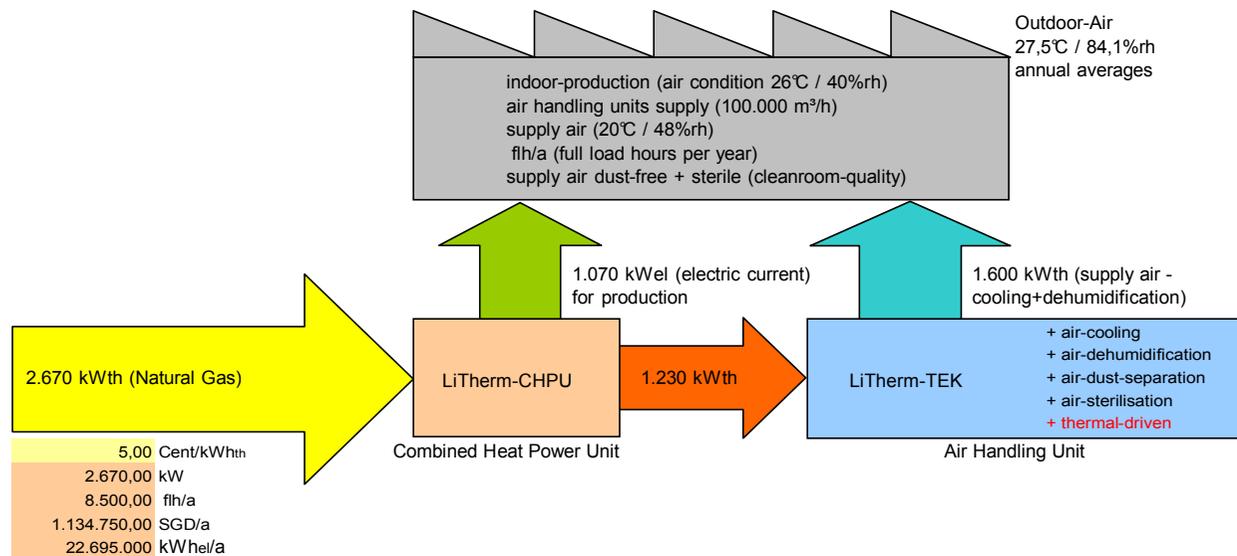
Keywords:

- supply air cooling
- supply air dehumidification via dewpoint-cooling
- electric driven cooling+dehumidification-plants

Total Energy Consumption Costs

| | |
|---------------------|--------------|
| 1.819.000,00 | SGD/a |
| 1.394.000,00 | SGD/a |
| 3.213.000,00 | SGD/a |

thermal energy and electric power balance with LiTherm-TEK by kW+



Keywords:

- highly efficient upgrade for existing airhandling units
- supply air cooling
- supply air dehumidification
- prevention of corrosion for supply air humidity < 50%
- supply air dust-separation
- supply air sterilisation
- waste heat utilisation via
- thermal driven cooling+dehumidification plants
- electricity generation for personal usage

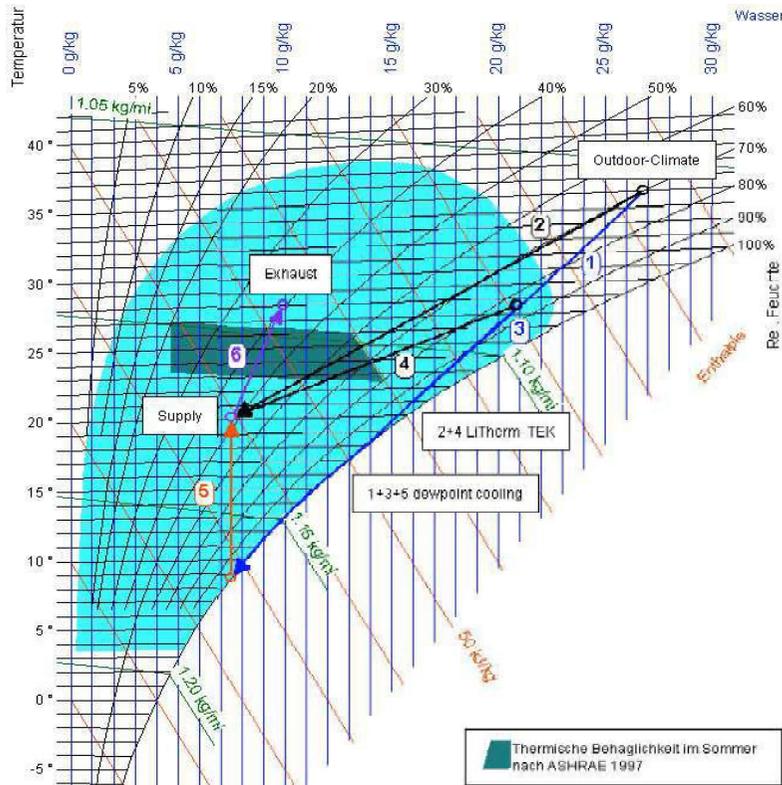
LiTherm-TEK by kW+

Total Energy Consumption Costs

| | |
|---------------------|--------------|
| 0,00 | SGD/a |
| 1.134.750,00 | SGD/a |
| 1.134.750,00 | SGD/a |

Air Conditioning Costs Savings

| | |
|---------------------|--------------------|
| 3.213.000,00 | SGD/a |
| -1.134.750,00 | SGD/a |
| 2.078.250,00 | SGD/a = 65% |



(3) dewpoint cooling

| | ein | aus | Einheit |
|----------------------|-----------|------------|---------|
| Temperatur: | 27.5 | 8.8 | °C |
| Rel. Feuchte: | 84.5 | 100 | % |
| Abs. Feuchte: | 20.936908 | 7.507925 | g/kg |
| Dichte feucht: | 1.08703 | 1.168269 | kg/m³ |
| Enthalpie feucht: | 81.094302 | 27.750131 | kJ/kg |
| Volumenstrom feucht: | 100000 | 91822.3162 | m³/h |
| Kühlmedium: | 6 | 12 | °C |

| Leistung Bereiche: | |
|--------------------|-----------|
| Bereich 1 | 30.2846 % |
| Bereich 2 | 22.7698 % |
| Bereich 3 | 17.1197 % |
| Bereich 4 | 12.0716 % |
| Bereich 5 | 9.6772 % |
| Bereich 6 | 7.27630 % |

(1) dewpoint cooling

| | ein | aus | Einheit |
|----------------------|------------|-------------|---------|
| Temperatur: | 27 | 8.8 | °C |
| Rel. Feuchte: | 70 | 100 | % |
| Abs. Feuchte: | 26.798618 | 7.507925 | g/kg |
| Dichte feucht: | 1.057035 | 1.168269 | kg/m³ |
| Enthalpie feucht: | 103.949403 | 27.750131 | kJ/kg |
| Volumenstrom feucht: | 100000 | 100779.7545 | m³/h |
| Kühlmedium: | 6 | 12 | °C |

| Leistung Bereiche: | |
|--------------------|-----------|
| Bereich 1 | 33.7031 % |
| Bereich 2 | 23.7289 % |
| Bereich 3 | 16.7037 % |
| Bereich 4 | 11.2899 % |
| Bereich 5 | 8.27860 % |
| Bereich 6 | 5.82812 % |

(6) reheating after dewpoint cooling

| | ein | aus | Einheit |
|----------------------|------------|-------------|---------|
| Temperatur: | 8.8 | 20.2 | °C |
| Rel. Feuchte: | 100 | 48 | % |
| Abs. Feuchte: | 7.507925 | 7.507925 | g/kg |
| Dichte feucht: | 1.168269 | 1.122865 | kg/m³ |
| Enthalpie feucht: | 27.750131 | 39.402122 | kJ/kg |
| Volumenstrom feucht: | 91822.3162 | 100363.2900 | m³/h |

| | | |
|-----------------------------|-------------|------|
| Massenstrom trocken: | 111855.1276 | kg/h |
| Leistung mit feuchter Luft: | 361.433807 | kW |

(4) LiTherm-TEK

| | ein | aus | Einheit |
|----------------------|-----------|-------------|---------|
| Temperatur: | 27.5 | 20.2 | °C |
| Rel. Feuchte: | 84.5 | 48 | % |
| Abs. Feuchte: | 20.934179 | 7.519581 | g/kg |
| Dichte feucht: | 1.087091 | 1.122865 | kg/m³ |
| Enthalpie feucht: | 80.832989 | 39.402122 | kJ/kg |
| Volumenstrom feucht: | 100000 | 96661.16677 | m³/h |

| | | |
|-----------------------------|-------------|------|
| Massenstrom trocken: | 106490.7212 | kg/h |
| Leistung mit feuchter Luft: | 1225.556364 | kW |

(2) LiTherm-TEK

| | ein | aus | Einheit |
|----------------------|------------|-------------|---------|
| Temperatur: | 27 | 20.2 | °C |
| Rel. Feuchte: | 70 | 48 | % |
| Abs. Feuchte: | 26.798618 | 7.519581 | g/kg |
| Dichte feucht: | 1.057035 | 1.122865 | kg/m³ |
| Enthalpie feucht: | 103.949483 | 39.402122 | kJ/kg |
| Volumenstrom feucht: | 100000 | 92370.34123 | m³/h |

| | | |
|-----------------------------|-------------|------|
| Massenstrom trocken: | 102945.7262 | kg/h |
| Leistung mit feuchter Luft: | 1845.798599 | kW |

LiTherm-TEK

Air handling Calculations within the Mollier-Diagram (psychrometric chart)
 The Mollier-Diagram for humid air describes the relationship between temperature and relative humidity and water vapour content

LiTherm-TEK is a new high efficient generation of cooling and dehumidification plants. LiTherm-TEK-plants are thermal driven instead of conventional electric driven dewpoint cooling plants for cooling and dehumidification.

Electric power consumption of electric driven cooling+dehumidification-plants is about half of the calculated thermal power requirement.

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(6) indoor air conditions - internal thermal load (sensible heat + latent heat)

| Zuluft | Abluft | Einheit |
|----------------|--------|---------|
| Luftdruck abs. | 0.95 | bar |
| Sensible Wärme | 250 | kW |
| Latente Wärme | 190 | kW |
| Wärmelast | 440 | kW |

| | | | |
|----------------------|-------------|-------------|-------|
| Temperatur: | 20.2 | 29.097499 | °C |
| Rel. Feuchte: | 48 | 39.337786 | % |
| Abs. Feuchte: | 7.519581 | 9.913169 | g/kg |
| Dichte feucht: | 1.122865 | 1.09191 | kg/m³ |
| Enthalpie feucht: | 39.402122 | 53.57112783 | kJ/kg |
| Volumenstrom feucht: | 100294.8778 | 103383.6091 | m³/h |
| Massenstrom trocken: | 111777.5271 | | kg/h |



AVERAGE WEATHER IN SINGAPORE, SINGAPORE

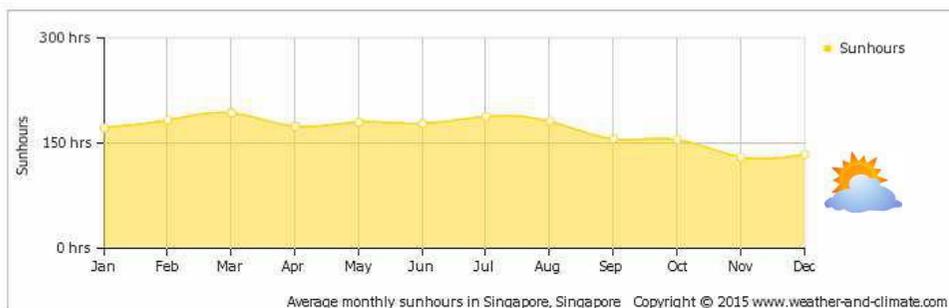
What's the best time to travel to Singapore in Singapore? Here are some facts:

- On average, the temperatures are always high.
- Most rainfall (rainy season) is seen in January, February, March, April, May, June, July, August, September, October, November and December.
- On average, the warmest month is May.
- On average, the coolest month is January.
- December is the wettest month.
- June is the driest month.

For more specific information please take a look at the graphs shown below.

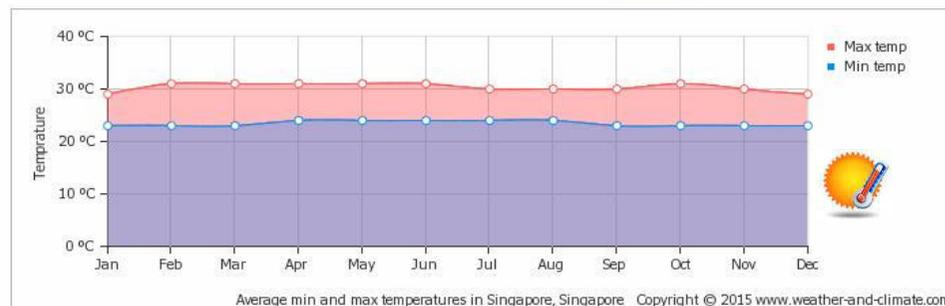
AVERAGE MONTHLY HOURS OF SUNSHINE OVER THE YEAR

This is the monthly total of sunhours



AVERAGE MINIMUM AND MAXIMUM TEMPERATURE OVER THE YEAR

The monthly mean minimum and maximum daily temperature. Show in [Fahrenheit](#) »



AVERAGE HUMIDITY OVER THE YEAR

This is the mean monthly relative humidity



The **annual average for temperature** in Singapore is **27,5°C**.

Singapore's temperature annual average high is 31 °C (89 °F)

Singapore's temperature annual average low is 25 °C (76 °F)

Singapore's average daily temperature fluctuates by only a couple of degrees over the course of a year. Overall, December and January are the coolest months.

The highest daytime temperatures occur in April, while the warmest nights are during May and June.

May and June has the highest average monthly temperature (24-hour mean of 27.7°C and 27.8°C respectively) and December and January are the coolest (24-hour mean of 26.0°C).

The **annual average for relative humidity** in Singapore is **84,1 %rh**. The averages for relative humidity range throughout the day from a maximum of 96 percent to a minimum of 64 percent.

The annual amount of sunshine in Singapore is 2.022 h/a. Sunlight in Singapore averages 12 hours and 7 minutes a day. That amounts to 4.423 hours of daylight in a year.