Danish Test Reference Year, TRY
Meteorological Data for HVAC and Energy

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CONTENTS

1. INTRODUCTION

Meteorological data for HVAC and energy
Danish Test Reference Year, TRY
(SBI report 135, in Danish)

The present report gives a survey of the weather parameters used for the "Danish Test Reference Year, TRY" and the corresponding set of data from meteorological observations made during a 15-year period. In addition a short description is given of the measuring methods used for the most important weather parameters. (Chapter 2).

The "Danish Test Reference Year, TRY" is selected in accordance with a method recommended by the working group "Solar energy programme" in the EEC. (Chapter 3 and App. 1).

The total number of data in the "Danish Test Reference Year, TRY" and the 15-year dataset are available on magnetic tape only. Chapter 4 provides information regarding the magnetic tape and instructions for the use of its data.

Appendix 2 contains selected tables and diagrams with some of the most important weather data. (In this translation given as examples only).

Appendix 3, TRY's developed for EEC countries, has been added to this translation.

STRUCTURE OF THE REFERENCE YEAR

"Danish Test Reference Year, TRY" comprises outdoor climatic data for one year composed of twelve typical months chosen from the 15-year period on which the reference year is based. Each month contains recorded - and some calculated - outdoor climatic data for every hour throughout the month. The Test Reference Year, TRY, provides values of 33 weather parameters mesured simultaneously and shows the natural variation of the

parameters throughout the year. In this respect it differs from the data generally available, and it is thus useful for the calculation of systems influenced by more than one parameter or by the variation with time of the parameters.

The individual months of the Test Reference Year have been selected from observations made throughout 15 years (1959-1973) at Værløse air base and at Højbakkegård at Tåstrup. The individual months chosen are typical as regards monthly mean values and variations throughout the month of the daily mean temperature, daily maximum temperature, and daily total of solar radiation. In the selection is included an over-all evaluation of a larger number of weather parameters based on a comparison with the 30-year normal period for Denmark. Based on such criteria the most suitable months of January, February, etc. have been chosen.

The Test Reference Year consists of the months:

January 1967	May 1961	September 1965
February 1968	June 1963	October 1962
March 1966	July 1963	November 1964
April 1962	August 1971	December 1970

FIELDS OF APPLICATION OF THE TEST REFERENCE YEAR

For the design of buildings with their heating and ventilating equipment heat balances must be calculated in order to find the most favourable systems with respect to quality of indoor climate, to energy consumption, and to initial and working costs. The weather data of the TRY are particularly suitable for such calculations of heat balances. Numerous computer programmes are available for this purpose.

With respect to many other problems in connection with heating and ventilation the weather data of the TRY will make it possible to obtain an improved basis for evaluation. As examples we may mention automatic control, calculations of solar heat-

ing equipment, heat pumps, and equipment for heat recovery, choice of energy type, and vapour diffusion through walls and roofs.

The TRY may also be useful for the solution of a number of problems outside the field of heating and ventilation. This applies for instance to weather resistance of building materials, arrangement of outdoor recreation areas with special reference to thermal comfort, storing of materials, and possibly, to building planning.

The data may moreover be used as basis for the selection of simpler types of weather data for special purposes, for instance frequency distributions of the contents of heat and moisture in outdoor air, or weather data for the hottest or coldest periods in the year.

When only single parameters are required, or when the variation with time of the parameters is irrelevant, it is recommended to use the tables and graphs of the 15-year data set.

The TRY is not useful in connection with problems for which infrequently occurring extremes are decisive, as for instance for the evaluation of risks of wind damage. For this purpose statistical information based on observations throughout longer periods should be used, for instance the 15-year data set or - better - the normal 30-year period.

Although the data of the test TRY are based on observations made in the surroundings of Copenhagen, they may be considered to be reasonably reliable for calculations applying throughout the country. Weather conditions within the central areas in the large cities and in areas within 200 metres from the coast may show certain deviations, however.

2. WEATHER OBSERVATIONS

The Test Reference Year and the 15-year data set are based on weather observations made at the air base at Værløse during

the years 1959-1973, both years included, supplemented with observations of solar radiation made at Højbakkegård near Tåstrup, and number of hours of sunshine observed at the meteorological station at the Copenhagen port. The material has been placed at our disposal by the Meteorological Institute and the Veterinary and Agricultural University.

The Air Force Base at Værløse (20 km NW of Copenhagen) is a main synoptic weather station in Denmark where observations and recording of the individual weather parameters are made every hour according to international rules as mentioned in (2, 3) and in the next chapter. The weather parameters of the reference year are thus directly comparable with weather parameters observed at other synoptic stations in Denmark and abroad.

The observations were made at the hours, and written down on special forms. The values are later, together with sunshine hours from Copenhagen harbour, transferred to magnetic tapes.

Since solar radiation parameters are not observed at Værløse, we have, for these used data measured at the experimental farm, Højbakkegård, near Tåstrup (20 km W of Copenhagen), which belongs to the Royal Veterinary and Agricultural University. The measurements are recorded automatically.

The reference year and the 15-year weather dataset contain all the weather parameters recorded, Figure 1. The most important parameters are given by their numerical value, while the remaining are given in the same codes as in synoptic weather reports, (3). The units stated in connection with the reference year are the same as those used in synoptic weather reports. Computed parameters are given in SI units.

Below is given a short description of the measurement methods used, and the calculation of some parameters. Some less important parameters are not described. All measurements are made at the Air Force Base Værløse, unless otherwise stated. Hours are Danish Standard Time (Central European Time CET).

Observation		Interval or observation time
Dry bulb temperature	^{o}C	h
Dew point temperature	^{o}C	h
Relative humidity	%	h
Enthalpy, calc.	kJ/kg	h
Minimum temperature Maximum temperature	^{o}C	7 and 19 CET
Snowcover and-thickness, State of ground surface		13 CET
Hours with clear sun	h	24 CET
Global radiation (on horizontal)	W/m^2	h
Diffuse radiation, calc.	W/m^2	h
Normal radiation, calc.	W/m^2	h
Precipitation	mm	1,7,13 and 19 CET
Cloud cover		h
Wind direction		h
Wind speed	knots	h
Visibility		h
Weather		h
Weather since last major observation		h
Cloud cover in low or medium altitude	oktas	3h
Cloud types, low altitude		3h
Altitude of lowest clouds		3h
Cloud types, medium altitude		3h
Cloud types, high altitude		3h
Cloud cover, lowest clouds $\geq$ 5/8 of sky		h
Cloud type herein		h
Altitude hereof or vertical visibility		h
Cloud cover, lowest clouds $\leq$ 4/8 of sky		h
Cloud type herein		h
Altitude		h
Barometric pressure -900.0	mbar	3h
Character of change in pressure		3h
Weather symbols (not always present)		h
Month, day, hour		h

Figure 1. Weather parameters in the "Danish Reference Year, TRY". "h" indicates hourly presence, "3h" every third hour (the "synoptic" hours 1, 4, 7, 10 --- CET). CET means Central European Time ~ GMT + 1. All temperatures are given with $0.1^{o}C$, pressure with 0.1 mbar, precipitation 0.1 mm, and radiation with 1 W/m^2 and wind speed with 1 knot as least significant digit.

Errors might occur in all measurements, and the material has therefore been screened for various possible errors in the most important weather parameters. The chapter "Check of measured values" describes the techniques applied and corrections made.

MEASURING METHODS

(Abridged translation of the chapter Measuring methods)
All data are given per hour unless otherwise specified.

Dry bulb temperature. Measured in a meteorological hut, 2 m above ground. Tenth of ^{o}C.

Dew point temperature, tenth of ^{o}C.

Relative humidity, percent.

Enthalpy of air. kJ/kg. Calculated from the expressions:

$$i = 1.005 \cdot t + 1.84 \cdot x \cdot t + 2501 \cdot x$$

$$x = 0.622 \cdot rh \cdot p_{mv} / (1013 - p_{mv})$$

$$p_{mv} = 6.106 + 0.460 \cdot t + 0.01093 \cdot t^2 + 0.000467 \cdot t^3$$
for $0^{o}C \leq t_d \leq 30^{o}C$

$$p_{mv} = 6.106 + 0.4405 \cdot t + 0.01345 \cdot t^2 + 0.0001804 \cdot t^3$$
for $t_d \leq 0^{o}C$

where
- i is enthalpy of air, kJ/kg
- x is moisture content of the air, kg/kg
- p_{mv} partial pressure of saturated water vapour, mbar
- t is dry bulb temperature, ^{o}C
- t_d is dew point temperature
- rh relative humidity, fraction

Maximum and minimum of air temperature. Given at 7 a m and 7 p m, for the preceding 12 hours. Tenth of ^{o}C.

Snowdepth Given once a day 1 p m, cm.

Sunshine hours. Given once a day, 12 p m total for the day. Tenth of an hour. Measured at Copenhagen harbour, (Office of Customs). The Campbell-Stokes sunshine recorder gives normally no registration for solar altitudes less than 3 deg., and therefore too few hours recorded.

Sunradiation. Global radiation on a horizontal surface, W/m^2. Measured at Tåstrup.

Direct normal radiation (beam radiation) and Diffuse sky radiation on horizontal surface. Direct and diffuse are values computed from global radiation and cloud cover observations. A modified Kimura-Stephenson method is used (6).

Precipitation mm. Given 7 a m and 7 p m, for the preceding 12 hours. Tenth of mm. -1.0 indicates precipitation less than 0.1 mm.

Cloud Cover Observations. Okta's. Total cloud cover is given every hour, the others at 1 a m, 4 a m, 7 a m, etc.

Clear sky	N = 0
Part of the sky covered:	
1/8 or less	1
2/8	2
-	
-	
7/8 or more	7
8/8, overcast	8
Amount of cloud cannot be observed	9

The other cloud data follow the WMO observation practice (3).

Wind direction and wind speed

Measured 10 m above ground, mean value for 10 minutes.
Direction is given as deka-degrees from north. 09 is east, 18 south, 27 west, 36 north, 00 is calm and 99 is unsteady, low speed.
Wind speed, knots (knot = 0.514 m/s)

Barometric pressure.

"Reduced pressure" to sea surface, and corrected for temperature. Given in tenth of mbar minus 900 mbar.
Example: 1045.6 mbar is given as 1456.

CHECK OF MEASURED VALUES

At the preparation of the Danish Reference Year, TRY and the 15-year dataset, that part of the data material, being of special interest for HVAC calculations, was critically examined, i.e. the data material concerning dry bulb temperature, humidity, radiation, and wind.

Subsequently additions and corrections were made according to principles as described below. As a principal rule, added or corrected data are indicated so that they do not appear to be authentic, measured values.

In the original material a number of data are missing, either because all measurements at certain hours are missing, or because for certain hours some of the measurements are missing. Moreover it has been necessary to reject some values of measurement for being beyond reasonable limits. Finally, in some cases during the calculation of derived values (humidity, diffuse radiation, normal radiation) discrepancies between the different data of measurement appeared. To avoid such discrepancies, it has been necessary to make a choice between contradictory data, as well as an adjustment of some of them.

Measurements at night

In the years before 1963, at Værløse no measurements were taken at 11 p m, 12 p m, 2 a m, and at 3 a m CET. Therefore, for those months of the Reference Year dating from 1959-1962 all data for these hours are "synthetic", i.e. calculated on the basis of data from before and after the missing hours. This applies to the months of April, May and October in the

Reference Year. For the remaining months of the Reference Year there are observations of cloud cover and measurements of wind direction and -velocity, made at the hours mentioned, whereas the temperatures are still "synthetic".

Dry bulb temperature

The dbt at 11 p m and 12 p m were found by linear interpolation between 10 p m and 1 a m. Given the dbt's t_{22}, t_{01}, t_{04} and t_{05}:

$$t_{23} = (2t_{22} + t_{01})/3, \quad t_{24} = (t_{22} + 2t_{01})/3$$

For the months September through April, similarly, t_{02} and t_{03} were found by linear interpolation. That can be accepted because the nightly minimum dbt in these months normally occur after 4 a m.

For the months May through August, however, a linear interpolation might cause a systematic error. Another interpolation is therefore used if $t_{05} \geq t_{04}$:

$$t_{02} = t_{01} + (t_{04} - t_{22})/6$$
$$t_{03} = t_{01} + (t_{04} - t_{22})/3$$

For $t_{05} < t_{04}$ linear interpolation between t_{01} and t_{04} is used.

Gaps in the sequence of outdoor air temperatures due to rejected or missing records, others than the ones at night already mentioned, were filled in by means of linear interpolation. Most of these gaps are only one or two hours.

Temperature gradients larger than 4 ^{o}C per hour are individually checked regarding their probability, considering also other weather parameters at that day.

Maximum and minimum temperatures

In the Reference Year maximum and minimum dbt's are stated at 7 a m and 7 p m for the preceding 12 hours.

Corrections are made according to the following criteria: Maximum dbt's below the highest not rejected hourly values in the preceding period are raised. Maximum values exceeding the highest recorded hourly values by 2 ^{o}C are rejected and replaced by the highest hourly values. Likewise, the minimum dbt's are worked up. At night, however, minimum dbt's down to 4 ^{o}C under the hourly measured or computed minimum are accepted because of the long intervals when no measurements take place.

Missing maximum or minimum temperatures are filled in with highest or lowest hourly values.

Humidity of the air

Some of the months in the original material contain relative humidity (rh) for every hour, and wet bulb temperatur (wbt) for certain hours. For other months wbt is stated for every hour, and rh for certain hours. In some periods only one parameter is available.

For calculation of dew point temperature (dpt), enthalpy and sometimes rh as a general rule the most frequently occurring parameter is used.

Where discrepancies exist between humidity parameters or for missing data in larger intervals, artificial data have been inserted based on measurements from nearby stations. For shorter lacunes, the dpt is made by interpolation, and other humidity parameters are then computed.

Beside the manual checking a computerized check is made regarding rapid changes for some parameters.

By dbt under 0 deg C, the rh is lowered to values corresponding to saturation over ice if the measured or computed value is over dpt, and enthalpy is afterwards computed according to the lowered rh.

Radiation data

The hourly values for the global radiation at Tåstrup have been read off from multipoint recorder charts for the years 1959-1966. The registration appears as 24 points per hour, and in lightly clouded weather it can be difficult to estimate a reasonable hourly mean value from that many points extended over a large range.

The global radiation value given for an hour is integrated from 30 minutes before to 30 minutes after the hour. They deviate therefore from international recommendations demanding integration over the preceding hour (2, 3). Radiation is given in W/m^2.

The daily sums of these hourly values have been compared with the ones found from the same multipoint recorder charts by the Hydrotechnical Laboratory at the Royal Veterinary and Agricultural University.

Deviations not exceeding 5 percent or 50 W/m^2 of the daily sums are accepted. For a large number of cases with larger deviations, the reading off from the recorder charts has been repeated and checked.

For some periods of up to a few days' duration the registration is missing. Values of the global radiation calculated from cloud observations at Værløse have been inserted.

For 1959 measurements are reduced with 5% due to a known calibration error.

For the years 1967-1973 the measurements are recorded on code tape for every 10 minutes. The hourly mean values are calcu-

lated on the basis of the measurements with the minute indications of 40, 50, 00, 10, 20, and 30.

For the entire period 1959-1973, all hourly values of global radiation, G, are checked with the probable maximum global radiation G_{max} according to solar altitude and humidity content in the air. For 305 hours, where G exceeded G_{max} + 50 W/m^2, G has been reduced to G_{max} (6).

The global radiation is split into direct normal radiation and diffuse radiation on horizontal, using cloud observations from Værløse.

Discrepancies between the hourly measured global radiation at Tåstrup and the observed cloud cover at Værløse have necessitated, in a number of cases, the use of a modified cloud cover for this splitting. Finally, the computed direct normal radiation is checked to avoid impossibly large values.

Wind

Missing data on wind velocities have been linearly interpolated.

Missing data on wind directions are more specially treated. For missing hourly values a linear interpolation via the smallest angle has been made. At intervals of two hours, the nearest adjacent values have been inserted. For three missing hours, the outer values have been put equal to the adjacent values, after which the central value has been found by interpolation. For longer intervals, however, and in some cases where the wind turned 180°, it has been necessary manually to insert reasonable data. Here comparisons with data measured at Kastrup (Daily Weather Report) have been made. Different criteria for sorting out incorrect data, which could show as unreasonable jumps of wind direction or wind velocity, have not discarded any values.

3. SELECTION OF MONTHS FOR THE TRY

The TRY shall, for the most important weather parameters, show a typical annual variation, and further show typical deviations from this regular annual variation. That is especially important for heat-balance calculations.

The months for the TRY are therefore chosen from the 15-year period 1959-73 according to three criteria:

A Months with abnormal weather conditions were excluded. A comparison between appr. twenty different weather parameters of each of the months of the observation period and the corresponding normal values from the period 1931-1960.

B Selection of months with typical mean values of the three most important weather parameters:
Daily mean temperature, daily maximum temperature, and daily total of global radiation. For the months November-February: Sunshine hours are used instead of global radiation. Monthly mean values are compared with the average values of the fifteen months of the observation period.

C Selection of months with typical variations of the three parameters, i.e. with both hot and cold days.

Criteria B and C rank the 15 months according to the three most important weather parameters. The most suitable month then is selected, if not rejected according to criterion A.

The intended use of the Test Reference Year - and the selection criteria - have determined the construction of the TRY of individual months. Shorter periods would result in too small deviations from mean values and too many abrupt changes in values in going from one period to the next.

CRITERION A

To enable complete evaluation of the climatic conditions at a point of observation in Denmark, observations of the weather throughout a period of thirty years are needed. For the purpose of excluding months with abnormal weather conditions, a comprehensive meteorological evaluation has been made of each month of the period 1959-1973 by comparing with mean values from the whole of the country for the same month during the thirty-year normal period for Denmark, i.e. 1931 through 1960.

Monthly mean temperature	x
Mean of daily maximum temperatures	x
Mean of daily minimum temperatures	x
Absolute monthly maximum temperature	
Absolute monthly minimum temperature	
Frequencies of wind velocities	x
Monthly mean atmospheric pressure	x
Hours of sunshine	x
Numbers of days with precipitation	
Monthly amount of precipitation	x
Monthly mean humidity	x
Number of days with fog	
Number of cloudless and overcast days	
For winter months: Number of frost days, ice days, snow days, layer of snow.	
For summer months: Number of days with daily max exceeding 25 ^{o}C. Number of days with thunder.	

Figure 2. Weather parameters included in the comprehensive meteorological evaluation according to criterion A. Weather parameters which are considered to be particularly important to the evaluation are marked with an x.

This evaluation has been made by an experienced climatologist, cand. scient. Stig Rosenørn, using monthly mean values of

about twenty different weather parameters, see Figure 2. A description of the method is given in (8).

For each month in the 15 years monthly means of the weather parameters are compared with corresponding monthly means and standard deviations of monthly means in the 30-year period. Each month has then been characterized as "qualified", "accepted", "poor" or "impossible". Figure 3 indicates this characterisation.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1959	A	I	I	I	I	I	I	I	I	A	A	I
1960	A	D	A	A	I	A	I	D	I	I	A	I
1961	A	I	I	I	A	A	I	D	I	I	I	D
1962	I	I	I	K	I	I	I	I	I	A	D	I
1963	I	I	I	I	I	A	A	I	A	A	I	I
1964	I	A	I	A	I	I	I	D	A	I	K	A
1965	I	K	K	I	I	A	I	I	A	I	I	I
1966	I	I	D	I	K	I	A	I	A	I	D	I
1967	A	I	I	A	A	I	A	D	D	I	A	D
1968	D	K	I	I	I	I	I	I	I	I	I	I
1969	I	I	I	A	D	A	D	I	I	I	I	I
1970	I	I	I	I	D	I	I	A	D	A	A	A
1971	K	D	I	A	K	D	K	K	I	A	D	I
1972	I	D	I	D	D	I	A	D	I	D	A	A
1973	I	I	I	A	D	A	D	D	A	I	I	D

Figure 3. Qualification characters for all months 1959-73.

K: qualified A: acceptable
D: poor, but useable if no better exists
I: impossible

Months used in the final TRY are underlined.

CRITERIA B AND C

Typical means and variations.

B. Selection of months with typical monthly means for the three most important weather parameters, daily mean temperature, daily maximum temperature, and daily total of global radiation, or, for November through February, daily total of sunshine hours.

For each month in the 15-year period the monthly mean values are compared with the mean value for all 15 months. The deviations are normalized with the standard deviation of the 15 monthly values.

C. Selection of months with typical variations, e.g. with both warm and cold days. For each month, and for the same three weather parameters, is calculated the standard deviation on each day's deviation from a smoothed annual variation curve. The monthly standard deviations are normalized with the standard deviation of the 15 monthly values.

Criteria B and C deliver for each month in the 15 years 2 normalized values for each parameter, totally 2 x 3 figures, which characterize the month. The largest absolute value of these 6 figures is then used as classification number to classify the month. The best suited month is that with the lowest classification number, that is with the smallest deviation from the typical.

Figure 4 shows, as an example, for the 15 months of June, those 6 values which give the deviation from the typical, according to criteria B and C. The best months are June 1963 (0.57), second is June 1961 (0.80) and third June 1964 (1.01).

As June 1963 at the large scale evaluation, criterion A, has been characterized as "acceptable" (=A), and none of the three best Junes have got a better characterization, June 1963 is chosen for the Danish Reference Year, TRY.

In app. 1 is given a description of the mathematical selection procedure. It corresponds to the method described in (1), with the modifications now that sunshine duration is used instead of global radiation for the months November through February, and that a smoothed annual variation curve (3-order harmonic) is used instead of the mean values for each of the 365 days in the year for calculation of criteria B and C.

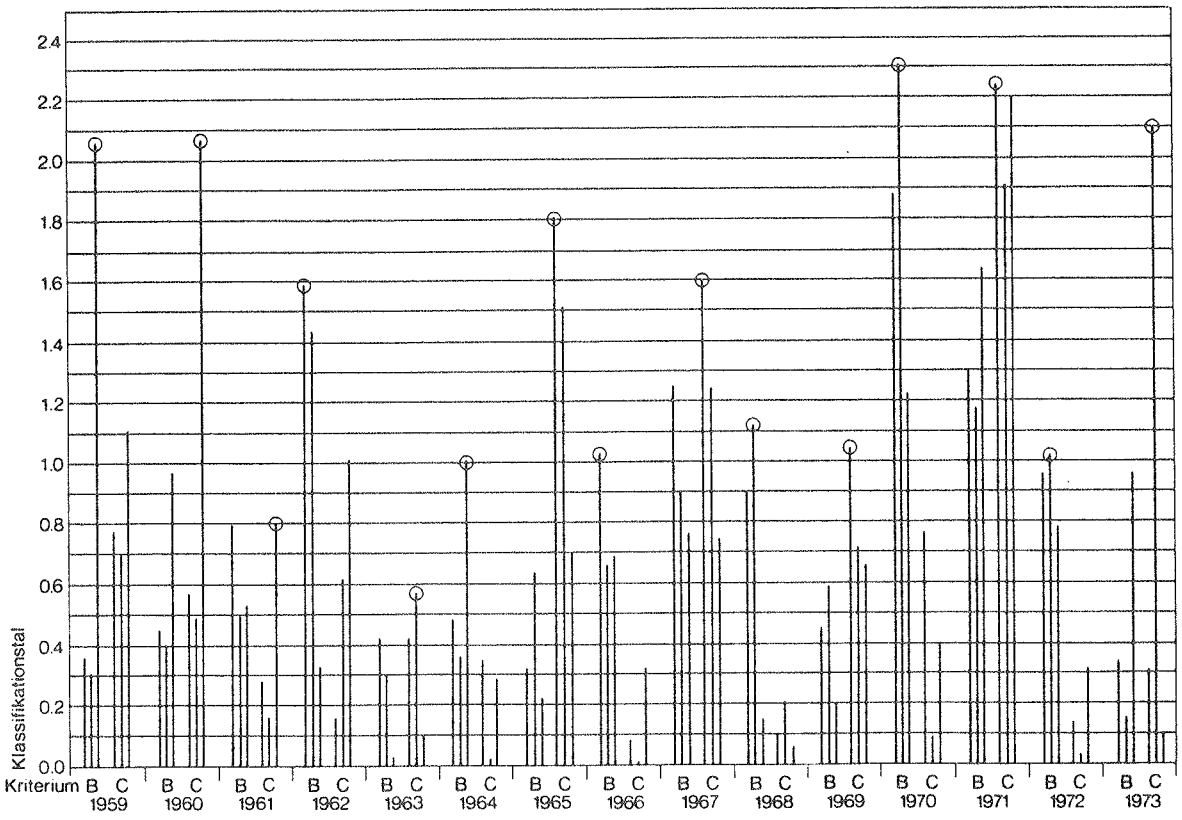


Figure 4. Graphical representation of the figures used for the selection of the month of June for the reference year according to criteria B and C. For each of the fifteen months and for each criterion, the height of the lines represents the normalized values, as measures of their deviations from the typical course. The order in which the parameters is given is daily mean temperature, daily maximum temperature, and total of solar radiation. ⓘ denotes the decisive classification figure of the months. The year with the lowest decisive classification figure is preferred. For June it is thus 1963.

MONTH	1. PRIORITY	2. PRIORITY	3. PRIORITY
JAN	67. A 0.48	59. A 0.55	72. I 0.73
FEB	59. I 0.77	68. K 0.77	64. A 0.91
MAR	62. I 1.13	66. D 1.25	63. I 1.27
APR	69. A 0.39	71. A 0.61	62. K 0.64
MAY	70. D 0.46	61. A 0.71	73. D 0.87
JUN	63. A 0.57	61. A 0.80	64. I 1.01
JUL	63. A 0.49	66. A 1.15	73. D 1.19
AUG	71. K 0.75	60. D 0.87	68. I 1.21
SEP	66. A 0.75	65. A 0.82	70. D 1.05
OCT	62. A 0.57	65. I 0.66	63. A 0.74
NOV	70. A 0.55	64. K 0.55	62. D 0.62
DEC	70. A 0.78	73. D 1.03	63. I 1.08

Figure 5. The three best months and the resulting classification figure according to criteria B and C, and the characters (K, A, D or I) according to criterion A. Underlining indicates selected months for the TRY. September 1965 was selected for the Reference Year in preference to September 1966 because it gave better results with various application programs.

4. SBI WEATHER DATASET ON COMPUTER TAPE

The datasets "Danish Reference Year, TRY" and the 15-year dataset 1959-73 are available on computer tape, from Danish Building Research Institute, SBI, Box 119, DK-2970 Hørsholm, Denmark.
Price 500 Dcr. plus VAT.

The datasets are delivered on a 9 track tape 1600 bpi, no-label. EBCDIC, no overpunches and no decimal points. 1 record per hour, logical record length 80, block size 4000 characters.

Figure 6 shows weather parameters, observation times and FORMAT description. (FORTRAN types).

The "Danish Reference Year, TRY" is also delivered together with 28 other EEC TRY's on tape, see att. 3.

GUIDE FOR USE

Missing data are given as blanks, causing FORTRAN-program to read 0 (zero). No data are missing in dbt, dpt, rh, enthalpy, max. and min. temperatures, three radiations, wind direction and velocity, and total cloud amount.

Snow thickness, snow layer and ground surface. Conditions are from 1970 measured at h 7.00 a.m., but recorded for h 13.00.

Precipitation less than 0.1 mm are given as -1.0. Recording at h 7 and h 19 always covers the preceding 12 hours. Recording at h 1 and h 13 is for the preceding 6 hours only.

Pressure is achieved by adding 900 mb to the recorded value.

Observation	Interval or observation time	Column	Fortran Format code
Station no. (here always zero)		1-5	I5
Dry bulb temperature ^{o}C	h	6-9	F4.1
Dew point temperature ^{o}C	h	10-13	F4.1
Relative humidity %	h	14-16	F3.0
Enthalpy, calc. kJ/kg	h	17-20	F4.1
Minimum temperature ^{o}C	7 and 19 CET	21-28	2F4.1
Maximum "			
Depth and coat of snow cm, quarters	13 CET	" "	F4.0, 2F2.0
State of ground surface			
Hours with clear sun h	24 CET	" "	F4.1,4X
Global radiation (on horizontal) W/m^2	h	29-31	F3.0
Diffuse radiation, calc. W/m^2	h	32-34	F3.0
Direct normal radiation, calc. W/m^2	h	35-37	F3.0
Precipitation mm	1,7,13 and 19 CET	38-40	F3.1
Cloud cover octas	h	41	F1.0
Wind direction deka-degr.	h	42-43	F2.0
Wind speed knots	h	44-45	F2.0
Visibility	h	46-47	F2.0
Weather	h	48-49	F2.0
Weather since last major observation	h	50	F1.0
Cloud cover in low or medium altitude octas	3h	51	"
Cloud types, low altitude	3h	52	"
Altitude of lowest clouds	3h	53	"
Cloud types, medium altitude	3h	54	"
Cloud types, high altitude	3h	55	"
Cloud cover, lowest clouds ≥ 5/8 of sky	h	56	"
Cloud type herein	h	57	"
Altitude hereof or vertical visibility	h	58-59	F2.0
Cloud cover, lowest clouds ≥ 4/8 of sky	h	60	F1.0
Cloud type herein	h	61	F1.0
Altitude	h	62-63	F2.0
Barometric pressure -900.0 mbar	3h	64-67	F4.1
Character of change in pressure	3h	68	F1.0
Not used (always blank)		69	1X
Indicator for artificial data etc.	h	70-71	A2
Year, month, day, hour (for TRY: year=11)	h	72-79	4I2
Record no. per hour (always 0)	h	80	I1

Figure 6. Danish 15-year weather data set and Danish Test Reference Year (TRY). CCMS-format for 1 logical record per hour, 80 characters.
"h" indicates hourly presence, "3h" every third hour (the "synoptic" hours 1, 4, 7, 10 ---- CET). CET means Central European Time ~ GMT + 1. All temperatures are given with 0.1 ^{o}C, pressure with 0.1 mbar, precipitation 0.1 mm, and radiation with 1 W/m^2, and wind speed with 1 knot as least significant digit. Wind direction deka-deg from North.

An indicator for corrected or added data is given for each hour. In the chapter concerning check of measured data is described which corrections have been made. The following indicator values are used, summed up to a binary half word (16 bits):

Indicator	Condition
1	dbt corrected or interpolated
2	Humidity parameters interpolated [1]
4	Computed global radiation, or corrected cloud cover for splitting diffuse and direct radiation
8	Wind direction interpolated or manually inserted
16	Wind velocity interpolated
32	Cloud cover N interpolated
64	Lower cloud cover interpolated
128	Daily max. temp. corrected or added
256	Daily min. temp. corrected or added
512	The hour is included in the TRY (For the 15-year dataset only)
1024	February 29 (This day is omitted in most TRY versions)
2048	Humidity parameters computed from other original data, or manually corrected rh

Figure 7. Indicators for corrected or added data.

[1] Manually corrected humidity parameters are not always indicated.

RESTRICTIONS FOR USE

It is the intention that the 'Danish Reference Year, TRY' documented in this report (in Danish, SBI-Report 135) should be the common basis of outdoor climate for various HVAC and energy calculations in Denmark.

The "Danish Reference Year, TRY" can be used free, but to ensure that calculations based on the Reference Year really will be comparable, the following restrictions for using the weather data of the Reference Year have been defined:

1. The Reference Year should not be copied or handed over to other institutions or companies. The Danish Building Research Institute itself wants to make the distribution in order to be able to distribute later supplementary material. (The Thermal Insulation Laboratory has a special permission).

2. Nothing must be modified or added to the data of the Danish Reference Year, TRY. On the other hand, it is permissible to make extracts from the Reference Year, i.e. to omit all data of a certain sort, e.g. the wind velocity or the weather symbols.

3. When selecting data from the Reference Year for calculations, where only certain values are used, it has to be documented when referring to "Danish Reference Year, TRY" or "SBI-Report 135", how these single values are selected.

4. The designation "Danish Reference Year, TRY" should only be used for data or indicated in connection with calculations to which the Danish Reference Year, TRY is used, if the above-mentioned conditions are observed.

REFERENCES

1. Statens Byggeforskningsinstitut. 1974. Vejrdata for VVS-tekniske beregninger. Referenceår. SBI-rapport 89, 2. oplag 1977. København. (In Danish).

2. Meteorologisk Institut m.fl. 1967. Meteorologiske koder. København.

3. World Meteorological Organization. 1971. Guide to meteorological instrument and observing practices. WMO No. 8. TP. 3. Geneva.

4. Aslyng, H.C. and Jensen, Sv.E. 1966. Radiation and energy balances at Copenhagen 1955-64. Den kgl. Veterinær- og Landbohøjskoles årsskrift 1966, p. 22-40. København.

5. Kimura, K. and Stephenson, D.G. 1969. Solar radiation on cloudy days. ASHRAE transactions No. 2106 1969/II. New York.

6. Lund, Hans. 1979. Revised splitting procedure for calculation of direct normal radiation and diffuse radiation. Internal report. Thermal Insulation Laboratory. Technical University of Denmark.

7. Test Reference Year (TRY). Final report. CCMS Rational Use of Energy, Pilot study. 1977. Report NATO/CCMS 60. National Technical Information Service, ERDA. Springfield, Virg.

8. Lund, Hans and Eidorff, Stig. 1980. Selection methods for production of Test Reference Years. App. by R. Dogniaux. Final report (short version). Report EUR 7306 EN.

APPENDIX 1

DESCRIPTION OF MATHEMATICAL SELECTION METHOD

For every day of 15 years, we have observations of three meteorological parameters for the day t, $x_{i,t}$, i = 1, 2 or 3, daily mean dbt, daily max dbt and daily total of global radiation, or, for November through February, daily sunshine hours. The observations are supposed to be results of a stochastic process which is periodic, the period being one year. It is necessary therefore first to eliminate the seasonal variations from $x_{i,t}$ to get a residual element which reasonably may be assumed to be the result of a stochastic process. This should actually be done by considering the deviations of the observations from the true mean $\bar{x}_{i(15)t}$ for 15 days. Since this value is still noisy, we use instead daily values $x_{i(15)t}$ derived from a 3rd-order harmonic function from the 15 years. This means that instead of using the measured parameters $x_{i,t}$ we may consider the residual

$$y_{it} = x_{i,t} - x_{i(15)t}$$

Although the distribution of y_{it} is not known, it is assumed to be a normal distribution. This assumption, and neglecting a possible correlation between the individual characteristics and a possible autoregression in the process, signifies considerable simplifications of the actual conditions. But since the object is solely to select typical months and neither to judge estimated values nor to test hypotheses, these simplifications are considered to be permissible.

For the year j and the month k, the meaning of t will be the individual day of a month, and it is then possible to calculate mean and standard deviation of the residual now named y_{ijkt}.:

$$\bar{y}_{ijk} = \frac{\sum_{t=1}^{n} y_{ijkt}}{n} \qquad \text{(mean)}$$

$$s_{ijk} = \sqrt{\frac{\sum_{t=1}^{n} (y_{ijkt} - \bar{y}_{ijk})^2}{n-1}} \qquad \text{(s.d.)}$$

With n = 28-31 days, both $\bar{y}_{ijk}$ and s_{ijk} may be considered to have a normal distribution, and the average value for fifteen years of both mean and standard deviation (for the month k) is found from:

$$\bar{y}_{i\cdot k} = \frac{1}{15} \sum_{j=1}^{15} \bar{y}_{ijk}$$

and

$$\bar{s}_{i\cdot k} = \frac{1}{15} \sum_{j=1}^{15} s_{ijk}$$

In the case the quantity $\bar{y}_{i\cdot k}$ will be very near or equal to zero, but it is retained in the following expression for the sake of the systematics:

$$s_{(\bar{y}ijk)} = \sqrt{\frac{\sum_{j=1}^{15} (\bar{y}_{ijk} - \bar{y}_{i\cdot k})^2}{14}}$$

$$s_{(\bar{s}ijk)} = \sqrt{\frac{\sum_{j=1}^{15} (s_{ijk} - \bar{s}_{i\cdot k})^2}{14}}$$

For every month k there are 3 · 15 values of the monthly mean y_{ijk}. These 45 values are now normalized so as to make them comparable and we have:

$$fy_{ijk} = \left| \frac{\bar{y}_{ijk} - \bar{y}_{i\cdot k}}{s_{(\bar{y}ijk)}} \right|$$

The smaller fy_{ijk}, the smaller the deviation of y_{ijk} from the total mean. The standard deviation values, s_{ijk} may be normalized in the same way:

$$fs_{ijk} = \left| \frac{s_{ijk} - \bar{s}_{i \cdot k}}{s_{(sijk)}} \right|$$

For a specified month and a specified year we now have six normalized values which show how much the mean and the standard deviation deviates from the average value of the 15 means and 15 standard deviations. The smaller the deviation, the more suitable the month will be for a reference year.

Criteria B and C indicate that for a certain month k, the month of the year j to be selected is one for which the values of fy_{ijk} and fs_{ijk} are small.

For each month k of year j, the largest of the six values of fy and fs is selected as the classification values $f_{ijk}(max)$. For a month k, we obtain fifteen maximum values which may be arranged according to increasing magnitude:

$$f_{i(1)k}(max),\ f_{i(2)k}(max)\ \text{----------},\ f_{i(15)k}(max)$$

The brackets around the figures of the subscript indicate that the expressions are arranged in increasing magnitude. The month k is taken from the year represented by $f_{i(1)k}(max)$, because this is the year in which the maximum normalized deviation of mean or standard deviation for the month is smaller than for any other of the years in question. The second best month k is the one represented by the next term in the series, etc. etc. Figure 5 of the report indicates the three most suitable years for each month.

APPENDIX 2

TABLES OF WEATHER DATA OF THE DANISH REFERENCE YEAR, TRY

(Examples only of each type. Complete tables available in: Vejrdata for VVS og Energi i Dansk Referenceår, TRY. (In Danish) SBI-report 135. Statens Byggeforsknings Institut 1982).

Monthly mean values of 21 weather parameters from the Reference Year, from the period 1959-1973 and from the normal period 1931-1960. (pp 30-31).

Daily values of air temperature, maximum temperature, total radiation, and dew point temperature during the month of the Reference Year and corresponding mean values from the period 1959-1973. (p 32, example only).

Calculated probable total radiation on clear days and monthly means. (p 33).

Frequency of the conditions of the air within specified temperature and humidity intervals represented in h-x diagrams. Given as number of hours during the entire Reference Year, during each month and during the four seasons of the year. (p 34, example only).

Cumulated values of air temperature, relative humidity, enthalpy, and absolute humidity. Given in hours during the entire Reference Year, during individual months and during the four seasons of the year. (p 35, example only).

	PERIODE	JAN	FEB	MAR	APR	MAJ	JUN	JUL	AUG	SEP	OKT	NOV	DEC	ELL.	I.ALT GEN. SUM
UDELUFTTEMPERATUR, °C dbt	REF.AR, TRY	-0.6	-1.1	2.6	6.6	10.6	15.7	16.4	16.7	13.7	9.2	5.0	1.6	G	8.1
	1959-73	-1.0	-0.5	1.9	5.9	10.9	15.2	16.1	15.9	12.9	8.9	4.5	0.8	G	7.7
	1931-60	-0.1	-0.4	1.7	6.2	11.1	14.5	16.6	16.3	13.1	8.7	4.9	2.2	G	7.9
DØGNMAKSIMUMTEMP., °C daily max dbt	REF.AR, TRY	1.4	1.6	5.4	10.9	14.5	20.3	21.0	21.5	17.6	12.6	7.8	3.4		
	1959-73	1.0	1.7	5.0	9.9	15.3	20.0	20.4	20.4	17.0	12.2	6.7	2.7		
	1931-60	2.0	2.2	5.0	10.2	15.7	19.0	21.1	20.6	17.2	12.0	7.2	4.1		
MANEDS-MAKSIMUMTEMP., °C GENNEMSNITLIG MANEDS- MAX. I PERIODEN abs. max dbt	REF.AR, TRY	6.6	6.0	9.8	20.9	25.0	25.6	28.1	29.4	21.9	19.2	10.6	7.6		29.4
	1959-73	5.7	6.7	11.4	17.3	22.4	26.6	27.1	26.9	22.4	18.0	12.3	7.7		27.1
	1931-60	7.0	7.5	11.5	17.5	24.0	26.5	28.0	26.5	23.0	17.0	11.0	8.5		28.0
DØGNMINIMUMTEMP., °C daily min dbt	REF.AR, TRY	-2.9	-5.0	-0.1	2.7	6.8	10.4	11.9	12.0	10.8	5.5	2.4	-1.1		
	1959-73	-3.4	-3.3	-1.2	2.0	6.6	10.4	12.0	11.4	8.6	5.3	1.9	-1.6		
	1931-60	-2.4	-3.0	-1.3	2.4	6.3	9.7	12.2	12.2	9.7	5.9	2.6	0.1		
MANEDS-MINIMUMTEMP., °C GENNEMSNITLIG MANEDS- MIN. I PERIODEN abs. min dbt	REF.AR, TRY	-12.9	-14.9	-7.9	-1.0	2.2	5.6	7.4	4.8	6.4	-2.7	-4.5	-8.3		-14.9
	1959-73	-13.5	-12.4	-7.7	-4.0	1.1	4.9	7.4	6.2	1.4	-1.4	-5.7	-11.2		-13.5
	1931-60	-12.0	-11.0	-8.5	-3.5	0.0	4.0	7.5	6.5	3.0	-0.5	-3.5	-8.0		-12.0
DUGPUNKTTEMPERATUR, °C dpt	REF.AR, TRY	-1.2	-2.1	1.4	3.6	6.6	8.9	11.5	10.9	11.1	7.1	3.6	0.1		
	1959-73	-1.9	-1.7	-0.2	2.5	6.5	10.3	12.3	12.0	9.9	7.0	3.0	-0.3		
	1931-60 *)														
ABSOLUT FUGTINDHOLD, G/KG prec. water	REF.AR, TRY	3.5	3.3	4.2	5.0	6.1	7.2	8.6	8.3	8.3	6.4	5.0	3.9	G	5.8
	1959-73	3.4	3.4	3.8	4.7	6.2	8.0	9.1	8.9	7.8	6.4	4.8	3.8	G	5.9
	1931-60 *)														
RELATIV LUFTFUGTIGHED, % rh	REF.AR, TRY	94	91	91	82	78	67	74	71	85	87	91	88	G	83
	1959-73	92	90	86	81	77	75	80	80	83	88	90	92	G	84
	1931-60	89	87	85	78	72	73	76	79	83	86	89	91	G	82
ENTALPI, KJ/KG	REF.AR, TRY	8.1	7.1	13.3	19.2	26.2	34.1	38.3	37.7	34.8	25.3	17.6	11.5	G	22.5
	1959-73	7.5	8.0	11.5	17.6	26.5	35.5	39.2	38.5	32.6	25.0	16.7	10.3	G	22.5
	1931-60 *)														
GLOBALSTRALING, WH/M² DAG DØGNSUM global radiation	REF.AR, TRY	406	1187	1895	3961	5017	6188	5187	4350	2773	1415	639	384	G	2790
	1959-73	472	1086	2277	3739	5054	6027	5071	4245	2981	1480	602	349	G	2790
	1931-60 *)														
DIFFUS STRALING, WH/M² DAG diffuse radiation	REF.AR, TRY	279	582	1137	1843	2382	2612	2565	1979	1477	782	387	210	G	1357
	1959-73	282	590	1100	1696	2114	2484	2550	2037	1491	792	352	210	G	1312
	1931-60 *)														

*) The values do not exist.

Monthly mean values from the reference year, from the period 1959-1973 from which the months of the reference year have been selected, and mean values for the entire of Denmark from the normal period 1931-1960.

	PERIODE	JAN	FEB	MAR	APR	MAJ	JUN	JUL	AUG	SEP	OKT	NOV	DEC	ELL.	IALT GEN. SUM
SOLSKINSTIMER, H/DAG MÅLT VED TOLDBODEN, KBH. 30-ÅRS PER.: HELE LANDET sunshine hours, per day	REFERENCEÅR 1959-73 1931-60	0.8 1.1 1.3	2.2 1.9 2.3	2.5 3.5 4.1	5.3 5.2 6.0	6.0 7.0 8.3	8.8 8.5 8.6	7.3 6.7 8.0	7.0 6.8 7.1	4.8 5.2 5.5	2.8 3.1 3.2	1.0 1.4 1.4	1.3 0.9 0.9	G S G	4.1 4.3 4.7
SKYDÆKKE, % GENNEMSNIT KL 8, 14 OG 21 cloud cover	REFERENCEÅR 1959-73 1931-60	81 77 74	75 74 72	78 64 62	62 63 58	65 58 53	51 52 55	61 60 58	55 55 57	53 55 56	67 64 67	70 74 77	69 75 78	S G G	66 64 64
VINDHASTIGHED, M/S GENNEMSNIT KL 8, 14 OG 21 wind velocity	REFERENCEÅR 1959-73 1931-60 **)	5.6 5.4 4.5	5.5 5.5 4.5	6.4 5.9 4.2	5.5 5.5 4.2	5.4 5.1 3.9	3.8 4.8 3.8	3.3 4.5 3.7	5.5 4.5 3.6	5.2 4.8 3.7	3.5 4.8 4.0	5.0 5.7 4.1	4.7 5.0 4.2	G S G	4.9 5.1 4.0
BLÆSTDØGN, ANTAL DØGN MED 6 BEAUFORT ELL. DEROVER = 10.7M/S KL 8, 14 ELLER 21 winddays	REFERENCEÅR 1959-73 1931-60	5.0 3.2 5.0	3.0 3.3 3.9	3.0 5.0 4.6	1.0 3.3 4.0	0.0 2.3 3.0	0.0 1.8 2.6	0.0 0.8 2.2	7.0 1.4 2.5	1.0 2.3 2.8	0.0 2.5 3.4	3.0 3.6 4.2	1.0 3.4 4.3	S S S	24.0 32.8 43.0
LUFTTRYK, MB pressure	REFERENCEÅR 1959-73 1931-60	1014 1015 1013	1013 1014 1014	1010 1014 1016	1013 1012 1014	1012 1015 1016	1013 1015 1014	1017 1013 1013	1013 1013 1013	1010 1015 1015	1019 1015 1014	1013 1010 1014	1018 1012 1012	G G G	1014 1014 1014
NEDBØR, MM/MÅNED precipitation	REFERENCEÅR 1959-73 1931-60	75 44 55	21 38 39	64 36 34	26 52 39	35 51 38	51 54 48	79 89 74	64 77 81	69 77 72	22 62 70	29 78 60	66 53 55	S S S	600 710 644
NEDBØR, ANTAL DØGN PR. MÅNED MED MINDST 0,1MM raindays	REFERENCEÅR 1959-73 1931-60	21 13 15	12 11 13	18 11 10	15 13 12	11 11 10	9 10 11	11 11 13	15 12 14	10 10 14	9 11 15	13 16 16	12 13 16	S S S	156 144 159
FROSTDØGN, ANTAL DØGN MED MINIMUMTEMPERATUR < 0 C FRA KL 7 TIL KL 7 frostdays	REFERENCEÅR 1959-73 1931-60	24.0 22.1 21.0	19.0 18.5 19.0	12.0 17.9 19.0	2.0 7.1 6.0	0.0 0.1 1.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.5 0.1	2.0 3.1 2.0	6.0 7.7 6.1	15.0 17.3 14.0	S S S	80.0 94.4 88.0
ISDØGN, ANTAL DØGN MED MAKSIMUMTEMPERATUR <= 0 C FRA KL 7 TIL KL 7 icedays	REFERENCEÅR 1959-73 1931-60	9.0 10.3 8.9	5.0 8.5 8.5	1.0 2.7 2.8	0.0 0.1 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 1.1 0.1	7.0 6.1 2.8	S S S	22.0 28.7 23.0
SOMMERDAGE, ANTAL DØGN MED MAKSIMUMTEMPERATUR OVER 25 C summerdays	REFERENCEÅR 1959-73 1931-60	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.1 0.6	3.0 3.5 2.1	4.0 3.6 3.8	3.0 2.5 3.4	0.0 0.3 0.3	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	S S S	10.0 10.0 10.0

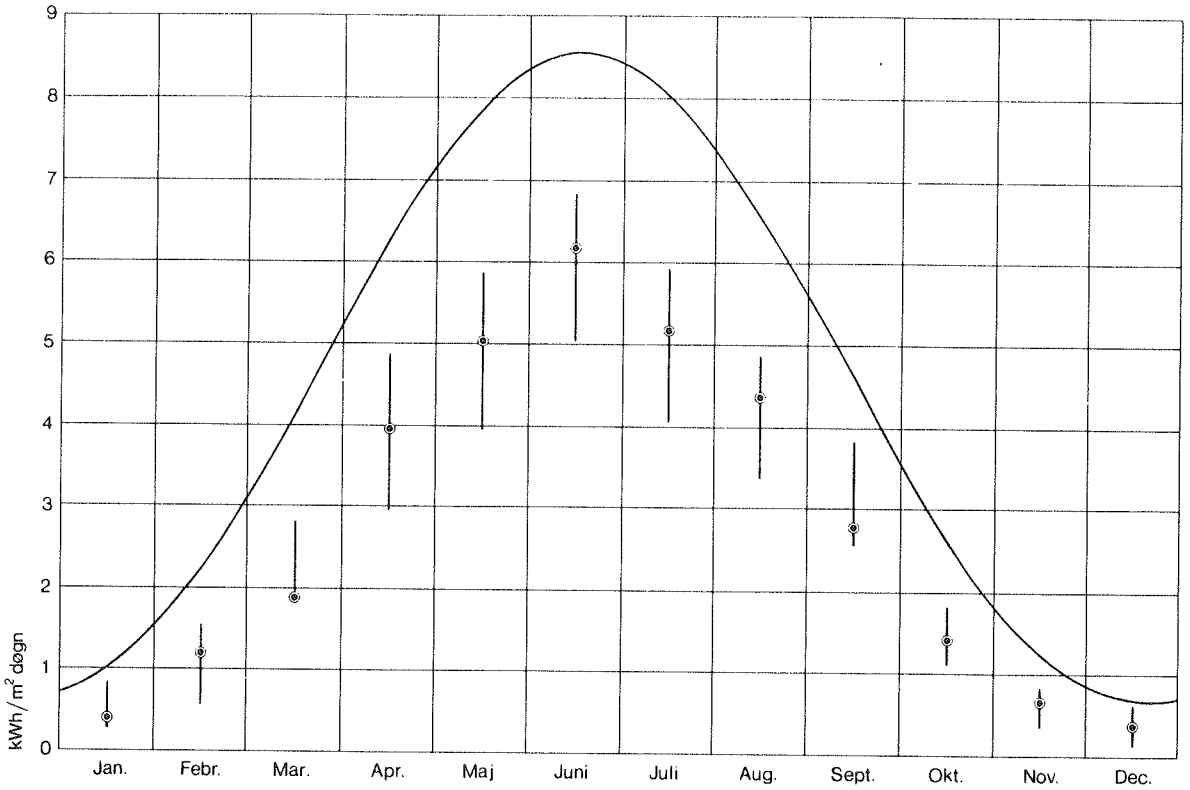
**) LANDSGENNEMSNIT FOR LANDSTATIONER

Monthly mean values from the reference year, from the period 1959-1973 from which the months of the reference year have been selected, and mean values for the entire of Denmark from the normal period 1931-1960.

OKT 72 / DAG	UDELUFTTEMPERATUR °C / Cronological	Ranked	Mean ranked	MAKSIMUMTEMPERATUR °C / Cronological	Ranked	Mean ranked	GLOBALSTRALING WH/M² DAG / Cronological	Ranked	Mean ranked	DUGPUNKTTEMPERATUR °C / Cronological	Ranked	Mean ranked
1	13.2	4.7	4.6	17.2	7.6	7.9	1929	186	253	12.0	-1.0	2.0
2	14.6	5.5	5.4	19.2	8.0	8.4	3109	286	361	12.1	1.4	3.2
3	14.4	5.6	5.8	17.5	8.3	9.1	2320	454	428	12.5	3.4	3.9
4	12.2	5.7	6.2	15.0	8.6	9.6	1133	509	480	11.0	3.6	4.5
5	10.2	6.1	6.8	15.2	10.0	9.9	2645	623	555	7.9	3.7	5.0
6	8.7	6.6	7.2	13.5	10.0	10.1	1096	632	620	8.3	3.9	5.4
7	11.0	7.0	7.5	14.6	10.5	10.4	1179	633	688	9.5	4.5	5.8
8	10.4	7.6	7.7	13.7	11.2	10.7	1782	715	732	8.1	5.1	6.1
9	9.3	8.2	8.0	11.4	11.4	11.1	817	734	837	8.7	5.3	6.3
10	9.1	8.2	8.1	14.4	11.4	11.3	1541	817	894	8.4	5.4	6.5
11	8.8	8.6	8.4	10.5	11.4	11.5	632	957	952	7.2	6.2	6.8
12	8.2	8.7	8.6	12.8	11.4	11.7	2486	1051	1064	5.1	6.7	7.0
13	6.1	8.8	8.8	12.4	12.0	11.9	2524	1076	1142	3.6	7.1	7.3
14	7.6	8.8	9.0	12.0	12.0	12.1	1511	1086	1241	3.9	7.2	7.4
15	4.7	8.8	9.1	11.4	12.1	12.2	2765	1096	1327	-1.0	7.2	7.7
16	9.7	9.0	9.3	11.4	12.3	12.4	1051	1133	1382	8.4	7.4	7.8
17	11.4	9.1	9.5	13.9	12.4	12.6	1883	1179	1517	8.3	7.9	7.9
18	12.1	9.3	9.6	15.0	12.5	12.8	1076	1511	1598	9.7	7.9	8.2
19	9.6	9.4	9.8	12.1	12.8	13.0	1838	1541	1630	6.2	7.9	8.3
20	8.8	9.6	9.9	14.5	13.5	13.2	2469	1782	1704	5.3	8.1	8.5
21	8.8	9.7	10.2	12.5	13.7	13.5	633	1838	1745	7.1	8.3	8.7
22	9.0	9.9	10.4	11.4	13.9	13.7	509	1883	1902	7.4	8.3	8.9
23	8.2	10.2	10.6	10.0	14.4	14.1	286	1884	1984	6.7	8.4	9.1
24	8.6	10.4	10.9	12.3	14.5	14.4	957	1929	2112	7.2	8.4	9.3
25	9.9	11.0	11.2	11.2	14.6	14.5	454	2320	2210	7.9	8.7	9.5
26	9.4	11.4	11.3	12.0	15.0	14.8	186	2469	2322	7.9	9.5	9.8
27	5.6	12.1	11.8	8.3	15.0	15.2	1884	2486	2453	1.4	9.7	10.1
28	6.6	12.2	12.1	10.0	15.2	15.5	1086	2524	2580	3.4	11.0	10.6
29	5.7	13.2	12.5	8.0	17.2	16.0	715	2645	2719	4.5	12.0	11.0
30	5.5	14.4	13.1	7.6	17.5	16.8	623	2765	2927	3.7	12.1	11.6
31	7.0	14.6	13.9	8.6	19.2	18.1	734	3109	3133	5.4	12.5	12.4
Mean	9.2	9.2	9.3	12.6	12.6	12.5	1415	1415	1467	7.0	7.0	7.6
Std.dev. for 11 years			1.1			1.1			228			1.1
Mean for 30 years			8.7			12.0			MGL			MGL
Std.dev. for 30 years			1.3			1.3			MGL			MGL

Cronological
Ranked: Ranked in ascending order
Mean ranked: Mean of ranked values for 15 months during 1959-1973
Std.dev.: Standard deviation of monthly mean values

October: Daily values of mean temperature, maximum temperature, global radiation and dew point temperature. Mean values and standard deviations.

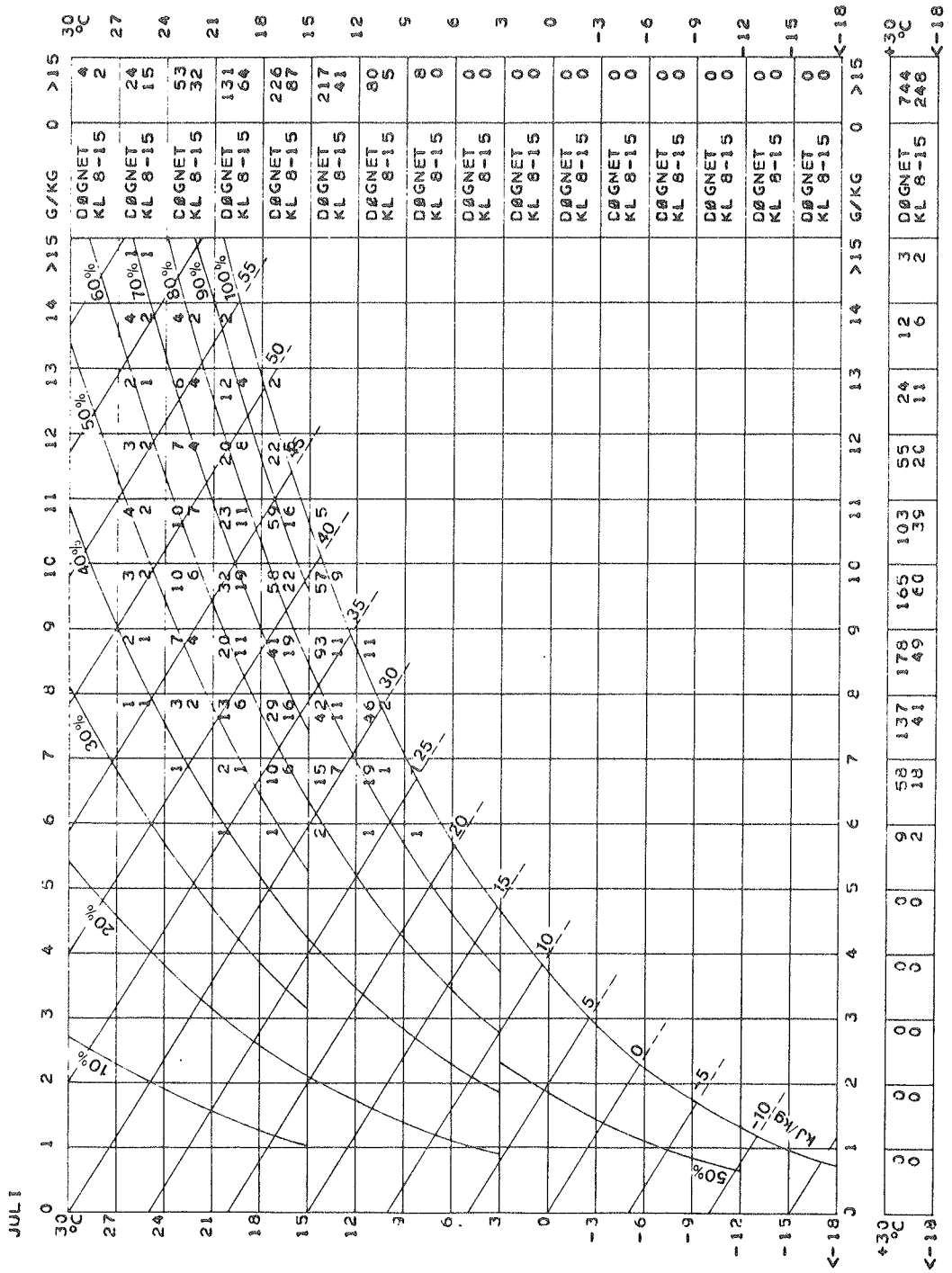


Global radiation, daily amount, kWh/m^2 day

— Computed maximum, probable global radiation for very clear days. Daily sum of hourly values, used after adding 5% or 50 W/m^2 for acceptance/rejection of hourly values.

⊙ Monthly mean value in Danish Reference Year, TRY.

| Indicates highest and lowest monthly mean in the years 1959-73.



July: Number of hours during which the condition of the air is within specified temperature and humidity intervals plotted in a h-x diagram. The table gives number of hours during the 24 hours and during the period 8 a.m. to 3 p.m. (i.e. until 4 p.m.). Similar tables are given for each month, and for the entire TRY year.

SEPTEMBER	GEN	MAX	MIN	*																
TEMPERATUR, °C				*	-18	-15	-12	-9	-6	-3	0	3	6	9	12	15	18	21	24	27
DØGNET	13.7	21.4	6.6	*	720	720	720	720	720	720	720	720	720	686	542	197	44	2	0	0
KL 8-15, INCL	15.4	21.4	9.8	*	240	240	240	240	240	240	240	240	240	240	225	125	38	2	0	0
KL 16-23, INCL	13.8	19.8	8.9	*	240	240	240	240	240	240	240	240	240	239	191	62	6	0	0	0
REL. FUGT., %				*	0	10	20	30	40	50	60	70	80	90	100					
DØGNET	85.3	100.0	59.0	*	720	720	720	720	720	720	713	623	497	317	0					
KL 8-15, INCL	80.1	100.0	59.0	*	240	240	240	240	240	240	236	180	111	62	0					
KL 16-23, INCL	83.0	97.0	60.0	*	240	240	240	240	240	240	237	203	152	68	0					
ENTHALPI, KJ/KG				*	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50	55	60
DØGNET	34.8	50.4	21.4	*	720	720	720	720	720	720	720	720	695	601	338	112	21	1	0	0
KL 8-15, INCL	37.5	50.4	27.9	*	240	240	240	240	240	240	240	240	240	234	155	75	20	1	0	0
KL 16-23, INCL	34.6	47.2	24.5	*	240	240	240	240	240	240	240	240	238	197	111	27	1	0	0	0
ABS. FUGT., G/KG				*	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DØGNET	8.3	12.2	5.9	*	720	720	720	720	720	720	718	621	437	216	54	8	1	0	0	0
KL 8-15, INCL	8.7	12.2	6.3	*	240	240	240	240	240	240	240	218	167	102	36	8	1	0	0	0
KL 16-23, INCL	8.2	10.8	6.1	*	240	240	240	240	240	240	240	209	134	61	10	0	0	0	0	0

September: Number of hours during which the condition of the air shows higher values than the values of temperature, relative humidity, enthalpy, and absolute humidity given. The number of hours are given a) for 24 hours, b) for the period 8 a.m. through 3 p.m., and c) for the period 4 p.m. through 11 p.m. Similar tables are given for each month, and for the entire TRY year.

APPENDIX 3

TRY'S DEVELOPED FOR EUROPEAN COMMUNITIES COUNTRIES

TRY's are available from sources given at p 39. They are normally delivered as a tape with 29 TRY's for the following stations.

U.K.	Aberporth, Eskdalemuir, Kew, Lerwick
France:	Carpentras, Limoges, Macon, Nancy, Nice, Trappes
Belgium:	Oostende, Saint-Hubert, Uccle
Netherlands:	De Bilt, Eelde, Vlissingen
Italy:	Bolzano, Cagliari, Crotone, Amendola-Foggia, Genova, Milano, Monte Terminillo, Roma Ciampino, Trapani, Venezia
Denmark:	Copenhagen
Ireland:	Dublin, Valentia

Data formats

The 29 European Test Reference Years are all delivered on one computer tape with specifications as follows:

Tape 9 track 1600 bpi no-label, ASCII or EBCDIC. Each TRY is recorded as one file with 8760 records. Record length 40. Block size 960 (24 hours). All TRY's contain 365 days, i.e. February has always 28 days.

Short Reference Years, SRY, with only 56 days, are available for the same stations.

The EEC-TRY-format

Post	Parameter	Format
1	Station identifier	A3
2	Time indicator (L or T)	A1
3	Dry bulb temperature, 0.1^{o}C	14
4	Global radiation J/m^2	14
5	Diffuse sky radiation J/cm^2	14
6	Direct normal radiation J/cm^2	14
7	Sunshine duration minutes	14
8	Relative humidity %	13
9	Wind speed 0.1 m/s	13
10	Indicator for artificial data, hexadecimal	22
11,12,13	Year-1900, Month, Day	312
14	Hour (1-24). Local Standard Time	12

TRY description

A brochure "Test Reference Years, TRY's" is available with the tape or can be ordered separately (Nr. EUR 9765).

It gives the requirements and specifications for Test Reference Years and tables of some characteristic values for the TRY's. The tables give monthly mean values and extremes for most parameters in the TRY's, and differences against the multi-year periods from which the TRY has been selected.

Where to obtain ECC-TRY tapes

Cenergia ApS
Walgerholm 17
DK-2750 Ballerup
Denmark
Tel. (02) 660099

Direction de la Météorologie
Service Météorologique Métropolitain
2, avenue Rapp
F-75340 Paris Cedex 07
France

KNMI
P.O. Box 201
NL 3730 AE De Bilt
The Netherlands
Tel. (30) 766911
Telex 47096 KNMI NL

Meteorological Office, MET, 0.1.
Eastern Road, Bracknell
Berkshire RG12 2UR
U.K.
Tel. 0344/420242
Telex 849801

National Research Council
Progette Energetica
Via Nizza 123
I-198 Roma, Italy

Institut Royal Météorologique
3, av. Circulaire
B-1180 Bruxelles
Belgium
Tel. 374.67.88
Telex 21315 Meteobru

Meteorological Service
Glasnevin Hill
IRL-Dublin 9
Ireland
Tel. 424411
Telex 25239 CAFO EI