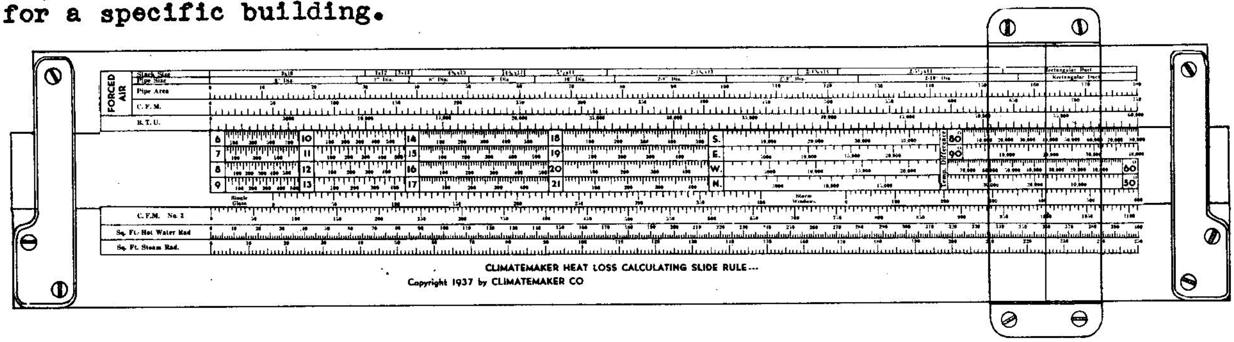
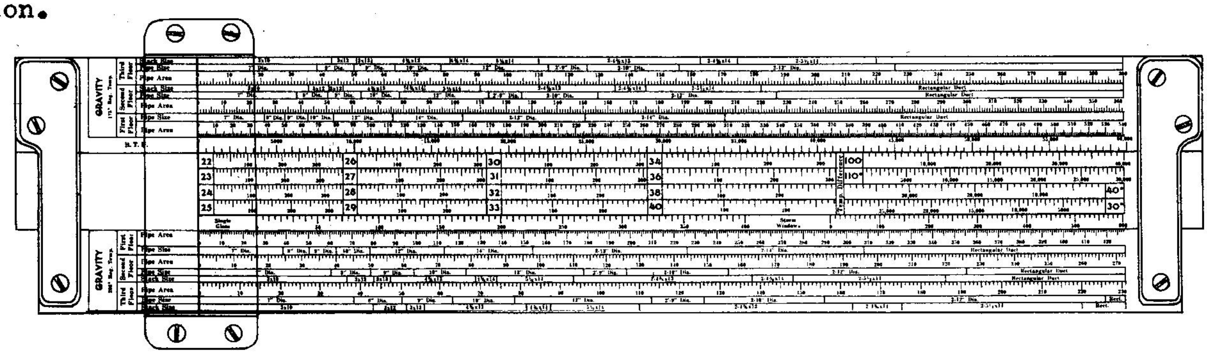
THE CLIMATEMAKER SLIDE RULE

For figuring heat losses from buildings in B.T.U's per hour and determining:

1. Heater size; 2. Blower size (for forced warm air heating systems); 3. Warm air pipe area, pipe size, and stack size for: a. Forced warm air in residences b. Gravity warm air heating for first, second and third floors - using either 175° register temperature (for super-excellent gravity warm air heating jobs);or 200° register temperature for competitive type gravity warm air heating systems, low in cost, but that will still work quite satisfactorily and will have more ability to push the heated air up the pipes than other gravity warm air heating systems have; 4. Hot water radiation required in square feet; 5. Steam radiation required in square feet; 6. Size oil burner, coal stoker or gas burners required for a specific building.



Above is a picture of the front of this slide rule. See how it gives you answers in B.T.U. and, for forced warm air: C. F. M., pipe area, pipe size, stack size, and also in square feet of hot water radiation and square feet of steam radiation.



Above is a picture of the back of the slide rule. See how it gives you answers in B. T. U. and, for gravity warm air heating, for either 175° or 200° register temperature in: pipe area, pipe size, stack size, for first, second and third floor rooms.

HAND FIGURING TAKES TOO LONG - YET ACCURACY ESSENTIAL

Competition is too keen today for the heating contractor who guesses at the size heater and pipes required. Conditions require correct knowledge of heat losses, equipment that is adequate but not a nickle's worth more than is actually needed. This means that heat losses must be exactly figured. Further, insulation is being extensively used. Customers demand to know of their heating contractor how much can be saved in reduced size of heating equipment if they use a certain kind of insulation in walls and ceilings. Heating contractors must be able to answer questions like these quickly and accurately.

The method used to get the correct answers to questions like these is well known. It is outlined in detail in authoritative engineering guides. But to go through the long, tedious calculations required to determine these answers correctly requires more work, more hand figuring, multiplying, adding, and dividing than can be done in a reasonable length of time. To do it yourself is to impose on yourself so much work as to prevent you from doing your regular work, and to hire someone else to do it for you is to add so much cost to an individual job as to put you out of the competition. Yet the figuring must be done, if you are to answer such questions intelligently, correctly and honorably.

If you can answer correctly, and are able to show architect, engineer or home owner your work, show him the reasons for the opinion you offer, your remarks carry conviction that will frequently result in your being given a job at a price higher than the competitor asked - and your margin of profit may be better on that account.

THE CLIMATEMAKER SLIDE RULE is therefore designed to: Eliminate work, speed up work, standardize the method of heat loss calculations, improve accuracy, eliminate mental fatigue and effort and above all, to SAVE TIME!

WHAT THE CLIMATEMAKER SLIDE RULE IS

THE CLIMATEMAKER SLIDE RULE is three pieces of treated wood, held together at the ends by metal strips. The middle piece of wood slides in between the outer pieces. Printed on the wood, both on the front and back sides of the wooden strips, are scales, numbered to correspond to the information sought and obtained. Over the whole assembly are two pieces of glass, called an "indicator" which slide back and forth, held in position by an inbuilt spring, and kept in position by the outer wooden strips. In the middle of the piece of glass is a thin line, called a "hair line". By sliding the glass indicator back and forth, and setting the hair line until it is immediately over certain numbers, it is possible to measure off, on the rule, certain numbers (on the middle piece of wood - called the sliding scale),and read the answers immediately below the hair line on the stationary pieces of wood (called the stationary scales). The many scales on the movable piece provide scales for measuring almost any conceivable condition which may arise in heat loss determination, and the many scales on the stationary scales provide many different answers at the same time.

By measuring on the scales and reading the answers underneath the hair line, much addition, multiplication and division is saved.

HOW IT WORKS

To determine the size furnace, warm air pipes and circulating fan in a warm air job, or the size boiler and radiation in a radiator job, the amount of heat that must be supplied to the building to overcome the heat that leaks out of the building (heat loss) must be determined as accurately as possible. The amount of heat loss is, of course, dependent upon:

1. The outdoor temperature.
2. The wind velocity out of doors.
3. The building construction - amount of glass surface, kind and type of wall construction, and amount of such wall surface.
4. Size of the building and amount of surface exposed to outdoor temperature.

When these things are known, the total quantity of heat required to be supplied can be calculated.

The measure of quantity of heat in the U.S.A. is the British Thermal Unit (B.T.U.) and it is defined as the quantity of heat required to raise the temperature of one pound of water one degree. It is a measure of quantity of heat, like a bushel is the measure of a quantity of oats.

Since heat is lost from a building from windows and doors, walls, floors and ceilings, it is necessary first to determine the area in square feet of these surfaces and to put these down on a chart (supplied with the slide rule) in a space provided for the purpose.

number underneath it, and measure out to the right in the same manner as you did for wall. Looking down on the stationary scales, you now have the total heat loss for glass, wall, infiltration and floor.

Ceiling loss is next. Looking at the chart, select the factor for ceiling, line that number up underneath the hair line, and proceed as you did for wall and floor. Looking down at the stationary scales, you now have the total B.T.U. heat loss for glass, wall, infiltration, floor and ceiling. This is the total heat loss and your heat loss calculating is finished.

NOTE: In making this heat loss, the two sides of the rule are interchangeable. If you can't find all the numbers you want on one side, turn over to the other side and go ahead with them, turning the rule over again and reading the answers on the other side, or either side.

CORRECTIONS FOR OTHER OUTDOOR TEMPERATURES OR FOR OTHER INSIDE TEMPERATURES

The outside temperature conditions in U. S. A. to be figured in sizing heating plants vary from 40 below zero (110 degree temperature rise if inside of 70 above zero is taken as standard) in Minnesota, and northern Montana, to 40 above zero (with an inside temperature of 70) in New Orleans, the Gulf Coast, Texas etc. Hence, the rule provides compensation for all of these extreme conditions and the variations in between. The calculation you have completed was figured for zero outside temperature and 70 inside. (70 degree rise) We recommend that calculations be made on that basis.

Assume that the calculated loss you have just completed shows a heat loss of 10,000 B.T.U. on the 70 degree rise basis. Assume also that you want to figure an outside temperature of 40 below zero. Holding the hair line steady, bring the slide rule left, until the line to the right of 110° (110° rise) is underneath the hair line. Then move hair line to the right until it is over the 10,000 figure on that scale. Looking down on the stationary scale, read: 15,600 B.T.U., the heat loss required at 40 below zero.

Assuming a base calculation of 10,000 B. T. U., zero to 70, but an outside temperature to be figured of 40 above zero, proceed in the same way. With the 30° scale (30 degree rise) set the LEFT line on the 30° scale underneath the hair line, and move to the LEFT until you come to the 10,000 mark on that scale. Looking at the stationary scale, read: 4,400 B.T.U., the heat loss on a plus 40 to 70 (30 degree rise) basis. NOTE: You have to back up; that is, move to the left when the basis is warmer than zero to 70; and move to the right or increase when the basis is colder than zero to 70.

Similar adjustments (corrections) may be made for 80 degree rise (minus 10 to 70); 90 degree rise (minus 20 to 70); 100 degree rise (minus 30 to 70); 110 degree rise (minus 40 to 70); and for 60 degree rise (plus 10 to 70); 50 degree rise (plus 20 to 70); 40 degree rise (plus 30 to 70); and 30 degree rise (plus 40 to 70).

FIGURING INSIDE TEMPERATURES OTHER THAN 70

70 degrees above zero, Fahrenheit, is the standard indoor temperature in U.S.A. However, your customer may say: "Grandma lives with us and we want all the living rooms and her room figured to 80°. In that case, complete the base calculation (zero to 70) in the usual manner. Then for those particular rooms, instead of correcting to 80 degree rise (minus 10 to 70), correct to 90 degree rise (minus 10 to 80 indoors). This is assuming that minus 10 is the outdoor figuring temperature.

Similarly, the customer may say: "Figure the kitchen to only 60° and the garage to 40°. We just want to keep the car from freezing." In the case of the kitchen, figure the heat loss in the usual manner, but correct for 10 degrees less than for the other rooms. For instance, if your outdoor temperature is minus 10 to 70, correct all of the other rooms to an 80 degree rise, but simply do not make any correction on the kitchen. You will then have a figure equal to minus 10 to 60.

It is then necessary to indicate whether the glass is single (only one pane) or whether storm windows and doors are used. It is also necessary to select the kind of wall construction. The chart describes different kinds of wall construction (brick veneer, frame, etc.) and gives differing amounts of insulation in such walls and values (amount of heat lost from such walls). These values,when multiplied by the temperature rise (number of degrees above zero to be figured - for instance, if figuring an outside temperature of zero, and an inside temperature of seventy, we say we are figuring a 70 degree "Rise"). Then under the heading indicating a 70 degree rise is shown a number called a "factor".This number (B.T.U's lost per square foot of wall surface per hour at that temperature difference) corresponds to the numbers shown on the rule.

There are numbers on the rule for every conceivable combination of wall construction, floor or ceiling construction. If the chart does not describe the kind and type of wall construction and the insulation that your particular job has, go to the Guide of the American Society of Heating and Ventilating Engineers, and from the data there given, calculate your own wall factor. You will then find a number on the slide rule to correspond to it.

Heat is also required in a building to heat air that is blown in through cracks around windows and doors,through the walls themselves, and leakage caused by opening and closing doors. The amount of heat required for such a purpose is necessarily an estimate, an "educated guess"; but such a guess should be based on as many years of past experience as possible, and the amount of guessing done in this connection should be exactly the same amount every time under the same conditions. Hence, in the slide rule, the "Infiltration" factor is a definite percentage added to the total heat loss through glass and wall - a larger percentage for north exposure,a less amount for east and west,still less for south.

Ceilings often have different construction from wall, with more or less insulation. Floors often are quite different in construction,but heat losses must be figured through them, as they frequently have unexcavated, unheatED spaces beneath them. Further, wall, floor and ceiling construction may be different in one part of the house from in another. Hence, on the chart a separate space is allowed to show the construction of wall, glass, floor and ceiling for each room in the house.

THE CALCULATION ON THE SLIDE RULE

Set the hair line over the vertical lines on the extreme left side of the stationary scales. Move the sliding scale until the zero of "Single Glass" (or if storm windows, then the zero of "Storm Windows") is immediately underneath the hair line of the movable indicator. Move the movable indicator to the right until hair line is immediately over the number indicating the number of square feet of exposed glass (combination of glass in windows and doors) of that particular room. Stop indicator at that point. Reading on the stationary scale, you can see the number of B.T.U's required to heat that room on account of the heat loss through the glass.

Leaving the indicator stationary, move the sliding scale until the heavy line immediately to the right of the large numbers (indicating the factors for wall construction) is immediately underneath the hair line. Measure out (by moving hair line indicator to the right) until the numbers on that particular scale correspond to the number of square feet of exposed wall for that particular room. Hold the hair line stationary at that point. Looking down on the stationary scales, you can now read the total heat loss in B.T.U's for both the exposed glass and wall surface of the room.

Next, you are to add for the Infiltration (wind in-leakage). Holding the hair line steady, move the sliding scale until the line immediately to the right of the letters "S, E, W, and N" is immediately underneath the hair line. The graduations on these scales are in B.T.U's. Looking at the B.T.U. scale, and noting the total B.T.U's now shown (total heat loss of the glass and wall), move the indicator to the right until the hair line is over a number which corresponds to the total B. T.U. loss through glass and wall. Looking down on the stationary scale again, the figure you now see on the B.T.U. scale is the total heat loss for glass, wall and infiltration.

Now comes floor loss. Looking at the chart,you select your factor for floor construction. Holding the hair line steady,bring the right line for the factor-

In the case of the garage, since the outside temperature is minus 10, and the inside temperature is 40 (total of 50 degree rise), figure the heat loss in the usual manner, zero to 70, and correct (moving to the left) for the 50 degree rise. This will give the B. T. U. loss for the garage inside temperature of 40 degrees, outside minus 10.

Any combination of other conditions may be similarly figured.

DETERMINING PIPE SIZE, STACK SIZE, C.F.M., FEET OF RADIATION, ETC.

Having determined the B. T. U. loss in accordance with all of the above, you will find that this B. T. U. loss is the same on both sides of the rule, either front or back.

On either side of the rule however, you will find that the hair line is also over other figures, indicating the quantities of these. The names are on the extreme left of the rule.

Assuming a B. T. U. loss of 10,000 B.T.U., and looking at the numbers on the stationary scales, on the front of the rule we find that this B.T.U. loss would also require for FORCED AIR FOR RESIDENCES: 125 C.F.M. (cubic feet of air per minute) forced circulation to be delivered by the fan for that room. This would require a pipe having an area of 30 square inches. The closest size commercial round pipe would be 7" in diameter. This would have to be connected to a vertical wall stack of 3 x 12" in size. Another standard of forced air would require for the same B.T.U. 184 C.F.M.

If you would like to know how many feet of hot water or steam radiation this amount of warm air would be equivalent to, simply look on the lower scale underneath the hair line and read: 66 square feet of hot water radiation, or 41½ square feet of steam radiation.

Turning the rule over on its back, you now get the following answers for GRAVITY WARM AIR HEATING: Lower scale: 200° register temperature (OK for competitive jobs), you require for 10,000 B.T.U.: 1st floor - 71 square inches of warm air leader pipe, which would be obtainable in one 10" diameter pipe; second floor, 45 square inches of area, which would be obtainable in an 8" diameter pipe, and this for good gravity warm air heating practice would require the use of a 3 x 12" wall stack.

For a third floor room the pipe area would be 39 square inches of pipe area, which would require one 8" warm air leader pipe, and the wall stack size would be 3 x 10" for best gravity warm air practice.

The same information is given for a better, more expensive type of gravity warm air system, based on 175° register temperature.

SELECTING THE HEATER SIZE - WARM AIR HEATING

Repeat the processes described above for each room in the building, including all halls and stairways. Add up the total heat loss of all rooms. This is the total heat loss of the entire building - the total heat required to be delivered at the registers by the heating system.

LINE LOSS

"Line Loss" is the name given to the heat lost from the pipes between the top of the furnace (warm air furnace bonnet) and the registers. This varies in accordance with the length of each individual run, and the temperature of the space through which the pipe passes. In the very best conditions, with the pipes passing through a heated basement space and none of the pipes over thirty feet long, this line loss is usually taken as 11% (11% of the heat available at the bonnet of the furnace). Hence, to arrive at the heat needed at the bonnet of the furnace, divide the heat required at the registers (as obtained above) by 89 and multiply by 100, and the result is the B.T.U's required at the bonnet of the furnace. If the line loss is assumed to be 20% (because of longer runs or partially unheated, although fully excavated, basement space) then divide the capacity at the registers by 80 and multiply by 100 to get the capacity at bonnet of furnace. In the case of pipes going through unexcavated spaces, line losses as high as 30 or even 40% have been known, but these are unusual. In such cases, consult the Guide of American Society of Heating and Ventilating Engineers for full data on calculation of line losses per lineal foot of duct.

In steam or hot water heating, similar provision must be made for line losses.

SELECTING HEATER SIZE

Warm air furnaces are usually rated in B. T. U's available at the registers (in which case the manufacturers have assumed a 10 or 11% line loss). If your actual line losses are more, discount the manufacturer's rating accordingly.

SIZING STOKER OR OIL BURNER

Take the B.T.U's required at the bonnet of the furnace as determined above. This is known as the OUTPUT of the furnace or the heat delivered by the burning fuel after having allowed for the loss up the chimney.

Most coal furnaces are 60% efficient at the bonnet. Hence, take the OUTPUT and divide it by 60 and multiply by 100. The result is the B.T.U. INPUT - the heat given off by the burning fuel inside of the furnace. Take the INPUT and (assuming that there are 12,000 B.T.U's in one pound of coal) divide the INPUT by 12,000. This will give the number of pounds of coal required per hour to heat the house.

NOTE: Hand fired coal furnaces may be figured as 60% efficient at the bonnet. Special designs, such as those with finned firepots, may be figured more efficient. Forced air jobs may be figured 65% efficient. Specially designed furnaces with more than average heating surface may be figured at efficiencies as recommended by manufacturer's tests.

SELECTING OIL BURNERS

For oil burning furnaces, take the OUTPUT as described above. Specially designed oil burning furnaces, such as the CLIMATEMAKER OILBILT, may be figured as high as 75% efficient. For ordinary oil burning in a converted coal furnace, 65% is high enough to figure. Assume that we are sizing a burner for an Oilbilt furnace. Take the OUTPUT, divide it by 75 and multiply by 100. The result is the INPUT. Assume that #3 oil is being burned. Divide the INPUT by 140,000 B.T.U's (the number of B.T.U's in one gallon of #3 oil). The result is the number of gallons of oil per hour that must be burned to heat the house.

FOR GAS

Follow the same general procedure with reference to gas. Find the number of B.T.U's per cubic foot of gas (ask the gas company). Divide the INPUT by the number of B.T.U's per cubic foot, and the result is the number of cubic feet of gas that must be burned per hour.

HAND FIRED COAL GRATE AREA

In hand fired coal it is necessary to specify grate area. Take the INPUT, divide by 12,000 B.T.U's per pound of coal, and the result is the number of pounds of coal that must be burned per hour. From the manufacturer's catalogs, get the area of the grate (in square feet) that they have available in different sizes of furnaces. Divide the square feet of grate area into the number of pounds of coal per hour, until you get a figure approximating 7 pounds of coal per hour per square foot of grate area, for gravity warm air jobs; not over 10 pounds of coal per hour for forced air systems. Then specify the size furnace having this grate area that gives you combustion rates not exceeding these figures.

In sizing steam or hot water boilers, the same general rules are followed, always keeping in mind that manufacturer's ratings in square feet of hot water or steam radiation that the boiler will heat are based upon the following definitions:

1 square foot of hot water radiation equals

1 square foot of hot water radiation equals 150 B.T.U's.
1 square foot of steam radiation equals 240 B.T.U's.

Line loss in radiation systems may be slightly less due to the policy of covering pipes.

Otherwise the method is identical in sizing boilers, radiation, stokers and oil burners. Consult manufacturer as to the efficiency of his particular boiler.

FIGURING THE COST OF HEATING PER HEATING SEASON.

On the next page (page #9), we give a short cut method of figuring the cost of heating per season, by coal, oil, or gas.

The table gives several divisors. Different ones for different parts of the U. S. A., different ones for coal; for oil; for gas.

Take the B. T. U. HEAT LOSS, capacity required AT THE REGISTERS, and divide that figure by the divisor, for example, for coal. The result is the number of tons of coal required to heat a building having that heat loss, for an entire heating season. Multiply by the price of coal per ton, and you have the cost of heating with coal, per heating season. Similarly, to determine the cost of heating that particular building with oil, divide the B. T. U. loss at the registers, by the divisor for oil, and the result is the number of gallons of oil required to heat the building for the entire heating season. Multiply by the price of oil per gallon, and you have the cost of heating with oil. Similarly, divide the B. T. U. loss at registers by the divisor for gas, and you have the number of therms of gas required for the entire heating season. Get the cost of gas per therm (100,000 b.t.u.) from the gas company. Multiply the number of therms required per heating season by the price per therm, and you have the cost of heating per season, with gas as a fuel. With all of this information now available you are able to make a direct comparison of the difference in the cost of heating with coal, oil, or gas.

In the case of designed units (oil designed, or gas designed heaters), it is allowable to decrease the total thus obtained by either 10%, 15%, or 20%, depending upon the efficiency of the particular heater, and method of heat transmission to the rooms. Thus, if a standard boiler-burner unit is used, allow 10% reduction in the calculated cost of heating for the extra efficiency of the unit. If a furnace-burner unit, allow 15%. If a furnace-burner unit of the forced air type is used (a very efficient method of heat transmission) allow up to 20% reduction in cost of heating over the figures given by above method of calculation.

EXAMPLE:
Assume that the heat loss of the house (heat required at the registers) is 100,000 b.t.u. per hour.
FIND THE COST OF HEATING WITH:
a. Coal.
b. Oil.
c. Gas.
Assuming that the house is located in Chicago, Ill.

From the table given on the next page, we find that the divisor for Chicago, for coal is 6,376. Dividing 100,000. by 6,376, we get 15.68 tons of coal required per year. Multiplying 15.68 tons by the prevailing price of $6.00 per ton and we get $94.00, the cost of heating with coal per year.

For oil, we find that the divisor is 44.5. Dividing 100,000. by 44.5 we get 2250, the number of gallons of oil that will be burned per year. Multiplying by the prevailing price of oil per gallon, (7¢ per gallon) we get $157.50, the cost of heating per season with oil. With an oil designed forced air heating unit, this might be reduced as much as 20%. So, multiplying $157.50 by .80, we get $126.00, the cost of heating with oil per heating season, with an oil designed unit.

For gas, we find that the divisor is 39.7. Dividing 100,000. by 39.7, we get 2520 therms of gas. Multiplying 2520 by 10¢ per therm (average price), we get a cost of $252.00 for heating with gas, per season.

Assuming that a gas designed unit is to be used, we can reduce this figure by as much as 20%, hence, multiplying $252.00 by .80 we get $208.00, the cost of heating per heating season with gas fuel in a gas designed forced air heating system.
From the above it is easy to make a comparison of the cost of heating with coal, oil, and gas.

In the example given we find:

COAL	$ 94.00
OIL	126.00
GAS	208.00

Hence, oil is 34% more expensive than coal, and gas is 60% more expensive than oil; or gas is 114% more than coal.

Of course, the actual costs in your community will be different, based upon your prevailing costs of coal, oil, or gas.

It should be kept in mind that these figures are only estimates, based upon degree days, and upon the best obtainable data. The actual results obtained in any residence depend to a great extent upon the living habits of the family, and if the family will insist upon leaving windows open where the cold outdoor air can blow upon the room thermostats, leaving doors open all night, etc., these results will be wrong. Also, seasons vary from year to year, some years being colder, others warmer than others - hence, you should not guarantee what any person's heating cost is going to run per season. However, the above method gives reliable information as nearly as it can be calculated, from available data.

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In summary, keep in mind that the heat loss calculation is the basic factor in your costs. If you are to make money, you must know your costs exactly.

It is worth your while to study any method that will increase accuracy and reduce work.

THE CLIMATEMAKER SLIDE RULE

Manufactured by

THE CLIMATEMAKER SLIDE RULE CO.
Box 904
Bloomington, Ill.

FACTORS FOR FIGURING ANNUAL FUEL COSTS

STATE	CITY	OUTSIDE TEMP. FIGURED	COAL Divide B.T.U. Loss per Hour by Factor below to get Tons of Coal for Year	OIL Divide B.T.U. Loss per Hour by Factor below to get Gals. of Oil for year	GAS Divide B.T.U. Loss per Hour by Factor below to get No. of Therms for Year
Ala..	Birmingham..	5	12,880	89.9	67.9
Ariz.	Phoenix.....	30	13,840	96.8	86.4
	Flagstaff...	-10	3,665	25.65	22.9
Ark..	Hot Springs.	0	13,155	91.8	82.1
Cal..	San Francisco	40	4,356	30.4	27.2
	Los Angeles.	40	9,890	69.2	61.8
Colo.	Denver......	-15	7,230	50.5	45.1
D.C..	Washington..	0	7,665	53.7	48.
Fla..	Jacksonville.	25	20,850	145.8	130.2
Ga...	Atlanta.....	5	11,290	79.1	70.5
Ill..	Chicago.....	-10	6,376	44.5	39.7
	Springfield.	-10	7,303	50.9	45.4
Ind..	Indianapolis	-10	7,510	52.5	46.8
	Evansville..	0	10,440	73.1	65.2
Iowa.	Dubuque.....	-20	6,692	46.7	41.7
	Des Moines..	-10	6,190	43.3	38.7
Ky...	Louisville..	- 5	8,580	59.9	53.7
Kans.	Topeka......	-10	7,580	52.9	47.4
Me...	Portland....	- 5	5,160	36.2	32.3
Md...	Baltimore	5	7,075	49.6	44.3
Mich.	Detroit.....	-10	6,450	45.	40.3
Mass.	Boston......	0	5,780	40.5	36.1
Minn.	Duluth......	-25	4,922	34.4	30.8
	Minneapolis.	-20	5,660	39.7	35.4
Mo...	St. Louis...	-10	8,713	61.	54.5
N. Y.	New York City	10	5,613	39.3	35.1
	Albany......	-10	6,120	42.8	38.2
Nebr.	Lincoln.....	-15	6,825	47.8	42.6
N. J.	Atlantic City	5	6,194	43.3	38.7
Ohio.	Cleveland....	- 5	6,155	43.1	38.5
	Columbus.....	- 5	6,920	48.4	43.2
Ore..	Portland.....	10	6,745	47.2	42.2
Pa...	Pittsburgh...	- 5	7,040	49.3	44.
	Philadelphia.	10	6,065	42.5	37.9
S.D..	Sioux Falls..	-30	6,515	45.6	40.6
Tenn.	Nashville....	0	9,870	69.	61.7
	Knoxville....	0	9,960	69.7	62.2
Texas	El Paso......	10	15,700	109.9	98.
	San Antonio..	20	18,370	128.6	115.
Utah.	Salt Lake City	- 5	7,001	49.1	43.7
Va...	Richmond.....	10	7,915	55.4	49.5
	Norfolk......	10	8,960	63.1	56.
Wash.	Seattle......	15	5,340	37.35	33.3
	Spokane......	-15	6,980	48.9	43.7
Wis..	Green Bay....	-20	5,490	38.45	34.3
	Milwaukee....	-10	5,435	38.	33.9
Man..	Winnipeg.....	-30	4,485	31.35	28.
Ont..	Toronto......	-10	5,175	36.2	32.4

EXAMPLE *

120,000 B.T.U. per Hour at Chicago, Illinois.

120,000 | 6,376 | 18.8 Tons of Coal.

THE CLIMATEMAKER SLIDE RULE CO.
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