

# Historical Data Tabulation (Tab = History)

## 1. Specify Labels and Units for data.

You may specify the labels and units for the period, and the dependent and independent variable. Although degree days (DD) may be calculated for the period using the average temperature data on the weather tab, you may enter DD as an independent variable here. This may be useful when you have gas billing data and heating degree days from the gas bills.

## 3. View your data.

Each variable entered can be viewed on the time sequence graph for any period specified by the date or sequence number.

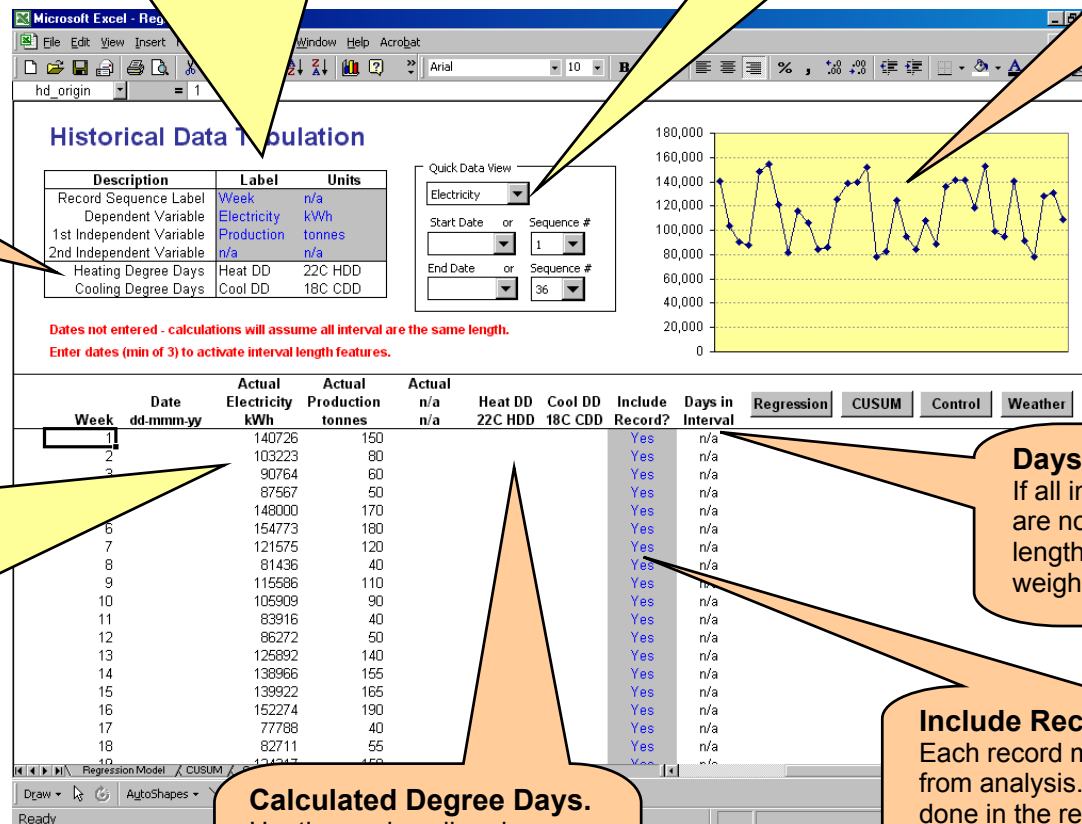
## Time Series Graph

Date is plotted for the specified interval for inspection. This graph can be copied to a new page for further manipulation

**Calculated Cooling Degree Days.**  
Cooling degree days

## 2. Enter data.

For each period, as identified by the record sequence label, you may enter data for a **date**, **one dependent variable** (electricity in this example), and up to two dependent variables (production in this example).



## Calculated Degree Days.

Heating and cooling degree days are calculated for the intervals using the dates entered and the degree days calculated on the weather tab.

## Days in Interval

If all intervals (weeks in this example) are not the same length, the interval length is calculated and used to weight the regression analysis

## Include Record? (Yes or No)

Each record may be excluded from analysis. This is typically done in the regression analysis – initially all values are YES

# Linear Regression Analysis Tool (Tab = Regression)

**Selected Data**  
The data for the selected period is displayed in a scrolling window

**4. Tune by excluding data points**  
Place your cursor on the row and use this button to exclude or include points

**4a. Edit the data for the current row.**  
Place the cursor on the row and

**5. Tune by adjusting degree-day base temperatures**  
As per weather tab.

**1. Select a period for regression analysis.**  
Begin the regression analysis by selecting a start date and duration – it is often helpful to set the start date and add points one at a time by extending the duration.

**2. Select the independent variable**  
Each of the two variable input and CDD and HDD can be selected.

**3. Select X-Y or time series graph view**

**Scroll through selected data**

**Graphical Analysis**  
Graph may be configured as an X-Y graph dependent vs. independent, or as a time series of both independent and dependent variables. Graph axis are labeled accordingly and include the term (/day) when a time weighted regression is used.

**Regression Model**  
The regression model is displayed. Slope and intercept are calculated along with the regression coefficient. If the interval lengths are not equal, a time weighted regression will be used and units will include the term per day (/day)

Week	Date	Electricity kWh	Production tonnes	Include
1		140726	150	Yes
2		103223	80	Yes
3		90764	60	Yes
4		87567	50	Yes
5		148000	170	Yes
6		154773	180	Yes
7		121575	120	Yes
8		81436	40	Yes
9		115586	110	Yes
10		105909	90	Yes
11		83916	40	Yes

**Regression Model**

Dependent Variable: Electricity  
Independent Variable: Production  
Slope: 514.9 kWh/tonnes  
Intercept: 61,116 kWh  
R<sup>2</sup>: 0.997

# CUSUM Analysis Tool (Tab = CUSUM)

**1. Establish a baseline model for the CUSUM.** Using the regression analysis develop a model for the baseline period. Determine an equation in terms of slope and intercept.

**2. Copy the model from the regression analysis.**

**3. Select a period for the control chart.** Specify the start and duration of the control chart – by slowly incrementing the duration you can simulate the progress of consumption

**CUSUM Chart**  
By definition the baseline period will have a slope of zero - in this example the first 11 weeks. Note the changes in slope of the CUSUM. Each change signals a change in energy consumption

Week	Date	Actual Electricity kWh	Production tonnes	Baseline Predicted kWh	Difference (Act - Base) kWh	CUSUM kWh
1		140,726	150	138,345	2,381	2,381
2		103,223	80	102,305	918	3,299
3		90,764	60	92,008	-1,244	2,055
4		87,567	50	86,859	708	2,763
5		148,000	170	148,643	-643	2,121
6		154,773	180	153,791	982	3,103
7		121,575	120	122,899	-1,324	1,779
8		81,436	40	81,710	-274	1,505
9		115,586	110	117,751	-2,165	661
10		105,909	90	107,454	-1,545	2,206

**Calculated Data**  
The data used to construct the CUSUM chart is displayed in this pane and may be view and scrolled.

# Control Chart Tool (Tab = Control)

**1. Establish a model for the current pattern.**  
Using the CUSUM and regression analysis select a period for the current pattern. Use the regression analysis to determine an equation in terms of slope and intercept.

**3. Select a period for the control chart.**  
Specify the start and duration of the control chart – by slowly incrementing the duration you can simulate the progress of consumption

**Control limits displayed on the control chart**  
In this example the current pattern is week 19 to 25 – establishing the control limits.

**2. Copy the model from the regression analysis.**

**4. Set the control limits**  
Using the range the data exhibited during the current pattern set the upper and lower control limits.

**Calculated Data**  
The data used to construct the control chart is displayed in this pane and may be view

Week	Date	Actual Electricity kWh	Production tonnes	Control Chart Predicted kWh	Difference (Act - Pred) kWh
1		140,726	150	125,171	15,555
2		103,223	80	93,686	9,537
3		90,764	60	64,691	6,073
4		87,567	50	80,193	7,374
5		148,000	170	134,166	13,834
6		154,773	180	138,664	16,109
7		121,575	120	111,677	9,898
8		81,436	40	75,695	5,741
9		115,586	110	107,180	8,406
10		105,909	90	98,184	7,725

# Target Analysis (Tab = Target)

## 2a. Elimination of High Usage

Using the regression analysis tool exclude points representing high usage to establish a new model – use this as a target.

## 2. Develop Target Models

This page provides five methods of determining a target performance model. Each model is represented by an equation of the form  $y=mx+b$ .

## Baseline data points.

The baseline data points used to derive the model are plotted.

## 2b. Best fit of Improved Performance

Use data from a period after energy savings actions are taken to reduce consumption.

## 2c. Best Historical Performance

Inspect the historical data using the regression analysis &/or/CUSUM, to determine the best historical performance.

## 2d. Specific Reduction

The slope and intercept are reduced by a percentage &/or absolute amounts. The reductions should be linked to specific actions that improve the efficiency (reduce slope) or reduced baseload (reduced intercept).

## 2e. Arbitrary Percentage Reduction

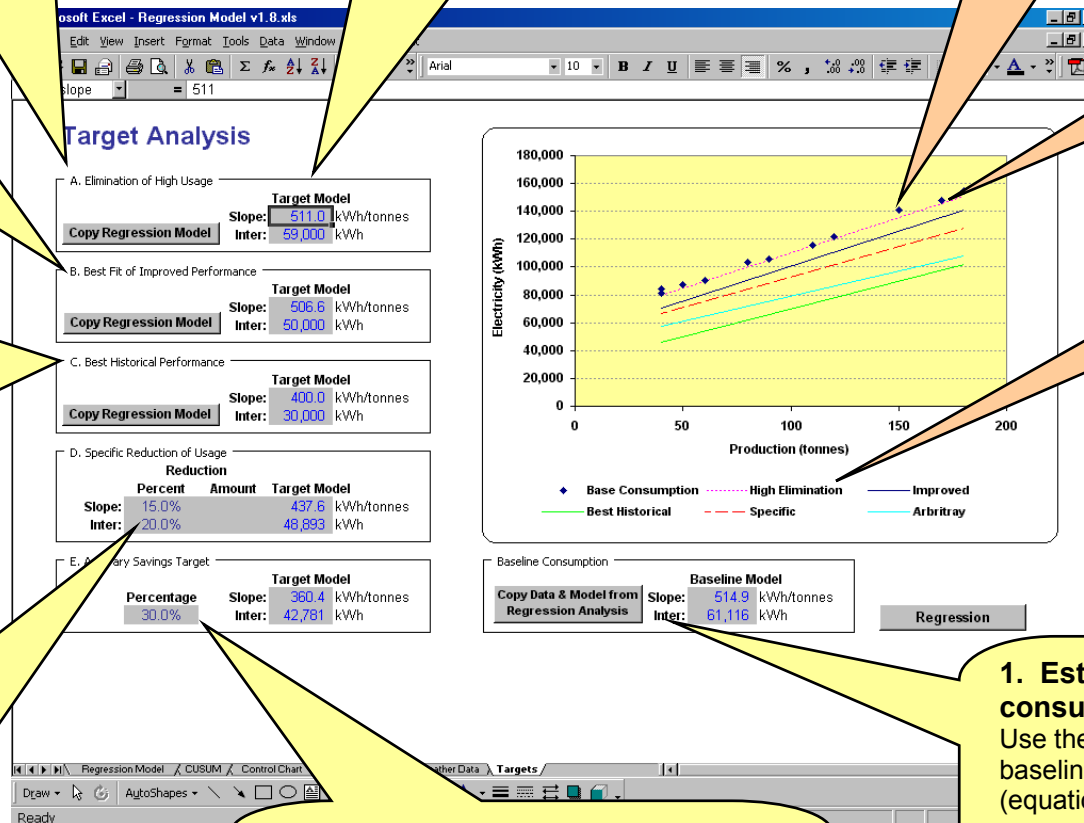
The slope and intercept of the baseline model are reduced by the percentage specified. This is the least desirable model as it may not be practically attainable.

## Baseline

The baseline model is plotted as a line on the graph.

## Target models

Each of the five target models are plotted using the equations specified.



## 1. Establish baseline consumption.

Use the regression analysis to select a baseline period and determine the model (equation) to represent the baseline consumption. Use the Copy button to copy data and model onto this page.

# Historical Temperature and DD Calculation (Tab = Weather)

**1. Enter dates.**  
Enter a valid date for each day in the period covered. (max capacity is 2 years = 730 days)

**2. Enter average daily temperature.**  
Enter an average temperature for each day (max capacity is 2 years = 730 days)

**4. Select cooling base temperature.**

Use the up/down arrows to select an appropriate base temperature for cooling degree days. This is typically 22C, but may vary depending upon building type and cooling loads. This value may be adjusted from the regression analysis page in order to find the balance point temperature for the cooling systems.

**3. Select heating base temperature.**

Use the up/down arrows to select an appropriate base temperature for heating degree days. This is typically 18C, but may vary depending upon building type and internal heat sources. This value may be adjusted from the regression analysis page in order to find the balance point temperature for the building

**Calculated Cooling Degree Days.**

Cooling degree days are calculated for each day and as a running sum for the entire period.

**Calculated Heating Degree Days.**

Heating degree days are calculated for each day as a running sun for the entire period.

Date	Ave Daily Temperature	HDD	Sum of HDD	CDD	Sum of CDD
01-Jan-99	4.99	26.99	26.99		
02-Jan-99	2.24	19.76	46.75		
03-Jan-99	5.77	16.23	62.98		
04-Jan-99	-1.23	23.23	86.21		
05-Jan-99	1.69	20.31	106.52		
06-Jan-99	7.68	14.32	120.84		
07-Jan-99	3.6	18.4	139.24		
08-Jan-99	-0.1	22.1	161.34		
09-Jan-99	-0.86	22.86	184.2		
10-Jan-99	-2.68	24.68	208.88		
11-Jan-99	-8.75	30.75	239.63		
12-Jan-99	-7.2	29.2	268.83		
13-Jan-99	-6.88	28.88	297.71		
14-Jan-99	-10.22	32.22	329.93		
15-Jan-99	-9.61	31.61	361.54		
16-Jan-99	-9.38	31.38	392.92		
17-Jan-99	-7.08	29.08	422		
18-Jan-99	-4.9	26.9	448.9		
19-Jan-99	-4.13	26.13	475.03		
20-Jan-99	-6.23	28.23	503.26		
21-Jan-99	-5.85	27.85	531.11		
22-Jan-99	-8.84	30.84	561.95		
23-Jan-99	-3.45	25.45	587.4		
24-Jan-99	-3.01	25.01	612.41		