Change over Time Analysis (CoTA) Viewer

Sub-national energy consumption

*Understanding change over time
for small areas*

-User Guide-

URN:11D\672

Contents

Contact Information

For further information or for copies of the CD please contact Will Rose using the following contact:

Telephone: 0300 068 6909
E-mail: will.rose@decc.gsi.gov.uk

Or write to the following postal address:
Will Rose
Area 6B
Energy Statistics
Department of Energy and Climate Change
3 Whitehall Place
London, SW1A 2AW

Copyright

Before using CoTA Viewer please note that it contains data and information derived from Ordnance Survey, Department of Energy and Climate Change, and Office for National Statistics sources. All are protected by © Crown copyright. You may need an Office for Public Sector Information licence if you wish to re-use the data, see the following link for further information http://www.nationalarchives.gov.uk/doc/open-government-licence/open-government-licence.htm. You will not be able to re-use any data from the Neighbourhood Statistics website without this licence. The contents of this User Guide are also © Crown copyright.

Acknowledgements

The data used in CoTA Viewer were supplied by the Office for National Statistics and the Department of Energy and Climate Change. The product has been developed by the Office for National Statistics with consultation from several local authorities.

Summary

Change over Time Analysis (CoTA) Viewer is a visual tool which assists the analysis of change over time for small areas.

Electricity and gas use data spanning 2005 to 2009 is used to visualise change over time for the following geographic boundaries in England:

- English Region;
- Local Authority (LA);
- Lower Layer Super Output Area (MLSOA);
- High and low consuming groups of MLSOAs
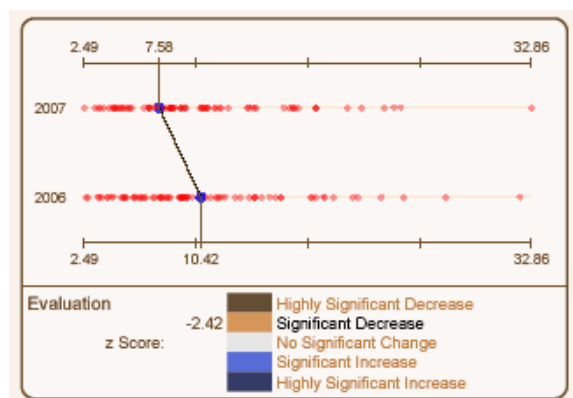
CoTA Viewer supports the work included in a Neighbourhood Statistics Strategy[1] published by ONS in December 2008 and updated in October 2009 called *'Analysing Change over Time for Small Areas: A Strategy'*. Please see Appendix A for a description of the background to this project.

The tool consists of three different screens: 1) The Regional View 2) The LA View and 3) The Group Analysis View:

1) The Regional View
Has my local authority changed compared to others in the region?
This screen shows the regional distributions of electricity and gas consumption and number of meter points, and how they may have changed from 2005 to 2009 using box plots and summary tables. You may select the local authority which you wish to analyse at this stage and compare its distribution to the regional distribution.

2) The LA View
Has there been much change <u>within</u> a local authority? And which MLSOAs have experienced <u>significant</u> change?
For the local authority of your choice, this screen visualises the MLSOA data distribution for electricity and gas consumption and number of meter points, and any change over time using maps, histograms, scatterplots and lineplots. A significance test also evaluates whether any visible change for individual MLSOAs is statistically significant.

3) The Group Analysis View
Is the gap closing between the high consuming MLSOAs and the rest? And, is this <u>gap</u> <u>significant</u>?
This page allows you to split a chosen local authority into groups (such as by a pre-defined electricity and gas conusmption threshold). The difference in change over time for these two groups is then analysed using box plots and a summary table. You may then see if there is a difference between the two groups of MLSOAs, and whether it is statistically significant.
Please see Appendix B for a discussion of the data used in CoTA Viewer.

---

[1] Full references can be found at the end of this User Guide.

CoTA Viewer: Getting Started

Running the CD

CoTA Viewer uses interactive graphics, and you may need to install a Scalable Vector Graphics (SVG) plug-in for your browser to view it. Many users will already have these plug-ins installed but if not free SVG plug-ins are available. Please see the Requirements section in Appendix C for more information.

The CD contains all the relevant boundary and data files work. It may be run directly off the CD, using Windows Explorer (or equivalent). However, it will perform more efficiently if you copy the entire CD contents across to a local hard-drive or network drive.

To run CoTA Viewer double-click on the 'index.html' file. Once you have CoTA Viewer open, you can get it to fill the whole screen by pressing the F11 key. Then when you wish to return it to its original size, simply press F11 again.

How to Use CoTA Viewer

A. Step-by-Step

CoTA Viewer is fairly intuitive to use, but to make the best use of it please follow these step-by-step instructions for the first use.

Simple examples for most steps are provided and are an optional read, but may be useful if you need additional help to interpret your analyses.

Information on how specific parts of CoTA Viewer work are provided in the blue boxes, and more detail on some of the methods used in the green boxes.

A quick reference guide to the screen functionality is also provided in Section 2: Screen Interface. Appendix D contains some simple information if you wish to print or extract images from CoTA Viewer.

A.1 Data selection screen

When CoTA Viewer first loads you are presented with a drop down box to select which energy use variable you would like to use. Click on the drop down arrow and select a variable from the following list:

- Ordinary domestic electricity
- Economy 7 electricity
- Industrial and commercial electricity
- Domestic gas
- Industrial and commercial gas
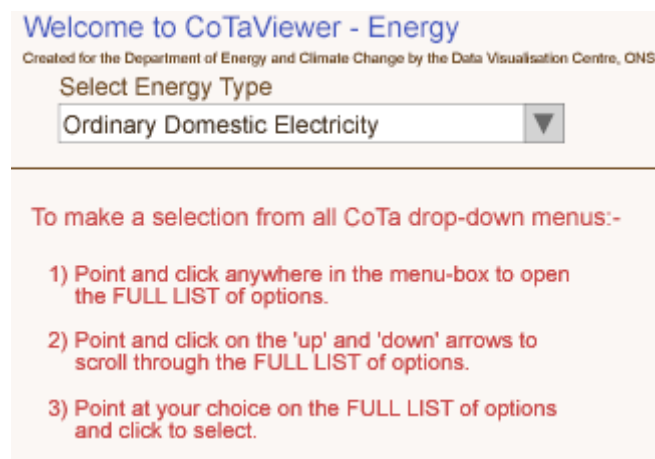
Once you have selected a variable, you will be prompted to select a start year and an end year for analysing change over time. CoTA will compare the changes in selected variable between the two years.

Click on both drop down menus and select from the years available. Once you have selected both years, the box will identify which measures are available for that year.

Once you are happy with your selections, click on 'Load Data' button and CoTA Viewer will then load your selections. This may take a couple of minutes depending on the speed of your computer.

A.2 Using the data buttons.

Using the buttons

The data displayed on the screen(s) will depend on which button is selected:

EXAMPLE: the change in 'Consumption per Meter' button has been selected – as seen below; this highlights the button in green.

Selecting a button on the 'No. of Meters' row will show total number of meters count .

Selecting a button on the 'Consumption' row will always show total consumption data for the selected variable.

Selecting a button on the consumption per meter will show average consumption per meter point, calculated for the selected variable. This is calculated by dividing the total consumption by the total number of meter points.

Selecting buttons in either the 2005 or 2008 column will show the corresponding year's data.

The buttons on the CHANGE column will always relate to the change between the two selected years.

Screen One. REGIONAL VIEW
What is the context for small area change?

The examples here work at the regional distribution of meter points and ordinary domestic electricity, along with the change from 2005 to 2008 using box plots and summary tables.

You can also select the local authority which you wish to analyse at this stage and compare its distribution to the regions, and observe how conditions may be changing around your area. You can reset your analysis at any time using the 'Reset' button located in the bottom right of the tool.

Step 1.1 Examine the regional picture of Ordinary Domestic Electricity consumption

You can examine Ordinary Domestic Electricity consumption distributions to start to build a regional picture to provide a context for analysis. You may like to look at the 'Using Boxplots' and 'Summary Tables' information box on page 10.

Step 1.1 EXAMPLE: the number of ordinary domestic electricity meter points for 2008 is selected.
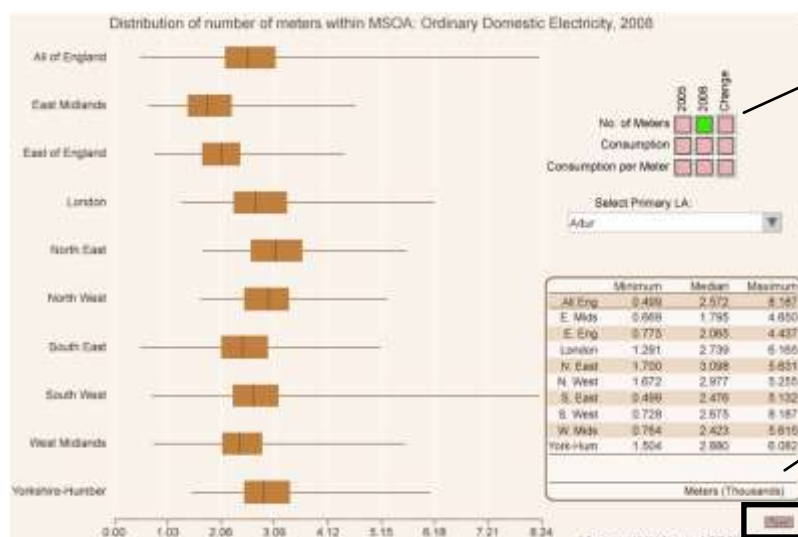
1. Click once to select a year of data for the 'No. of meters' to look at, i.e. 2008.

2. The summary table will then display the figures which underpin the box plots.

3. Regional box plots will be produced to show the distribution of number of ordinary domestic electricity meter points of all MLSOAs in each region for the year selected on the button panel.

Step 1.2 Examine the regional picture of electricity or gas consumption

As well as the number of meters, you may examine the distribution of electricity or gas consumption – either by total consumption or by average use per meter.

Step 1.2 EXAMPLE: Consumption for 2008 has been selected, showing the distribution of total domestic consumption for all the MLSOAs within each region for 2008.
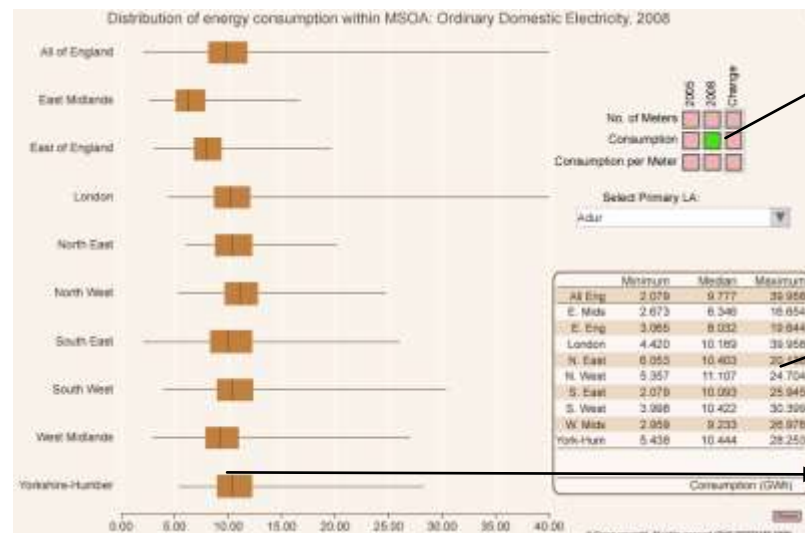
1. Click once on the relevant button to examine either the total consumption or average consumption.

2. The summary table will be immediately updated.

3. The box plots will also change to show the data distribution for the chosen variable.

Choosing total consumption or average consumption

CoTA Viewer visualises change using <u>either</u> total consumption per region or average use per meter point in particular region – it is up to you to decide which is most appropriate for the area you wish to analyse.

There are issues associated with using one rather than the other, largely depending on factors such as the demographic of the LA and volatility of MLSOAs within it. The decision on which one to use should be based on two considerations:
  1) The purpose of your analysis
  2) The issues to consider related to the data.

Using Box plots

The box plots display the distribution of the meter point or consumption data, dependent on your data selection from the button panel, for each of the MLSOAs within each region.

The box plots used in CoTA Viewer are not exactly the same as those produced in statistical packages such as SPSS. The main difference is that the ends of the lines (whiskers) extend to the minimum and maximum data values, with each whisker representing 25 per cent of the data. Outliers are therefore not shown on these plots. The box itself contains 50 per cent of the data, the line in the middle being the median (middle) MLSOA. The first edge of the box represents the first quartile (Q1) of the data, and the top edge the third quartile (Q3).

For more information on how to interpret box plots please refer to Appendix B (page 37) of the Strategy. Full references can be found at the end of this User Guide.

Summary Tables

The data shown in the table is dependent on the selection you make on the button panel. It displays the summary statistics which underpin the box plots. That is the minimum and maximum data values (labelled on the table Min and Max), the median (Med).

Step 1.3 Examine change over time

By selecting one of the 'change' buttons the distribution of change for the corresponding meters or consumption data will be displayed for the years initially chosen.

Step 1.3 EXAMPLE: the change in consumption per meter between 2005 and 2008 is displayed, calculated as the difference in the average consumption per meter values for the two years.
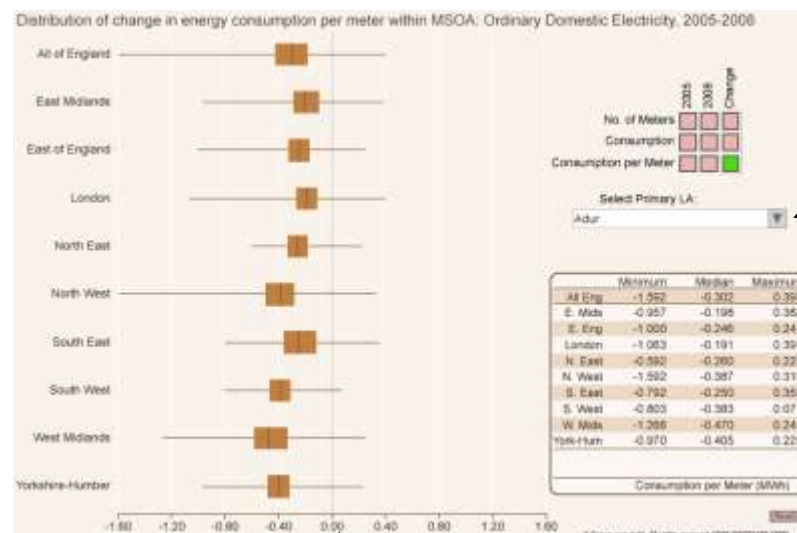
1. Click one of the change buttons to see change in either number of meters, total consumption or average consumption per meter.

2. The box plot and summary table will be updated to show 'change' data.

3. The centre line marks 'zero' change. MLSOAs distributed on the negative axis have seen a decrease in average consumption, and those on the positive axis have seen an increase.

Step 1.4 Select a local authority

Here you may select the local authority of your choice for further analysis.

Step 1.4 EXAMPLE: Warwick is about to be selected from the drop-down list.
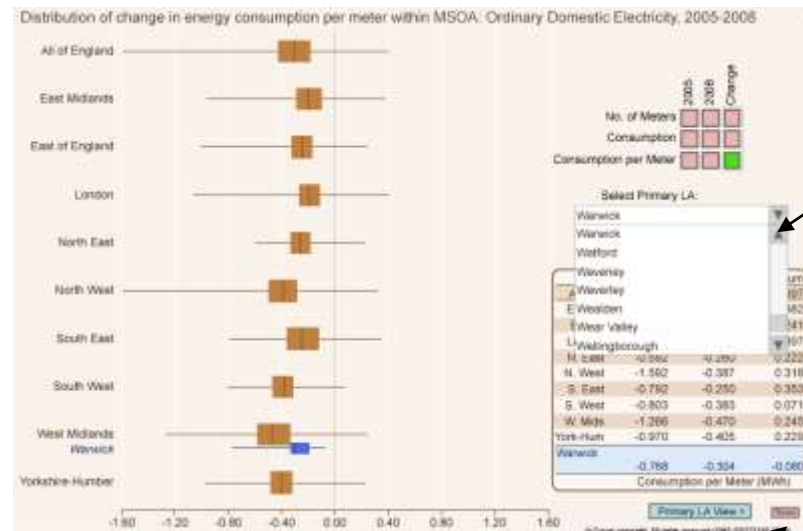
Click on the down – arrow to reveal a drop–down list of all local authorities. Find the LA you are interested in analysing and click once to select it.

Hint: Type in the first two letters of the LA you want to select to find it in the list more easily.

If you wish to look at different years or variables click the 'Reset' button at any time to start a fresh analysis.

Step 1.5 Display the local authority on the regional picture

Step 1.5 EXAMPLE: Warwick distribution of the change in average consumption per meter point for 2005 to 2008 has been added to the West Midlands box plot, and to the bottom of the summary table.
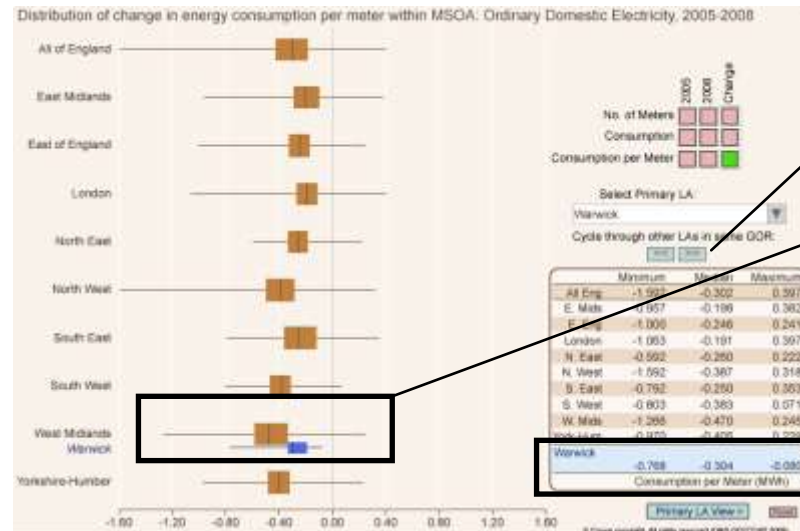
1. Scroll through to see the data for other LAs in the same region.

2. The distribution of the MLSOAs in the LA will be added to the box plots next to the relevant GOR.

3. The corresponding summary data for your LA will also be added to the bottom of the summary table.

You can easily see how the selected LA fares compared to other LAs in the region by clicking on the scroll buttons (2. in the figure above).

The scroll buttons move alphabetically through the other LAs in the region and will update the blue box plot and the summary table. It does not update the primary LA that you selected.

When you have finished examining the Regional View, select the 'Primary LA View' button(located in the bottom right hand corner of the tool) to move to the next stage of the analysis (pictured below).

Primary LA View >

13

Screen Two LOCAL AUTHORITY VIEW

Has there been much change <u>within</u> the local authority?

Investigate how the overall local authority and the individual MLSOAs within it are changing over time.

CoTA Viewer visualises the MLSOA data distribution for electricity and gas consumption or number of meter points, and any change over time using maps, histograms, scatter plots and line plots. A significance test also evaluates whether any visible change for an individual MLSOA is statistically significant.

Using the buttons

As with the Regional View screen the data displayed on the Local Authority view is dependent on the data selection you make on the button panel.

As well as the 9 standard buttons seen on the Regional View screen, you will also notice that there are two types of additional button; these extend the analysis.

In summary:
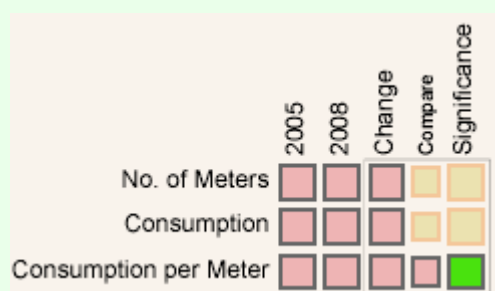
The COMPARE buttons produce a scatter plot to compare the data for 2005 against 2008 for each MLOSA.

The SIGNIFICANCE buttons produce a line plot to visualise how much the MLSOAs have changed over time.

You will see that sometimes the buttons are 'greyed – out' and are not selectable. This is because you need to examine the overall change before looking at the comparison and significance test. The buttons encourage you to perform the analysis in this order.

Step 2.1 Examine spatial patterns on a map

Again, the example for this section is Warwick LA using ordinary domestic electricity consumption data for 2005 and 2008.

By selecting any of the data buttons – No. of Meters, Consumption or Consumption per Meter, for either of the years, you may examine spatial patterns for your local authority which you selected on the Regional View page.

Step 2.1 EXAMPLE: Energy consumption for 2008 for Warwick has been selected. The map shows the local authority and its constituent MLSOAs, and is shaded to show where MLSOAs containing high and low ordinary domestic electricity consumption are located.

4. Click to zoom and pan around the Local Authority.

1. Select the data you wish to view.
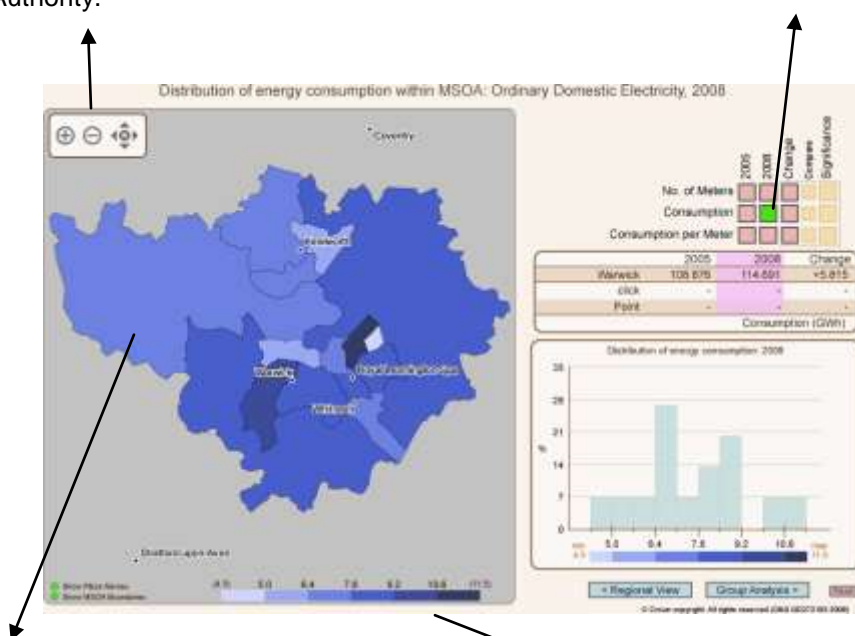
2. Map of the selected Local Authority with constitutional MLSOAs and town locations is shown.

3. Corresponding legend is shown here. Map is shaded according to the data selected to view on the button panel.

Please note: If you wish to select another LA, return to the Regional View page or select the 'Reset' button to start a fresh analysis.

Step 2.2 Examine the data distribution using a histogram

You may also examine the data distribution for your local authority.

Step 2.2 EXAMPLE: Electricity consumption for 2008 has been selected. The summary table shows total electricity consumption for both 2005 and 2008, and the change over time (2005-2008). It shows that overall electricity consumption has increased over time for Warwick 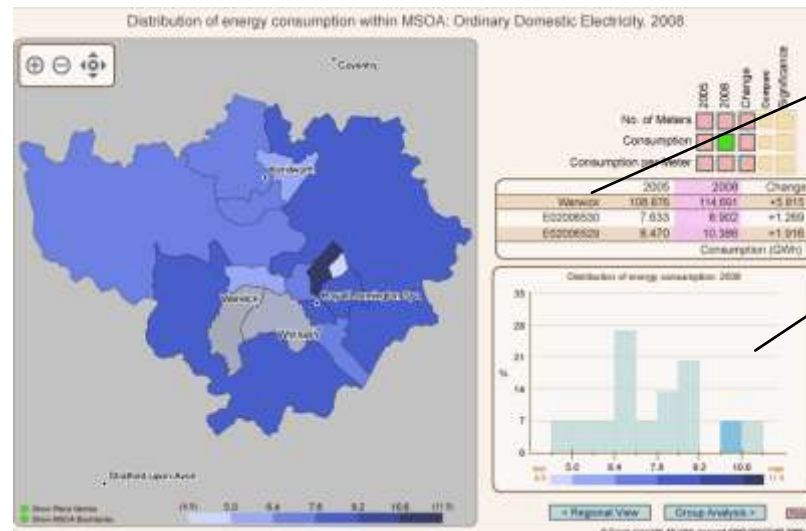by 5,815 kWh. The histogram shows the % of MLSOAs which have the same electricity consumption as each other for 2008 (according to the scale on the x-axis).

1. The overall local authority data is shown at the head of the summary table.

2. The distribution of the data for the MLSOA in the LA is shown in the histogram.

3. Please note: the values contained in the last bar will contain values up to the maximum shown.

Histograms

A histogram is a specialised form of bar chart. They are used to visualise the shape of the distribution of the values of a variable. A histogram shows the relative concentration of observations across the complete range of values that a variable takes by subdividing the variable into equally sized value ranges (commonly referred to as "bins") along the x-axis. The number or percentage of observations in each value range is then plotted on the y-axis.

Histograms provide a rapid visual impression of the shape of a statistical distribution. This is particularly useful if you need to decide whether a distribution appears to have particular characteristics (for example if it is normally distributed).

For more information on histograms please refer to 'Creating Common Statistics' on the Neighbourhood Statistics Analysis and Guidance toolkit. Full references are at the end of this Guide.

Step 2.3 Examine MLSOAs within the local authority using 'point and click'

You may locate data values and location for individual MLSOAs to see how small areas within the local authority are faring.
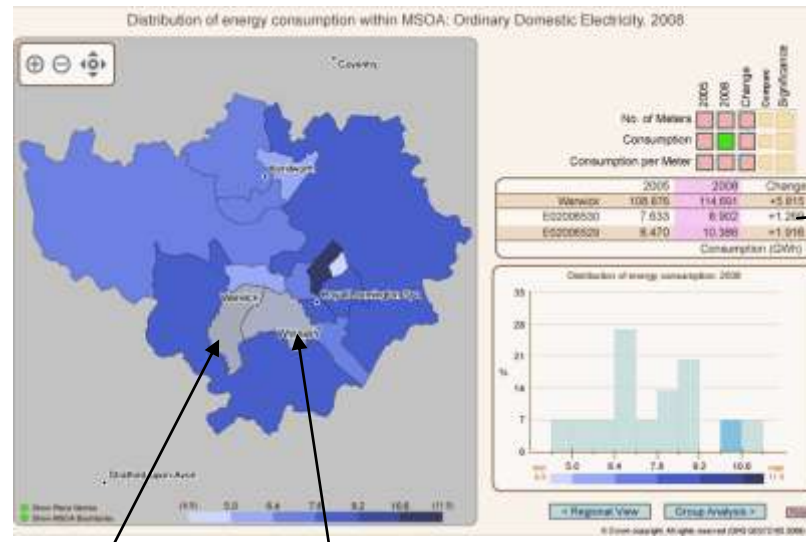
1. Select the MLSOA you with to view.

For the 'Point and click' MLSOA identification hover the cursor over the map to identify an individual MLSOA in the summary table. Click once to hold that MLSOA in the table. Hover <u>again</u> and point at any MLSOA you wish to compare with the MLSOA 'held' in the table.

Step 2.3 EXAMPLE: MLSOAs E02006530 and E02006529 have been selected within Warwick and added to the summary table by 'pointing and clicking'.

Step 2.4 Examine change over time for your local authority and its MLSOAs

The 'Change' buttons allow you to examine the change between the two years of data for total consumption, number of meters or average consumption per meter point.

Step 2.4 EXAMPLE: change in electricity consumption has been selected for Warwick. The map is shaded to show if MLSOAs have seen a decrease or increase in consumption over time. The histogram shows the percentage of MLSOAs which have seen a similar change (denoted by the scale on the axis).

1. Select one of the variables.

2. The consumption and change data for the LA and MLSOA selected will be shown in the summary table.

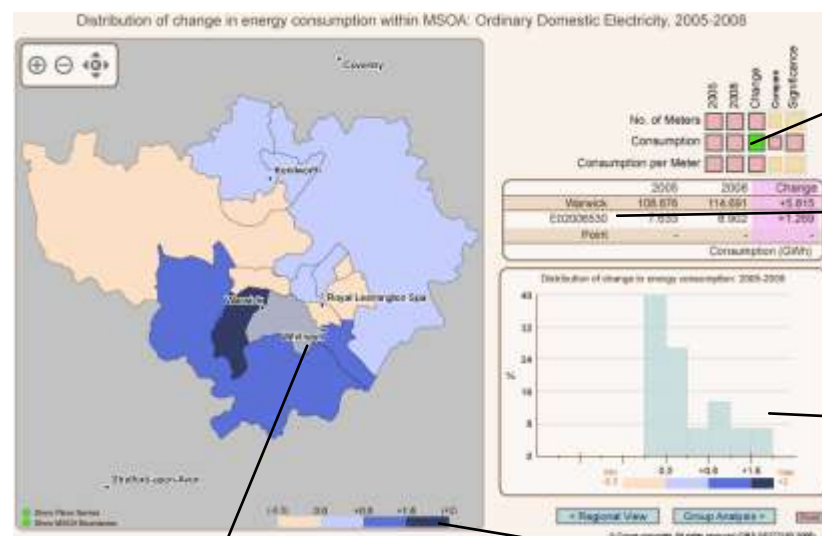3. Histogram of the change between 2005 and 2008 will be shown in the analysis panel.

For the 'Point and Click' MLOSA identification hover the mouse cursor over the map to identify an individual MLSOA in the summary table. Click once to hold that MLSOA in the table. Hover <u>again</u> and point at any MLSOA you wish to compare with the MLSOA 'held' in the table.

4. The map is coloured according to whether there has been an increase (BLUE) or decrease (BROWN).

Interpreting Histograms of Change

The histograms show the distribution of the difference in the data between the two years for each MLSOA.
How to interpret the histograms of change:

Please note: the values contained in the last bars will contain any greater than (>) values as well.

Negative values indicate a DECREASE over time and are shaded BROWN.

Positive values indicate an INCREASE or ZERO CHANGE over the time and are shaded BLUE.

Colour shading used for map.

Step 2.5 Compare the two years of data using a scatter plot

The 'Compare' buttons allow you to compare the data for selected time period for total consumption, number of meters or average consumption per meter point.

Step 2.5 EXAMPLE: data for average consumption per meter point is compared for 2005 and 2008. Most MLSOAs are located below the 45-degree line, indicating that more MLSOAs have seen a decrease in average consumption than an increase.
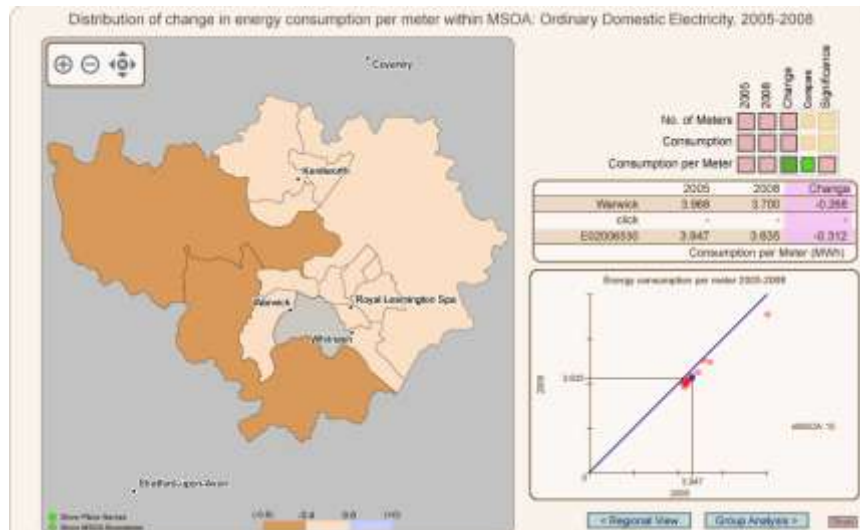
1. Select one of the COMPARE buttons.

2. The overall LA and any selected MLSOA data will be shown in the summary table.

3. A scatter plot will be shown in the analysis pane, with the MLSOA selected on the scatter plot or map being highlighted.

The map remains the same as previous, but you may 'point and click' at any MLSOAs you wish to identify data and change for.

Scatter plot

The data are displayed on a scatter plot as a collection of dots to represent MLSOA data points. The value of 2005 determines the position on the x–axis and the value of 2008 determines the position on the y–axis.

It is interesting to see if an MLSOA is located above or below the 45-degree line (the line which intersects the graph at a 45-degree angle). As this indicates whether there has been an increase or decrease in the respective data over time.

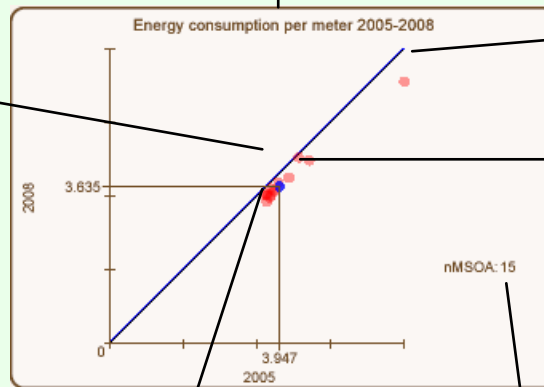An MLSOA identified on the map will be identified on the scatter plot and vice versa. Hovering over a data point will allow the MLSOA to be identified in the map in red and the summary table*. This is useful for identifying outliers on the scatter plot.

MLSOA data points above the 45-degree line have seen an INCREASE over time.

45-degree line

MLSOA data points below the 45 – degree line have seen a DECREASE over time.

Energy consumption per meter 2005-2008

MLSOAs close to the line indicate that there has been little change between the two years.

nMLOSA denotes the number of MLSOAs in the sample.

* Multiple data points
Please note that the darker coloured dots on the scatter plot represent multiple MLSOAs with the same value. In these instances the MLSOA identified (by hovering over the MLOSA data point to identify it on the map or summary table) will only be the top level MLSOA. However this is still a very useful function for identifying the outlier MLOSAs on the scatter plot which are usually only single data points, and so unaffected by this.

Step 2.6 Use a line plot to analyse change over time for individual MLSOAs

The 'Significance' buttons allow you to analyse the data for time 1 against time 2 for the total consumption, number of meter points or average consumption per meter point data by doing two things:
- a) producing a line plot
- b) computing significance test results for an individual MLSOA change over time, and shading the map accordingly (explained in more detail on the next page)

Step 2.6 EXAMPLE: The line plot shows that the MLSOA selected has seen a decrease in average electricity consumption between 2005 and 2008.
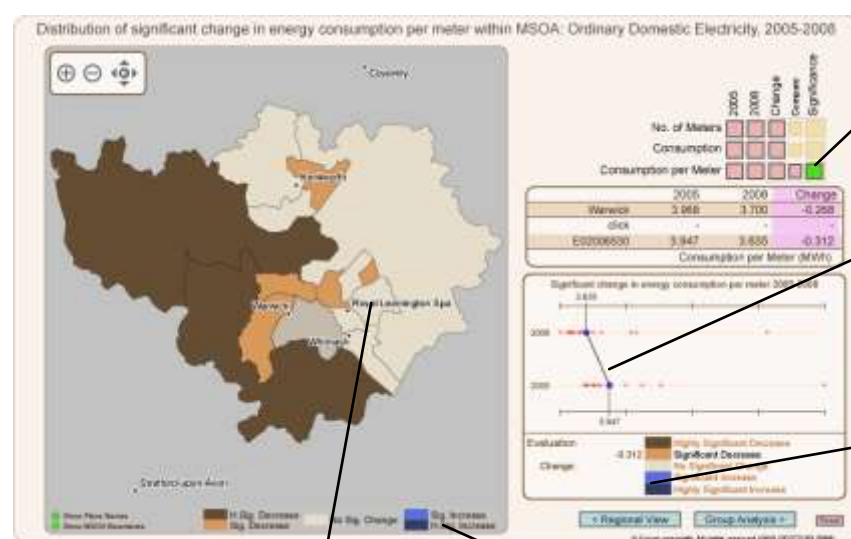
1.Select one of the SIGNIFICANCE buttons.

3. A line plot of the data for both years will be produced in the analysis.

4. The results of significance test for individual MLOSAs are computed and evaluated here.

2. Hover over map to identify MLSOA in the summary table and line plot, and to show the individual MLOSA z-score.

5. Map shaded according to significance test results.

Line plots
Line plots display individual MLOSA data for each year of data on two separate lines. Each dot represents an MLSOA (although darker dots mean that more than one MLSOA has the same value). Hovering over an MLSOA on the map will see it being identified on the line plot with a connecting line.
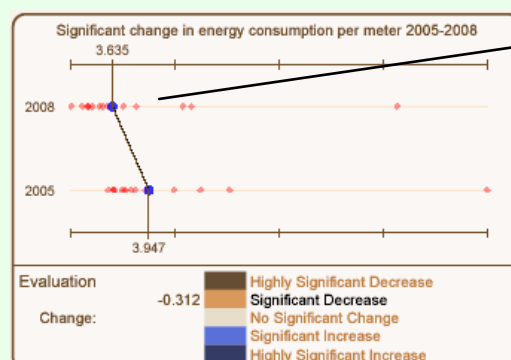
Darker coloured dots indicate more than one MLSOA with the same value.

A line will link the data points for the MLSOA selected on the map. The line indicates the direction of any change.

21

Step 2.7 Find whether individual MLSOA change is statistically significant

The line plot indicates the direction of change for individual MLSOAs within the local authority, and beneath the line plot the results of a significance test are computed and evaluated as well.

The test result can tell us whether change seen for an individual MLSOA is statistically significant, based on the assumptions used in the Standardised Difference Method. The map is then shaded accordingly.

The results from the significance test are evaluated on the screen.

This is the z-score value for the MLSOA calculated using the Standardised Difference Method. Any value greater than: ±2 = significant, ±3 = highly significant.
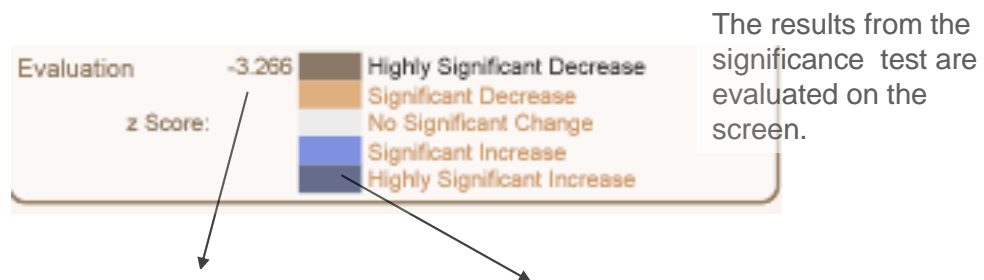
Colour key used to shade the map – indicating which MLSOAs have seen a non/significant change.

Note: If you go back to select the Compare button at this stage you may compare the significant change map with the scatter plot shown in Step 2.5

Step 2.7 EXAMPLE: the selected MLSOA had seen decrease in average energy consumption per meter point. The test statistic computed is -3.266 which is greater than 3, meaning that this decrease is Highly Significant according to our test.

Standardised Difference Method

This is a standard statistical procedure to test significant change for a small area. The test uses a standardised measure which takes into account that repeated measures were obtained for a small area at two time points. More specifically it can be used to test if the change in count or rate is statistically different from zero.

The test statistic is computed using the change for the small area divided by an estimate of the standard deviation of change for all the small areas in the local authority.

For more information on this method please refer to the Strategy Appendix B.

When you have completed this analysis click the 'Group Analysis' button to go to the next stage (pictured below):

Group Analysis >

Screen Three GROUP ANALYSIS VIEW
# Split your area into groups for analysis

On this screen you may split the MLSOAs in your local authority into 'high consuming[2]' and 'low consuming' groups in order to answer questions such as *is the gap closing between the high consuming MLSOAs and the rest?*

It is not essential to split your area into groups; however it is useful to do so in order to analyse how the groups have changed and to focus attention on a smaller set of areas.

Step 3.1 Split your local authority into groups using a threshold total consumption or average consumption per meter point .

You may be interested in whether areas which could be termed as 'high consuming', have seen a bigger decrease in consumption over time than those in the low consuming group.

In this case you need to decide on a threshold consumption to split your local authority by. You may have a threshold figure in mind, which would mean MLSOAs **below** this threshold will be included in the **low consuming group**, and those **above** the threshold will be in the **high consuming group.** If you do not have a threshold in mind you may wish to experiment with creating different groups in CoTA Viewer, until you find a suitable threshold:
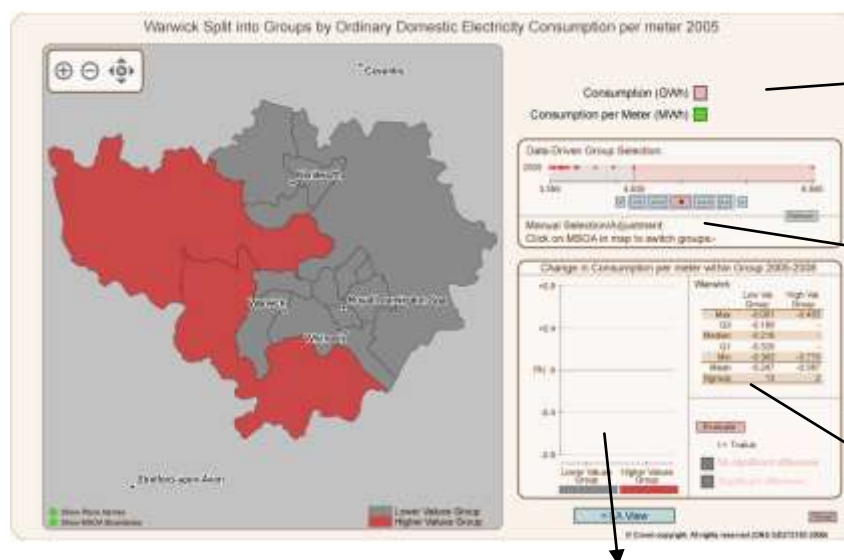
1.Select either consumption or average consumption per meter data to split the Local Authority by.

2. Use the threshold selector to choose a rate or count threshold to split the LA by, use manual adjustment to select or deselect individual MLSOAs if desired.

3. NGroup is useful at this stage, as shows the number of MLSOAs in each group.

4. Map pane shows how the LA is split into two groups of MLSOAs.

5. Analysis for the two groups will be shown here in the analysis.

---

[2] You can compare any two groups of MLSOAs in your local authority, selecting by high - consuming is one example.

Using the Threshold Selector

You will need to decide whether you want to split the local authority by total or average consumption. Once you have selected the data, the 2005 data will be shown on the line plot. Each data point represents an MLSOA.

Use the 3-speed selector buttons to select an appropriate threshold.

It is quicker to split large local authorities with many MLSOAs using the 'high' speed selection button <<< whilst smaller local authorities may need to be split with the 'slower' speed buttons:

MLSOAs highlighted in green belong to the group containing low consumption.

MLSOAs highlighted in red belong to the group containing high consumption

3-speed selector.
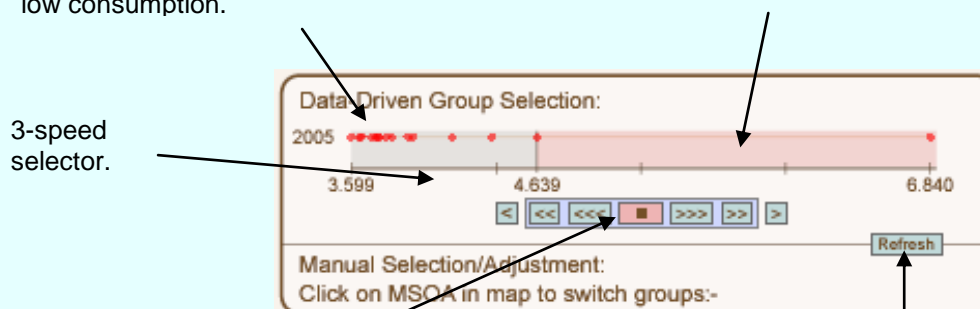
Press 'stop' to stop the selector at your desired threshold.

If you make a mistake or want to use a new threshold click 'Refresh'.

Once you have clicked 'stop' and chosen a threshold (in this example a average ordinary domestic consumption of 4,639 kWh), if there are some MLSOAs which you wish to omit, or others which you wish to include, click on the MLSOAs on the map to select/deselect them.

Step 3.2 Split the local authority using the manual MLSOA selection switch

Alternatively, you may wish to split your groups by another phenomenon, or by using a pre-defined list, for example you may be interested in seeing if MLSOAs which have had a certain intervention in place have improved more than others.

CoTA Viewer allows you to do this by using a manual selector. Of course the data won't show whether the intervention was the cause, but it could provide more evidence towards such a relationship.

Step 3.2 EXAMPLE: In this example a particular group of MLSOAs have been selected as being in the high consuming group. The local authority can then analyse whether there has been a difference in change over time between the two groups.
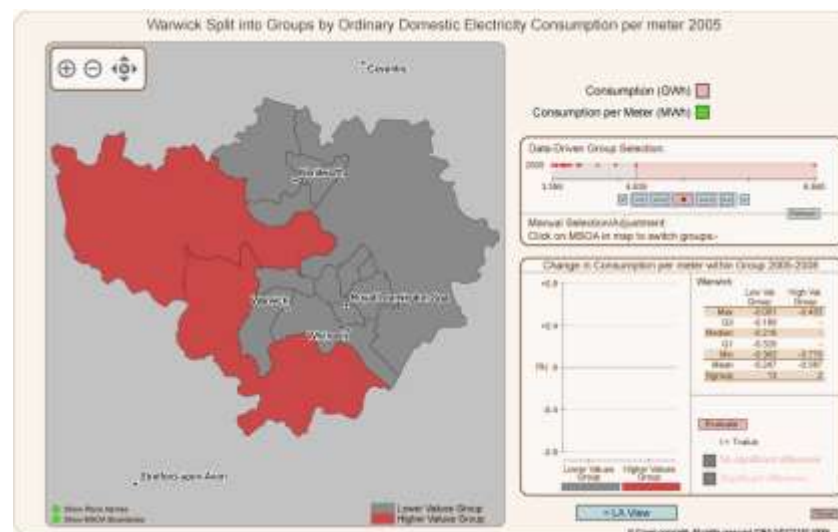
1. Select total or average consumption.

2. Check the NGroup figure if you want to know the size of your group.

3. Click once on the MLSOAs which you want to be included in the High group. Click any MLSOA once again to de-select it and remove it from the group.

4. Again, the map pane shows how the LA is split. RED = High, GREY = LOW.

Step 3.3 Examine the distribution of change for the two groups

Step 3.3 EXAMPLE: By clicking the 'evaluate' button the box plots, summary table and significance test are produced. In this example, the Grey group has a mean change of -1 compared to -3 for the Red group.

2. A box plot for each group shows the data distribution of the MLSOA change between 2005 and 2008. It should be possible to see if one group has changed more than the other, or if the gap is closing between the two groups.

1. Click Evaluate when you are happy with the selected groups, to create the box plots and compute the significance test.

Change in Consumption within Group 2005-2008

Warwick

	Low Val. Group	High Val. Group
Max	1.033	1.915
Q3	0.100	1.915
Median	-0.020	0.984
Q1	-0.100	0.337
Min	-0.217	-0.215
Mean	0.102	0.713
Ngroup	8	7

Evaluate

t = 1.912

🟩 No significant difference

⬜ Significant difference
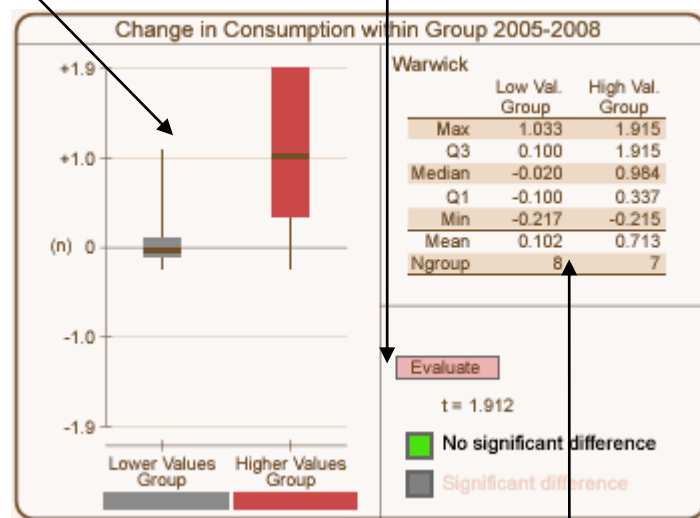
3. The summary data for the quartiles, the mean and the median is displayed in the summary table.

Step 3.4 Evaluate whether visible change is significant

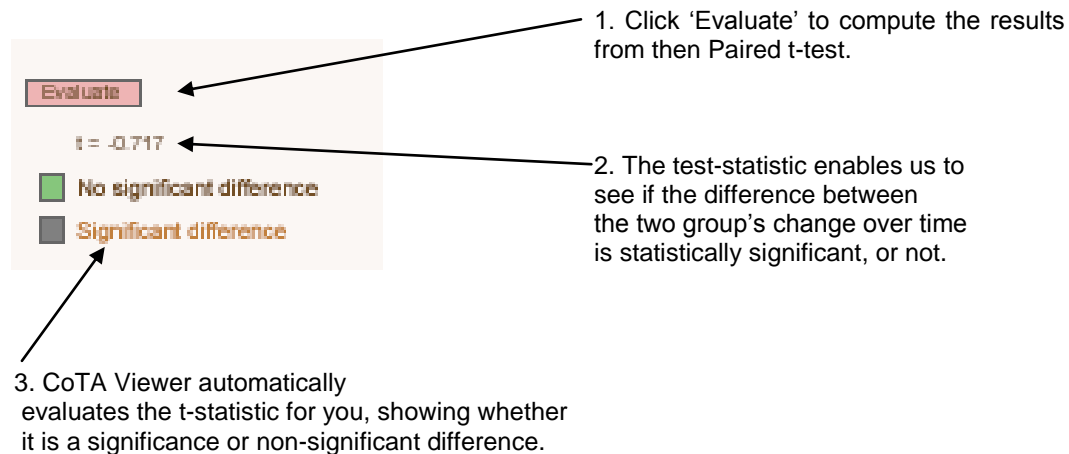Here we can explore if any change is statistically significant using a test called a Paired t-test.

Step 3.4 EXAMPLE: In the example shown the t-statistic is -0.717, which is less than 2 so we conclude that the difference between the two groups is not significant.

Step 3.4 Evaluate whether visible change is significant.

1. Click 'Evaluate' to compute the results from then Paired t-test.

2. The test-statistic enables us to see if the difference between the two group's change over time is statistically significant, or not.

3. CoTA Viewer automatically evaluates the t-statistic for you, showing whether it is a significance or non-significant difference.

Please note: caution should be exercised when analysing groups containing small numbers of MLSOAs.

Paired t-test

A paired t-test (sometimes referred to as matched pairs analysis) evaluates whether the change in the group of high consuming areas is significantly different to the change in the group of low consuming areas.

Energy consumption within an area is measured at two points in time and the difference is calculated. Then the differences of all MLSOAs is tested to determine whether the group of high consuming areas is changing in a different way to the group of low consuming areas. It is assumed that the group of high and low consuming areas are independent. Dependence over time is implicitly taken into consideration by testing the difference in total and average cosnumption.

The test statistic (t), under the null hypothesis that the difference between the means is zero, and therefore considers any value of the test statistic greater or less than 2 to be significantly different.

For more information on the Paired t-test please refer to the full Strategy.

B. Quick Reference - Screen Interface

The following annotated screenshots provide a useful quick reference guide to what each of the different parts of CoTA Viewer does.

We advise that you follow the *A. Step-by-Step Analysis* section the first time that you use the tool, as the analysis is best understood when performed in a certain order.

Screen One: Regional View Interface

Screen One is called the Regional View and visualises change over time for the regions with some comparative analysis for a local authority of your choice. It has the following appearance:

Regional View
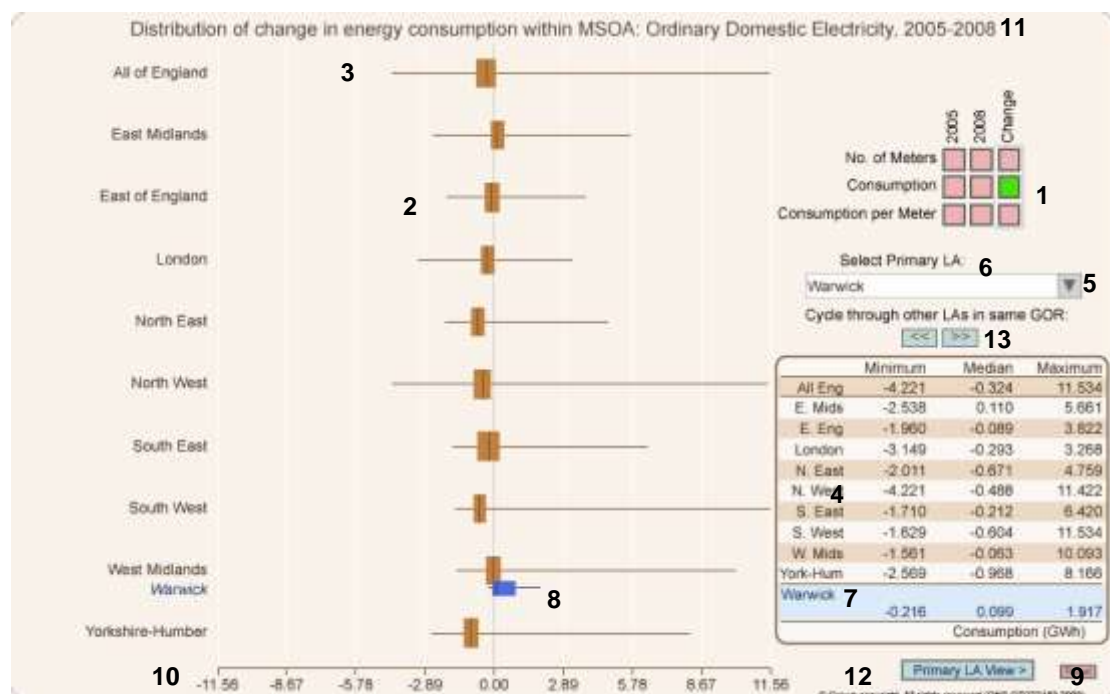
The numbers have been added for the purpose of illustration and relate to the following:

1. Selection button panel. The nine buttons on the panel allow you to switch between the different data available. You can view total consumption, number of meter points or average consumption per meter for the selected years. You can also view those variables, or their respective changes over time. Click on the data button that you wish to analyse, and this will automatically change the box plots and the data in the summary table.
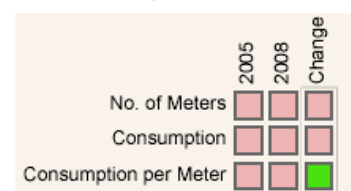
2. Regional box plots. Box plots for the nine regions display the distribution of consumption or number of meters, dependent on your data selection from the button panel (1). For more information on how to interpret box plots please

refer to Appendix B (page 65) of the full Strategy[3]. The box plots should gives an overall picture of how each English Region compares in context of each other.

3.   All of England box plot. These box plots show the distribution of data for all of the MLSOAs in England. Depending on your data selection from the button panel (1), total consumption, number of meters or average consumption per meter point will be displayed.

4.   Summary table. The data shown in the table is dependent on the selection you make on the button panel (1). It displays the summary statistics which underpin the box plots, the minimum and maximum data values (labelled on the table Min and Max) and the median (Med).

5.   Local authority drop-down selection list. Select the LA that you wish to analyse by clicking on the down-arrow and scrolling through the list of LAs in England. You can type in the first two letters of an LA in to jump to the position on the list.

6.   Show LA button. Click this once to add your LA to the box plot view and its data to the summary table. Click once again to switch the LA comparison off.

7.   Local authority summary. When the 'Show LA' button is on, summary data for the LA will be shown on the table for comparison.

8.   Local authority box plot. When the 'Show LA' button is on, the box plot of the data will be added to the GOR box plots for comparison. The LA box plot will always be added next to its English Region.

9.   Reset button. Click this button once to clear your selections and start a fresh analysis.

10. Scale axis label. Displays the data scale for the box plot.

11. Data title. Gives the title of the data displayed on the box plots and the summary table and is dependent on the selection you make on the button panel (1).

12. LA View button. Click this button once to move to the next stage of analysis on the Local Authority view screen.

13. Scroll through other LAs within your region to compare distributions.

---

[3] Full references can be found at the end of this User Guide.

Screen Two: Local Authority View Interface

Screen Two is called the Local Authority View, and visualises analysis for the local authority that you selected on the Regional View screen, and the MLSOAs within it. It has the following general appearance:

Local Authority View
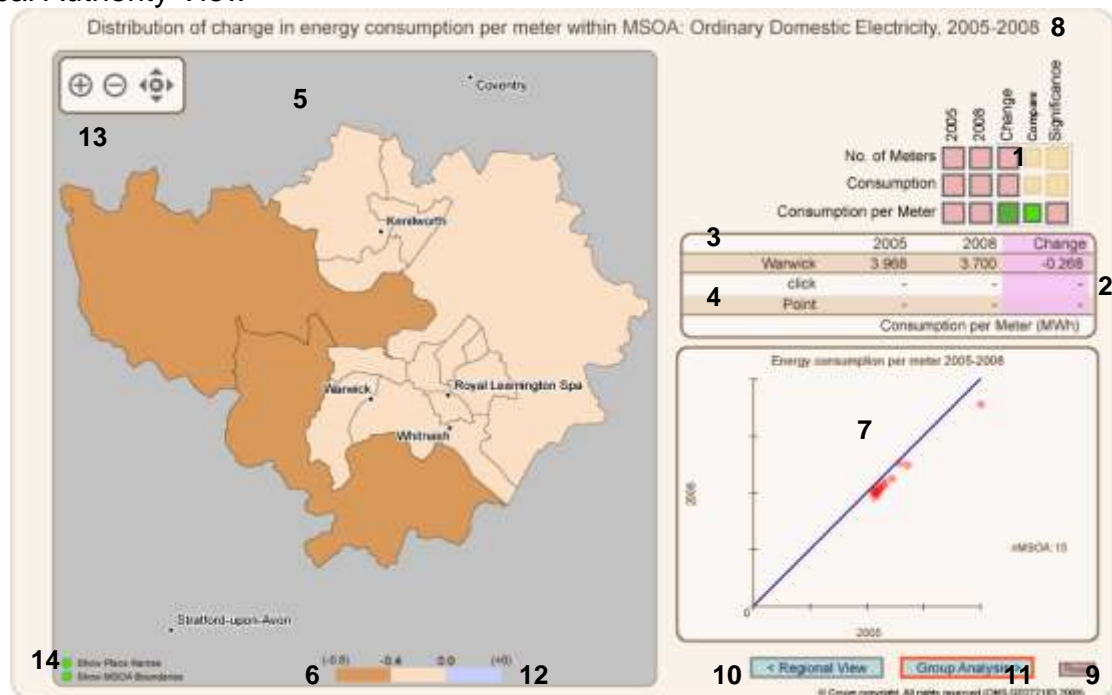
The numbers have been added for the purpose of illustration and relate to the following:

1. Analysis Button panel. This is similar to the button panel on the Regional view screen. There are some additional buttons on this screen: Selecting any of the 'Compare' buttons will produce a scatter plot of the data for both years in the Analysis View (7). The scatter plot helps pin-point which MLSOAs have either seen a data increase or decrease over time. The scatter plot is available for each dataset.
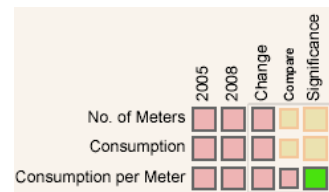
    Selecting the 'Significance' button will produce a line plot which shows how electricity consumption has changed between selected years for each MLSOA. Each data point represents an individual MLSOA, with darker coloured points representing more than one MLSOA with the same value. The results of a significance test and a new map are also computed here. Please see the Step-by-Step Analysis for more information on how to interpret these outputs.

2. Summary table. The data shown in the table is dependent on the selection you make on the button panel (1). It displays the summary statistics for the overall local authority, and up to two MLSOAs which you can select by pointing and clicking on the map view (5).

3. Local Authority name. Indicates which LA is being displayed (in the summary table, Analysis View pane and map).

4. Point-and-click referencing. This enables you to select up to two MLSOAs to be shown in the summary table alongside the overall local authority. You can hover and 'point' at the desired MLSOA on the map to add its data to the table, and 'click' to hold it in the table.

5. Map view pane. This pane displays the map of the local authority which you have selected, and all the MLSOAs within it. The data displayed on the map is dependent on the selection you make on the button panel (1).

6. Map Legend.

7. Analysis view pane. This pane displays the analysis to accompany the map and summary table and is dependent on the selection you make on the button panel (1). Either a histogram, scatterplot, or line plot with significance test results will be shown – please see Step-by-Step Analysis section for more information on this.

8. Data title. Gives the title of the data displayed on the map, summary table and analysis view pane. This is dependent on the selection you make on the button panel (1).

9. Reset button. Click this button once to clear your selections and start a fresh analysis on the Regional View screen.

10. Regional view button. Click this button once to move back to the Regional view screen.

11. Group Analysis button. Click on this button to move to the next stage of analysis – the Group Analysis.

12. Click on any map key to change the colours used.

13. Pan & Zoom click on + or – to zoom in or out, or the arrows to pan around the LA

14. Click on the radio buttons to hide or show town names and MLSOA boundaries. Hiding these makes panning and zooming quicker

Screen Three: Group View Interface

Screen Three allows you to split your local authority into groups of 'disadvantaged' and 'non-disadvantaged' MLSOAs and then see if there has been a statistically significant change over time between these groups.

Group Analysis View
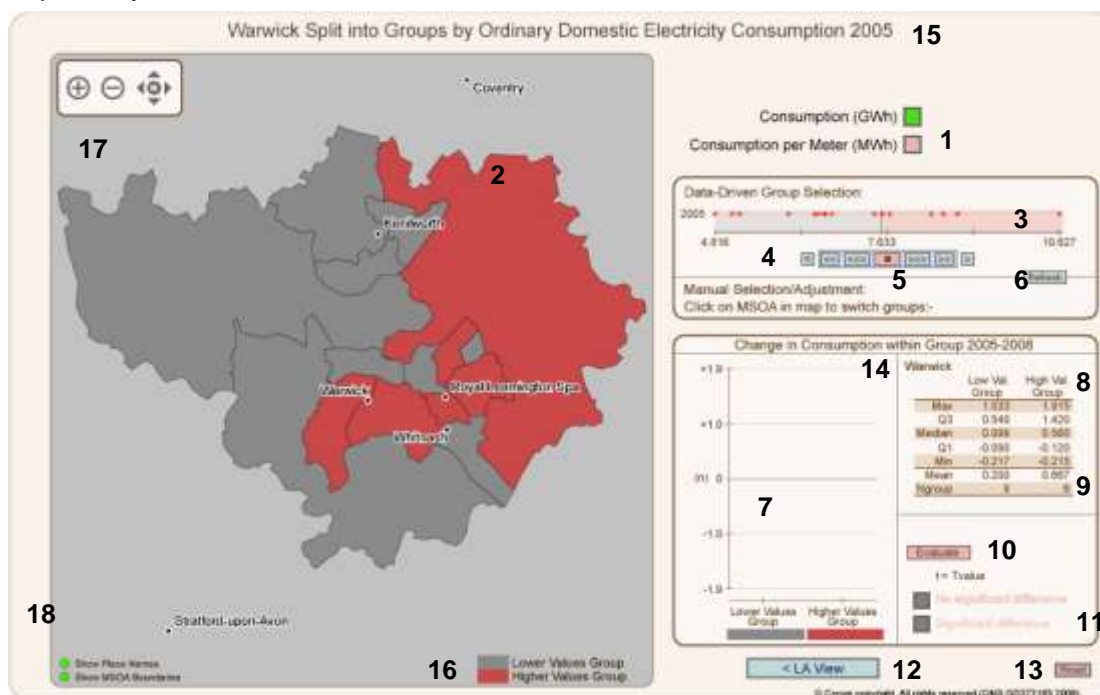
The numbers have been added for the purpose of illustration and relate to the following:

1. Total or Average consumption selection buttons. Select the Consumption (GWh) button if you wish to split and analyse your LA using the total consumption data, or Consumption per Meter (kWh) if you wish to split and analyse the LA by average use data.

2. Map view pane. This pane displays the map of the LA, and will be shaded according to how the MLSOAs are split in to 'high consuming' (red) or 'low consuming' group (grey).

3. Group threshold selector. Allows you to select a consumption threshold in order to split the LA. MLSOAs at the high end of the scale will always be included in the 'high consuming' group but it is just up to you where the threshold should lie.

4. Selector speed. There are several speeds to the threshold selector.
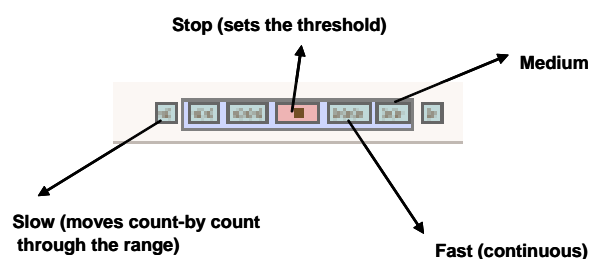
5. Manual MLSOA selector. MLSOAs can be also be manually selected to form the groups according to a pre-defined list, or de-selected to switch groups when using the threshold selection – simply click on the MLSOA to switch groups.

6. Refresh button. Click once to remove group threshold and start selection again.

7. Box plot of the groups. A box plot showing the distribution of the data is displayed for the high and low consuming groups. It is constructed after you have selected your mutually exclusive final groupings. A minimum of 5 MLSOAs need to be selected for the box plot for the 'high - consuming' group to be constructed.

8. Summary table. This is a table of the data underpinning the box plots.

9. NGroup value. Denotes the sample size(number of MLSOAs) N of each group.

10. Evaluate button. Click this button when you are happy with your group selection to create the box plots and significance test results.

11. Results of significance test. A Paired t-t test can be computed and evaluated to see if any visible change between the two groups is statistically significant.

12. Back to LA view button. Click this button once to move back to the local authority view screen.

13. Reset button. Click this button once to clear your selections and start a fresh analysis and return to the regional view.

14. LA name label. This label indicates the local authority which is being analysed.

15. Group Analysis View title.

16. Map legend.

17. Pan & Zoom click on + or – to zoom in or out, or the arrows to pan around the LA

18. Click on the radio buttons to hide or show town names and MLSOA boundaries. Hiding these makes panning and zooming quicker

Feedback

Many of the data analysis methods used in CoTA Viewer are still in development, and we would appreciate your feedback so that we can continue to make improvements. We would like to hear from you if you use any of our suggested methods and if you have any suggestions for future developments. If you would like to be involved in the consultation phase of future CoTA Viewer contact the Area Based Analysis Team at ABA@ONS.gsi.gov.uk.

Feedback regarding the data should be directed to Will Rose at DECC, will.rose@decc.gsi.gov.uk.

References

Below are the full references to the hyperlinks located in this User Guide.

Sub-national energy consumption statistics (DECC): http://www.decc.gov.uk/en/content/cms/statistics/regional/regional.aspx

Neighbourhood Statistics Service website available at: http://neighbourhood.statistics.gov.uk/

'Creating Common Statistics': Neighbourhood Statistics Analysis and Guidance toolkit available at: http://neighbourhood.statistics.gov.uk/dissemination/Info.do?page=analysisandguidance/analysistoolkit/analysis-toolkit.htm

Neighbourhood Statistics Analysis and Guidance (2008) *Analysing Change over Time for Small Areas home page*, Office for National Statistics, available at: http://neighbourhood.statistics.gov.uk/dissemination/Info.do?page=analysisandguidance/analysisarticles/change-over-time---guidance.htm
 (Home page).

Neighbourhood Statistics Analysis and Guidance (2008) *Analysing Change over Time for Small Areas: A Strategy*, Office for National Statistics, available at: http://neighbourhood.statistics.gov.uk/HTMLDocs/images/Detailed-Guidance-Final-3-0_tcm97-72757.pdf
(this is the full detailed guide).

Neighbourhood Statistics Analysis and Guidance (2008) *Summary Guide 'Analysing Change over Time for Small Areas: A Strategy'*, Office for National Statistics, available at:
http://neighbourhood.statistics.gov.uk/HTMLDocs/images/Summary-Final-v5_tcm97-72762.pdf (Summary version).

Neighbourhood Statistics Analysis and Guidance (2008) *Flow Chart 'Analysing Change over Time for Small Areas: A Strategy'*, Office for National Statistics, available at:
http://neighbourhood.statistics.gov.uk/HTMLDocs/images/COT-Flow-Chart-Final-v1-1_tcm97-72754.pdf (Flow Chart).

Office for Public Sector Information licence information http://www.opsi.gov.uk/click-use/index

Appendix A

Background

Identifying change over time is a critical part of developing and monitoring policies for small areas. A good understanding of change can help us to target policies or resources – or allow us to check whether existing policy interventions are having the desired effect. However, the process of analysing and understanding change over time brings a range of issues which can be complex.

In December 2008 Office for National Statistics launched a Strategy to help users to address such issues. The following publications are provided
- an outline of the main issues;
- a 5 stage strategy for analysis (Figure 1); and
- a range of suggested methods to use;

CoTA Viewer provides a follow-up to this work by visualising some of the methods suggested[4], using various interactive graphics. Although the approach suggested in the original strategy is not solely for use with ordinary domestic electricity consumption data; CoTA Viewer uses this data as an example as it provides a sound case study of change over time analysis and the issues outlined in the strategy.

Both CoTA Viewer and the strategy do not recommend a 'best' method, but instead provides options for analysts to **think** about and use appropriately to help answer questions when doing their own analyses.

A full explanation of the suggested methods of analysis can be found in the Strategy called *'Analysing Change over Time for Small Areas: A Strategy'* which you may download from the following link http://neighbourhood.statistics.gov.uk/HTMLDocs/images/Detailed-Guidance-Final-3-0_tcm97-72757.pdf[5]

Figure 1. The 5 Stage Strategy

❶	**Select your data**
❷	**Understand the context of your analysis**
❸	**Split your area into groups for analysis**
❹	**Understand how the groups are changing**
❺	**Test the significance of change for individual small areas**

---

[4] Please note that not all of the methods suggested in the ONS 5 Stage Strategy are illustrated in CoTA Viewer. You will also find that the order of the Steps in CoTA Viewer do not correspond to the 5-stages in the strategy. This is due to the underlying design of CoTA Viewer, and it not being appropriate or possible to visualise all stages.
[5] Full references can be found at the end of this User Guide.

Appendix B

Data Used

CoTA Viewer analyses change over time between 2005 and 2009 in energy consumption in English Local Authorities. The data are based on variables from the following datasets[6]:

MLOSA electricity and gas consumption for years 2005 – 2009
Those datasets contain the data on domestic and non – domestic electricity and gas consumption. The domestic electricity data are split by tariff (ordinary domestic and economy 7). The non – domestic consumption excluded the half – hourly electricity use, since this data are not available at the MLSOA level.
The gas consumption is split on domestic and non – domestic users, by the threshold 73,200 kWh. Any user consuming above this threshold is classed as non – domestic user.

Please Note:

1. The LA figures displayed in the tool have been produced by summing the rounded MLSOA counts, rather than using published LA figures. Therefore there may be some differences between the LA figures used in CoTA Viewer and those published elsewhere on Department of Energy and Climate Change.

2. CoTA Viewer uses data taken from the Department of Energy and Climate Change regional energy consumption dataset. Issues which need to be considered are explored in more detail in the Guidance note available at:
http://www.decc.gov.uk/en/content/cms/statistics/regional/regional.aspx.

3. Analysis at the small area level is not valid at the MLSOA level for the Isles of Scilly and City of London as there are not enough MLSOAs in the local authority. A warning message will appear if analysis is attempted. Caution should also be exercised when analysing groups containing small numbers of MLSOAs. The Office for National Statistics is preparing guidance on the minimum number of areas for analysis to be suitable.

4. The full Strategy presents issues of data quality to be addressed prior to, and during analysis to help analysts understand the topic of interest. Such issues will need to be considered when conducting change over time analysis so please refer to the full guide for advice.

5. Only a small change may be visible for some areas if you select a consecutive year analysis (2006 to 2007). In order to find evidence of a bigger change you may wish to use a larger time period for your own analysis.

6. CoTA Viewer uses LAD 2009 boundaries.

---

[6] The datasets are downloadable, along with supplementary information from the Department of Energy and Climate Change website:
http://www.decc.gov.uk/en/content/cms/statistics/regional/regional.aspx

Appendix C

Requirements

CoTA Viewer has been designed and tested to work using Windows Internet Explorer and Adobe SVG Viewer

Note: Internet Explorer users must install the free Adobe SVG Viewer 3.03 plug-in which can be downloaded from the following link: http://www.adobe.com/svg/viewer/install/

Please note we cannot guarantee that CoTA Viewer will work with other SVG viewers due to differing levels of SVG support and varying performance issues.

Known issues

CoTA Viewer may be run directly off the CD, using Windows Explorer (or equivalent). However, it will perform more efficiently if you copy the CD contents across to a local hard-drive or network drive.

Appendix D

Printing

It is advisable to print views from CoTA Viewer on a 'landscape' setting to avoid the images becoming distorted.

In Internet Explorer go to File > Page Set Up > click the radio button for 'landscape'.
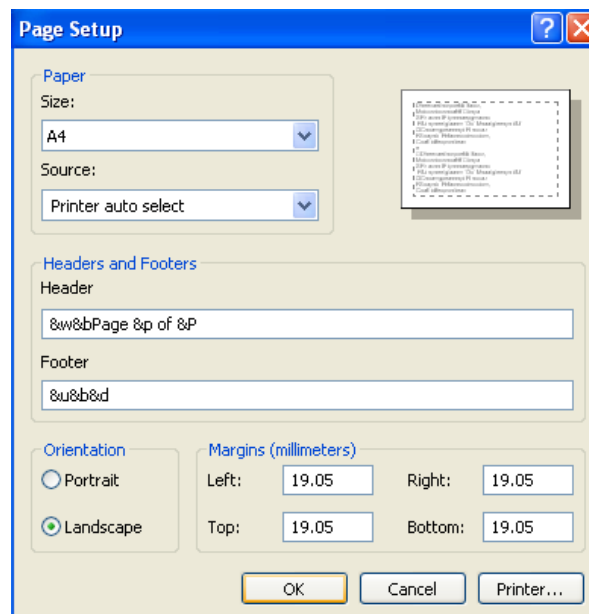
Extracting

To extract tables and images for use in reports, it is best to:
1) Use Print Screen (press PrtSc) to take a copy of the screen that you need;
2) Paste the image in to Microsoft Paint or a similar program where you may edit the screen;
3) Crop to the required size;
4) Then 'Copy and Paste' (Ctrl C + Ctrl V) into the new document.