Energy Conservation

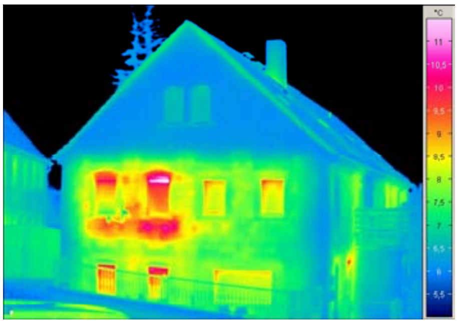
Made Easier with Infrared Thermography

Following the introduction of the *government* energy strategy in 2006 energy conservation became a focus for ordinary people as well as industry trying to find many more ways to save energy. Going hand in hand with a reduction of energy losses is a reduction in energy cost which means facility managers of both commercial and residential properties are under pressure to cut the losses.

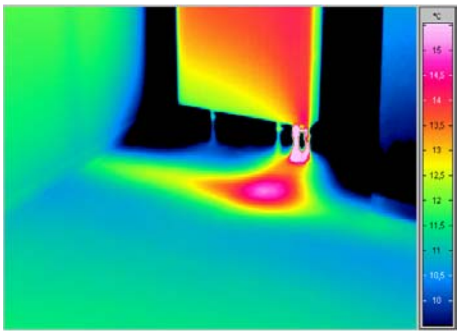
Legislation in place is based on the target laid down in the Kyoto protocol from 1997 which aims to reduce the emission of carbon dioxide and other greenhouse gasses. The European Union passed legislation covering the increase in energy efficiency of buildings (2002/91/EG). In the UK the first phase of this legislation came into effect in April 2006 supported financially by the Low Carbon Building programme for example and the second phase is now running under the supervision of the Building Research Establishment (BRE).

Legislation is one thing but you then have the problem of identifying buildings that are performing badly from an energy efficiency point of view. In countries with a history of reducing energy consumption infrared thermography has been long established as an effective and efficient method of doing this. The technology is based on the physical phenomenon that objects with a temperature above absolute zero (0.0 K or –273.15 °C) emit electromagnetic radiation. By determining the intensity of this radiation the surface temperature of the emitting object can be calculated.

Problematic areas on a building like poor insulation, air leakage and areas of damp but also problems with electrical installations can be quickly and easily identified using a thermographic camera (see images 1-4).

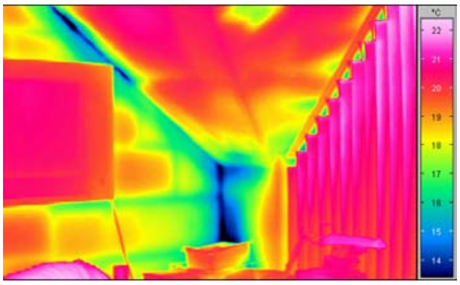


Img. 1 Image of a house having insulation problems taken with a camera resolution of 1,280 x 960 infrared pixels



Img. 2 n.n. leakage

Img. 3 n.n. Switchboard



Img. 4 n.n. mould

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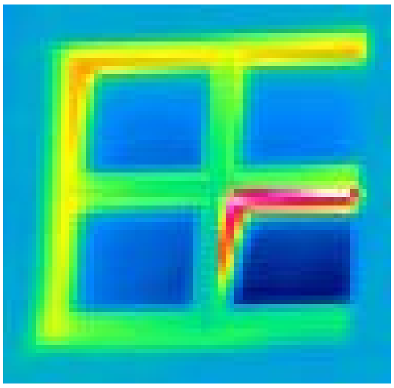
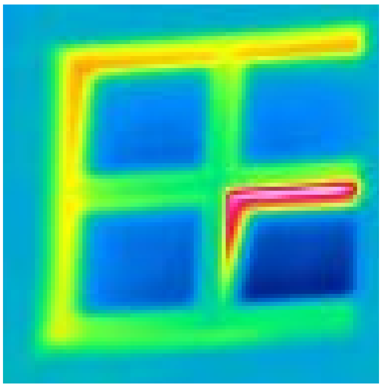
With a high-quality thermographic camera operating with 640 x 480 pixels a 30 mm lens a Field of View (FOV) of 5.3 m x 4.0 m can be seen in one image from a distance of 10 m with each pixel covering an area of just 0.8 x 0.8 cm. If this FOV is smaller than required the solution is to use a professional camera which has the option of interchangeable lenses. If a wide-angle lenses is used the FOV increases of course this is at the expenses of the geometric resolution as the size covered by each pixel also increases. However there are new cameras on the market with 1280 x 960 pixels which means you can have a large FOV without running into resolution problems. Using one of these new high-resolution cameras with four times as many pixels than the 640x480 and more than ten times the number of a 384x288 camera a very clear crisp image can be obtained using a wide-angle lens.

Lenses of coarse should be of a high quality as this determines how much of the infrared energy from the measured object is received by the camera detector. For building thermography you should always look for a camera with the option of additional lenses made of Germanium with a big XXX (e.g. f/1.0).

We have talked a great deal about the number of pixels which you may think is not that significant knowing that ‘overresolution’ in the visual digital camera market is hardly ever used. The situation with infrared cameras is different because the resolution is a lot lower due to the technology used in the detector, so with infrared the pixel count is still very important. Therefore using a camera of high resolution makes it possible to produce a high quality report with clear images (see images 5 and 6).



Img. 5 Image of a window with a resolution of 384 x 288 infrared pixels



Img. 6 Image of the same window with a resolution of 1,280 x 960 infrared pixels

However it is not just the geometric resolution that is important to be able to obtain quality measurement you also need good thermal resolution. This is especially true for building inspections because you are trying to detect small temperature differences, although building thermography in Europe is normal carried out at times of the year and day when the greatest difference between internal and external temperatures is available the difference in temperature between an area with a fault and an area without a fault is very small. Therefore a camera with the capability for differentiating between temperatures as small as 50mK (0.05 C) is required this is known as the ‘Noise Equivalent Temperature Difference’ (NEDT). The smaller the NEDT the better the quality of image that can be obtained.

Using a quality thermographic camera and the correct lens to cover the building or part of the building of interest and focused correctly will produce a quality thermogram. But the job does not finish there it is essential to have good analytical software to analyse the image and produce a quality report. Having the right tools available in the software make report generation easier and more effective, some tools that are

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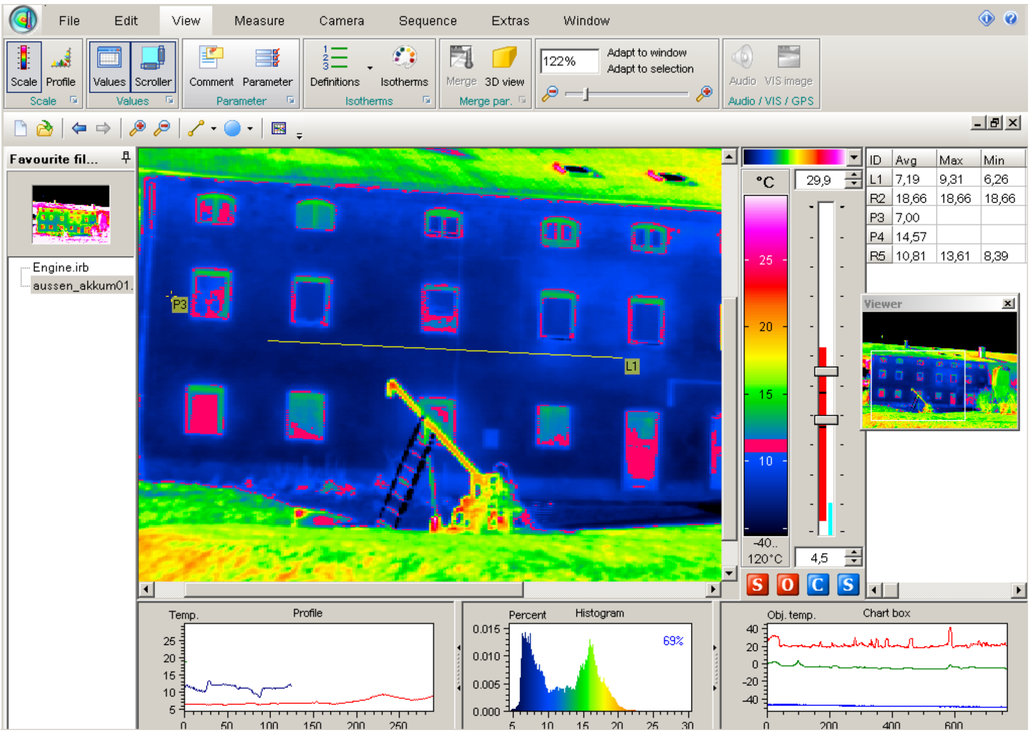
available are region of interest, isotherm (areas of the same temperature) and different colour palettes to name just a few. Following analysis of the thermogram a report can be written including all the results of the analysis indicating what action should be taken and where.



Img. 7   Screenshot of analysing software

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