Solar access made visible

The possible application areas for ICUE are illustrated here using a series of demonstration examples.

San Francisco: a dense urban setting

The first scene that was irradiation mapped using ICUE was a computer-aided design (CAD) model of the De Montfort University Campus in Leicester. Although it was instructive to visualize for the first time the solar access and how it relates to a particular built form, the De Montfort campus buildings are fairly low rise with only moderate overshadowing. It was decided therefore to apply the technique next to a dense urban setting with many high-rise buildings where it might be expected that complex patterns in the solar access would be revealed. This was indeed the case for the San Francisco city model (used earlier for the shading example), as can be seen from the five views of the 'target area' shown in Figure 19.4. The total annual irradiation (or illumination) is shown using colour (see legend in Figure 19.4). The image in the middle shows the view from the zenith of the 'target area'. The surrounding images show the views from the four mid-compass directions (e.g. north–east, south–east, etc.). Most readily apparent is the difference in the total annual irradiation between the two views from the north and those from the south. On closer inspection, the large gradients in total annual irradiation across many of the building facades becomes evident.[5]

These images are first and foremost representations of quantitative data the result of exacting computations. However, their significance can be readily appreciated by non-engineers: planners and architects who have seen the approach have understood immediately the significance of the data. This is in large part because the approach is image based. Each 600 × 600 pixel image is comparable to a visualization of the annual total of hourly data collected by 360,000 irradiance metres arranged over the building facades, ground, etc. Therein lies one of the key advantages of an image-based approach over a points-based calculation: the new technique makes visible, literally, the solar access in complex urban settings.[6] The individual pixel values can be read interactively on-screen using the ICUE display software.

The San Francisco city model was chosen because it was, at the time, the most detailed 3D model freely available on the World

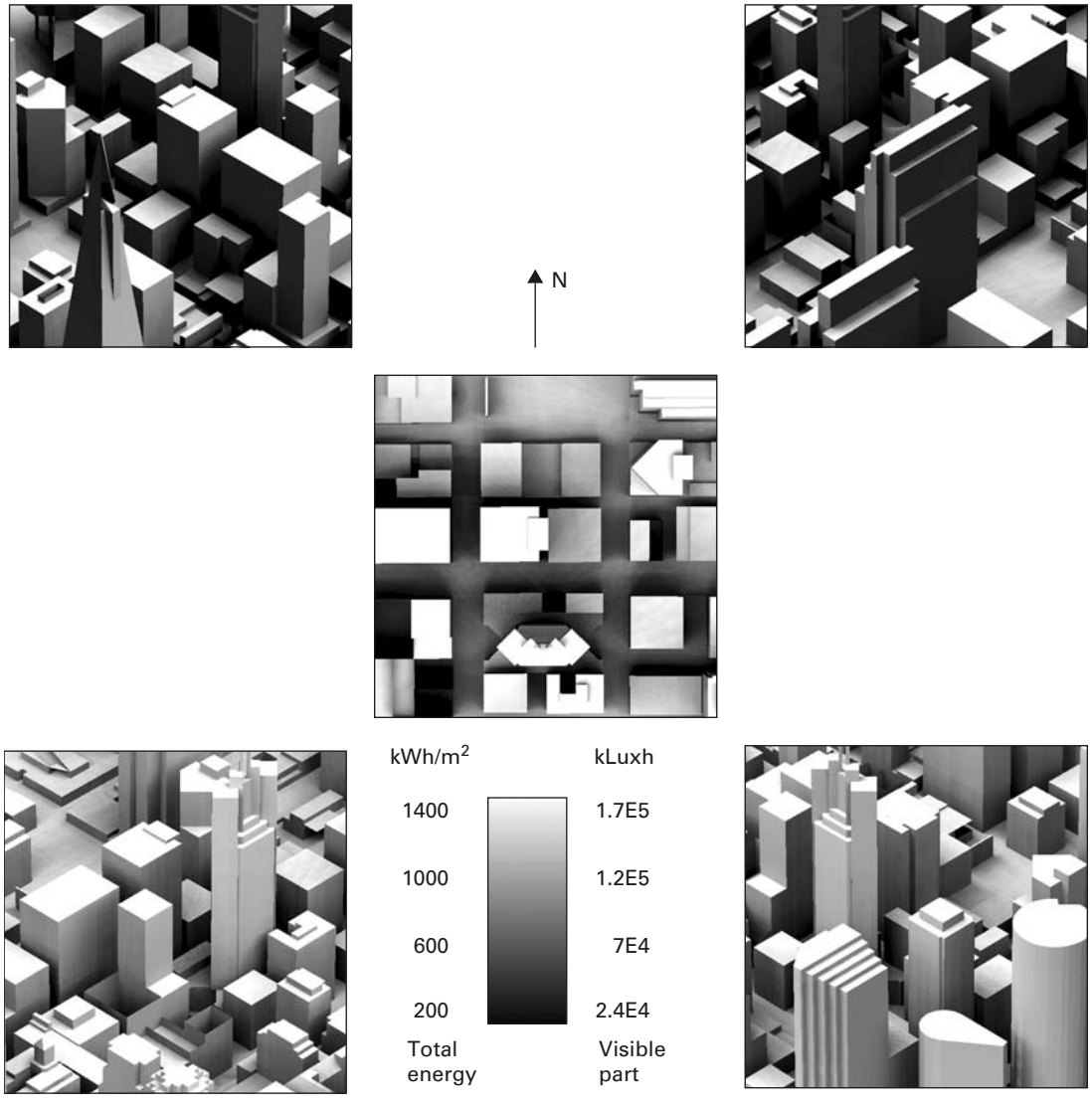

Figure 19.4
Solar access images for San Francisco.

Wide Web.[7] ICUE predicts total annual irradiation based on hourly meteorological data. Therefore, a time series of basic irradiance quantities for San Francisco was needed, that is hourly values of global horizontal irradiance and diffuse horizontal irradiance for a full year. The climate dataset, Typical Meteorological Year (TMY) for San Francisco, was downloaded from the Renewable Resource Data Centre in the USA. Hourly sun and sky conditions for San Francisco were derived from the meteorological data and used in the simulations. An unexpected feature of using San Francisco was that the total