The assessment of the available and exploitable resource base is naturally of primary concern to any power-producing technology. For wind power, this translates into assessment of the longterm wind speed and wind direction distributions at typical wind turbine hub heights - on a global, national, regional and local scale. In broad terms, wind resource assessment covers this entire range: from assessing the wind resource on a global scale to estimating the power production of a specific wind turbine at a specific site. Many different tools and techniques have been used for wind resource assessment - from wind measurements at prospective sites to wind tunnel simulations and advanced flow modelling. Among these approaches, the wind atlas methodology - developed at Risø National Laboratory over the last 25 years - has gained widespread recognition and is presently considered by many as the industry-standard tool for wind resource assessment and siting of wind turbines. The PC-implementation of the methodology, the Wind Atlas Analysis and Application Program (WAsP), has been applied in more than 70 countries and territories world-wide. The wind atlas methodology is based on physical descriptions and models of the wind flow, i.e. how the wind is transformed by the characteristics of the terrain over which it blows. The analysis part of the procedure estimates the influence of the topography surrounding a meteorological station and transforms the observed wind climate at this particular point into a regional wind climate which is valid for a region around the station. Several met. station analyses can be compiled into a wind atlas, which is then a description of the wind potential of a much larger area, say, a country or territory. The application part of the procedure employs the same models in reverse, in order to estimate the actual wind climate at any specific site and height within this region. The Danish and European Wind Atlases are examples of how the wind atlas methodology can be employed to estimate the wind resource potential for a country or a sub-continent. Recently, the methodology has also been used to determine and map the actual, expected wind resource of Denmark (an area of about 43,000 km2) with a high spatial resolution. Most applications of WAsP however, are concerned with estimating the expected power production from single wind turbines and wind farms. Examples from different parts of the world illustrate this and also serve to highlight the merits and limitations of the wind atlas methodology. Ongoing work at Risø to overcome these limitations will also be presented.