Europe has a long history of waste management, where regulation, implementation and enforcement have been the main drivers for the development and diversification of waste management technologies since the late 70s. Despite strong engineering development to minimise impacts to human health and the environment, waste generation and waste 'complexity' has increased with economic development. In recent years, the European waste industry has experienced profound and lasting transformation: the growth rate of waste generation has weakened and, most importantly, a significant shift has taken place from waste disposal to resources management, requiring modelling tools, such as life-cycle assessment (LCA) models, for carrying out environmental assessment, because of the complexity of the systems. A review of the key waste LCA models was performed in the present PhD project and showed that the results of these models most importantly depend on the technical assumptions and parameters defining waste management technologies. Some of these technical assumptions have evolved significantly from the early models to the more recent ones. An important purpose of waste LCA models is to perform environmental assessments of waste management systems and communicate the outcomes to develop evidence-based waste management policy. Global warming potential is an environmental indicator routinely modelled in LCA tools, but also reported by a number of other accounting protocols, leading to potential confusion. In this thesis, a review of the different waste management and greenhouse gases accounting mechanisms was carried out and a reporting framework, called the upstream-operating-downstream, or 'UOD' framework, proposed. As a mean of illustration, the global warming factor of six European member states was modelled. The outcome of the study indicates that, despite a common 'minimum' regulatory regime, the performance of waste management systems is very different among member states. The best performing member states are the nations which have promoted efficient material and energy recovery, leading to significant benefits to society, due to the substitution of primary resources. Another finding is that it is more robust to evaluate the waste management performance of member states by using environmental indicators (loads and benefits), rather than simply using the proportion of waste management technologies operated by each member state (structural indicators). Managing waste appropriately generates environmental benefits, leading to the comforting, and potentially misleading impression that waste generation is acceptable, as long as environmental value is gained from the recovery of materials and energy. However, it is quite clear that, if waste is not produced in the first place, through waste prevention activities, waste management impacts and benefits cease to exist. Problem solved. The issue is that a 'waste free' or a 'zero waste' society is a purely abstract concept that has little value at the policy level. Partial waste prevention is, nevertheless, a more realistic approach, currently embraced by European policy makers and defined as the highest priority of the waste hierarchy, according to the framework directive on waste. Waste prevention is, however, poorly implemented and little environmental quantification has been performed. To address this issue, a conceptual waste prevention model is provided in this thesis and applied to the waste LCA model, EASEWASTE. The main outcome of the research indicates that relatively small levels of waste prevention reduce environmental loads and benefits of waste management systems (not necessarily proportionally). Furthermore, significant environmental savings are observed from the avoided production of goods (upstream from waste management) due to waste prevention. More specifically, the study showed that the prevention of meat waste generates the highest environmental savings, compared to vegetable waste, beverage packaging and unsolicited mail.