Consumer demand for different food products has changed in important ways in OECD countries over the last thirty years driven by increasing per capita incomes, demographic shifts, and lifestyle changes. At the same time there have been significant structural changes in the food production and processing sectors. These changes have been driven by consumer demands but also by concentration and competition in the international food market, farm policy and programmes, technological innovations, and public policy and private attitudes related to food safety, nutritional labelling, environmental concerns and other food-related issues.

These changes in food production and consumption patterns in OECD countries have important implications for the environment. Although the most significant environmental impacts arise high in the food production and processing sectors, OECD households influence trends in these areas through their choice of diet and their demand for food-related services. Households also have direct environmental impacts through the way they purchase, store and prepare their food, and how much organic and packaging waste they generate. The OECD Sector Case Study on Household Food Consumption explored these impacts through case studies in four OECD countries: Austria, Poland, Sweden and the United States. This Study presents the key results from the national case studies and a separate study on methodologies and indicators for estimating household environmental impact.

Despite sometimes significant differences in per capita consumption of major food categories OECD countries share a rising trend toward higher consumption of meat (except Poland), cheese, fruits, vegetables and bottled drinks. Total caloric content is also increasing in several countries despite an already high calorie intake. Consumer spending on food as a percentage of total household expenditure has steadily declined in most countries, sharpening competition in the food processing and retail sectors and leading to an explosion in the number of food products and services offered to the consumer. Changes in the structure of the food production, processing and retail sectors reflect these trends.

The environmental impacts of household food consumption patterns depend on several factors, including where and how food is produced, processed, packaged, preserved, distributed, prepared and disposed of. The Study documents direct household impacts from household food consumption patterns in the areas of energy consumption, waste generation, transportation and GHG emissions. For example:

- *Energy*: The use of energy for food-related activities constitutes an important, but not the dominant, component of total household energy use (7-12%) although household *electricity* consumption has continued to grow with GDP due largely to expanding household ownership of appliances, including food related appliances (refrigerators, freezers, dishwashers, microwaves). There is still significant potential for efficiency gains for many household appliances and in food preparation techniques.

- *Transport*: The direct food-related transport impacts from household food consumption patterns are mainly related to individual passenger-car traffic, but the net impact of changes in food shopping patterns and the rapid increase in the number of hypermarkets and food shops, often located outside large cities and small towns, has not been fully evaluated. In the US, for example, shopping distances appear to be declining although the data are not disaggregated by shopping purposes. On the other hand, anecdotal information in Poland linked to a 15-fold increase in car ownership over the last 30 years (33-fold in the largest cities) and the creation of out-of-town hypermarkets suggests a growing portion of transport miles for household food shopping. Transport impacts are also tied to consumer demand for variety and year-round availability of certain food items.

- *Food and packaging waste*: Food losses begin on the farm and continue through the retail chain to the consumer. In the US, according to a study carried out by the USDA Economic Research Service more than 43.6 billion kilograms (27% of edible food available for human consumption in 1995) were lost by retailers, the food service

industry and consumers. Food service and consumer food loss accounted for nearly all of the waste. Food waste is the wettest and most dense component of domestic waste streams; composting is underdeveloped. The trend toward increased packaging for household goods, including pre-packaged foods and food service packaging has helped reduce food waste from spoilage, transportation and storage. However, it has also significantly increased the amount of non-organic wastes entering the waste stream from household food consumption and diversified the materials. Although recycling rates for many packaging materials have increased, wastes from household food consumption are among the least affected by these trends.

- *Greenhouse gas emissions*: Household GHG emissions are related to direct energy consumption for food conservation and preparation, food transport patterns, and choice of diet through upstream impacts on production, processing and distribution patterns. According to one German study the distribution and consumption of food together account for 42% of all CO_2 emissions connected to the food sector. Recent work using Lifecycle Analysis (LCA) provides additional information on the choice of diets and related impacts on global warming, and shows the importance of considering both production processes and transport distances when considering the GHG impact of one food product over another.

The most significant food-related environmental impacts are high in the production chain and have been studied and well documented elsewhere in the OECD. The Study provides a subset of examples to underline the link between changes in household demand for certain food products and services and environmental impacts higher in the food system. The demand for year-round availability of fresh fruits and vegetables, for example, has an impact through energy demand for greenhouse production or long-distance transport by road or air. The growing demand for lean meat has led to intensive animal production systems for pig meat and poultry that are important sources of water pollution. The Study also highlights some of the principal environmental pressures stemming from the food processing, distribution and retail sectors, which have received less attention to date in the OECD. Key environmental aspects related to these sectors include energy use, GHG emissions, discharge of high-strength effluents, localised odour problems, air pollution and chemical use and storage. From a policy perspective, this discussion is important for determining the most effective points for technological innovations or policy measures to reduce environmental impacts if short- to medium-term household food consumption patterns are taken as given.

The quantification of environmental impacts from household food consumption is a relatively undeveloped area of public policy research. In many cases, data are hard to find, or are collected at an aggregate level that makes it difficult to link household behaviour with a specific level of impact, and thus to define appropriate policy instruments. The information available from the case studies varies considerably in depth of analysis and data availability. Several methodologies have been developed and applied to food consumption analysis that can help improve the assessment of environmental impacts. The this Sector Study reviews some of those methodologies and proposes a set of 14 indicators that could be used to more closely monitor environmental impact trends in this area.

The Study concludes with a discussion of policy objectives and framework for policies to promote sustainable household food consumption. It shows that although there are no "sustainable food consumption" policies, growing concern over environmental health and food security are forging stronger links between traditional nutrition and consumer safety policy and environmental policy. It also examines specific policy measures to reduce the direct environmental impacts from household food consumption patterns. The discussion shows that some policies exist to deal with general household energy consumption and waste generation patterns, including sometimes specific measures relevant to household food activities. On the other hand, there are few examples of policies to deal specifically with food transportation or the greenhouse gas effects of food consumption patterns. The discussion also makes clear

that household food consumption patterns should not be treated in isolation but rather addressed as an important part of a set of daily household routines that influence and reinforce one another. More systematic analysis of the environmental and cost effectiveness of policy instruments to reduce the environmental impacts of food consumption is needed to refine this discussion. The Study also discusses policies and information to support informed consumer choice as one way of influencing upstream impacts in the food production and processing sectors. It also identifies issues where additional research is needed to better understand the net environmental impact of evolving food consumption trends.