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November 1996

Informatory Note on Refrigeration and Food

The role of refrigeration in worldwide nutrition

The **World Food Summit** will be held in Rome from November 13 to 17, 1996. Organised by the FAO (Food and Agriculture Organization), its objective is to determine suitable measures for ensuring that sufficient food, both in quality and quantity, is available to every inhabitant of our planet. This is what is referred to as world food security. The Summit will gather heads of state and of government, and representatives of intergovernmental and governmental organisations.

The IIR is participating in the World Food Summit because refrigeration is one of the best means of storing food, since it increases its shelf life while maintaining its quality, particularly its hygienic and nutritive properties.
The world food situation can be assessed with the following figures:

Years	World population (*)
1950	2,5 billion inhabitants
1995	5,7 billion inhabitants
2025 (forecast)	8,3 billion inhabitants

(*) World population prospects, the 1994 revision, United Nations, 1995.

Period	Number of undernourished inhabitants in developing countries (**)
1969-1971	920 million inhabitants
1990-1992	840 million inhabitants

(**) Sécurité alimentaire et nutrition, FAO, juin 1996.

The world's population grew by 86 million in 1994.

Most measures proposed till now for attaining universal food security have dealt with raising agricultural output, for example, by bringing more land under cultivation and increasing yields. However, it is also important to reduce post-harvest losses and to store agricultural produce better, in order to increase the effectiveness of the farmer's work and of costly farm inputs (e.g., fertiliser and irrigation). It is here that refrigeration should contribute to food security.

Today, out of a worldwide agricultural output of 4,500 million tonnes (including fish and seafood), only an estimated 350 million tonnes are refrigerated (i.e., chilled or frozen), whereas 1,500 million tonnes could be refrigerated to good effect. To put this in perspective, these 350 million tonnes would make up 40% by weight of the food consumed by the 1.2 billion inhabitants of industrialised countries and a lower percentage of that consumed in developing countries.
It is true, of course, that those who cannot afford rice or bread would not be able to buy refrigerated foodstuffs or a refrigerator, either. However, refrigeration's contribution is on a broader scale: in reducing post-harvest losses, in helping to solve the difficult problem of supplying food to the cities and in fostering international trade in foodstuffs.

The purpose of this note is to tell how refrigeration can improve everyone's diet, both quantitatively and qualitatively.

1 - Reducing post-harvest losses

Food losses in developing countries are considerable. Rates as high as 25 to 30% for worldwide losses are frequently cited in the literature. Worldwide fruit and vegetables losses are as high as 30 to 40% and much higher in developing countries. Three figures from the FAO are instructive here:

- The energy value of the world's agricultural output is equivalent to 19,900 kJ per capita and per day (1kcal = 4.18 kJ).
- The energy value of the food made available to the consumer is around 11,370 kJ per capita and per day. Roughly speaking, half of the difference between the two energy levels (8,530 kJ) corresponds to feed for cattle and seeds for planting, and half corresponds to losses occurring during storage, transport and retail sale (more than 4,000 kJ per capita and per day).
- The energy value of food strictly necessary for mankind is estimated at 9,235 kJ per capita and per day.

Therefore, current world agricultural output would be more than sufficient to feed all the earth's inhabitants if it were not for the uneven distribution that causes great problems locally. Reducing the losses would help solve them to a large extent.
The cost of refrigeration, including both the acquisition and the operation of equipment, can often be offset, especially for the most expensive produce, by the revenue from sales of foodstuffs that, without refrigerating equipment, would otherwise have been lost. Such foodstuffs include (in order of how important refrigeration is): fish, meat, dairy products and fruits and vegetables.

2 - Improving food safety

Quality– not just quantity– counts, particularly in making food safe. Food of animal origin, for example, is quite perishable, especially in warm-climate countries where bacterial growth is rapid. The use of refrigeration substantially reduces bacterial growth in foods and, therefore, reduces both food losses and food poisoning.

It is difficult to determine on a world scale the number of persons affected by food poisoning, or the economic cost to society in terms of worker absence and medical care, but intestinal illnesses have clearly become endemic in developing countries, due, in part, to unhealthy diets. Such illnesses often tire their victims to such a point that they are vulnerable to other illnesses, such as tuberculosis.

Here are two figures that show how widespread gastro-intestinal illnesses from food consumption are:

- The U.S. Department of Agriculture has estimated that pathogenic micro-organisms in meat lead to 4,000 deaths and 5,000,000 illnesses per year in the U.S., with a cost to the economy of about US$6 billion.
- The FAO and the World Health Organisation consider that 70% of the 1.5 billion cases of diarrhoea in children under five years of age (leading to 3 million deaths per year) are caused by an unhealthy diet.

It is plain to see that refrigeration can have quite beneficial effects on food safety.

3 - IMPROVING FOOD SUPPLY TO THE CITIES

Urban populations have exploded in developing countries, rising from 17% of the total population in 1950 to 35% in 1990, and, according to U.N. estimates, to 54% in the year 2020. The total urban population in developing countries will have grown twelve-fold between 1950 and 2020, from 295 million to 3,580 million.

To meet the new nutritional needs, greater and greater amounts of food, including perishable food, will have to be transported over greater distances and for longer amounts of time. Refrigeration limits losses that would otherwise be caused by poor handling, shocks, high temperatures and the duration of transport.

Very often, refrigerated storage on the production site, followed by transport in an insulated, non-mechanically refrigerated vehicle, is sufficient for limiting temperature rises and for preserving the quality of the produce. Today, refrigerated warehouses in developing countries are located mainly in large cities and in ports, but not, unfortunately, in farming areas.

4 - BENEFITTING FROM INTERNATIONAL TRADE

Worldwide exports of food requiring refrigeration are growing by 5% per year; most exports are transported overseas, including, in 1995, an estimated 40 million tonnes.

International trade in refrigerated food offers developing countries a double opportunity:

– Foodstuff imports

For war-torn or drought-stricken countries, as well as countries whose output is simply insufficient, efforts must be made toward making diets more balanced, while taking the necessary precautions against discouraging local production since the target in the future should be food self-sufficiency. Diets in such countries will continue to be composed mainly of grains, but a protein component, in the form of meat or fish, is crucial. Frozen food could be a suitable option here, and one that would be relatively practical with the use of self-contained, mechanically refrigerated containers.

– Exports of high-value-added produce

Tropical produce– including fruits like pineapples, mangoes, advocados, papaya, as well as vegetables, tropical fish and flowers– much of which comes from developing countries, are more and more popular in industrialised countries and a source of revenue for developing countries.

With a suitable logistic and commercial structure and certain standards of quality, such produce could bring in hard currency both for the growers and the country itself, thus creating jobs. However, tropical produce is especially perishable and therefore requires a flawless cold chain. Note that production and storage technologies applied to these export crops are often used later for local crops.

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A few decades ago, when most inhabitants of developing countries lived in rural areas, refrigeration was not absolutely necessary, since perishable fruit and vegetables were consumed just after harvest, and perishable meat, just after slaughter. Today, and even more so tomorrow, with the growth of urban population, the use of refrigeration is one of the most suitable means for storing and distributing food, thus contributing to universal food security, even if its cost might seem high.

Particular care must be taken in setting up cold chains in developing countries. A pragmatic approach is needed. Beyond purely technical problems, consideration must be given to food habits, energy costs, marketing structures, the possibilities for training and maintenance, and the need for step-by-step development.

National refrigeration development plans can help, but regardless of which path is chosen, the development of refrigeration is often one of the most effective and cheapest tools in meeting food needs.

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