

# DESIGNING EXERGETICALLY SUSTAINABLE INDUSTRIAL FOOD CHAINS

TI FOOD NUTRITION

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## Exergy analysis

The sustainability of industrial food chains can be assessed by exergy analysis. Such an analysis can be useful for understanding how the exergetic efficiency of the complete food chain would be affected by modifying or changing a process. Additionally, it can be used to compare the exergetic performance of two or more different production routes for producing the same food product.

The main benefits of the methodology are the identification of the locations in the system where most exergy losses occur, and the understanding of the reasons that cause those losses. This information will help an engineer to obtain insights for designing more sustainable industrial food chains. Therefore, the challenge for the food industry in the future is to produce food of maximum nutritive value by generating the least amount of irreversibility.

## Aim

We have the ambition to derive general guidelines on designing sustainable food chains from a thermodynamic perspective.

## Approach

In our research different industrial food production systems are analyzed:

- at the chain level to identify inefficient links with the help of thermodynamic indicators (e.g. cumulative exergy losses, specific exergy losses, exergetic efficiency etc).

- at the process level to understand which parameters influence exergy destruction (or entropy generation) the most.

The results of our analyses will also contribute in the development of a decision making tool for the food industry in collaboration with the *Operation Research & Logistics* department (Wageningen University).

This research is part of the project of the *Top Institute of Food & Nutrition*: “*Valorization of raw materials and process efficiency*”.

## IN A NUTSHELL...

- Exergetic analysis of food chains
- Generalization of the methodology for designing thermodynamically sustainable industrial food chains
- Development of a decision making tool for the food industry

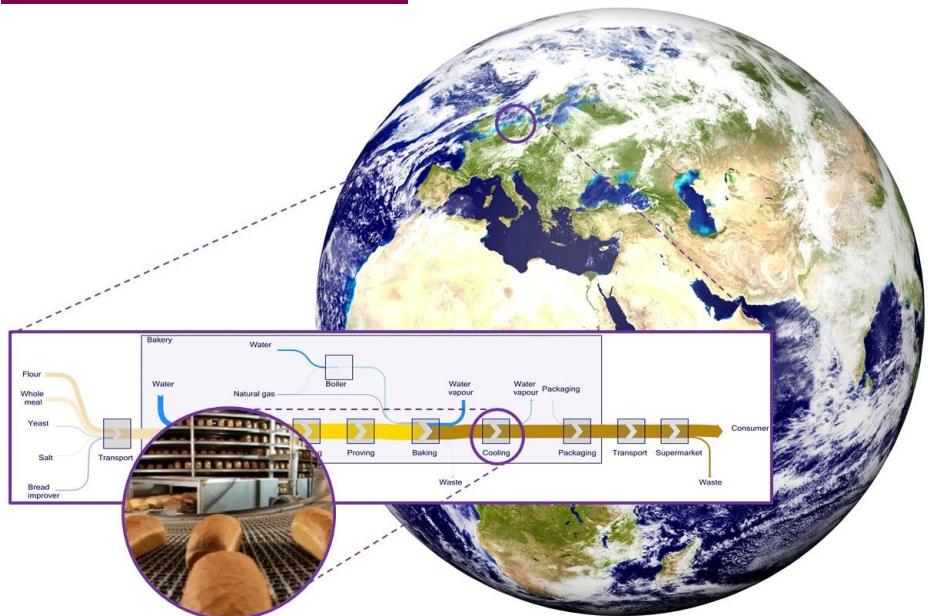
Chemical exergy of raw food



Chemical exergy of processed food



“Nutritive exergy”  
Reaching the consumer



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