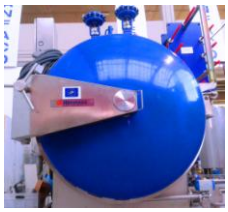
LIFE+ INDUFOOD

LIFE11/ENV/ES/530

Reducing Greenhouse Gases emissions in the food industry through alternative thermal systems based on induction technology

LIFE+ INDUFOOD: Co-funded by the LIFE EU program

Walking towards a more respectful industry with the environment


www.indufood.org

OBJECTIVE OF THE PROJECT

The main objective of the project is to reduce emissions of greenhouse gases (GHGs) in thermal processes in the food industry, which generally use a technology based on fossil fuels such as oil or natural gas.

To achieve this objective, the thermal systems of food industry were studied and two industrial scale prototypes were designed, a cooker and a retort. They allow line operation with steam and / or induction technology for heat input to compare results.

Budget:

Total 1.097.199,00 €

50 % Co-funded by EU

Start 01/08/12 - End 31/10/15

PARTNERS INVOLVED

ANFACO-CECOPESCA. Private National Technological Center constituted to give service to processing of seafood and food industries, being its purpose, among others, promoting the quality and R & D in the food industry and aquaculture as well as transfer of research results to the business community through projects based on continuous innovation.

GH Electrotermia S.A. Parent company of GH Group, one of the most experienced groups with induction heating for industrial applications in the world. It is an internationalized group with more than 50 years of know-how, innovation and experience, pioneering induction technology.

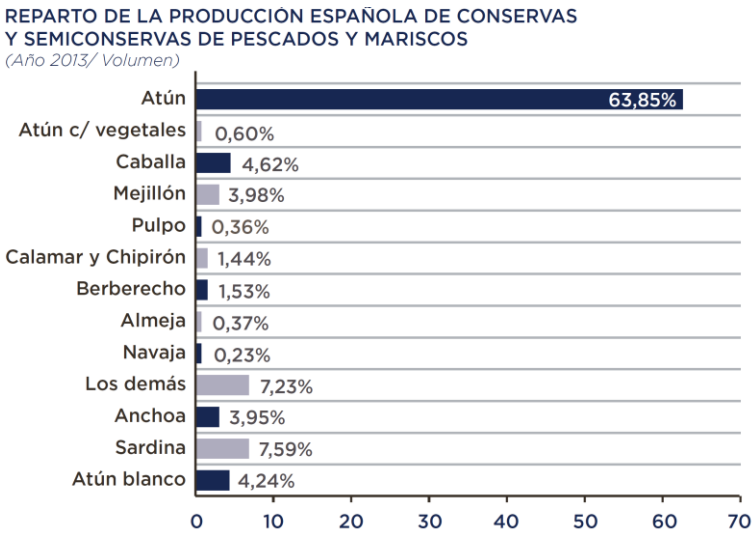
HERMASA. Company founded in 1972 in Vigo, with more than 40 years experience in design and manufacture of specific machinery for canning, frozen, packaged vegetables and canned pet food products.

SEAFOOD AND FISH CANNING INDUSTRY

The fish and seafood canning industry today remains as a **landmark and one of the strategic sectors of Galicia**, highlighting for its important economic and social weight, favoring the employment of a significant part of the population and, consequently, has a multiplier effect on the economy of the community where it sits.

Image 1. Representative sample of canned goods

In the year 2014, Galicia had **65 factories** of canned fish and seafood, which generate about **12,000 direct jobs**; this Galician sector contributed to GDP by 2.8% and generated 6.5% of industrial employment. Moreover, Galicia has remained since the beginning of the canning industry as the first Spanish community in producing these products, representing on average since the beginning of 21st century, 84% of the volume and 82% of the value of the total Spanish production of these foods.



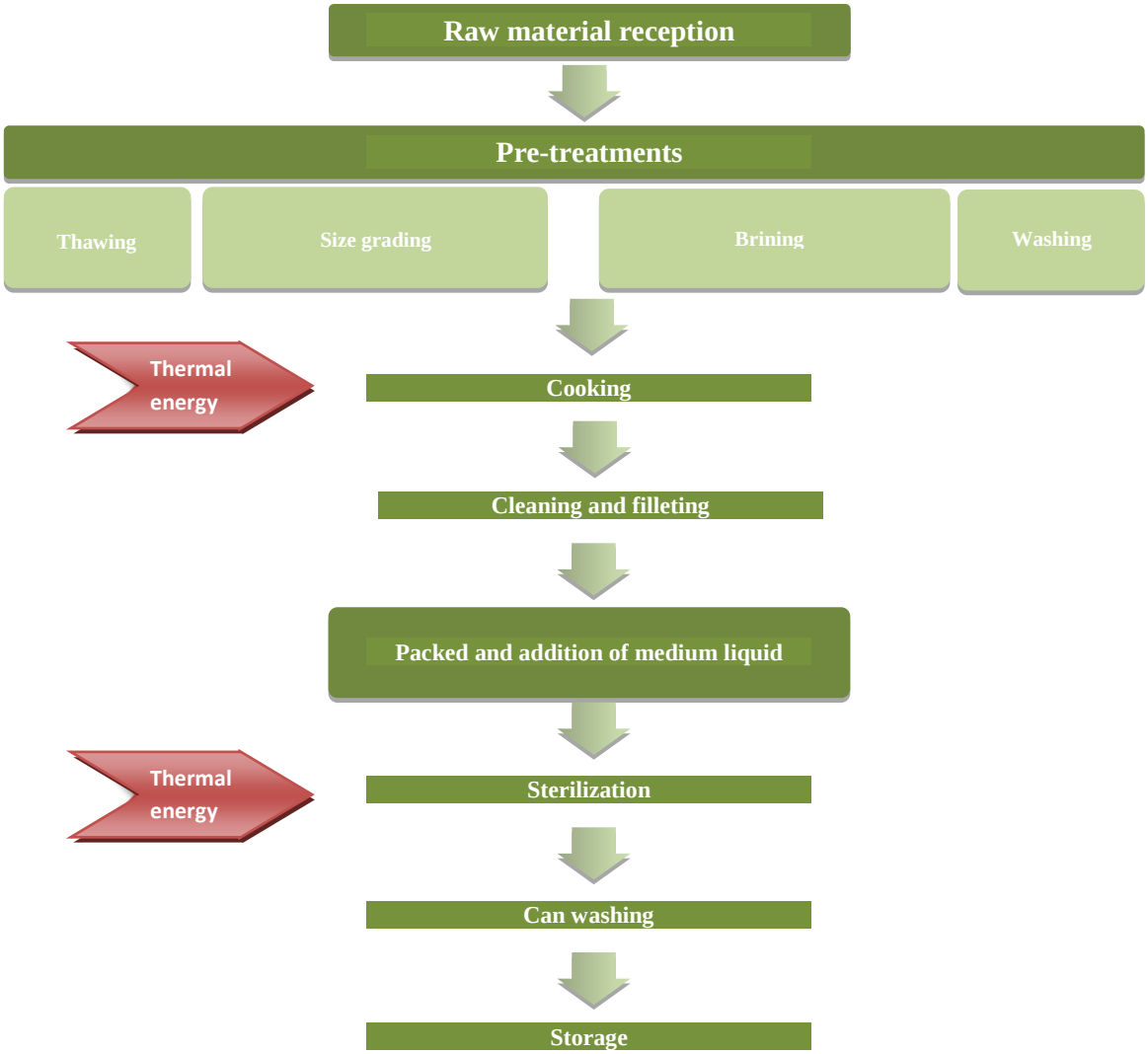
As for the distribution of production by species, **tuna** has remained the flagship of this sector since the 70s, and increasingly in the production quota, because if in 2000 accounted for 60% of total, currently accounts for almost **70%** of the market.

Despite the predominance of tuna, the range of species that can be found in canned food is **as broad as varied**, because in addition to the above products, other fish and seafood are used in canning as mackerel, squid, cockles , needles, razor clams, scallops, seaweed, sea urchin, caviar, etc. achieving a maximum quality.

CURRENT PRODUCTION PROBLEM

The canning industry covers the entire production process from the reception, including fish, cephalopods and seafood, fresh or frozen, until the packaging of cans and its final packing for distribution and sale. In this regard, the production process in the canning industry is very similar among factories; small specific differences exist depending on the final product.

From the point of view of **resource consumption and waste generation**, there are several common stages to most species production and installations in the canning industry, although with nuances in distinct stages.



Cooking processes and sterilization in canning industry require the majority of thermal energy, **50% and 38%** respectively of the total; this energy is obtained by burning fossil fuels in steam boilers that emit **greenhouse gases** to the atmosphere. The LIFE + INDUFOOD is a project where a new more efficient and sustainable technology is addressed, **the induction technology**, which can be powered by **renewable energy**.

INDUCTION TECHNOLOGY

The Induction heating is used for heat treatment of materials having metal parts, as the case of steel welding, in which the steel part immersed in the **magnetic field** increases its temperature generated by the process. In a basic configuration, a power supply generates an alternating current through an inductor (coil) and placing the piece inside produces the effect. Magnetic fields are generated without direct contact between load and inductor with high energy efficiency, being in some cases more than 90%.

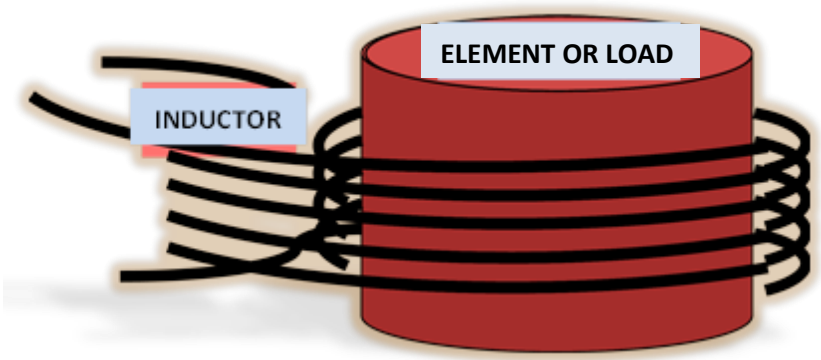
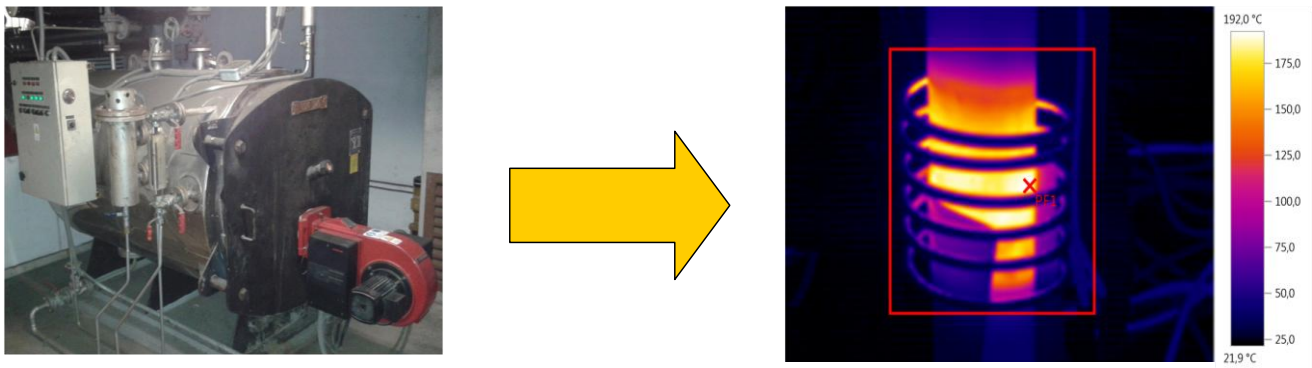


Image 1. Work scheme for induction application

In this project the processes of **cooking and sterilization** were optimized, as the greatest demanding points of thermal energy consumption, and giving an alternative to feed them by **electricity** through induction instead of fossil fuels. It has been studied the current induction in the core (Foucault) as well as the heat transfer rates within and associated Joule effect.



STEAM BOILER INDUCTION

Image 2. Substitution scheme of steam boilers in thermal processes to induction in the industry

To power induction technology is necessary to have energy generators that can be inserted in an isolated, waterproof, and airtight metal cabinet adaptable to the food industry conditions and job security for workers required.

DESIGNED PROTOTYPES

The design and manufacture of two new thermal systems were made using induction technology, corresponding to a **vertical cooker and a retort** to sterilization process. These systems have been placed in the **pilot plant of ANFACO-CECOPESCA** to be visited by anyone interested, and to look synergies for extrapolation to other food industry uses.

COOKER

The prototype designed at industrial pilot scale, was configured to work vertically with water and / or steam and with digital management systems. The CAD / CAE prefabrication tools were used and re-engineering tasks for optimization and modifications were made until the end of the project. The prototype was reconsidered several times in order to reduce energy losses to the environment and to achieve the best energy efficiency performance.

Image 3. Previous designs and final prototype model of LIFE INDUFOOD cooker

RETORT

The prototype of sterilization process is more complex, since it consists of an airtight container to be pressurized during processing. It needs to resists the different cycles of heating / cooling and the induction parameters were been adjusted based on these restrictions. Its configuration is horizontal and could work with a standard industrial canning cart.

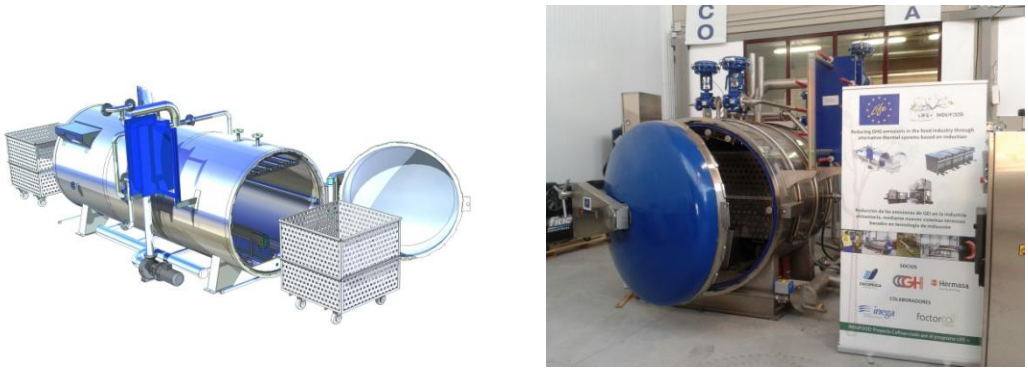


Image 4. Designs and final prototype model of LIFE INDUFOOD retort

OBTAINED RESULTS

Facing the validation and adjustment of prototypes, pilot scale plant tests were performed in ANFACO-CECOPESCA facilities. At the same time, traditional techniques for comparison between steam and induction systems were used. **Efficiency analysis** was performed at all levels, **both energy and water consumption**, focusing on its final implementation in real industry.

For the **cooking** process, tests were performed with product until it reaches 65 °C in its most restrictive point, the spine in whole tuna specimens, using induction technologies and steam boiler for comparison between them.

Similarly, pilot scale **retort** tests were performed using both, the traditional technique of steam boiler and induction technology. To this end, different sterilization values were fixed over a standard industrial cart with RR-125 cans inside. Distribution and heat penetration tests have been studied inside the prototype during the processes.

Image 6. Validation tests in ANFACO-CECOPESCA pilot plant

The **project results** have demonstrated some energy and water savings, approximately:

ENERGY SAVINGS OF 30% **WATER SAVINGS OF 20%**

Reducing emissions of greenhouse gases to 100% in case of being powered by renewable energies as solar panels or wind towers.

CARBON FOOTPRINT

The **carbon footprint** is a parameter representing the total emissions of greenhouse gases (GHGs), expressed as tonnes of CO_2 equivalent generated directly or indirectly by a product, service, organization or event throughout its lifecycle.

By measuring the carbon footprint, an overall picture of its contribution to **climate change** can be obtained. Also, measuring the carbon footprint is the first step to take in order to carry out a plan to reduce GHG emissions in a production.

HERRAMIENTA PARA EL CÁCULO DE LA HUELLA DE CARBONO DEL PROYECTO LIFE ENV/ES 000530 INDUFOOD

Empresa	ANFACO

Esta herramienta ha sido diseñada el objetivo de calcular la huella de carbono del proceso productivo de la industria conservera en base a la norma PAS 2050:2011 desarrollada por BSI. Se ha diseñado según el alcance de la cuna a la puerta. La unidad funcional de cálculo es 1 tonelada de producto.

* Datos: en estas pestañas se deben incluir los datos solicitados referidos al "preparado de materias primas", "cocción (para tres escenarios diferentes)", "limpieza y envasado".
* Cálculos: en esta sección se realiza el cálculo de la huella de carbono a partir de los datos introducidos en la sección anterior y a partir de los factores de emisión.
* Resultados: en esta sección se muestran los resultados obtenidos de la huella de carbono clasificados en diferentes categorías.
* Factores de emisión: se encuentran los factores de emisión empleados en el cálculo de la huella de carbono.

Para la determinación de la huella de carbono, únicamente se ha de completar la sección de entrada de datos de la herramienta, ya que el resto de secciones funcionan automáticamente a partir de la información incluida en esta.

Se presentan varias tablas independientes de toma de datos correspondientes a las distintas etapas del proceso productivo de la industria conservera. Cada tabla la deberá completar el agente correspondiente de la cadena de valor del proceso.

Preparación materias primas → Cocción → Limpieza y envasado → Esterilización → Lavado y almacenaje

IR AL ÍNDICE

During LIFE+ INDUFOOD project, a food industry awareness campaign has been done through a program of ongoing diffusion, and by developing a virtual calculation tool of carbon footprint. With this tool, industrial managers could determine the impact of their production decisions over their global GHG emissions.

Environmental benefits

- An improvement in environmental and energy management of an organization.
- It allows to know the main sources of greenhouse gas emissions of an organization, which is a point of reference when designing strategies for reducing emissions by applying more efficient techniques.
- It can identify the activities with the greatest potential to reduce emissions and propose specific targets for them.
- It facilitates the evaluation of alternative configurations of production and manufacturing methods, choice of materials, and selection of suppliers based on their GHG emissions associated.
- It saves costs due to a more efficient implementation of techniques instead of those that are currently in use.
- It represents an advance on future regulations and policies on climate change.

TECHNOLOGY TRANSFER AND DISSEMINATION

The working group of LIFE+ INDUFOOD project is highly aware of the importance of the **dissemination and presentation of results**, as a guarantor of technology transfer to the food industry. This will definitely be the key to reduce greenhouse gases in a plausible way to minimize any environmental impact associated to these processes.

To achieve this objective a two-way communication were followed, both online (www.indufood.org) and physical during different events.

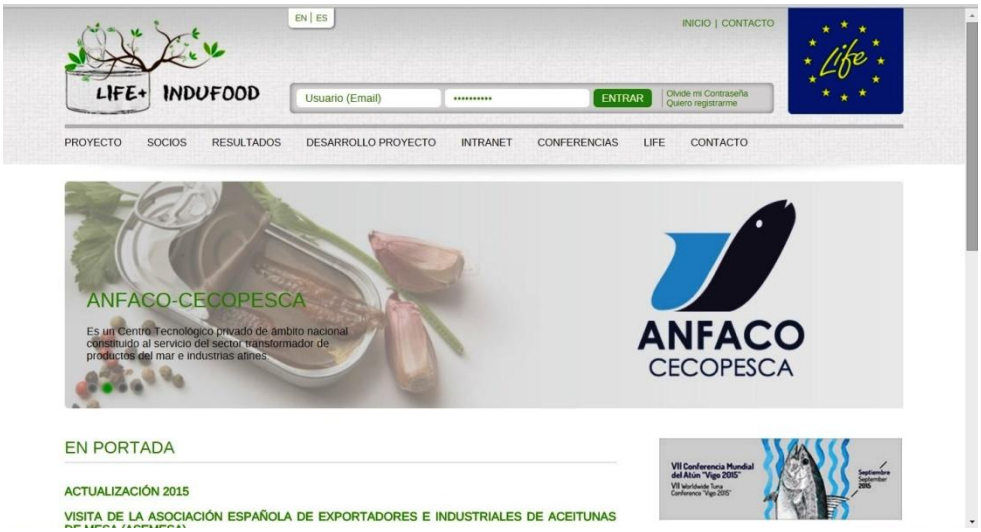


Image 7. Main web page of LIFE INDUFOOD project

During project implementation, its **results were presented** in numerous conferences, symposiums, workshops, etc. given by researchers, and during visits of international delegations to ANFACO-CECOPESCA pilot plant, and also through press news, that remarked the successes that have been accomplished.

Image 8. Demonstration project to a delegation from Mexico and a workshop presentation of the Xunta de Galicia

To the present day, the project is **open for a demonstrative visit to anyone** interested in ANFACO-CECOPESCA pilot plant facilities.