Mejoramiento de la Eficiencia Energética en el sub-sector de Frutas y Hortalizas

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Proyecto Tesla y análisis del sub-sector de frutas y hortalizas

FOOD GAMMA	
1st gamma	Fresh F&V for direct market selling
2nd gamma	F&V preserved by being sterilized through thermal processes, dried or processed with the use of a mix of techniques
3th gamma	Frozen F&V
4th gamma	Hygienically treated and ready-to-eat fresh F&V, to be maintained for a short time, packaged in a protective atmosphere
5th gamma	Softly cooked and ready-to-eat F&V, to be maintained for some weeks in controlled conditions

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Características del sub-sector de frutas y hortalizas

- In EU-28, F&V production corresponds to 17% of total agro-food production (10% vegetables and 7% fruits)

- Highly fragmented production chain

- F&V cooperative managers show very little interest for technology innovation

- Perishable products

- Food security

- 4ª gamma (*Minimally Processed F&Vs*)

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Características socio-económicas del sub-sector de frutas y hortalizas

Fruit and vegetables processing plants	Italy	Spain	France	Portugal
Production (tons/year)	19.000.000	18.000.000	8.400.000	807.938
Total number of F&V processing plants	1.856	3.407	1.082	247
Number of cooperatives	1.273	1.034	300	~60
Turnover (M€)	7.800	6.300	7.583	655
Number of employers	28.658	53.152	35.000	3.818

Sources: Osservatorio sulla Cooperazione Agricola Italiana 2011/Prometeia 2011 for Italy; Feria Internacional del Sector de Frutas y Hortalizas 2013/Observatorio Socioeconómico del Cooperativismo Español 2013 (datos 2012)/FIAB 2008/MARM 2009 for Spain; Ministère de l'Agriculture, de l'Agroalimentaire et de la Forêt 2013/CoopdeFrance 2009 for France; GPP 2013/Confagri 2013 for Portugal.

Major difficulties related to:
- different data sources for the different countries;
- specific data for F&V and, in particular, for fresh F&V;
- possibility of data comparison among the four countries;
- number of employers very difficult to estimate because of not registered employees; seasonality of the work in the F&V sub-sector; part-time and full-time employees, etc.

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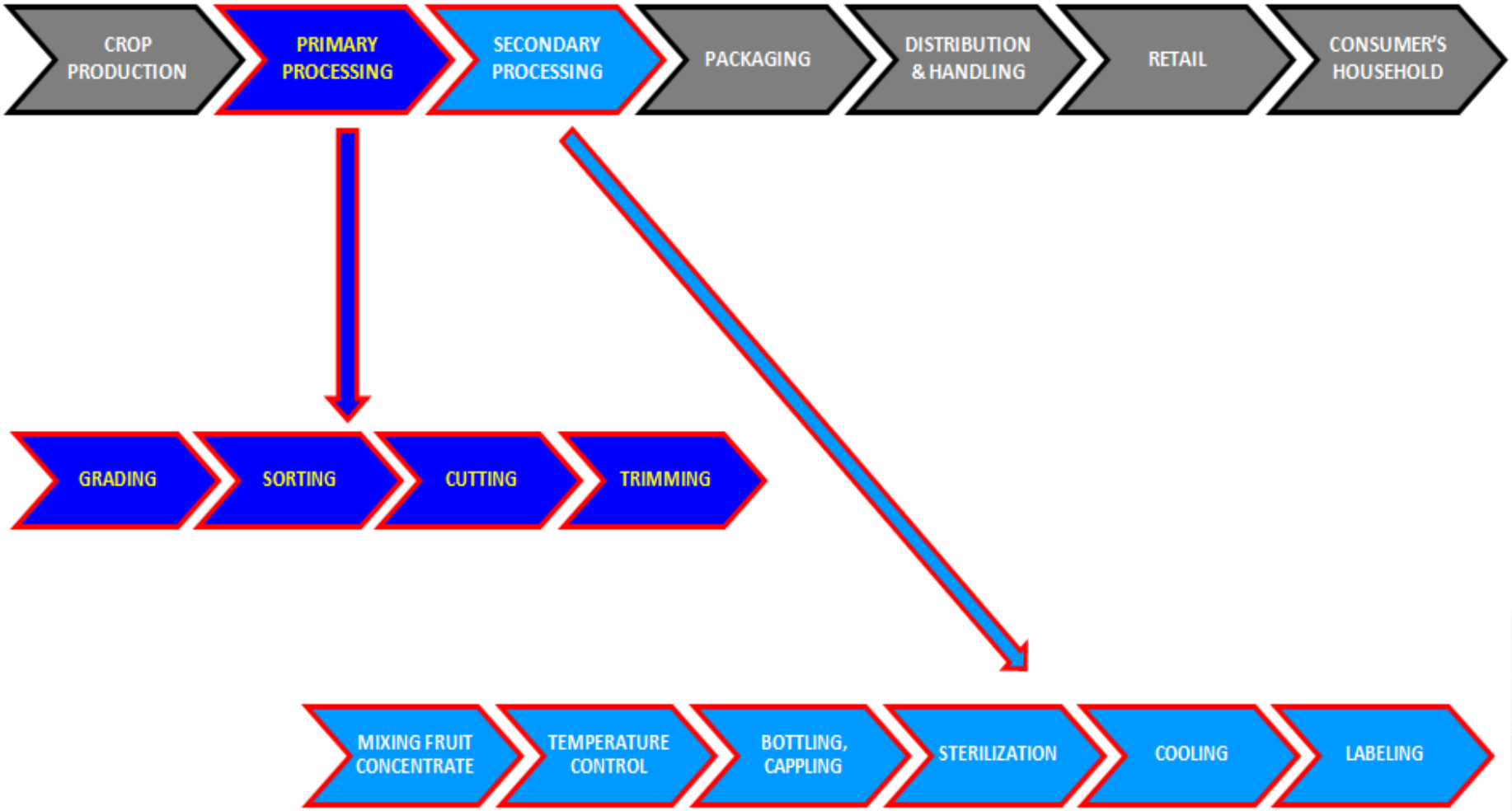
Primary and secondary processing in F&V cooperatives



Main processes in the F&V production chain. The activities related to primary processing are in dark blue background, while those related to secondary processing are in light blue. The processes that are in common in the production chain, including the final consumption, are in grey background.

Los procesos industriales el sub-sector de frutas y hortalizas

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SCOMPOSICIÓN DE LOS PROCESOS MÁS COMUN QUE SE LLEVAN A CABO EN TÍPICAS COOPERATIVAS OPERANTES EN EL SUB-SECTOR DE HORTOFRUTÍCOLO

- Recepción de materias primas (~2h)
- Limpieza y secado (~2h)
- Selección y calibrado (~2h)
- Envasado (~2h)
- Conservación en frío (~1día)

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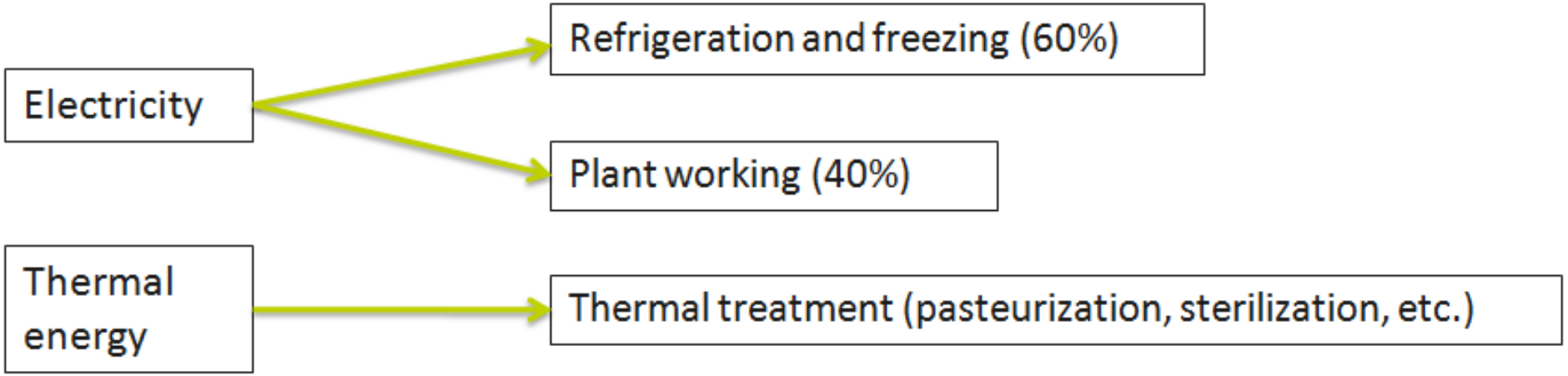
General scheme of energy consumption in F&V processing plants



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Consumos energéticos de los procesos industriales

Fase de procesado	%
Recepció	0,5
Lavado, selección y calibrado	8,2
Procesado: cortado, molienda, etc.	12,2
Blanqueado/secado	32,7
Refrigeración y enjuagar	1,1
Operaciones post-tratameinto: control, envase, embalaje	8,2
Tratamiento tèrmico de estabilización por calor	36,8
Refrigeración	0,2
Almacenamiento en frío	0,2
Energía total	**100,0**

Average energy consumption (in %) in typical Italian F&V cooperatives dealing with 2nd gamma

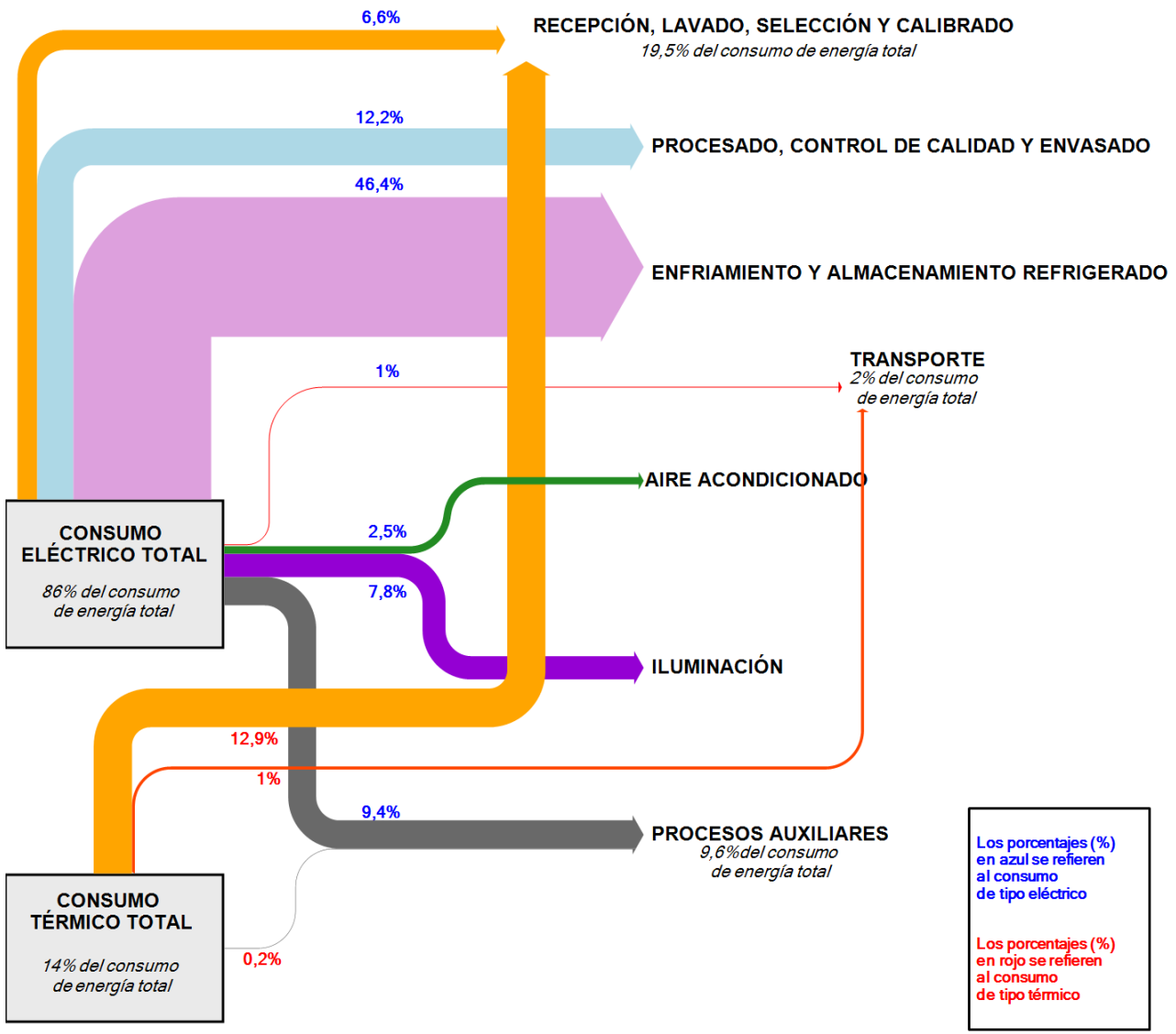
PORCENTAJES DE CONSUMO DE ENERGÍA EN LAS CENTRALES HORTOFRUTÍCOLAS ESPAÑOLAS BASADAS EN PROCESOS DE REFRIGERACIÓN.

FASE DE PROCESADO	%
Recepción de la materia prima, lavado, selección y calibrado	19,5
Procesado: cortado, molienda, calibrado, pelado, etc. Operaciones post-tratamiento, control de calidad y envasado	12,2
Refrigeración/almacenamiento en frío	46,4
Transporte	2,0
Aire acondicionado	2,5
Iluminación	7,8
Procesos auxiliares	9,6
ENERGÍA TOTAL	100,0

Fuente: Datos procedentes del análisis de diez centrales hortofrutícolas españolas, Cooperativas Agro-alimentarias, 2010.

Average energy consumption (in %) in typical Spanish F&V cooperatives dealing with 1st gamma

Consumos energéticos de los procesos industriales



Los porcentajes (%) en azul se refieren al consumo de tipo eléctrico

Los porcentajes (%) en rojo se refieren al consumo de tipo térmico

Balance de energía y consumos energéticos de los procesos industriales en cooperativas españolas que se estriban en procesos de refrigeración

Data proceeding from a 2010 analysis by Cooperativas Agro-alimentarias of ten Spanish F&V processing plants in the frame of the Tesla Project.

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Case Study

Available online at www.sciencedirect.com

ScienceDirect

Agriculture and Agricultural Science Procedia 00 (2015) 000–000

Agriculture and Agricultural Science Procedia

www.elsevier.com/locate/procedia

Florence "Sustainability of Well-Being International Forum". 2015: Food for Sustainability and not just food, FlorenceSWIF2015

Identifying strategies for energy consumption reduction and energy efficiency improvement in fruit and vegetable producing cooperatives: a case study in the frame of TESLA project.

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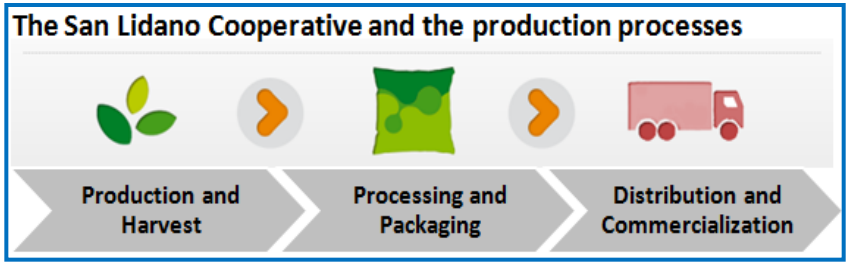
Abstract

TESLA (Transfering Energy Save Laid on Agroindustry) is a EU project pointing to the reduction of energy consumption and the improvement of energy efficiency in key agro-food sectors' cooperatives, as those processing fruit and vegetables. After a general analysis of energy consumptions during the first phase of the project, the processes responsible for the higher energy consumptions in these fruit and vegetable industries, as cold storage, have been identified. In the second phase of the project, a few case studies aimed at proposing customized solutions for reducing energy wastage and for improving energy efficiency in specific selected cooperatives have been performed. In this manuscript we report preliminary results of a case study carried out in an Italian horticulture cooperative having several production lines for fresh (1st range) and minimally processed (4th range) fruit and vegetable products. In this cooperative, an in-depth energy audit has been performed, and additionally a process simulation software has been applied to model, evaluate and improve the operations in this processing centre and in the supply chain from the primary production sites. Such case study may be used as an example for similar cooperatives of the fruit and vegetables sector, thus contributing in making this sector more economically and energetically sustainable.



- Production: 3.650 ton/year
- Main consumer: GDO
- Short and controlled production chain
- "*Benchmark*" cooperative
- System for recovering of the water used for operations and washing
- System for waste treatment

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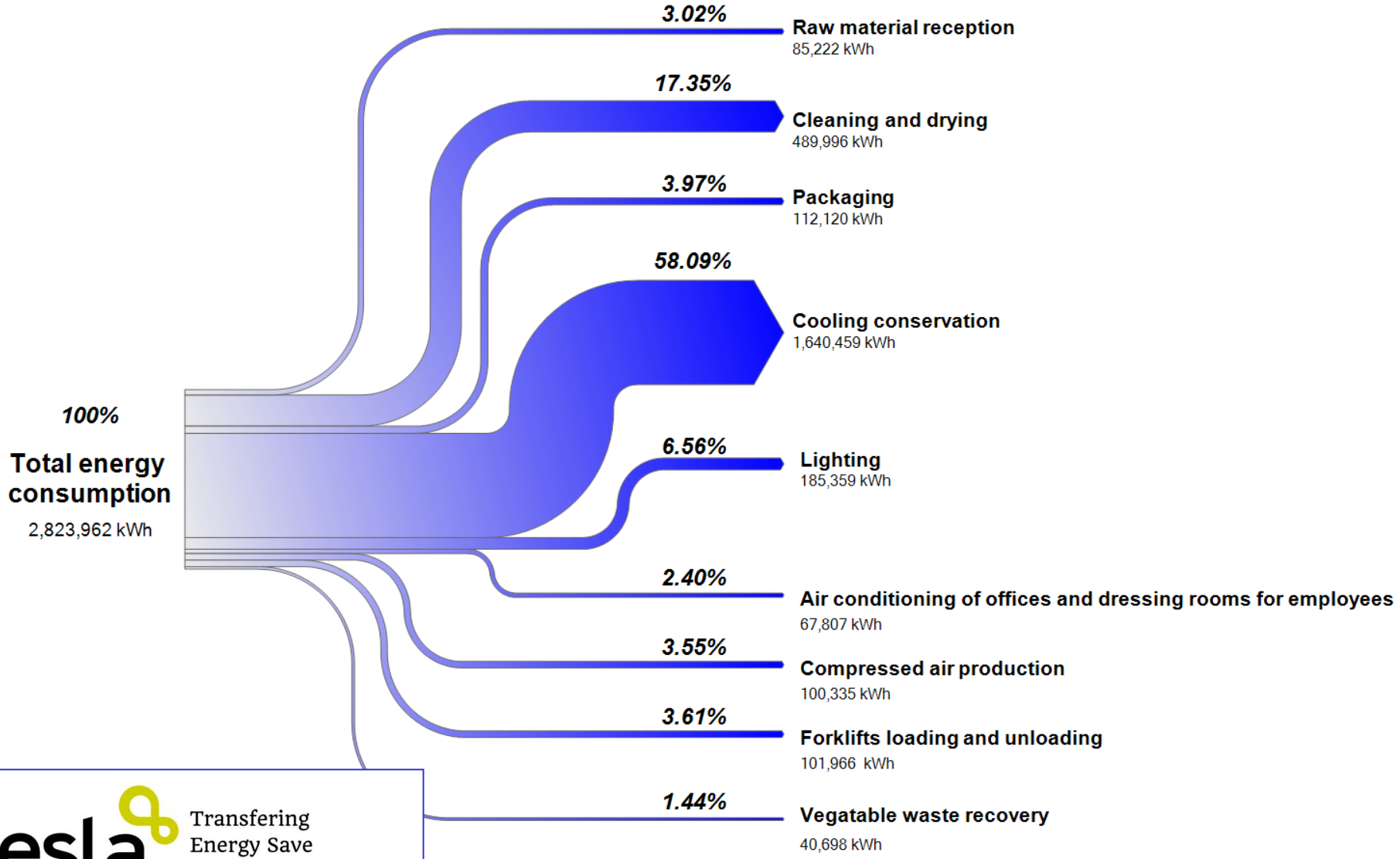
Case Study: Energy Audit



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Filosofía "LEAN & GREEN"
Lean Manufacturing

Sustainable Value Stream Mapping (Sus-VSM)
Simulación virtual de los procesos

La transformación de los productos hortofrutícolos rapresenta un sector llave de la industria agroalimentaria.
La metodología utilizada se enstriba en un audit energético acurado y en el estudio de los flujos de valor según el pensamiento de "Lean & Green", llevando a interesantes sugerencias para el mejoramiento de la eficiencia energética y la sostenibilidad de las cooperativas de este sector de produccion.

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Innovación tecnológica y *BATs* del sub-sector de frutas y hortalizas

- EE nei sistemi di raffreddamento (celle, camere refrigerate, ecc.)
  - Sistemi di accumulo del freddo
  - Isolamento delle celle frigorifere con pannelli di poliuretano
- Miglioramento dell'isolamento nelle celle frigorifere
- EE dei motori
  - Motori ad alta efficienza (IE3, IE4, IE5)
  - Far lavorare i motori dal 60 al 100% del pieno carico
  - Controllo/manutenzione dei motori per evitare il regime minimo
  - Regolazione della velocità di un motore tramite variatori di velocità (*VSDs*)
- Sistemi ad aria compressa (SAC)
  - Ottimizzazione della struttura del SAC
  - Inverter e volume di stoccaggio
  - Riduzione delle fughe dal SAC (con test periodici)
  - Alimentazione del/i compressore/i con l'aria esterna più fredda
  - Ottimizzazione del livello della pressione
- Installazione di *VDSs*
- Isolamento dei tubi e delle valvole
- Riscaldamento dell'acqua e dell'aria
  - Pannelli solari termici per il riscaldamento dell'acqua
  - Recupero del calore tramite un economizzatore o un condensatore
- Utilizzo dispositivi LED per l'illuminazione
- Strumento (*software*) di gestione

Fonte: « Manuale sull'efficienza energetica negli impianti di trasformazione dei prodotti ortofrutticoli ». *Tesla Project Deliverable*. Latini *et al.*, 2014.

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GRAZIE PER L'ATTENZIONE!!!

Carlo Alberto
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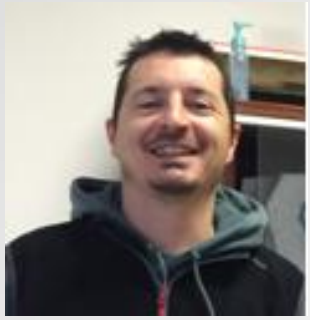

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