SIMPOSIUM CIENTÍFICO TÉCNICO expoliva 2021

Feria Internacional del Aceite de Oliva e Industrias Afines
International Fair of the Olive Oil and Allied Industries

Jaén, 22 a 24 de septiembre 2021

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PROYECTO OLIVEN

ECONOMÍA CIRCULAR EN LA INDUSTRIA OLEÍCOLA: GASIFICACIÓN APLICADA A LA VALORIZACIÓN DE ALPERUJO

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OLIVEN

PROJECT INFORMATION

FUNDING PROGRAMME

- ARIMNet (ERANET)

ARIMNet = Agricultural Research Innovation projects in the Mediterranean NETwork

- Call: ARIMNet2 2017 for **Young Researchers**
- Funding Institution: FP7 (European Union)
- Total Budget: 350.000 € (Funding = 250.000 €)
- Duration: 3 years (September 2018 – September 2021)

CONSORTIUM

- Partner 1 **(Coordinator): University of Jaén (UJA),** Spain
- Partner 2: Ankara University (AU), Turkey
- Partner 3: Olive Research Institute (ORI), Turkey
- Partner 4: L'Institut de l'Olivier (IO), Tunisia
- Partner 5: Direction Générale de la Production Agricole (DGPA), Tunisia
- External Colaborators: Circular Carbon (CIRCA), CO2 Consulting

BACKGROUND

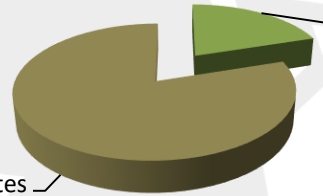
Electricity
Fuels
Chemicals
Water

Electricity
Fuels
Chemicals
Water

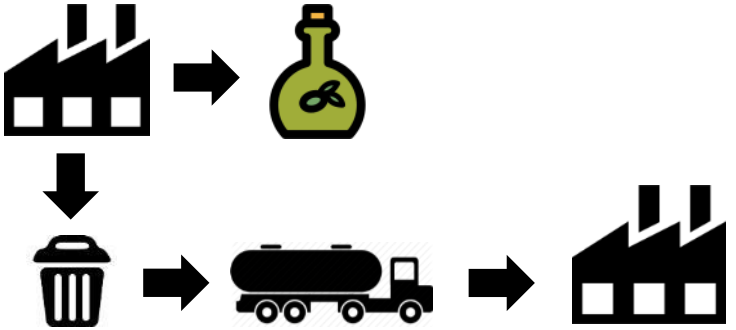
FARMING

PRUNINGS

100 kg olives produce > 80 kg of wastes



PRODUCTION & WASTE TREATMENT



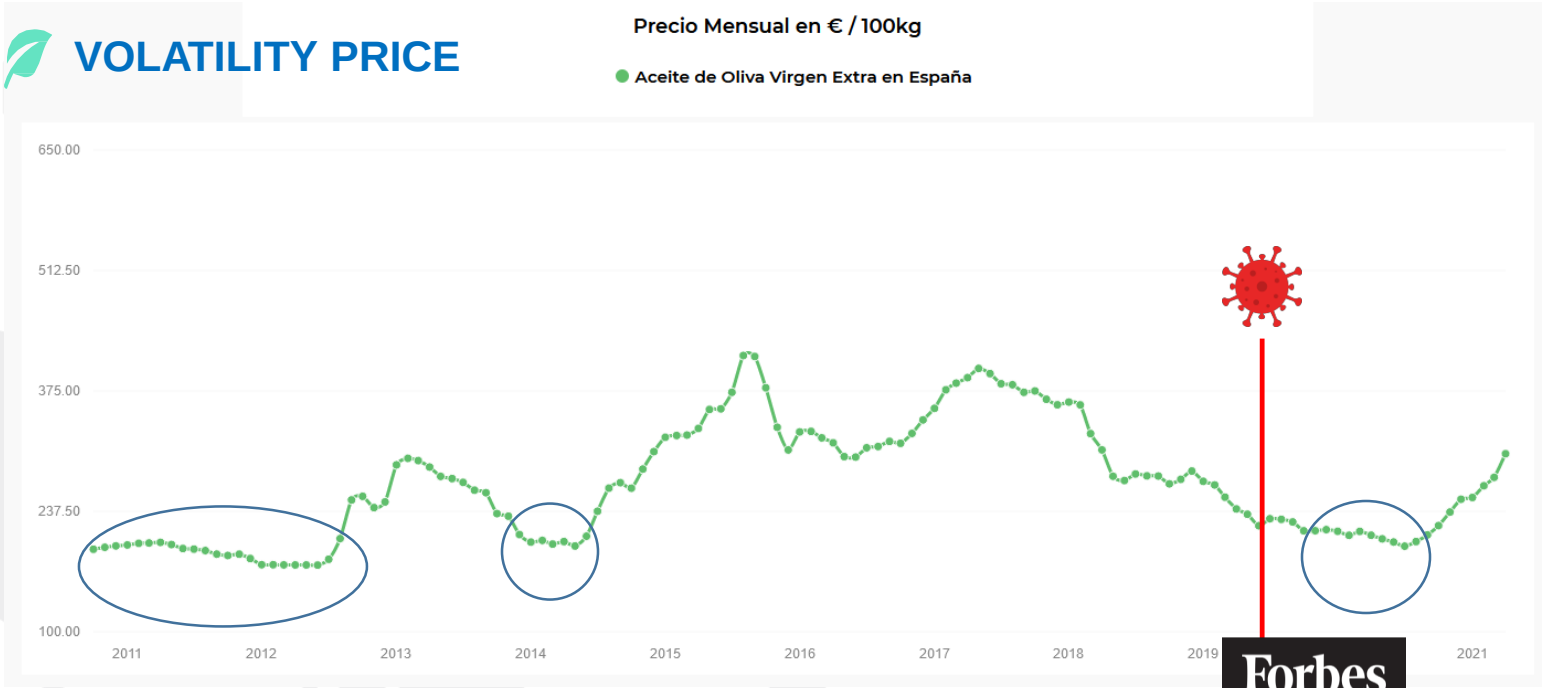
POMACE

STONES

WASTE WATER

CHALLENGES IN THE OLIVE OIL SECTOR

VOLATILITY PRICE

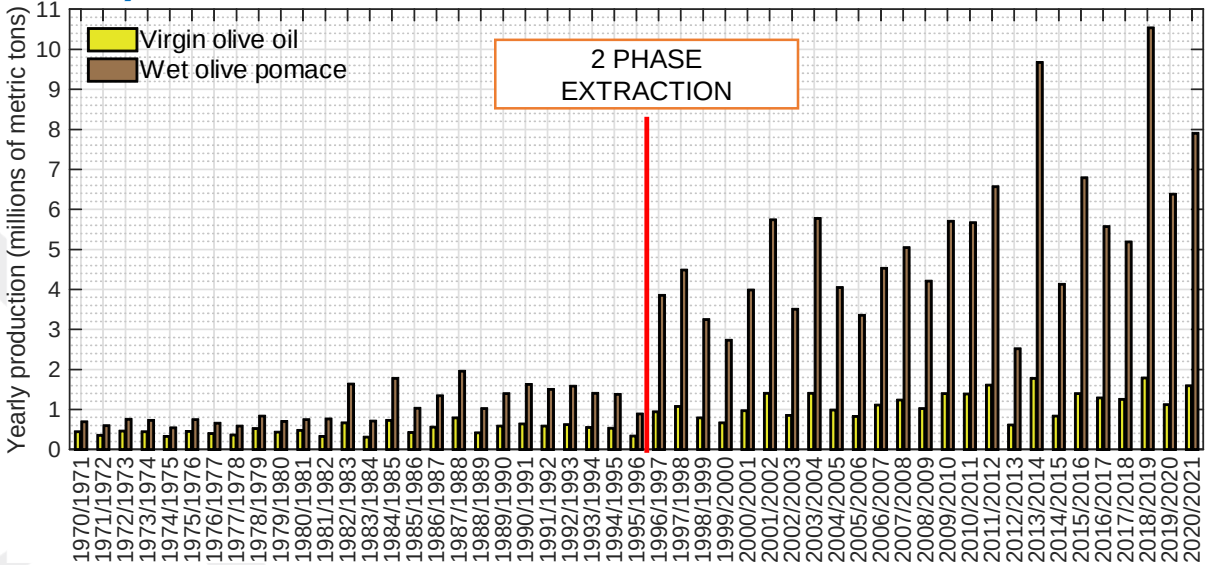


TODAY

- Strong reduction of the virgin oil price (> 40 %).
- Intensive Farming
- Social disturbances, strikes, poverty rises up for farmers and olive oil producers.
- Solution of the Governments → **More Subsidies**

CHALLENGES

OLIVE POMACE (ALPERUJO) MANAGEMENT



Features (harvests 2018/19 and 2019/20)

- Production of **large amounts of olive pomace** (increasing year per year)
- Nowadays **represents a cost** for olive oil mill owners.
- **Average costs (2-5 €/ton)**

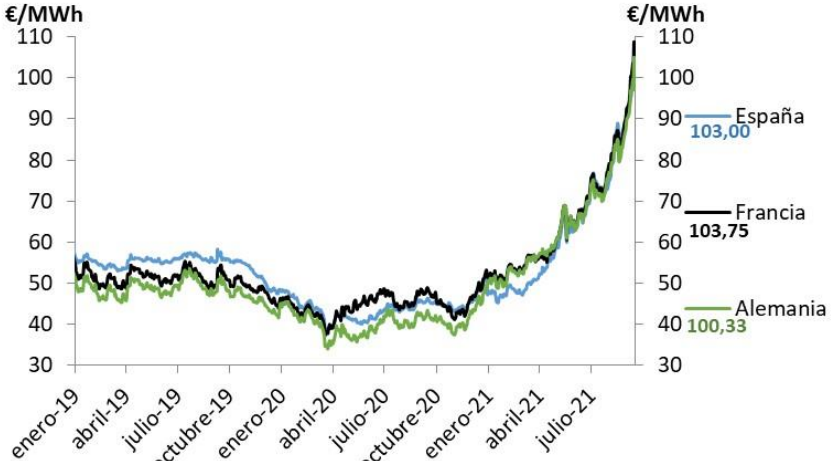
  → **50.000 - 100.000 €/harvest** (MILL = 20 – 30 million kg of olives)

- **Lower price** of olive pomace oil
- Transport of water (> 70%)

CHALLENGES

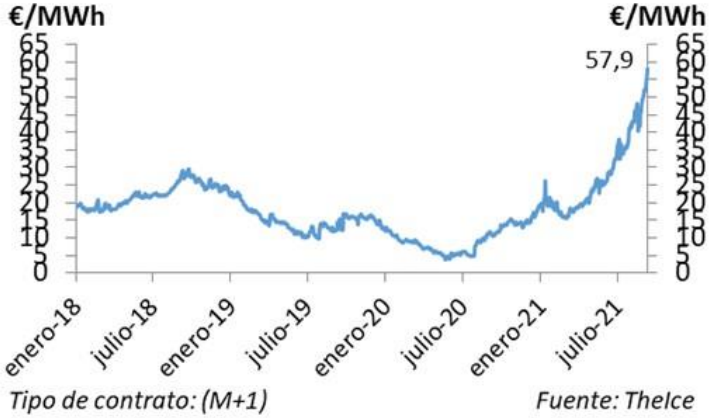
INCREASING OF THE ENERGY PRICES

Evolución del precio de la electricidad



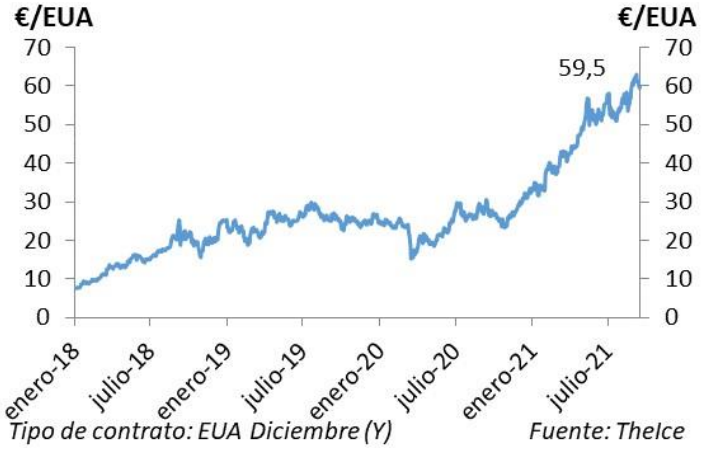
Fuente: EEX, OMIP, Elaboración propia

Evolución del precio del gas natural



Tipo de contrato: (M+1) *Fuente: Thelce*

Evolución del precio tonelada de CO_2



Tipo de contrato: EUA Diciembre (Y) *Fuente: Thelce*

Current situation

- **Increasing of the electricity bill** (> 20 %).

Medium size olive mill: 150.000 € (2020/21) → 200.000 € (2021/22)

- ORUJERA → 15-20% operating costs.
- PV technology is not a solution.

CHALLENGES

¿THE FUTURE OF AGRIFOOD SECTOR?

More Sustainability for 2030

- Reduction of pesticides + herbicides (50 %)
- Reduction of fertilizers (20 %)
- Increasing of organic farms (25 %)
- Increasing of the **energy efficiency**
- **Promote Circular Economy**

Forbes

EU Plans To Reduce Pesticides By 50%

The plan includes a target of reducing the use of pesticides by 50% in the next decade. The plan would also reduce sales of antimicrobials for farmed animals by 50%, and the use of fertilizers by 20%, by 2030. The share of organic farming would also be increased by 25% by 2030 - up from the current 8%.

EU executive s
organic farmlc

The European Commission has proposed
while cutting the use of pesticides and fer

Olimerca Información Oleícola Independiente

Los agricultores andaluces contra los ecoesquemas que les llevarán a la ruina

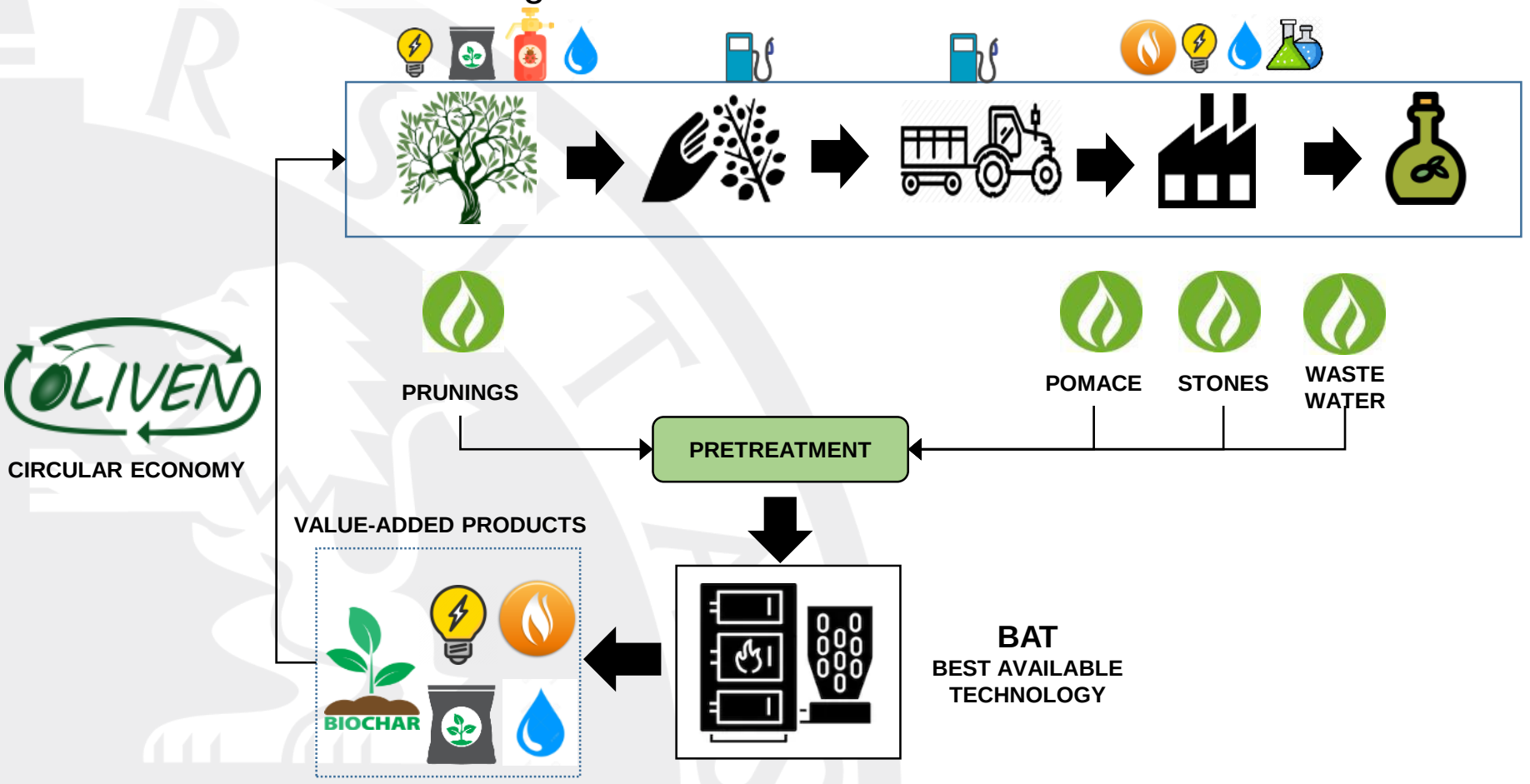
Así lo denuncian ASAJA, COAG, UPA y Cooperativas Agro-alimentarias de Andalucía

08/09/2021

OBJECTIVE

Main objective of OLIVEN

- Define **successful technologies for** olive industry **wastes/by-products valorisation** focusing on the **value chain enhancement.**



OBJECTIVE

Specific objectives

- **State-of-the-art** of the olive oil value chain and current wastes
- **Identify innovative and mature technologies** for olive wastes valorization. BATs → Best Available Technologies
- **Carry out a** Life Cycle Assessment (**LCA**) and Life Cycle Costing (**LCC**) of the current most representative olive oil value chain
  - From “cradle-to-gate”
- **Comparative LCA and LCC** analysis to evaluate the impact of the BATs
  - Future simulated scenarios
- **Install a demo-plant** in a real scenario
  - Knowledge transfer to the stakeholders




RESULTS

INFORMATION COLLECTION

STATE OF THE ART **most representative value chain** in each country

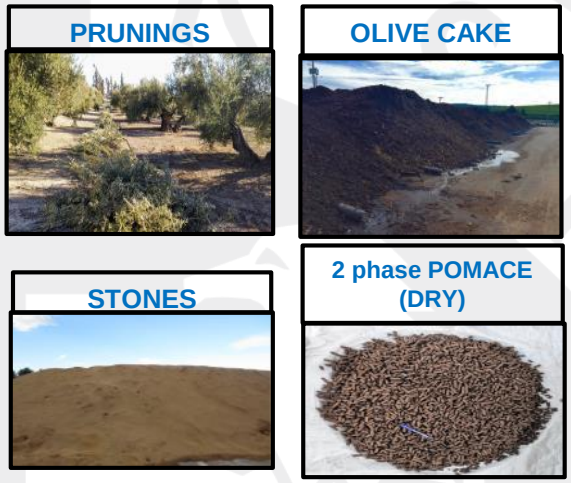
	SPAIN	TUNISIA	TURKEY
Olive tree surface (ha)	2.470.711	1.846.830	864.428
Virgin olive oil production (AVG tons 2014-2019)	1.314.118	195.000	186.800
Most representative region	Andalusia	Sfax – Sahel	Aegean
Olive grove share	62,5 % 73,4 % dryland 26,63 % Irrigated	37,2 % 98,4 % dryland 1,6 % Irrigated	52,5% 58,0 % dryland 42,0 % Irrigated
Olive tree density (trees/ha)	130 traditional	< 40 Traditional	250 intensive
Total of olive mills	1835 848 (Andalusia)	1721 1009 (Sfax-Sahel)	1229 398 (Eagean)
Main extraction process	2 phases (> 95 %)	3 phases (> 90%)	3 phases (55 %) 2 phases (45 %)

RESULTS

INFORMATION COLLECTION

Revision of the **BEST AVAILABLE TECHNOLOGIES** (BATs) and not yet BATs

Biomass Gasification Technology



- Renewable Electricity (15 %)
- Renewable Heat (60 %)
- BIOCHAR (15 %)

BIOCHAR

- Soil amendment
- Extremely porous **activated carbon**
- Absorbs water and nutrients (up to 5 times its weight)
- High cation exchange capacity
- Improve the soil microbial life

Cost = 2.000 €/kW_e

Payback = 4-6 years

250 kW_e = 300-350 m^2

Biomass consumption = 300 kg/h

RESULTS

LIFE CYCLE INVENTORY

- Development of normalized questionnaires according to ISO 14040 and 14044
- **Product Environmental Footprint Category Rules** for Olive Oil (EC)

SURVEYS

- face to face interviews
- phone calls
- mails
- web page

More questions…

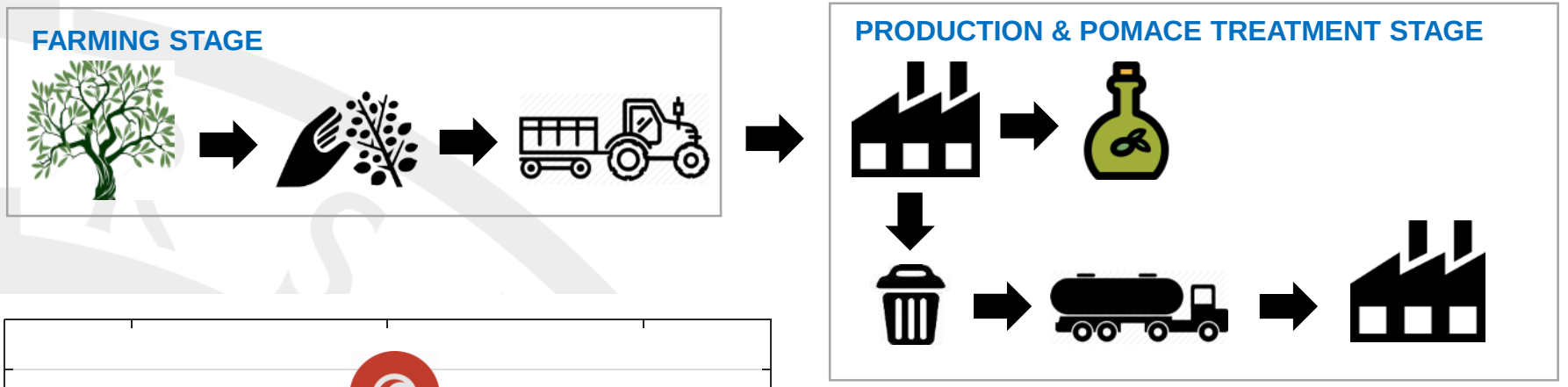
- Olives harvested?
- Type of cultivation?
- Organic or Traditional?
- Irrigation system?
- Distances (km)
- Type of transport (tractor, trailer, truck)
- Type of fuels
- Consumables, etc.
- Virgin olive oil produced

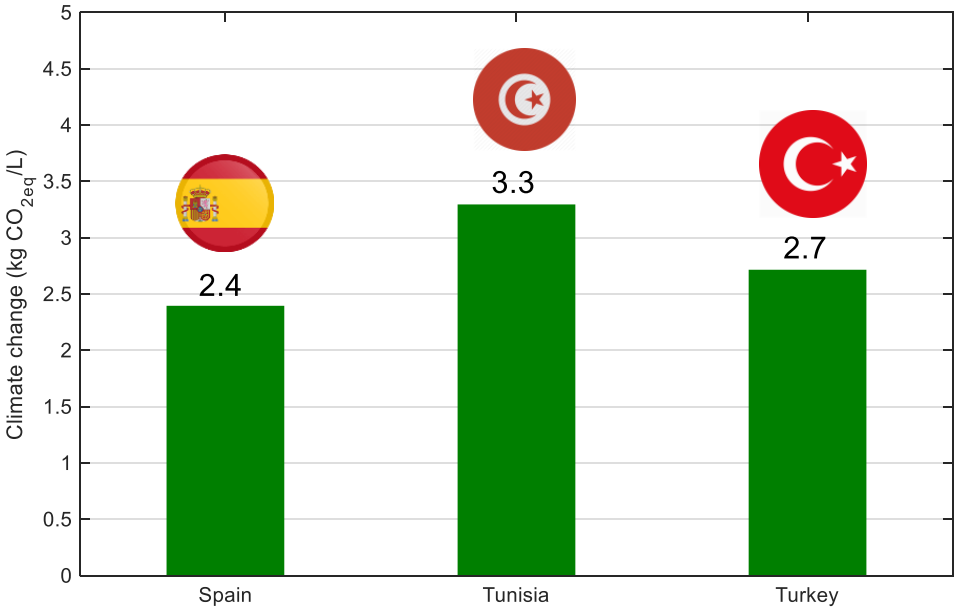
Some data reported during the last harvests

	TURKEY	TUNISIA	SPAIN
Nº of Harvests	2017-2020	2017-2020	2017-2020
Nº of farmers surveyed	45	35	62
Ha surveyed	1.500	1.000	2.000
Dryland	52 %	90 %	58 %
Irrigated	48 %	10 %	42 %
Number of mills surveyed	24	30	18
2 PHASES	33 %	10 %	100 %
3 PHASES	66 %	90 %	0

RESULTS

LIFE CYCLE ASSESSMENT (LCA)





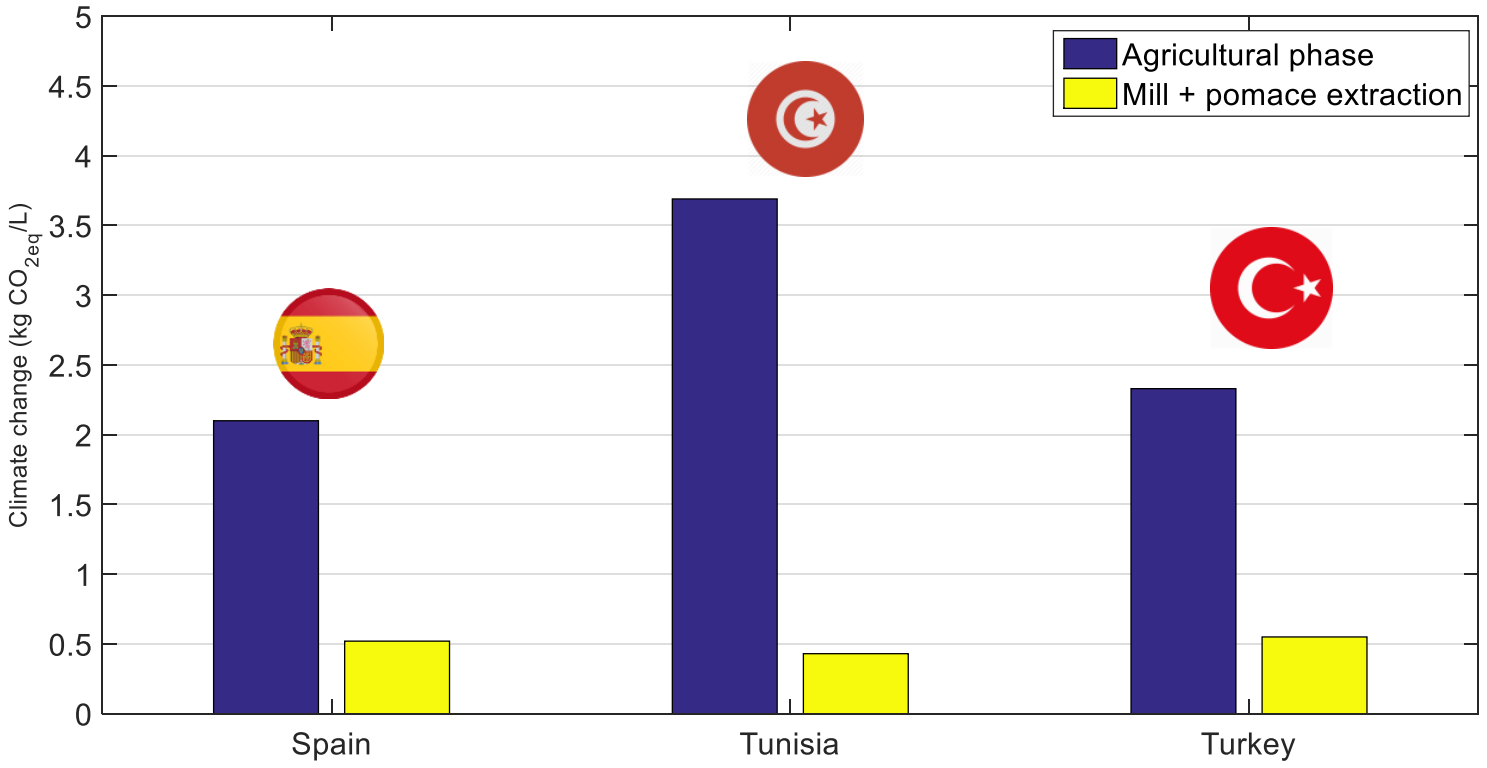
CLIMATE CHANGE INDICATOR

- **Traditional Spanish olive grove** produces the least impact in terms of greenhouse gas emissions (**GWP**) (**2.4 kg CO_2eq/L of virgin olive oil**).
- In 2nd place **Turkey (2,7 kg CO_2eq/L)** → **Intensive olive grove**
- In 3rd place **Tunisia (3.3 kg CO_2eq/L)** → **Traditional rainfed**

RESULTS

LIFE CYCLE ASSESSMENT (LCA)

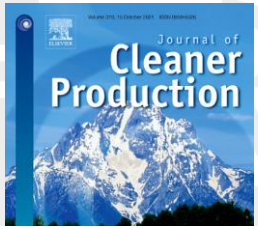
- **Agricultural phase** is the most harmful phase in the whole value chain with around **80% of weight** (Climate Change indicator).
- **Fertilizers + Pesticides + Herbicides > 50%**



RESULTS

LIFE CYCLE ASSESSMENT (LCA)

Traditional Spanish olive grove presents the **best value of carbon footprint** (reducing of the GHG emissions) → **better than the intensive farming's**



Journal of Cleaner Production 290 (2021) 125677

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Life cycle assessment of the Spanish virgin olive oil production: A case study for Andalusian region

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Journal of Environmental Management 293 (2021) 112951

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Life cycle assessment, C footprint and carbon balance of virgin olive oils production from traditional and intensive olive groves in southern Spain

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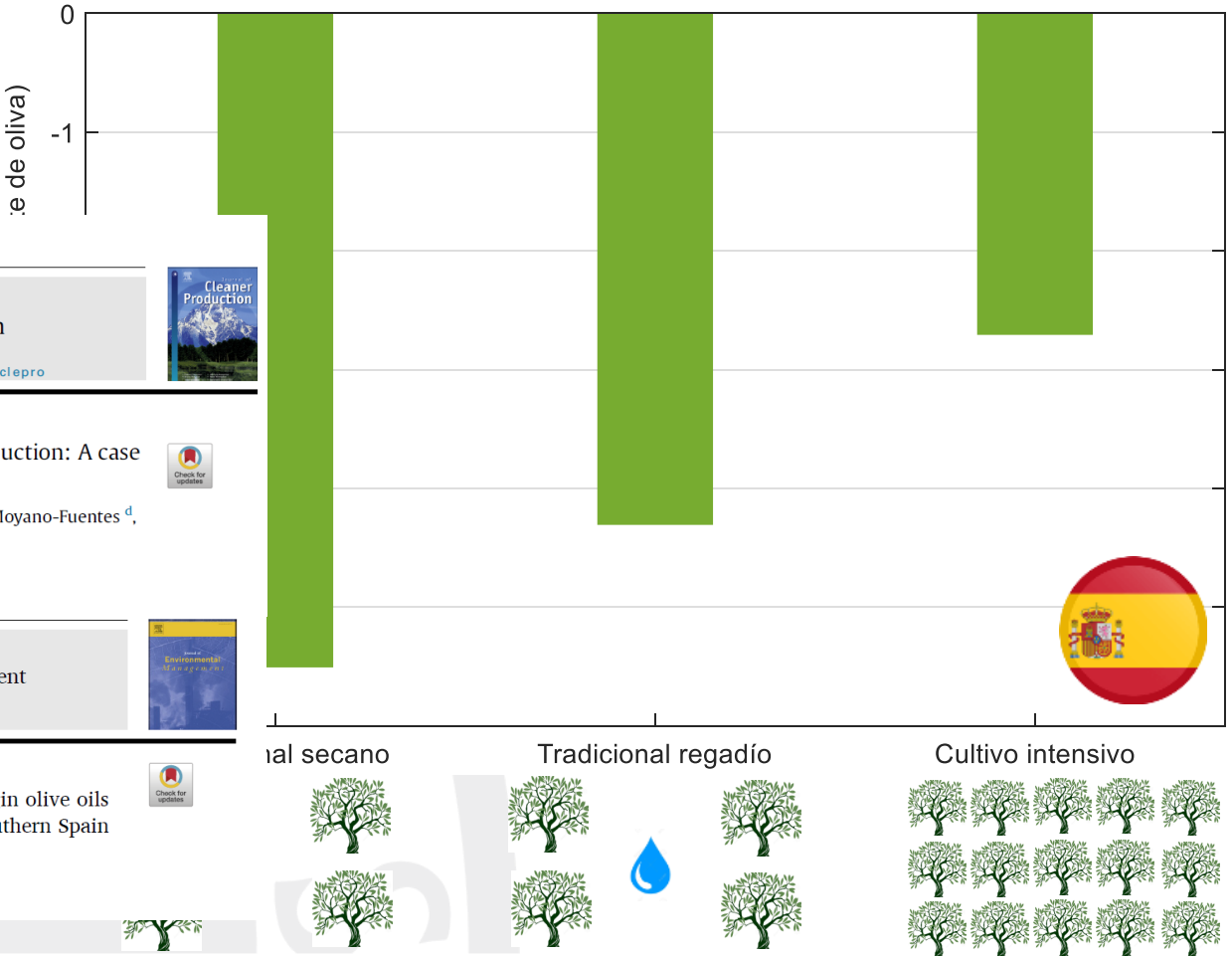


RESULTS

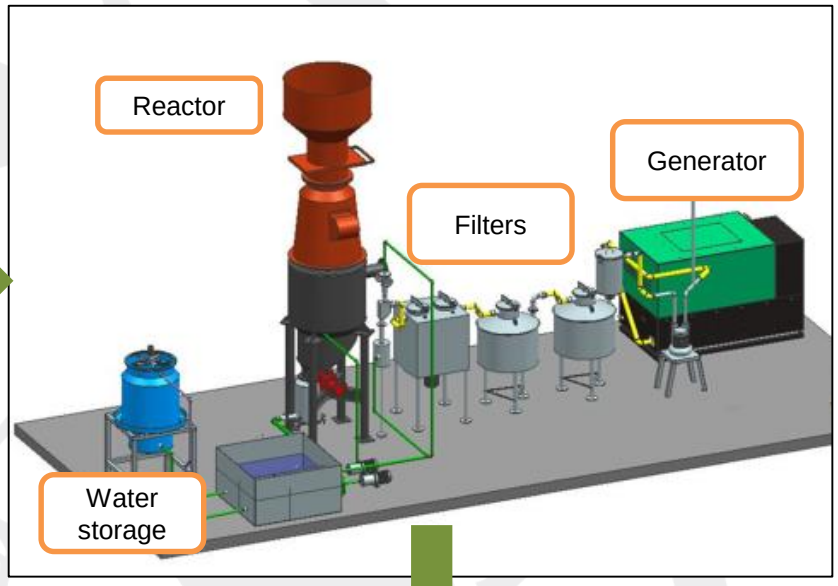
TECHNOLOGY TRANSFER

Demonstration of a **gasification plant** in a real scenario (olive mill) → IFAPA

OBJECTIVE → Technology transfer for stakeholders and economic study of the plant

ORUJILLO

PODA OLIVAR



Access to new markets for stakeholders

Renewable electricity
Direct reduction of bills (> 75%)

Heat
(Mill owners can dry the olive pomace in-situ)

Biochar production
(Soil amendment)

CARBON FOOTPRINT REDUCTION

ECO-LABEL

RESULTS

TECHNOLOGY TRANSFER → GASIFICATION PLANT

Junta de Andalucía
Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible
INSTITUTO DE INVESTIGACIÓN Y FORMACIÓN AGRARIA Y PESQUERA

- DEMO Plant installed in an **real scenario** (IFAPA) → 2 years (2022)
- More than **1.000 h of operating** (we started on June 2020),
- Successful operation of the system with **syngas (free of tars)**
- STUDY of the **biochar application** in the olive grove (IFAPA)

Universidad de Jaén

Proyecto OLIVEN

RESULTS

OLIVE POMACE VALORIZATION PLANT

PLANTA DE GASIFICACIÓN

Orujillo graso pelletizado
(15% humedad)

Electricidad Renovable
(500 kWe)

Biochar
(700 ton/año)

Agua caliente a batidoras
o bodega (frío)

Gases de combustión
motor

Trómel de secado

Balsa alperujo

20.000 ton/año
(9 meses)

Gases de
combustión
horno

Horno apoyo

Orujillo graso
(15% Humedad)

Orujillo
graso

RESULTS

ECONOMIC STUDY

TOTAL INVESTMENT COSTS	**950.000 – 1.200.000 €**
GRANT (30 %, CDTI Project)	280.000 – 360.000 €
INITIAL PAYMENT (15%)	140.000 – 180.000 €
LOAN (0% + €, a pagar en 10 años a partir del 2º año)	530.000 – 660.000€
TOTAL PAYMENT (in 10 years)	**670.000 – 840.000 €**

Economic scenarios (grant = 30%)	**Payback** (years)
WORST case	5-6
MEDIUM	4-5
BEST	3-4

ECONOMIC BENEFITS

- **Reduction of electricity bill (>75%)**
- **Reduction of olive pomace** transport costs
- Hueso de aceituna
- **Biochar**

CONCLUSIONS

- **ENVIRONMENTAL** → Carbon Footprint reduction of the whole value chain
  - ✓ OLIVEN > 20-25 % reduction in the Climate Change indicator (GWP)

- **ELECTRICITY BILL SAVINGS** FOR MILL OWNERS AND EXTRACTORS > 75 %

- **DIRECT OLIVE POMACE (ALPERUJO) DRYING** → transport costs

- **BIOCHAR** → New business models

150-250 €/ton

- **OLIVE PIT SAVING** (hot water available in the malaxing stage)

- **OLIVE PIT CLEANING AND DRYING** → increasing of the sale price (90-100 €/ton)
- **ECOLABEL**

- **REDUCTION OF THE PRODUCTION COSTS** > 10 %

Questions?

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Thanks for your attention!