

# BIOECONOMY IN GREECE

## Current situation, barriers, needs and opportunities

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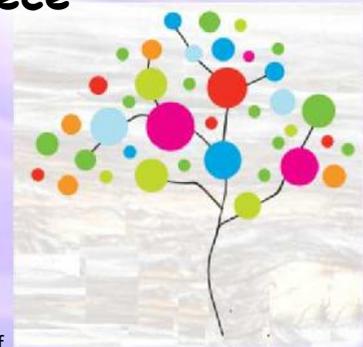
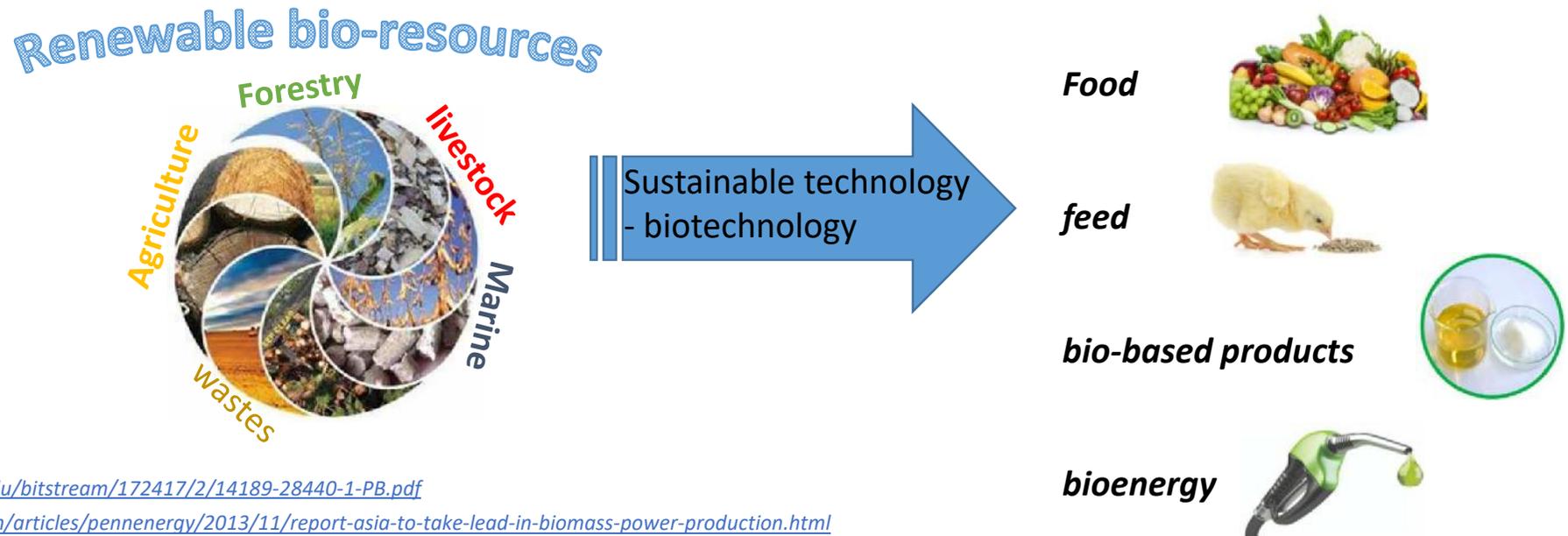


Photo: [http://foresteurope.org/wp-content/uploads/2016/08/Activity\\_booklet.pdf](http://foresteurope.org/wp-content/uploads/2016/08/Activity_booklet.pdf)

# What is Bioeconomy

The EC defines the bioeconomy as,

**“the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy”** (EC, 2012, p. 3).



<http://ageconsearch.umn.edu/bitstream/172417/2/14189-28440-1-PB.pdf>

<http://www.pennenergy.com/articles/pennenergy/2013/11/report-asia-to-take-lead-in-biomass-power-production.html>

# Bioeconomy policy around the world

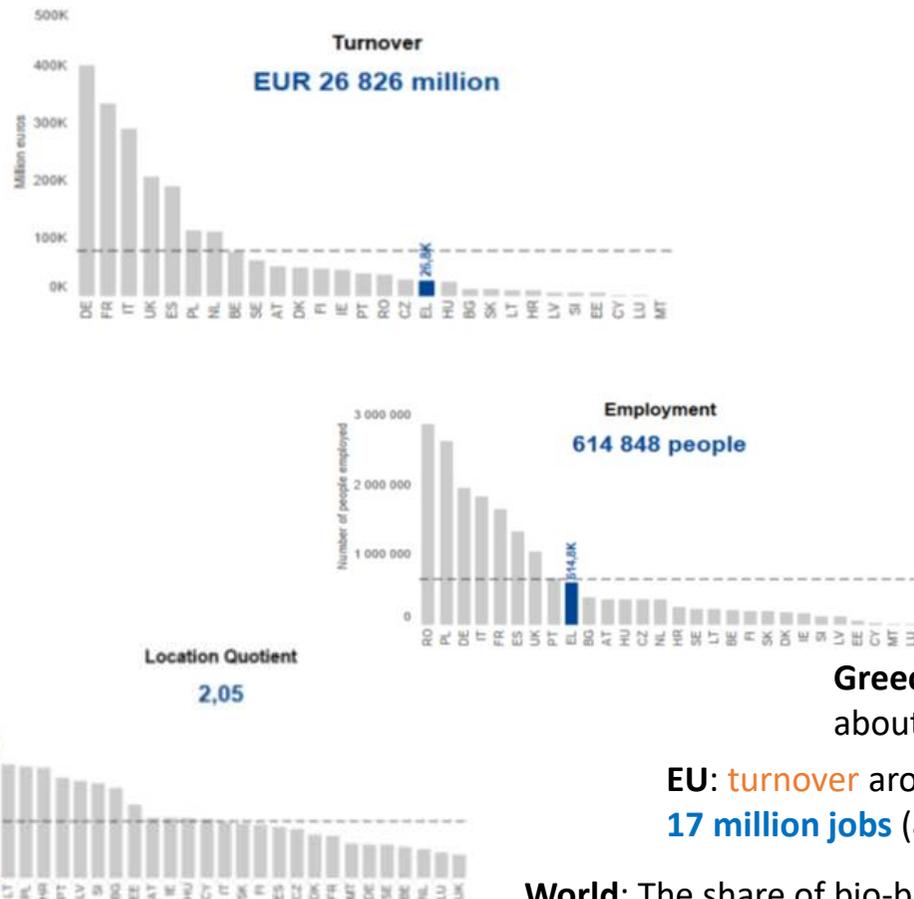


Sources: <http://bioekonomierat.de/en/international0/>

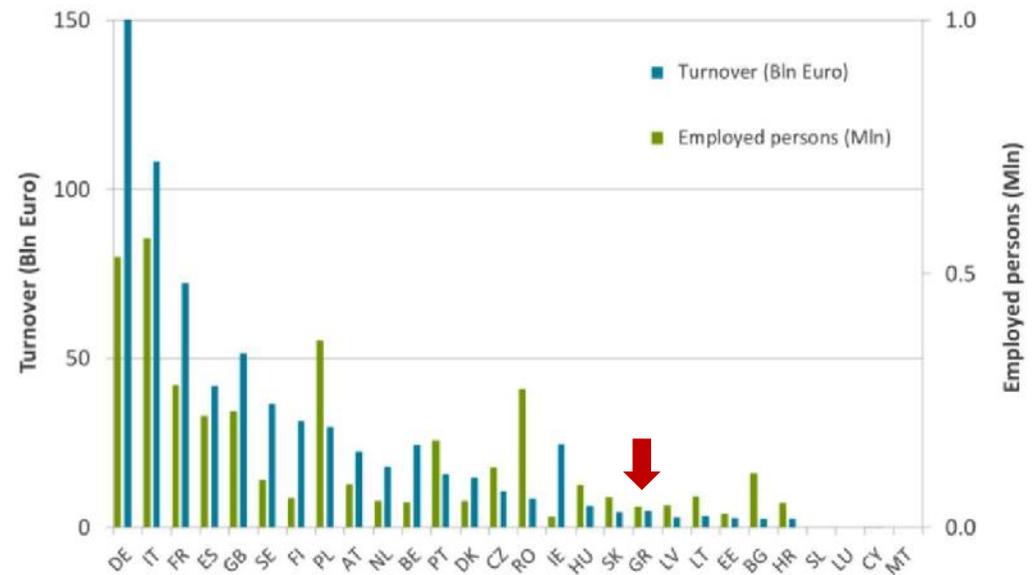
[https://www.tni.org/files/publication-downloads/tni\\_primer\\_the\\_bioeconomy.pdf](https://www.tni.org/files/publication-downloads/tni_primer_the_bioeconomy.pdf)

# Bioeconomy in Greece in figures

EU-28, 2014



EU-28, 2015



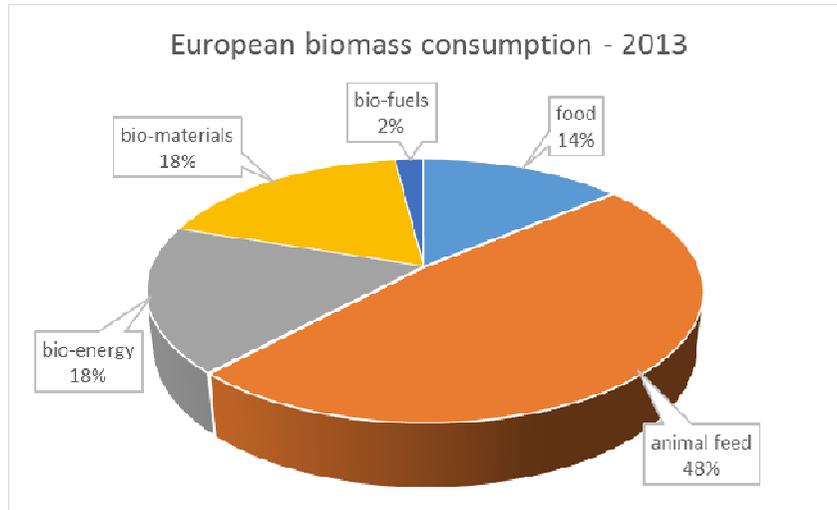
Greece: turnover of about **27 billions** and quite **0.5million employers** where about **80% of them work at the agricultural sector**.

EU: turnover around **2 trillion euro** (20% of non food & agriculture industries)  
**17 million jobs** (8.5% of the EU workforce)

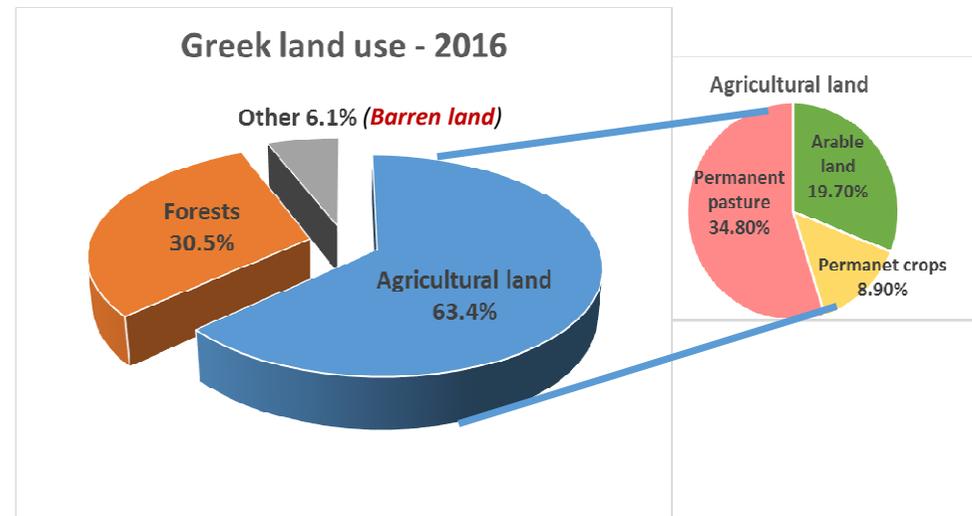
**World:** The share of bio-based products trade has raised from **10% in 2007 to 13% in 2014** (El-Chichakli et al., 2016).

# Biomass for Food and Feed Industry

## Greece



- In 2017 the agricultural sector contributed with **4.1% to the Gross Domestic Product (GDP)** where **70% was agricultural product** and **30% animal product** [1].
- The domestic food industry covers more than **1/4 (26%) of all businesses** in Greek manufacturing [2].



<https://www.cia.gov/library/publications/the-world-factbook/fields/2097.html>

Biomass remains largely unexploited in Greece & worldwide

On average, around **14% of the total biomass is exploited** around the globe (mostly in the field of energy).

**1 ton of biomass is equivalent to about 0.4 tonnes of oil.**

Sources:

1. <https://www.export.gov/article?id=Greece-Agricultural-Sector>
2. IOBE-2016 <http://www.sevipa.gr/blog/iobe-e-biomechania-trophimon-kai-poton-echei-te-megalytere-symbolo-ston-tomea-tes-metapoiases>

# Biomass for Food and Feed Industry

## Barriers for development

- Greek farmers are **heavily dependent on EU subsidies**, which constitute about 50% of their income.
- the **feed cost** is among the highest in EU.
- **Low innovation**

## Opportunities for development

- New food culture – Mediterranean Diet
- Development of novel foods and other new products

<http://www.agro24.gr/agrotika/agora/meletes-kladikes/idoy-giati-i-ellada-paramenei-mia-kata-vasi-agrotiki-hora-alla-me>

[http://www.gsrt.gr/Financing/Files/ProPeFiles161/%CE%A6%CF%85%CF%84%CE%B9%CE%BA%CE%AE%20%CE%A0%CE%B1%CF%81%CE%B1%CE%B3%CF%89%CE%B3%CE%AE%20\(1\).pdf](http://www.gsrt.gr/Financing/Files/ProPeFiles161/%CE%A6%CF%85%CF%84%CE%B9%CE%BA%CE%AE%20%CE%A0%CE%B1%CF%81%CE%B1%CE%B3%CF%89%CE%B3%CE%AE%20(1).pdf)

# Unexploited agro-industrial residues



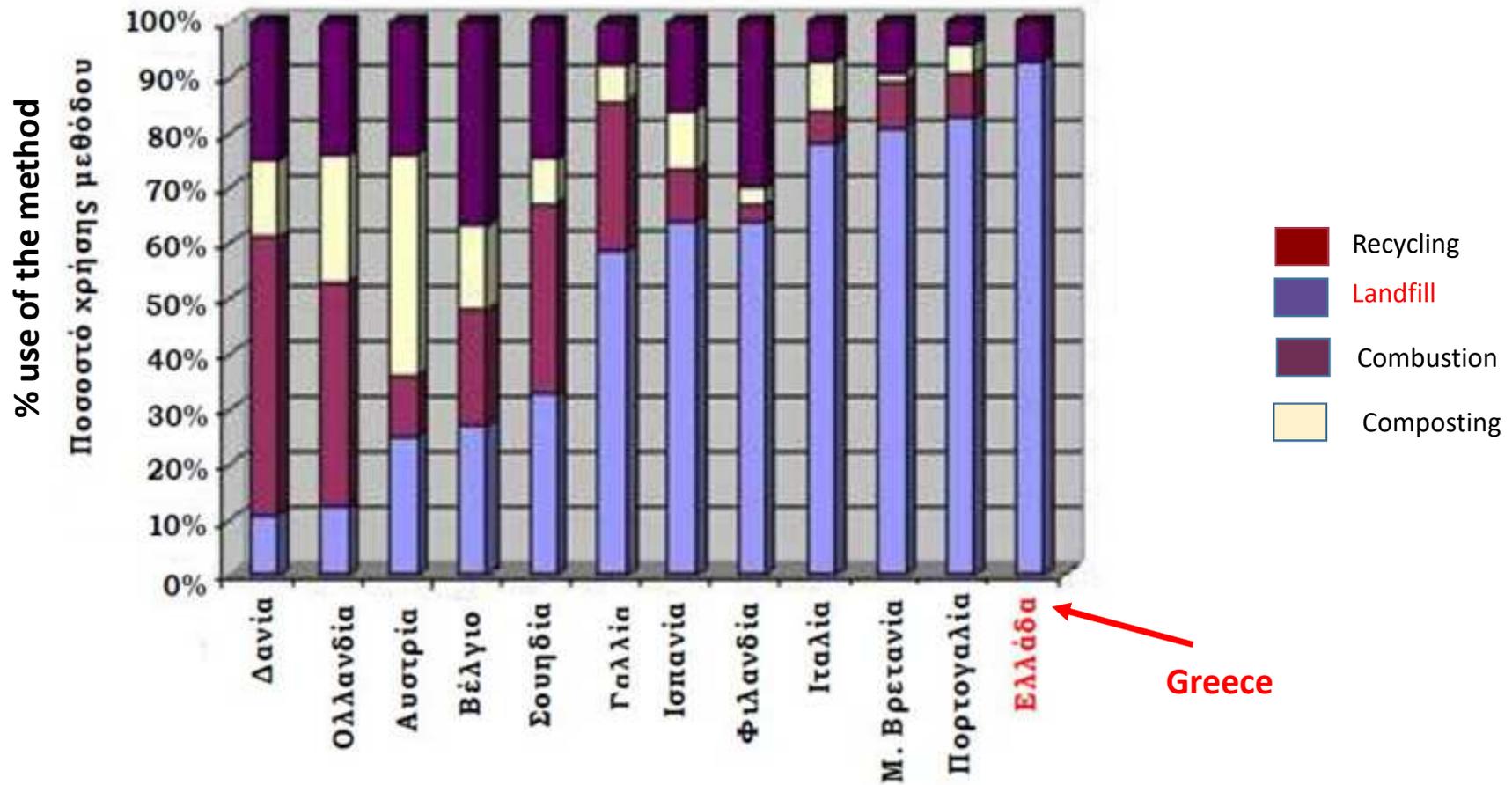
## Greece:

It is estimated that annual waste generation in Greece is **57.983.751 tn / y**, including agricultural and industrial waste (53%) and livestock manure (47%).

*Based on their anaerobic treatment scenario, **21.9 TWh of electricity** can be generated, accounting for **39% of the gross electricity consumption in Greece.***

**2012: 10.2 PJ of energy of unexploited agro-industrial residues**

## Management of solid wastes in Europe



Source: <http://ikee.lib.auth.gr/record/136056/files/GRI-2015-13998.pdf>

## Biomass for materials



Production of platform chemicals and products through the bio-refinery process.

In Greece bio-refineries for the production of chemicals and products are available basically only in lab/pilot scale. However recently there are some few initiatives for the establishment of commercial units.

# Biomass for materials

## Barriers for development

- Fragmentation of agricultural land in many **small properties** (lot size ~ 4.8 ha against 14,3 in EU -27 and average economic size of farm 9.266,8 € against 25.450,2 € in EU-27) => **lack of reliable transportation network and long-term supply of materials**
- **Low technical training** of farmers (32% have no education)
- **Difficulty in introducing new technologies** because of the age of rural population (60% of farmers over 45y old)
- **Reduction of employment** in the primary sector
- The **family employment** covers 85.5% of total employment in agriculture sector
- **Funding problems** from banks and state because of the economic crisis
- **Lack of control mechanisms** for the implementation of existing environmental legislation and penalties on offenders
- **The lack of public information** on the environmental benefits resulting in strong local resistance to projects
- **Bureaucratic licensing difficulties**
- **Instability of institutional and taxation environment**

### Sources:

- [https://www.espa.gr/elibrary/pa\\_espa\\_2014\\_2020.pdf](https://www.espa.gr/elibrary/pa_espa_2014_2020.pdf)
- <http://energypress.gr/news/se-exelixa-simantika-erga-viomazas-kai-epexergasias-apovlita>
- CRES 2013

# Biomass for materials

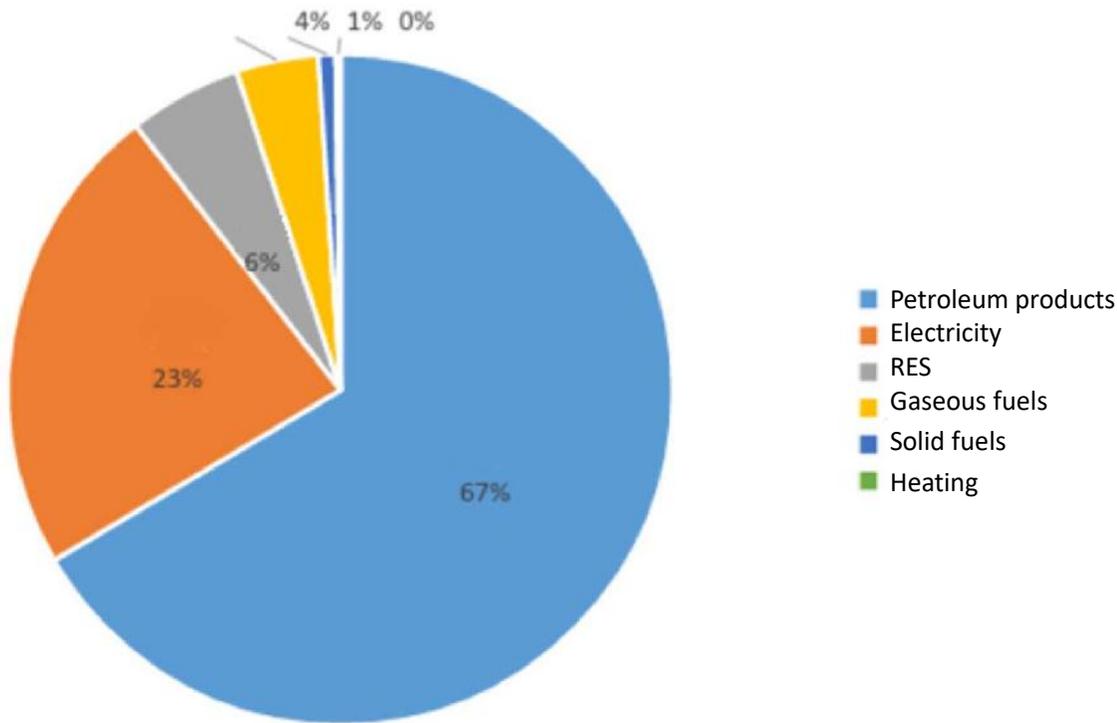
## Opportunities for development

- Currently **only a 3%** of the available biomass is **exploited** (mostly as fuel)
- Exploitation of biomass **allows synergies** with traditional agricultural and livestock activities
- Exploitation of biomass **can be used** for independent production of products (& electricity) **in remote areas**
- There are **reliable and proven technologies**
- There is **favourable legislative framework**
- Greece could **viably exploit** its renewable energy sources, under an environmentally friendly and economic viable way

### Sources:

1. <http://www.ecotimes.gr/1520/%CE%B2%CE%B9%CE%BF%CE%BC%CE%AC%CE%B6%CE%B1-%CF%80%CE%B7%CE%B3%CE%AE-%CE%B5%CE%BD%CE%AD%CF%81%CE%B3%CE%B5%CE%B9%CE%B1%CF%82/>
2. [http://www.cres.gr/energy-saving/images/pdf/biomass\\_guide.pdf](http://www.cres.gr/energy-saving/images/pdf/biomass_guide.pdf)

# Energy sector in Greece - 2011



Source: EU, DC Energy A1-June 2011, ESTAT, EC FIN, EEA

## Basic RES and % Total Primary Energy Supply

- biofuels and waste (4.0%)
- hydropower (2.0%),
- solar and wind power (each with less than 1.0%).

Source: National RTDI Strategy for Smart Specialisation 2014-2020

## Use of wood and wood residues (traditional biorefinery)

Fuelwood & mill residues: 2 M toe/year

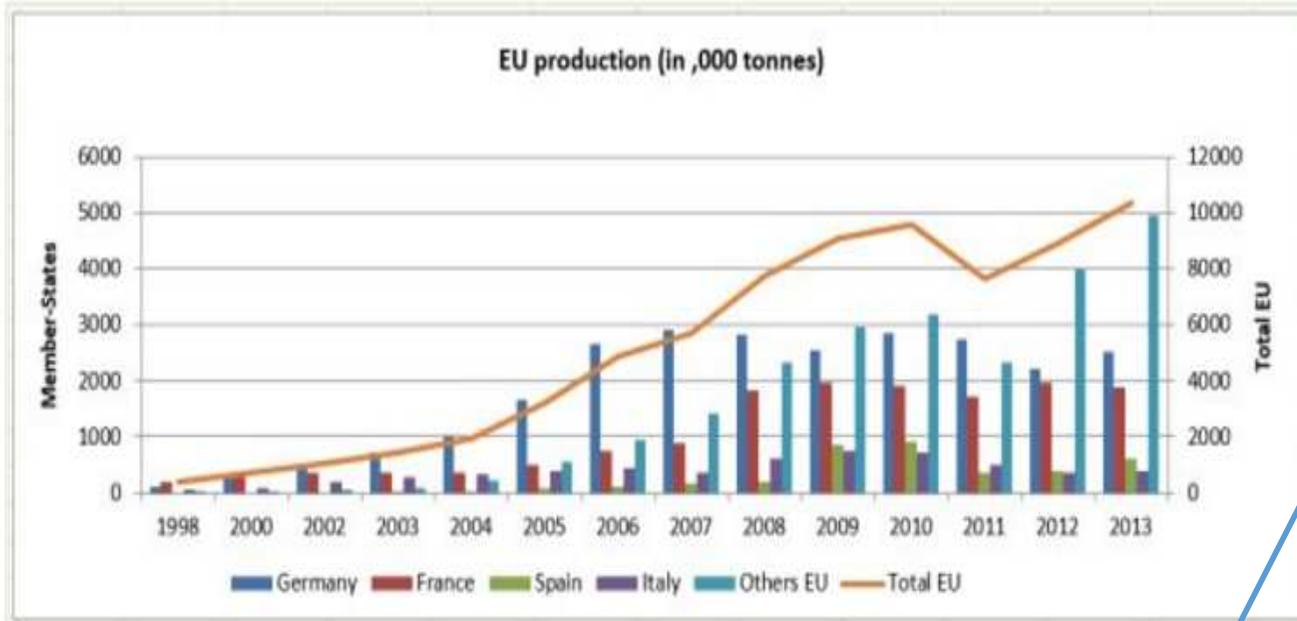
GDP Share: 2 B Euro

Total Employment: 30,000

Source: BIOTOPOS Network

# Bio-diesel industry in Europe

## Production capacity, 2013-2014



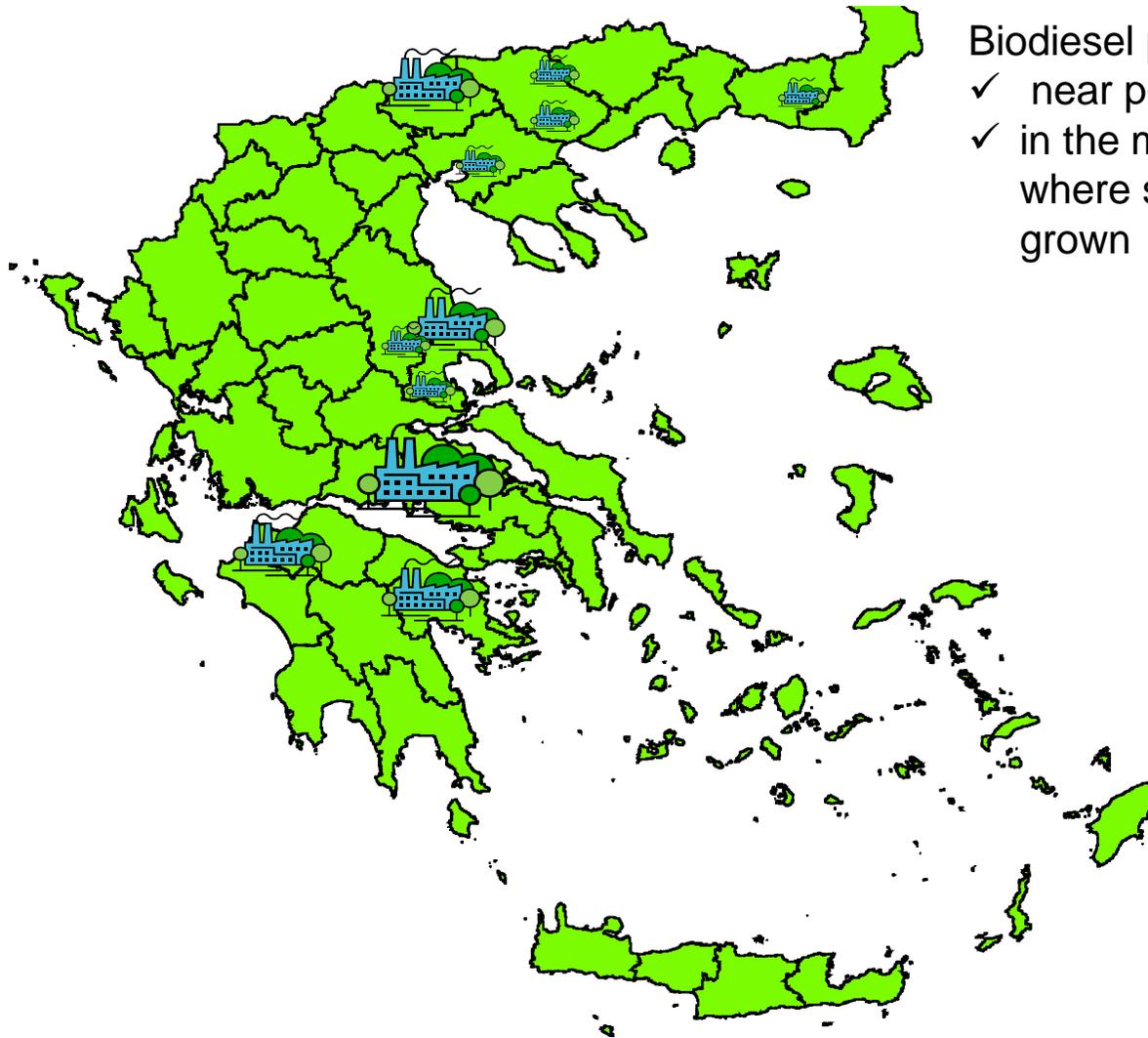
It is increasing rapidly

Greece has still low production capacity compared to other EU countries

COUNTRY	,000 TONNES	
	2014	2013
Austria	495	239
Belgium	741	565
Bulgaria	378	13
Croatia	55	33
Cyprus	20	1
Czech Republic	502	210
Denmark	250	334
Estonia	35	0
Finland	400	320
France	2445	1885
Germany	4655	2516
<b>Greece</b>	<b>702</b>	<b>220</b>
Hungary	158	150
Ireland	74	24
Italy	1837	387
Latvia	156	61
Lithuania	147	118
Luxemburg	20	0
Malta	5	1
The Netherlands	2505	1248
Poland	1269	648
Portugal	590	314
Romania	407	137
Slovakia	158	105
Slovenia	108	2
Spain	4194	618
Sweden	282	-
UK	505	277
<b>TOTAL</b>	<b>23,093</b>	<b>10,367</b>

Source: European Biodiesel Board <http://www.ebb-eu.org/stats.php>

## Geographic allocation of biodiesel plants in Greece



Biodiesel plants located:

- ✓ near ports
- ✓ in the main agricultural regions of Greece, where sunflower (and some rapeseed) are grown

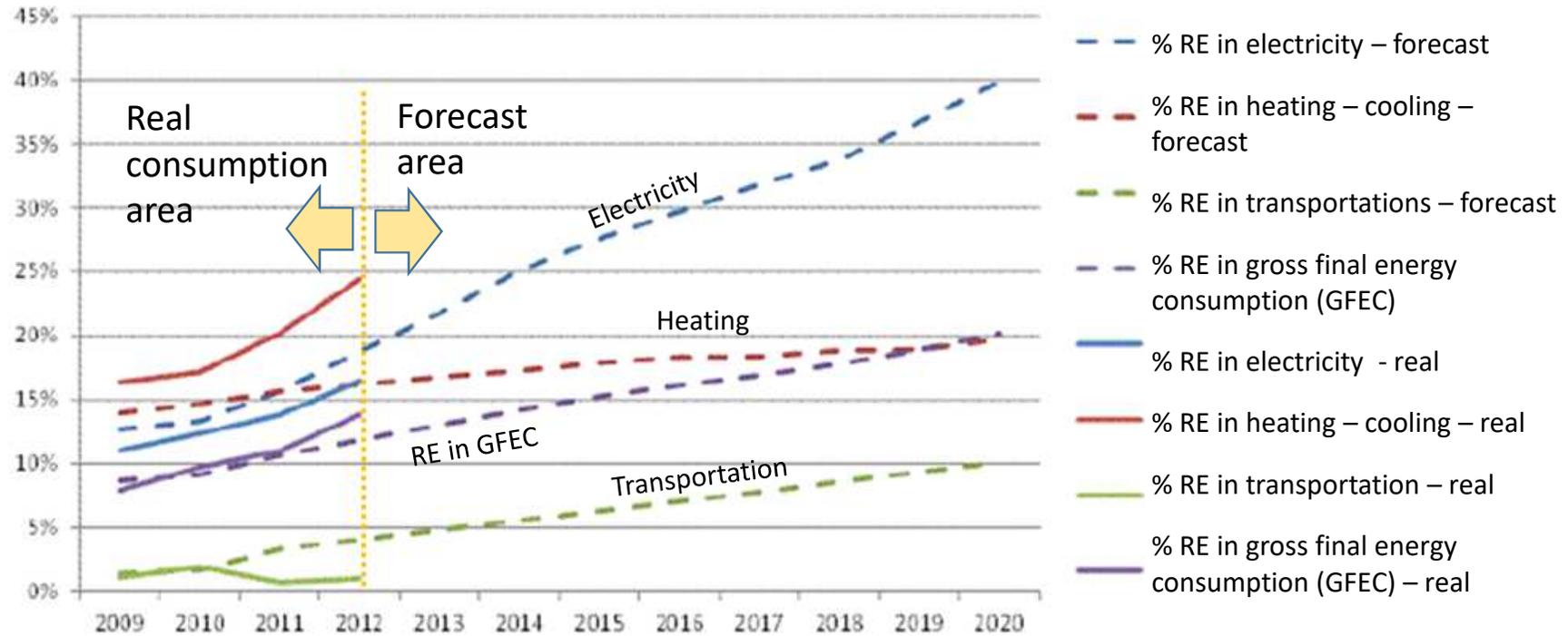
*Source: CRES, 2016*

## Biodiesel production in Greece

- ✓ **12 Greek companies** are operating in Greece, producing around **130,000 m<sup>3</sup> biodiesel** which accounts for the **93% of the biodiesel consumed in Greece**.
- ✓ Biodiesel is almost entirely produced **by local feedstock** (58% of vegetable oils and the rest from used cooking oils and cotton seed oils).
- ✓ However, **biofuels consumption in Greece is less than 2%**, because **bioethanol is not produced nor imported in Greece**, thus transportation fuels rely only on biodiesel.

*Source: CRES, 2018*

# Forecast of renewable energy (RE) penetration in the Greek market



# Energy sector in Greece

## Barriers for development

- **High price of raw materials** → which initiates biodiesel imports
- **Unstable and inefficient policy** , which affects the final price of the biofuel.
- **Huge bureaucracy**
- **Environmental licensing**
- **Disorganized and costly supply chain** of raw materials
- Unlike the interest and support at institutional level of RES projects for power generation, contribution of renewable energy to thermal energy and transportation, by the use of biofuels, remains relatively low mainly due to the **lack of appropriate financial mechanisms**
- **Lack of public awareness**
- **Lack of** substantial efforts to create a **framework for the marketability** of 'green' innovations

Sources:

[http://www.opengov.gr/minenv/wp-content/uploads/downloads/2012/04/EnPlan-RoadMap-2050\\_24april2012.pdf](http://www.opengov.gr/minenv/wp-content/uploads/downloads/2012/04/EnPlan-RoadMap-2050_24april2012.pdf)

CRES, 2016

[http://www.opengov.gr/minenv/wp-content/uploads/downloads/2012/04/EnPlan-RoadMap-2050\\_24april2012.pdf](http://www.opengov.gr/minenv/wp-content/uploads/downloads/2012/04/EnPlan-RoadMap-2050_24april2012.pdf)

# Energy sector in Greece

## Opportunities for development

- The exploitation of **agricultural and forestry residues** available in Greece may result in fuel quantities equal to about **3-4 MT petroleum/y**.
- Anaerobic digestion of the whole amount of **agricultural and livestock residues** could result in the production of **13.5 billion m<sup>3</sup>/y biogas**
- Anaerobic treatment of available **wastes could result in 21.9TWh of electricity** which corresponds to **39% of gross electricity consumption amount in Greece**
- The exploitation of **energy crops = 30 - 40% of the petroleum consumed annually in Greece.**
- For the period **2011-2035** the total new investments in power sector is expected to rise to € 28 trillion, corresponding to an average annual investment of approximately € 1,2 trillion.
- The Renewable Energy Sector (RES) achieved increase of 6.8% in 2010 to the value of the range at **€ 242.5 billion**.

**The low participation of renewable and other energy sources reveal high growth potential of the sector in the country through the utilization of untapped energy reserves available.**

**This situation has already attracted a significant number of foreign direct investment.**

# Initiatives in Greece regarding Bioeconomy

## Two graduate programs on Bioeconomy:

- In Athens by the Economical department of the University of Piraeus in cooperation with the Biology department of the National and Kapodistrian University of Athens.
- In Thessaloniki by the International University of Greece.
- Crete has been announced as bioeconomy region

- Bioeconomy Forum



(<http://bioeconomyforum.gr/>)

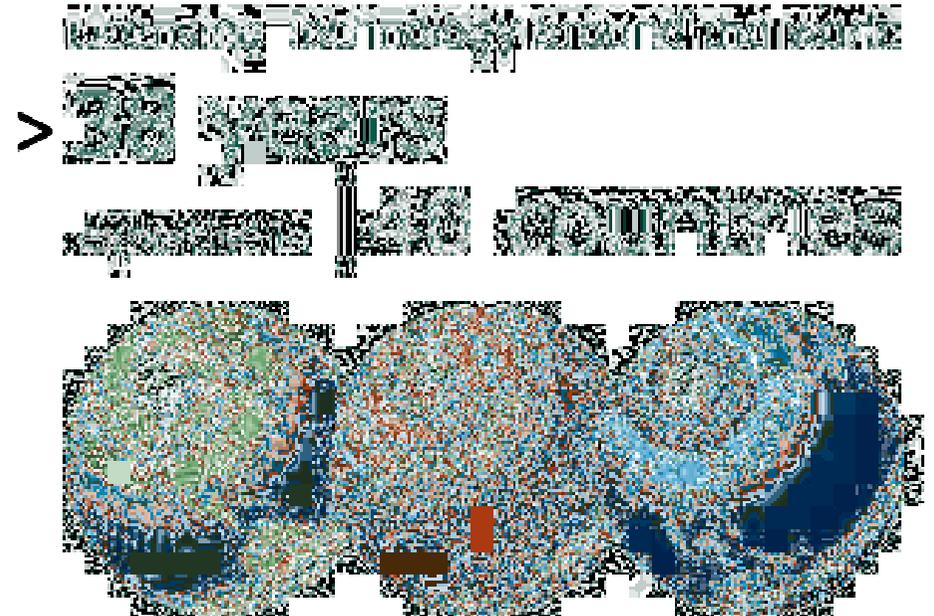
# Companies with Bioeconomy activities - Case studies



BINDING INNOVATION - Serving the Resin & Wood panel industry worldwide since 1977

Use of bio-based materials in the production of wood-based panels, like

- Microalgae
- Whey,
- Raw-materials from the recycling of cloths,
- Chemicals from the biorefinery of Agricultural and Forestry wastes



# Conclusion

- Greece has a high potential for bioeconomy developments in various sectors.
- An intense interaction is necessary between industrial, academic, and socio-economic stakeholders.
- Key points:
  - Bioeconomy policies at each EU country
  - Development of a coherent European framework—under which all policies that encompass bioeconomy sectors can develop.

# Kind contributions

**Mrs. Myrsini CHRISTOU**, Head of the Department of Biomass, Centre for Renewable Energy Sources and Saving (CRES).



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# Thank you very much!