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Biorrefinerías: Estatus más reciente

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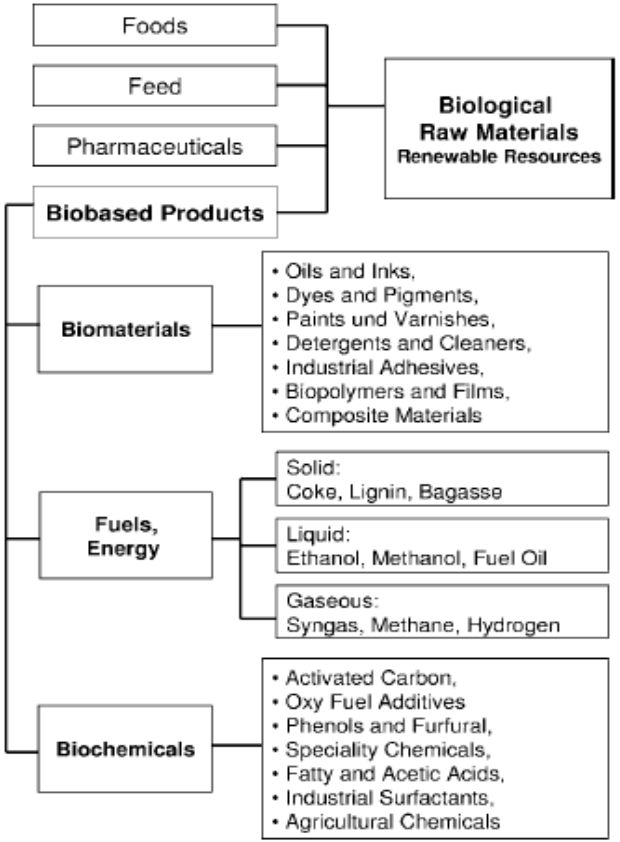
¿Qué son las biorrefinerías?



A biorefinery is a facility (or network of facilities) that integrates biomass conversion processes and equipment to produce transportation biofuels, power, and chemicals from biomass.

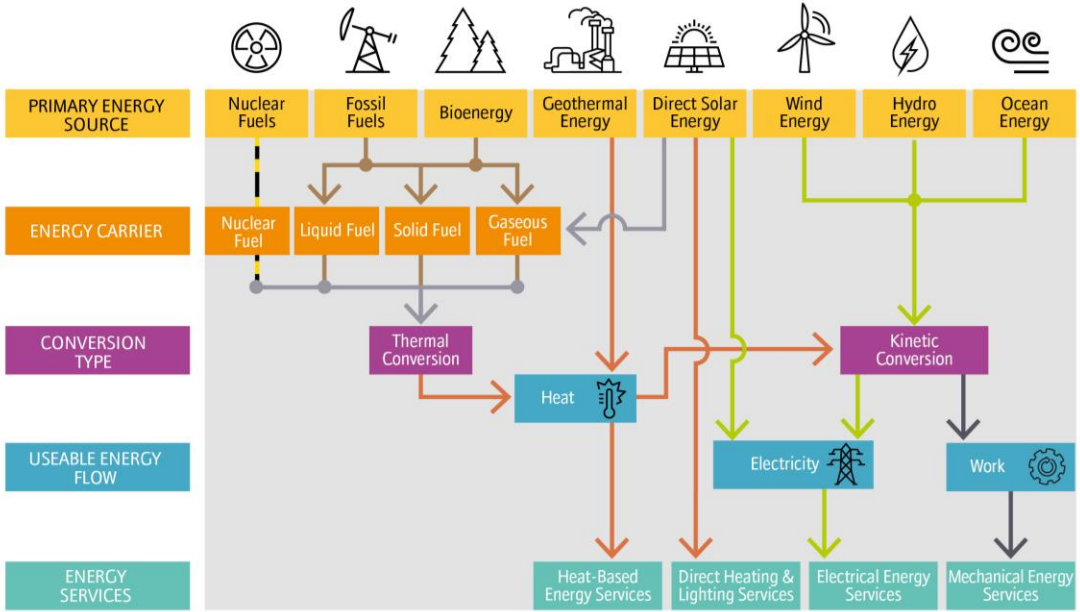
This concept is analogous to today's petroleum refinery, which produces multiple fuels and products from petroleum

- Agencia Internacional de Bioenergía

¿Realmente se requieren biorrefinerías?

¡Hablar de biorrefinerías es hablar de bioenergía!

Illustrative paths of energy from source to service
All connected lines indicate possible energy pathways. The energy services delivered to users can be provided with differing amounts of end-use energy.



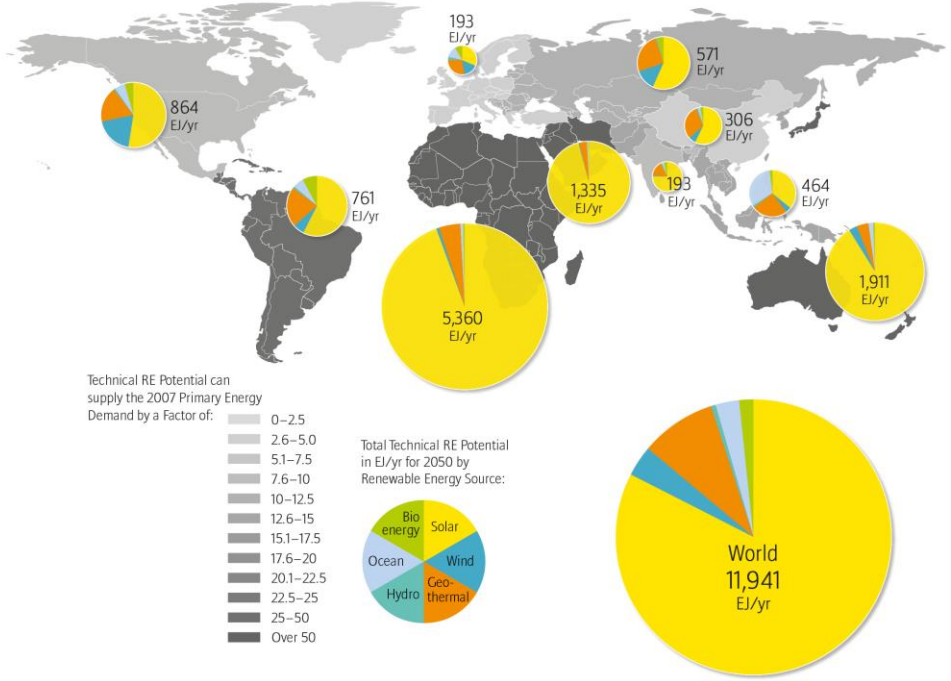
Renewables Global Futures Report Great debates towards 100 % renewable energy

REN21 Renewable Energy Policy Network for the 21st Century

Source: Reproduced from IPCC-SRREN, (Summary for Policy Makers, Figure TS 1.6, page 38) by Dr. Sven Teske/UTS/ISF

Biorrefinerías y energía renovable

Total technical renewable energy potential in EJ/yr for 2050



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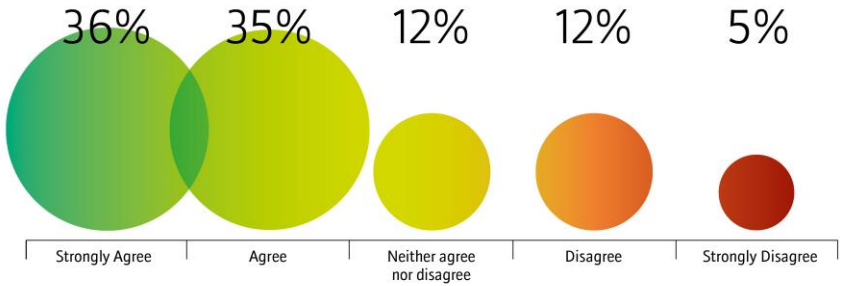
Is the transition to 100% renewables on a global level feasible and realistic?



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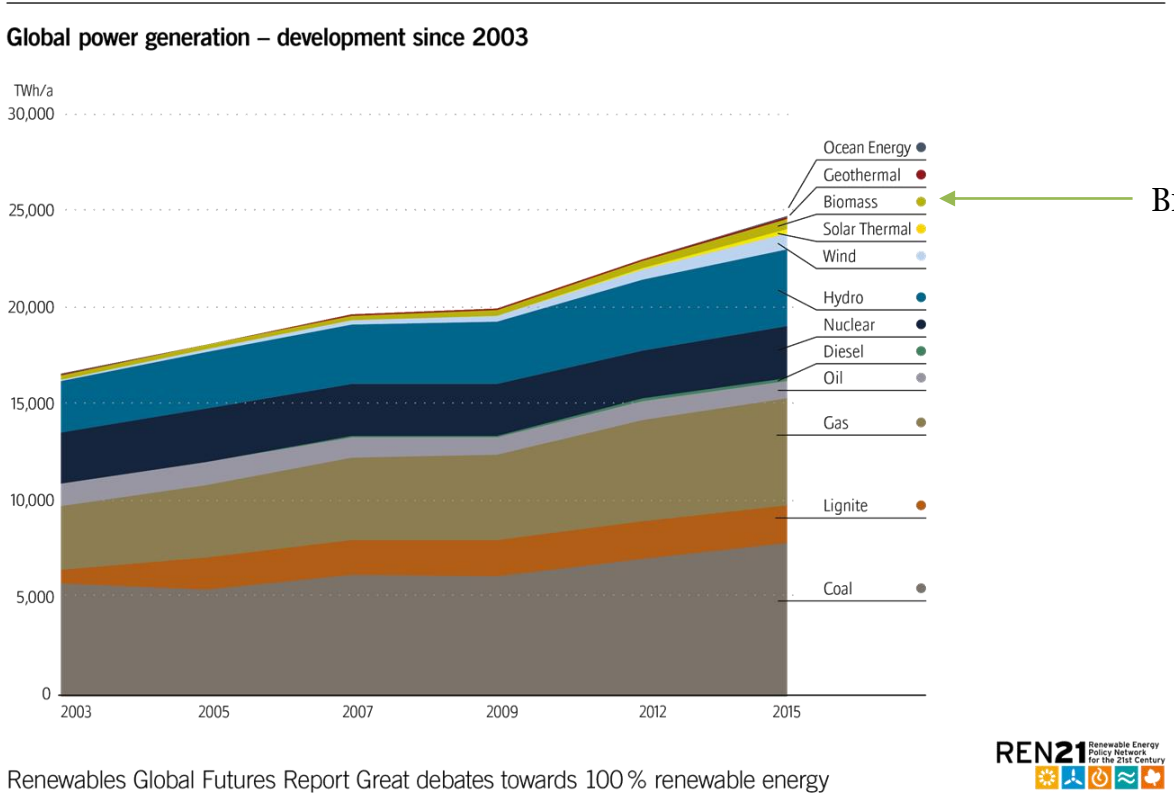
Source: IPCC-SRREN, Figure 10.19 l (Preceding pages)
Note:[2] The technical RE potentials reported here represent total worldwide and regional potentials based on a review of studies published before 2009 by Krewitt et al. (2009). They do not deduct any potential already utilized for energy production. Due to methodological differences and accounting methods among studies, these estimates cannot be strictly compared across technologies and regions, nor in terms of primary energy demand. Technical RE potential analyses published after 2009 show higher results in some cases but are not included in this figure. Some RE technologies may compete for land, possibly lowering the overall RE potential. Scenario data: IEA WEO 2009 Reference scenario (International Energy Agency (IEA), 2009; Teske et al., 2010), ReMIND-RECIPE 450ppm Stabilization Scenario (Luderer et al., 2009), MiniCAM EMF22 1st-best 2.6 W/2 Overshoot Scenario (Calvin et al., 2009), Advanced Energy (R)evolution 2010 (Teske et al., 2010).

Biorrefinerías y energía renovable

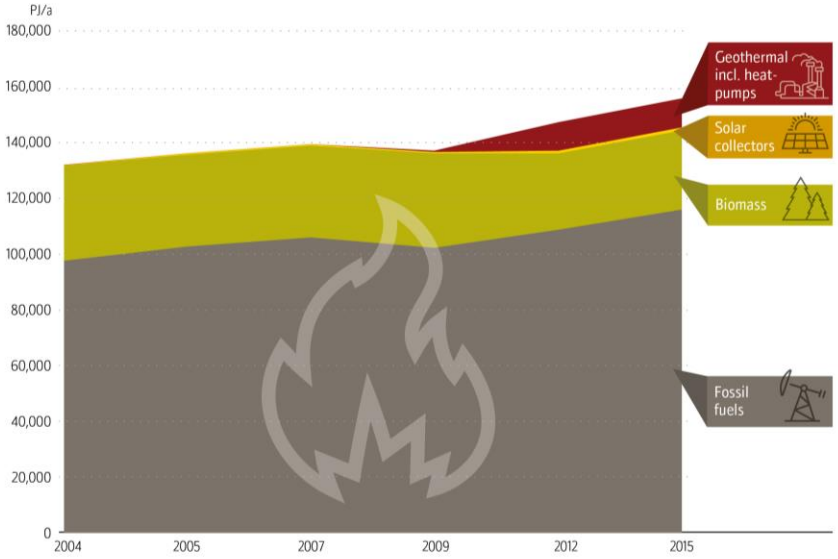


Bioelectricidad

Source: Data: International Energy Agency, Paris/France, Data compilation: Dr. Sven Teske, UTS/ISF, Australia

Biorrefinerías y energía renovable

Development of global heat supply by source, 2003 – 2015



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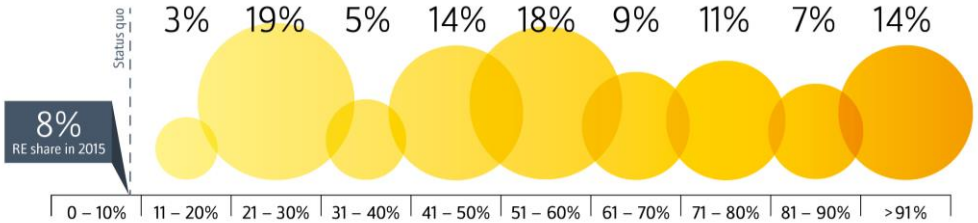
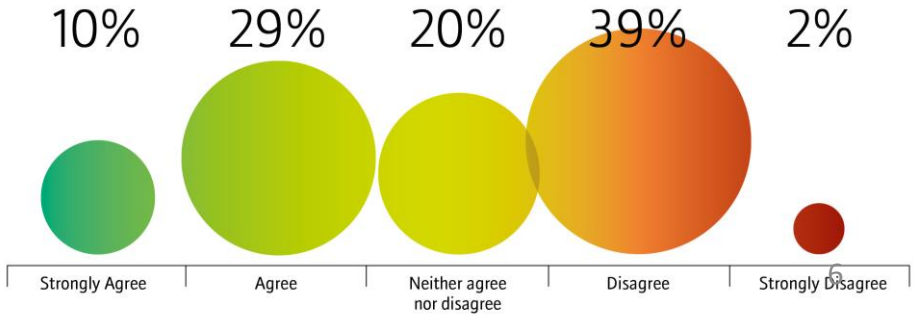
Source: Data: International Energy Agency, Paris/France, Data compilation: Dr. Sven Teske, UTS/ISF, Australia

What will be the share of global renewable heating energy consumption by 2050?

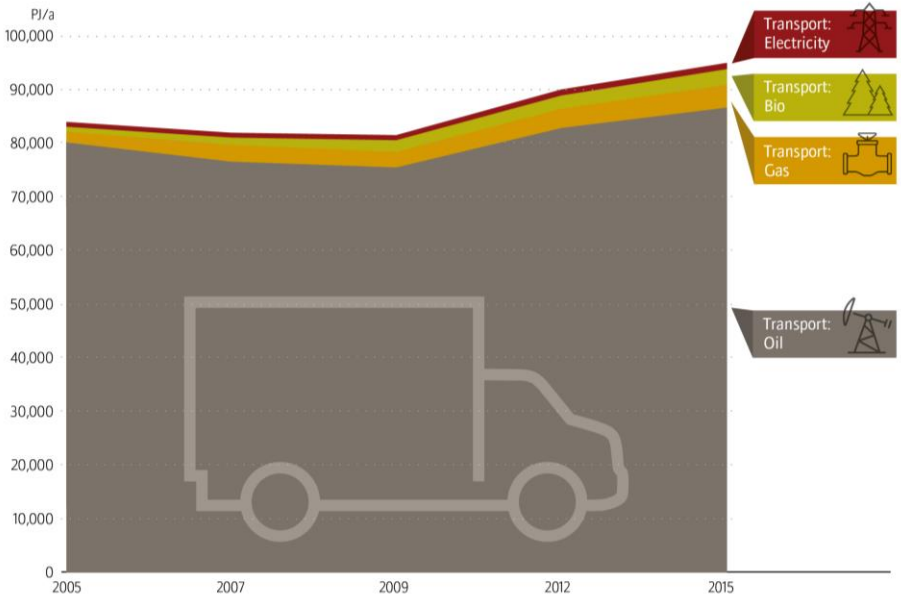


The electrification of the heating sector will continue and will lead to an almost complete electrification



Biorrefinerías y energía renovable

Development of global transport supply by source, 2003 – 2015



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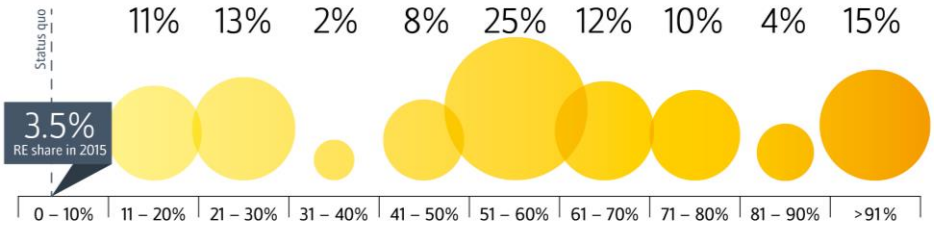
Source: International Energy Agency, Paris/France, Data compilation: Dr. Sven Teske, UTS/ISF, Australia

What will be the share of global renewable transport energy consumption by 2050?



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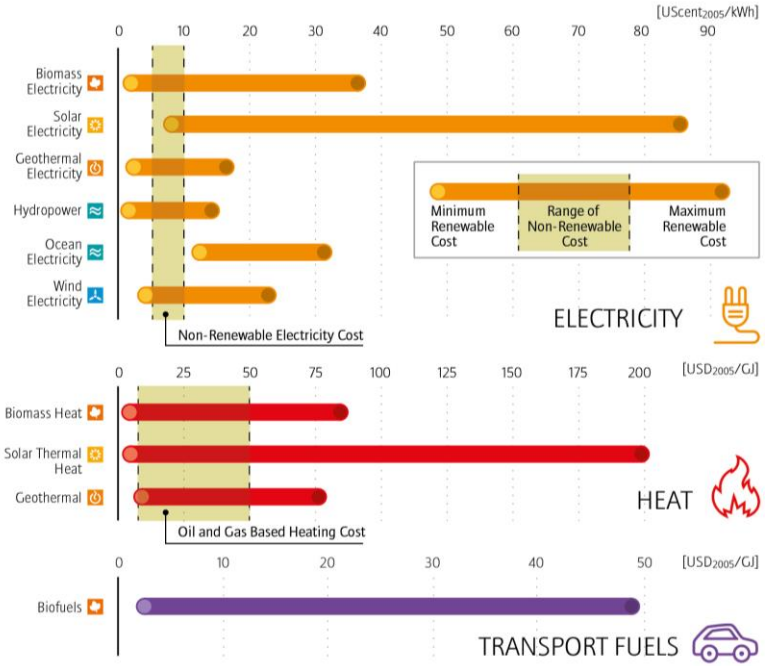
Biorrefinerías y energía renovable

Range of levelised costs of energy for selected commercially available renewable energy technologies compared to non-renewable energy costs – cost development, 2010 – 2015



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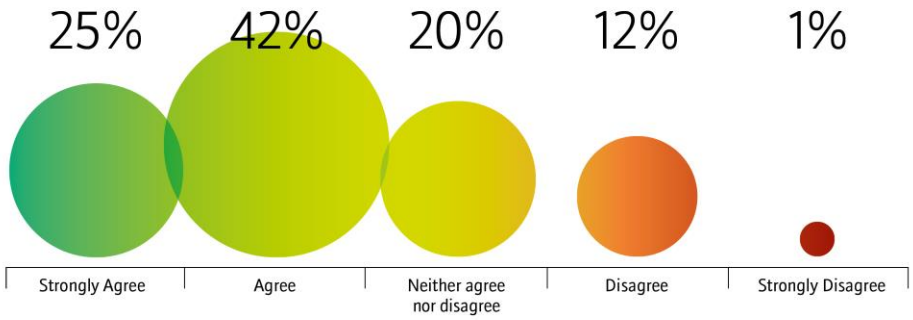
The cost for renewables will continue to fall and will out-pace all fossil fuels within the next 10 years



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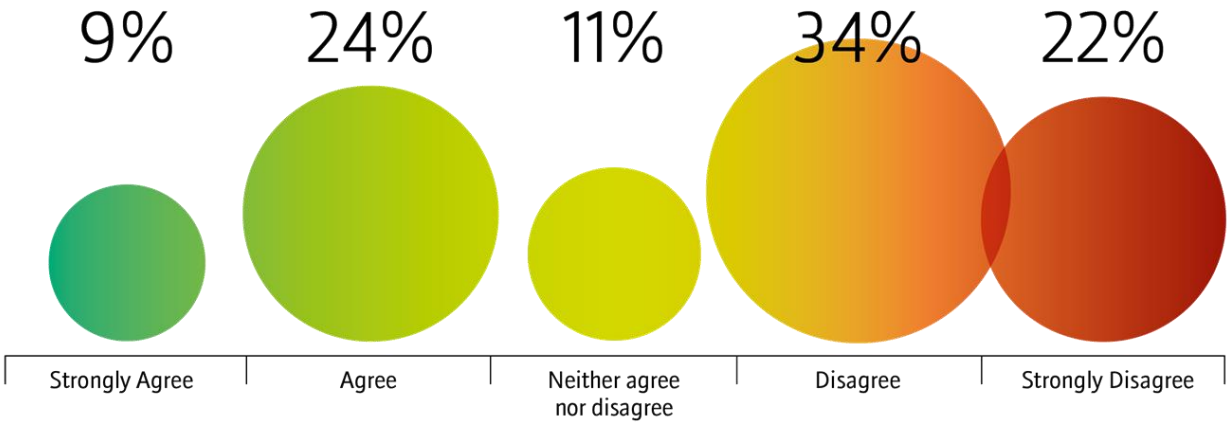
REN21 Renewable Energy Policy Network for the 21st Century

Source: Original graph from SRREN-IPCC, updated with data from REN21 and IRENA

Biorrefinerías y energía renovable

Decentralised renewable energy technologies will not be enough to give access to energy for all, meaning that large-scale conventional power plants are still required to provide energy access for all



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“La bioenergía será necesaria en nuestro futuro renovable”

¿Cómo la vamos a producir?

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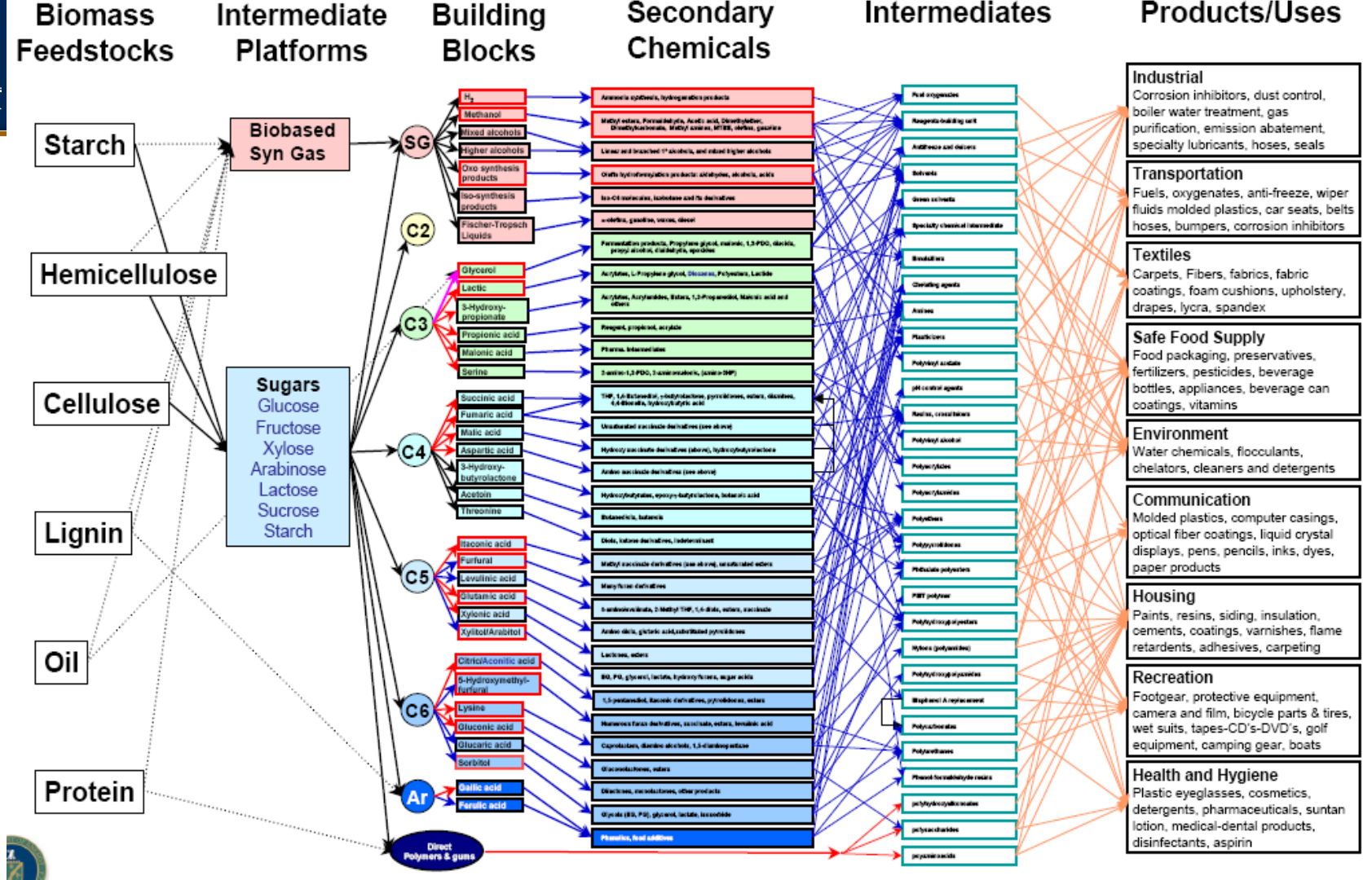


Plataformas de biorrefinería

4.1 Syngas Platform

Synthesis gas (syngas) is a mixture of mainly carbon monoxide and hydrogen. It is produced by subjecting biomass to extreme heat (over 430˚C/860˚F) in the presence of oxygen or air in a process known as gasification. After cleaning, the syngas can be used to produce power or can be converted into lower alcohols, fuel (e.g. Fischer-Tropsch diesel) and chemical products (83). Syngas can also be fermented to give methanol, ethanol, ammonia and potentially other chemical building blocks (12).

Promising syngas derived chemicals:
Methanol
DME (dimethylether)
Ethanol
Fischer-Tropsch diesel

Termoquímicos

4.3 C6 and C6/C5 Sugar Platform

Six carbon sugar platforms can be accessed from sucrose or through the hydrolysis of starch or cellulose to give glucose. Glucose serves as feedstock for (biological) fermentation processes providing access to a variety of important chemical building blocks. Glucose can also be converted by chemical processing to useful chemical building blocks.

Innovative fermentation products:
Succinic acid
Itaconic acid
Adipic acid
3-Hydroxypropionic acid / aldehyde
Isoprene/farnesene
Glutamic acid
Aspartic acid

Biológicos

Promising glucose chemical derivatives:
Sorbitol
Levulinic acid
Glucaric acid
Hydroxymethylfurfural
2,5-Furan dicarboxylic acid
p-Xylene

Químicos

Plataformas de biorrefinería

4.4 Plant-based Oil Platform

4.5 Algae Oil Platform … and Single-Cell oils

Promising glycerol derived chemicals:
Propylene glycol
Epichlorohydrin
1,3-Propanediol
3-Hydroxypropion aldehyde
Acrylic acid
Propylene
Methanol (via syngas)

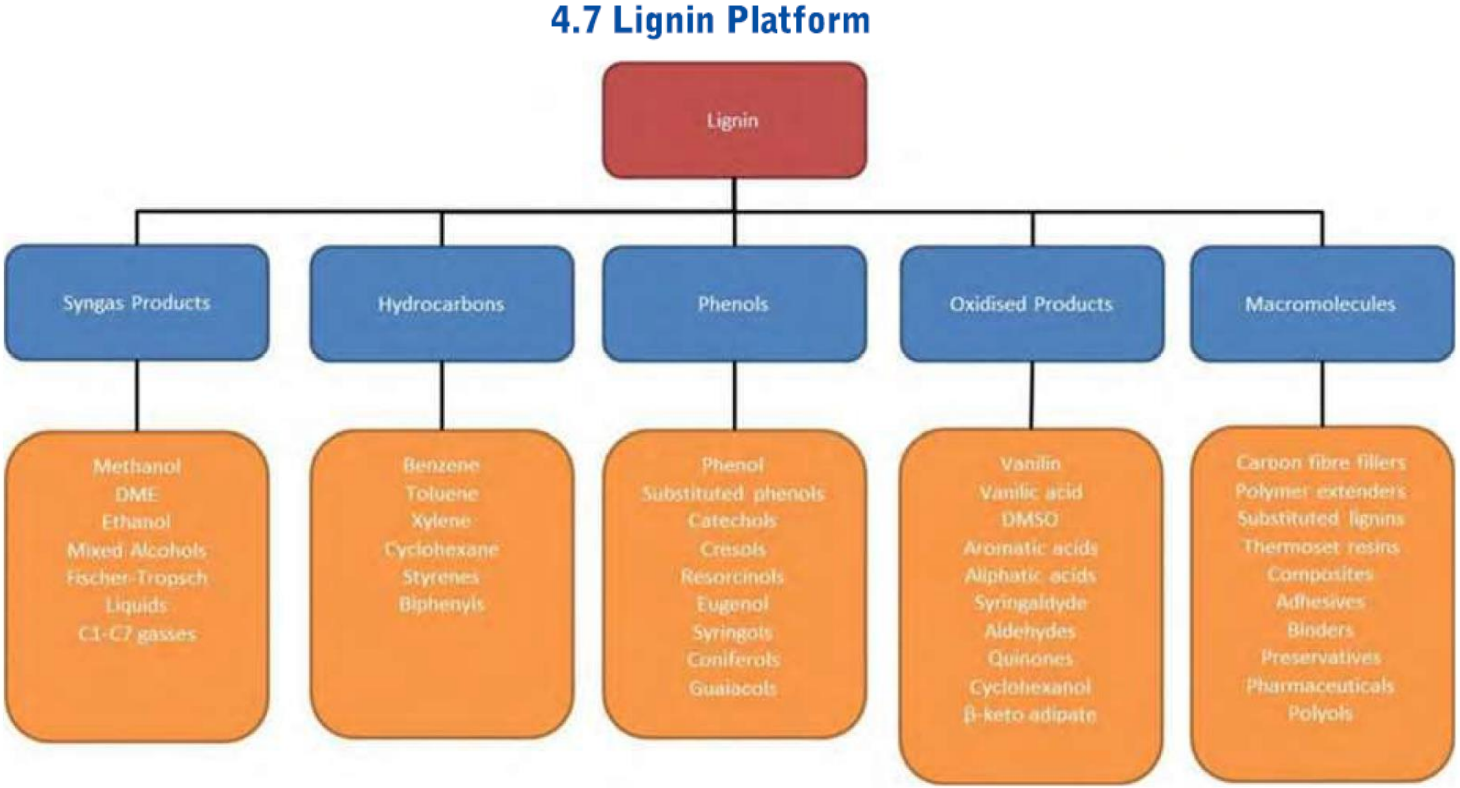
Químicos

Termoquímicos

Plataformas de biorrefinería

Químicos

Termoquímicos



Plásticos y polímeros de biorrefinería

Table 3. Bio-based chemicals assessed for market penetration and reference materials (adapted from ref (14)).

Bio-based chemical	Reference petrochemicals
Ethyl lactate	Ethyl acetate
Ethylene	Ethylene
Adipic acid	Adipic acid
Acetic acid	Acetic acid
n-Butanol	n-Butanol
PTT	PTT & Nylon 6
PHA	HDPE
PLA	PET and PS
FDCA	Terephthalic acid
Succinic acid	Maleic anhydride

Estado del arte

Table 6. Biomass-derived chemical building blocks.

Cn	Chemical	Company	Potential
1	Methanol	BioMCN, Chemrec	Growth
	Formic acid	Maine BioProducts	Pipeline
	Methane	Many	Growth
	Syngas	BioMCN, Chemrec	Growth
2	Ethylene	Braskem, DOW/Mitsui, Songyuan Ji'an Biochemical	Growth
	Ethyl acetate	Zeachem	Pipeline
	Ethanol	Many	Growth
	Glycolic acid	Metabolic Explorer (Metex)	Pipeline
	Ethylene glycol	India Glycols Ltd, Greencol Taiwan	Growth
	Acetic acid	Wacker	Growth
3	Lactic acid	Purac, NatureWorks, Galactic, Henan Jindan, BBCA	Growth
	Acrylic acid	Cargill, Perstorp, OPXBio, DOW, Arkema	Pipeline
	Glycerol	Many	Growth
	3-Hydroxy propionic acid	Cargill	Pipeline
	Propylene	Braskem/Toyota Tsusho, Mitsubishi Chemical, Mitsui Chemicals	Pipeline
	Epichlorohydrin	Solvay, DOW	Growth
	1,3-Propanediol	DuPont/Tate & Lyle	Growth
	n-Propanol	Braskem	Pipeline
	Ethyl lactate	Vertec BioSolvents	Growth
	Isopropanol	Genomatica, Mitsui Chemicals	Pipeline
	Propylene Glycol (1,2-Propanediol)	ADM	Growth

Estado del arte

4	n-Butanol	Cathay Industrial Biotech, Butamax, Butalco, Cobalt/Rhodia	Growth
	1,4-Butanediol	Genomatica/M&G, Genomatica/Mitsubishi , Genomatica /Tate & Lyle	Pipeline
	iso-Butanol	Butamax, Gevo	Growth
	Iso-butene	Gevo/Lanxess	Pipeline
	Methyl methacrylate	Lucite/Mitsubishi Rayon, Evonik/Arkema	Pipeline
	Succinic acid	BioAmber, Myriant, BASF /Purac, Reverdia (DSM/Roquette), PTT Chem / Mitsubishi CC	Growth
5	Furfural	Many	Growth
	Itaconic acid	a.o. Qingdao Kehai Biochemistry Co, Itaconix	Pipeline
	Xylitol	a.o. Danisco/Lenzing, Xylitol Canada	Growth
	Isoprene/ Farnesene	Goodyear/ Genencor, GlycosBio, Amyris	Pipeline
	Glutamic acid	a.o. Global Biotech, Meihua, Fufeng, Juhua	Growth
	Levulinic acid	Maine BioProducts, Avantium, Segetis, Circa Group	Pipeline
6	Sorbitol	a.o. Roquette, ADM	Growth
	Adipic acid	Verdezyne, Rennovia, BioAmber, Genomatica	Pipeline
	Lysine	a.o. Global Biotech, Evonik/RusBiotech, BBCA, Draths, Ajinomoto	Growth
	FDCA	Avantium	Pipeline
	Isosorbide	Roquette	Growth
	Glucaric acid	Rivertop renewables	Pipeline
	Citric acid	a.o. Cargill, DSM, BBCA, Ensign, TTCA, RZBC	Growth
	Caprolactam	DSM	Pipeline
n	PHA	Metabolic Explorer (Metex), Meridian plastics (103), Tianjin Green Biosience Co.	Growth
	Para-Xylene	Gevo, Draths*, UOP, Annellotech, Virent	Pipeline
	Dicarboxylic acids	Cathay Biotech, Evonik	Growth
	Fatty Acid derivatives	Croda, Elevance	Growth

* Draths is recently acquired by Amyris.

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Procesos de biorrefinería estudiados en CAISP

Biodiesel and Syngas from glicerol

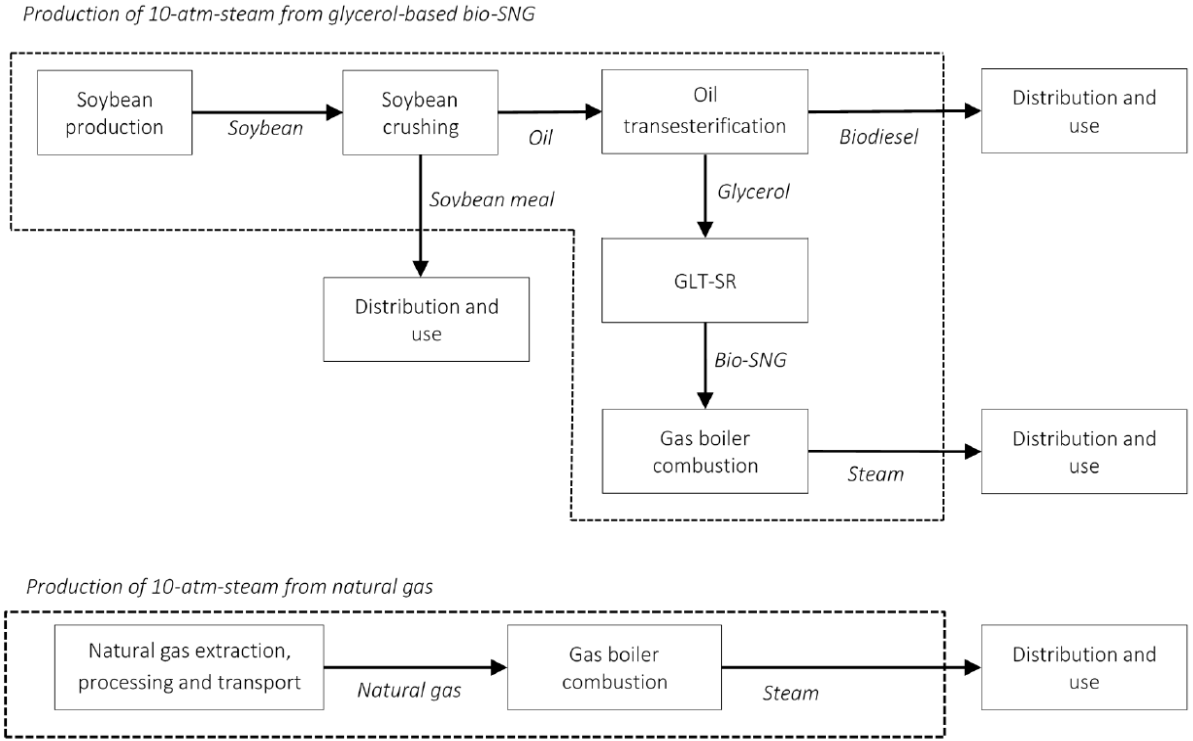


Figure 4. Scheme of the production of steam from glycerol-based bio-SNG and natural gas. Blocks outside the dashed lines are out of the system boundaries of the LCA. The system described in Figure 2 is represented by the GLT-SR block.

Energies 2019, 12, 678; doi:10.3390/en12040678

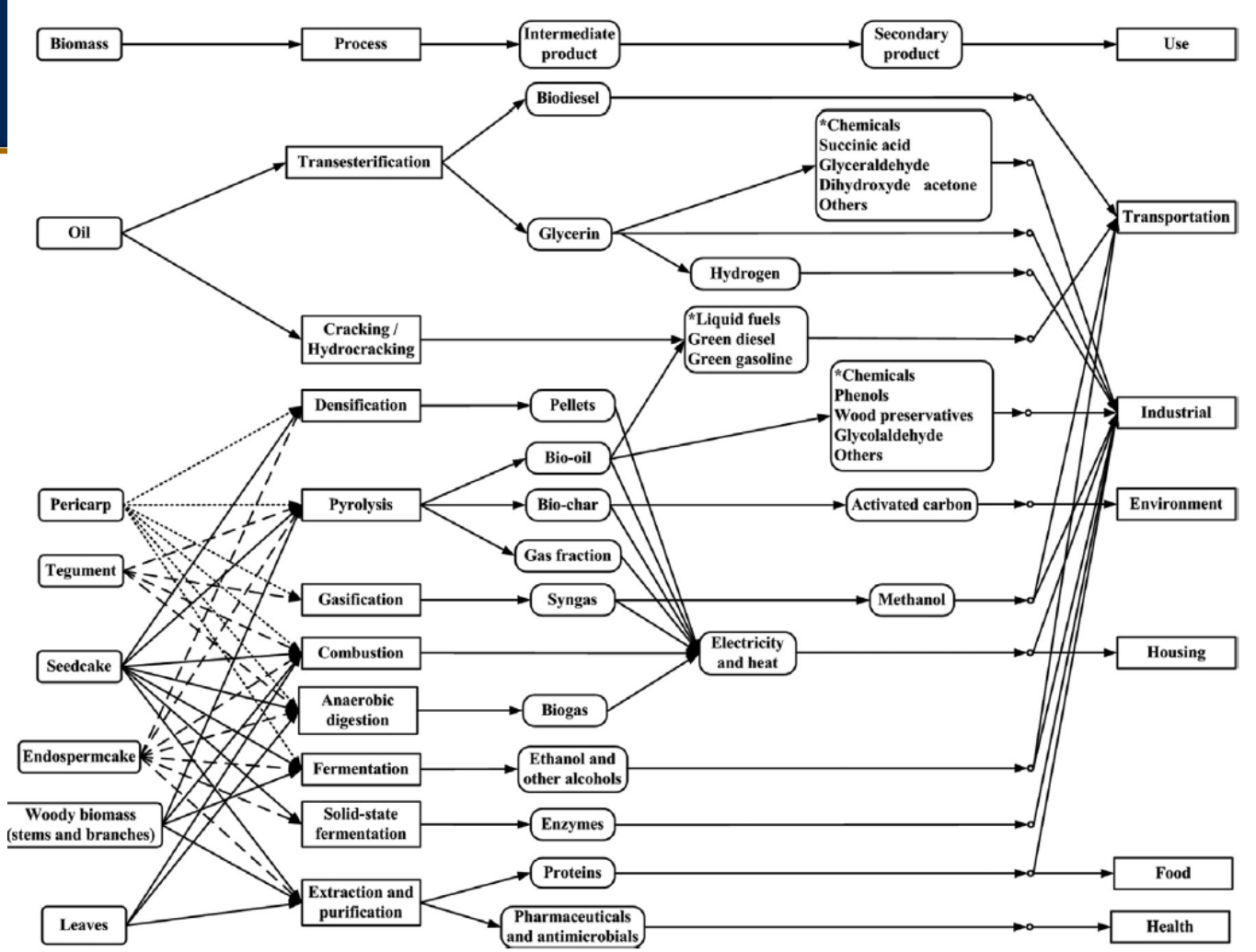


Fig. 2. Superstructure of a jatropha-based whole-crop biorefinery including the different processes individually studied in the literature.

Proceso de propuesta de biorrefinería de Jatrofa

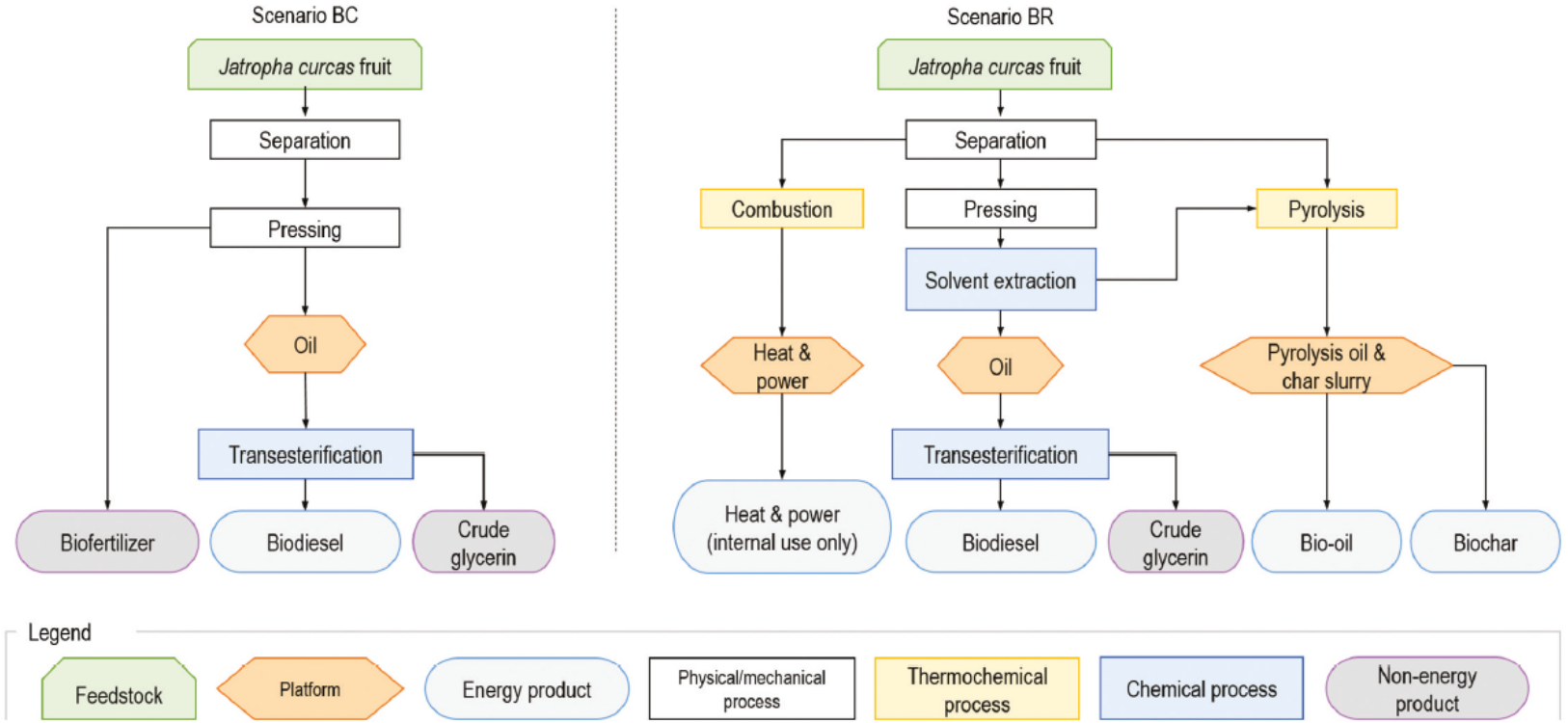
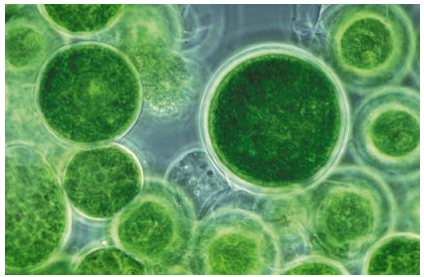
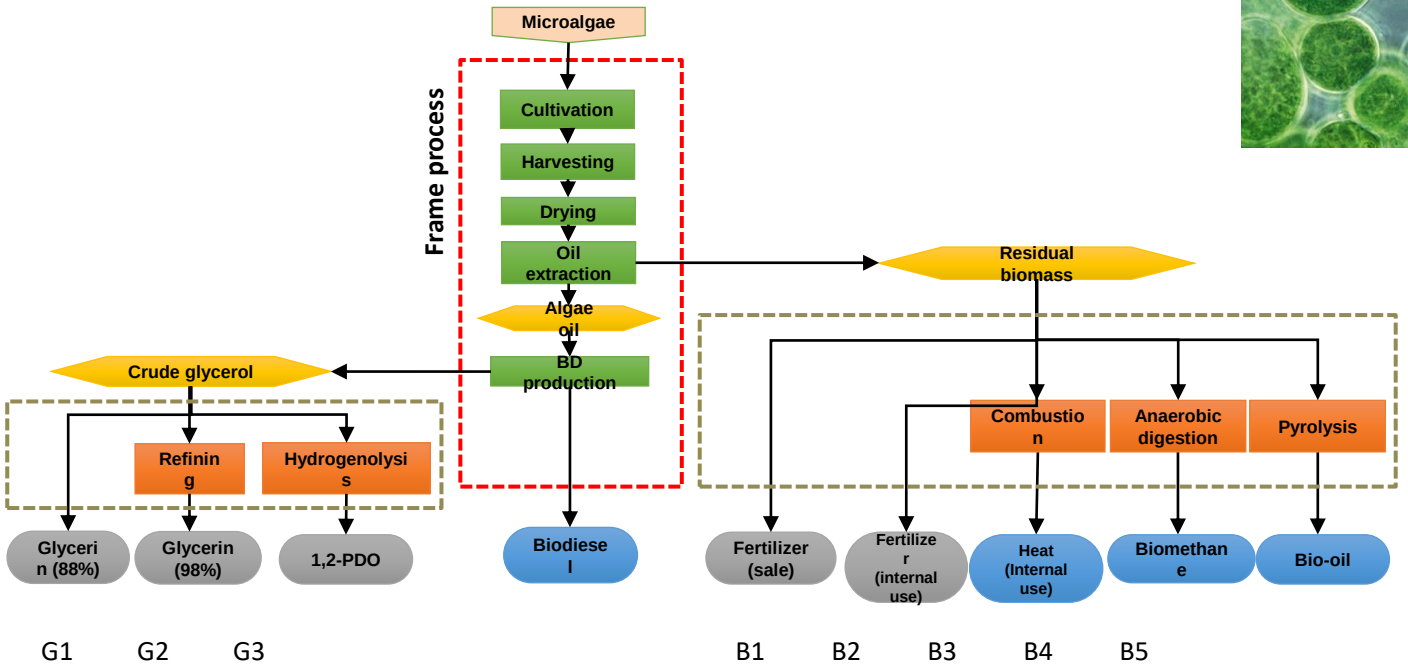


Figure 2. Feedstock-platforms-products diagram of the whole-crop biorefinery of jatropha.

Biofuels, Bioprod Bioref 2019, doi:10.1002/bbb.1940

Proceso de propuesta de biorrefinería de Microalgas





Renewable Sustainable Energy Rev 2020, doi:10.1016/j.rser.2019.109606

Proceso de propuesta de biorrefinería de Microalgas