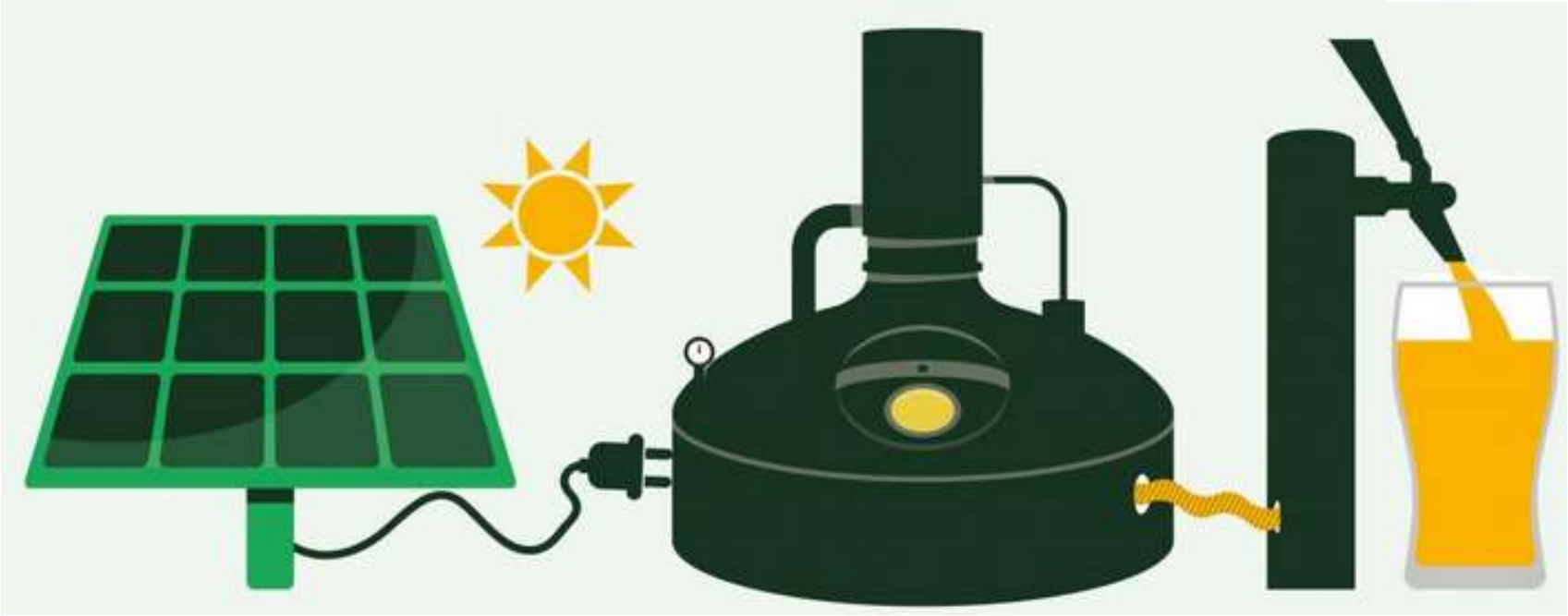
Congreso virtual "Sustentabilidad en la Industria Cervecera“
Marzo 2021

Agencia de Sustentabilidad y Cambio Climático



Soluciones Basadas en la Naturaleza y Economía Circular en la cervecería artesanal del sur: explorando posibilidades

Universidad Austral de Chile
Conocimiento y Naturaleza

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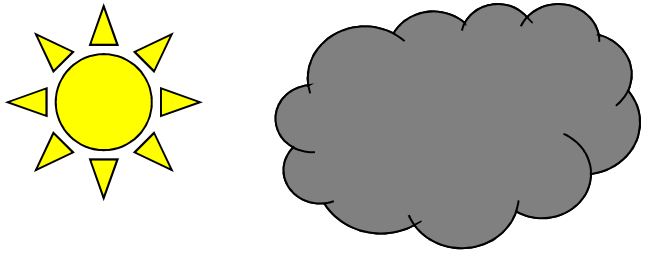
Centro de Estudios Ambientales
Universidad Austral de Chile

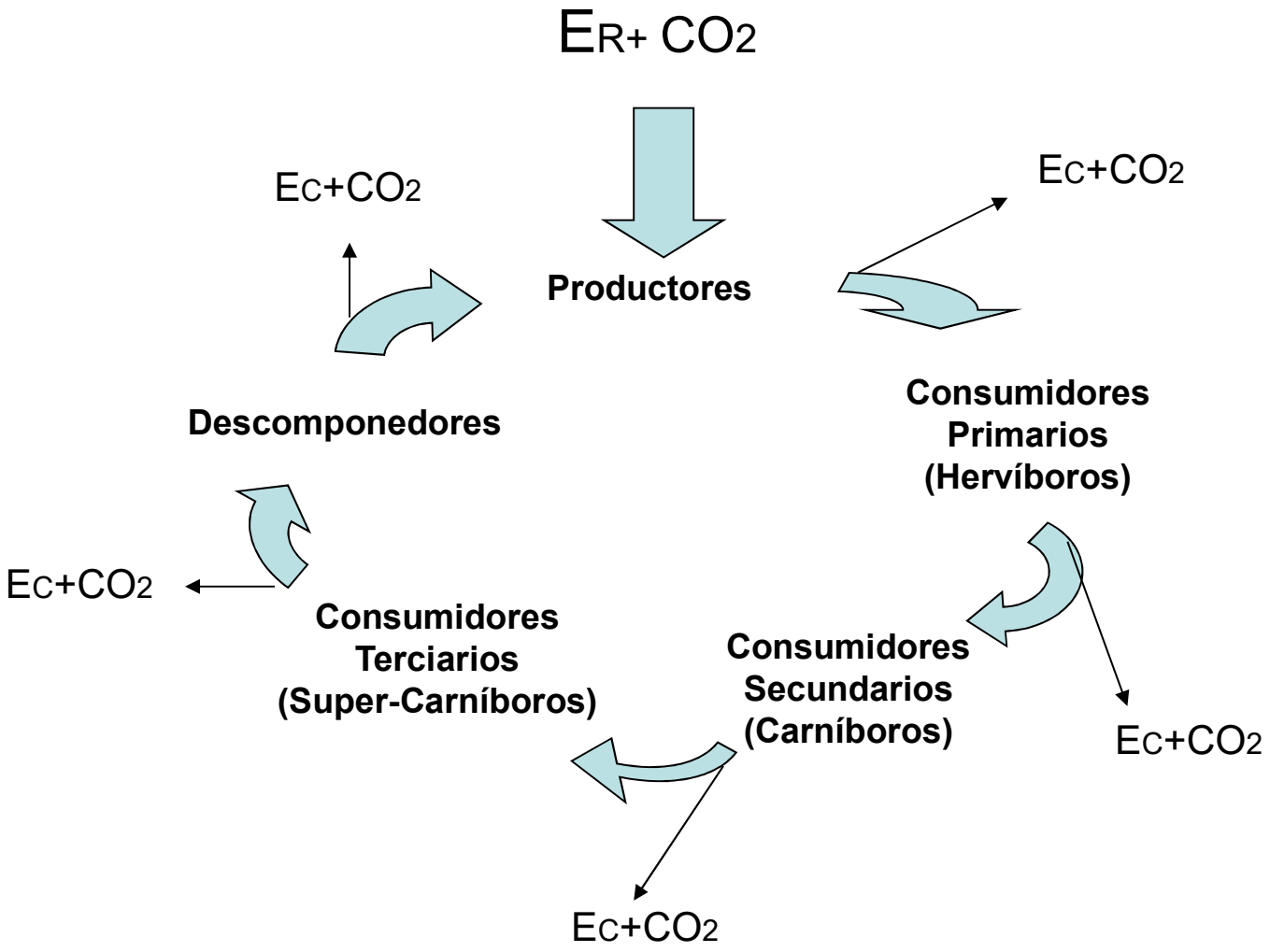
Centro de Estudios Ambientales
Universidad Austral de Chile

¿De qué se trata?

- Economía circular
- Soluciones basadas en la naturaleza

Esquema de un Ecosistema tipo





Contents lists available at ScienceDirect

Resources, Conservation & Recycling

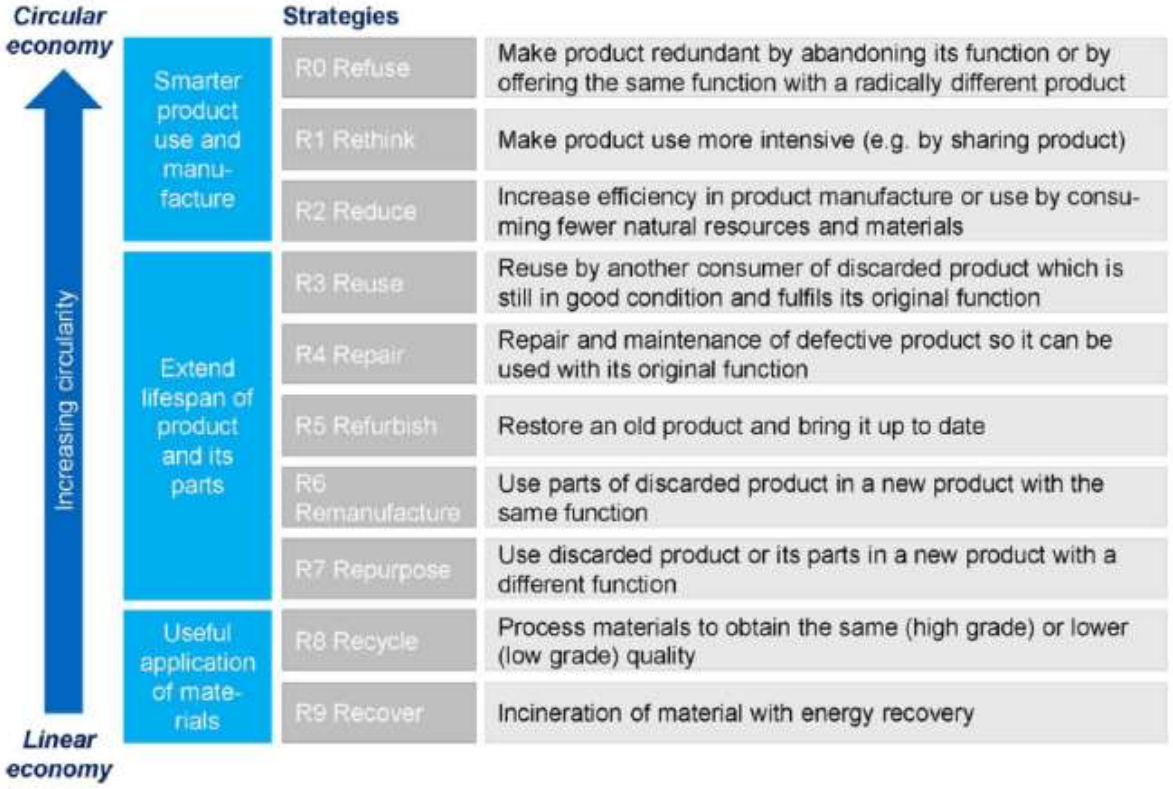
journal homepage: www.elsevier.com/locate/resconrec

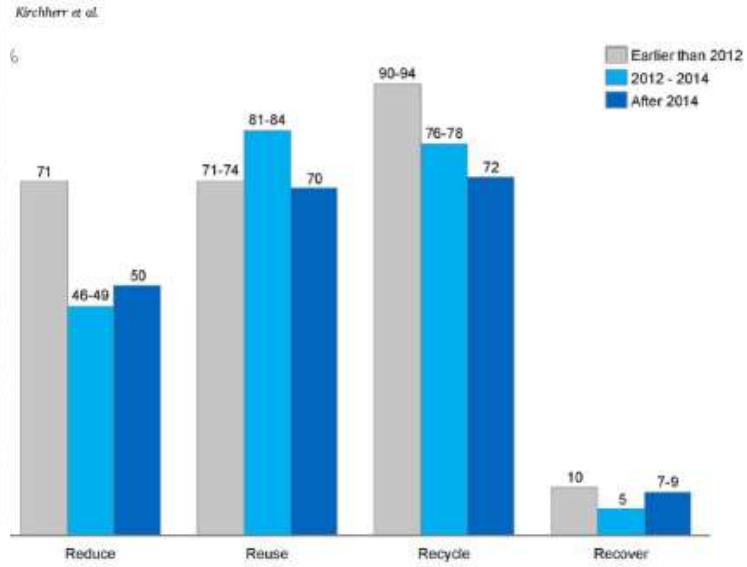
Review

Conceptualizing the circular economy: An analysis of 114 definitions

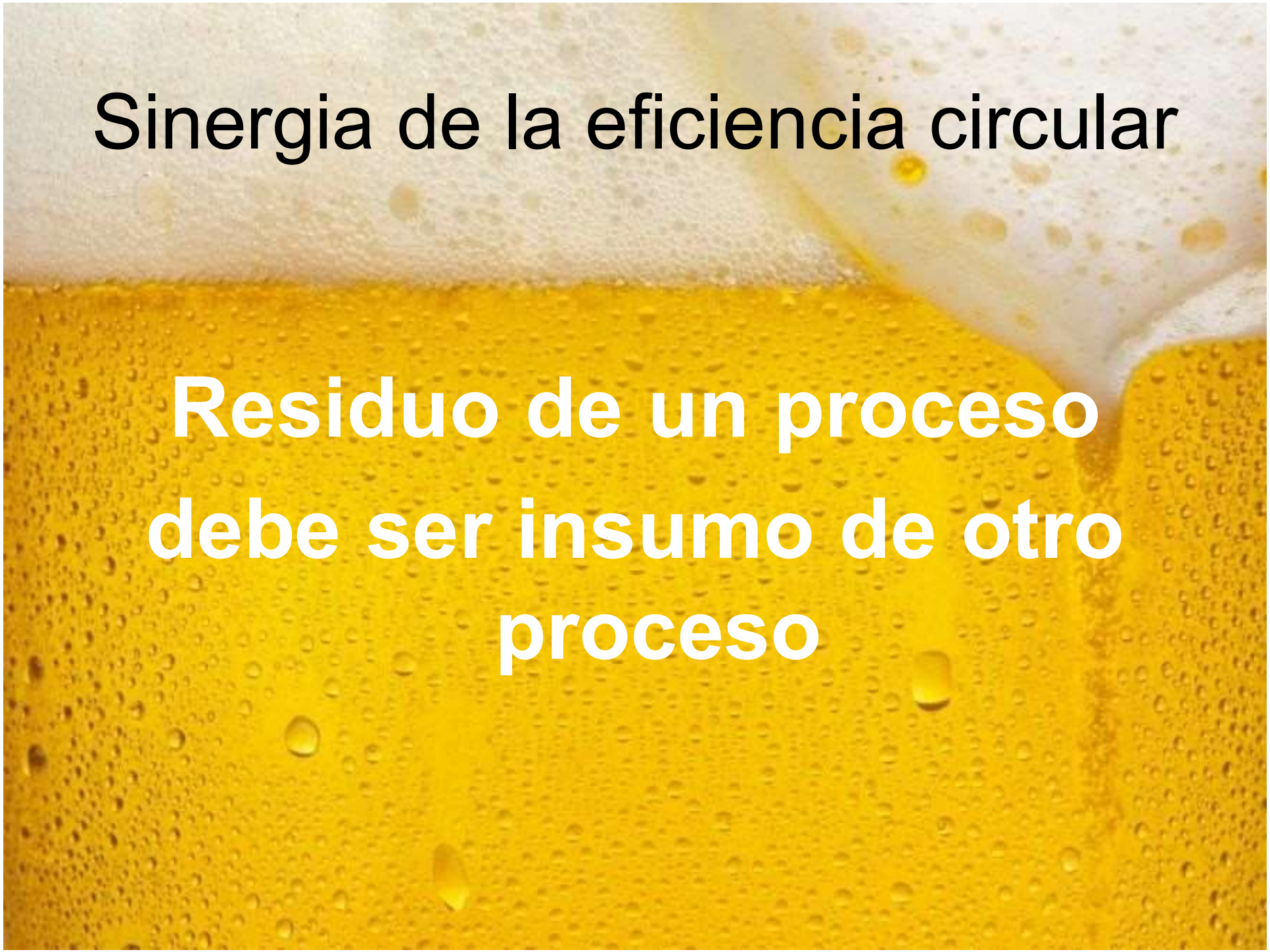
Julian Kirchherr*, Denise Reike, Marko Hekkert

Innovation Studies Group, Copernicus Institute of Sustainable Development, Utrecht University, The Netherlands

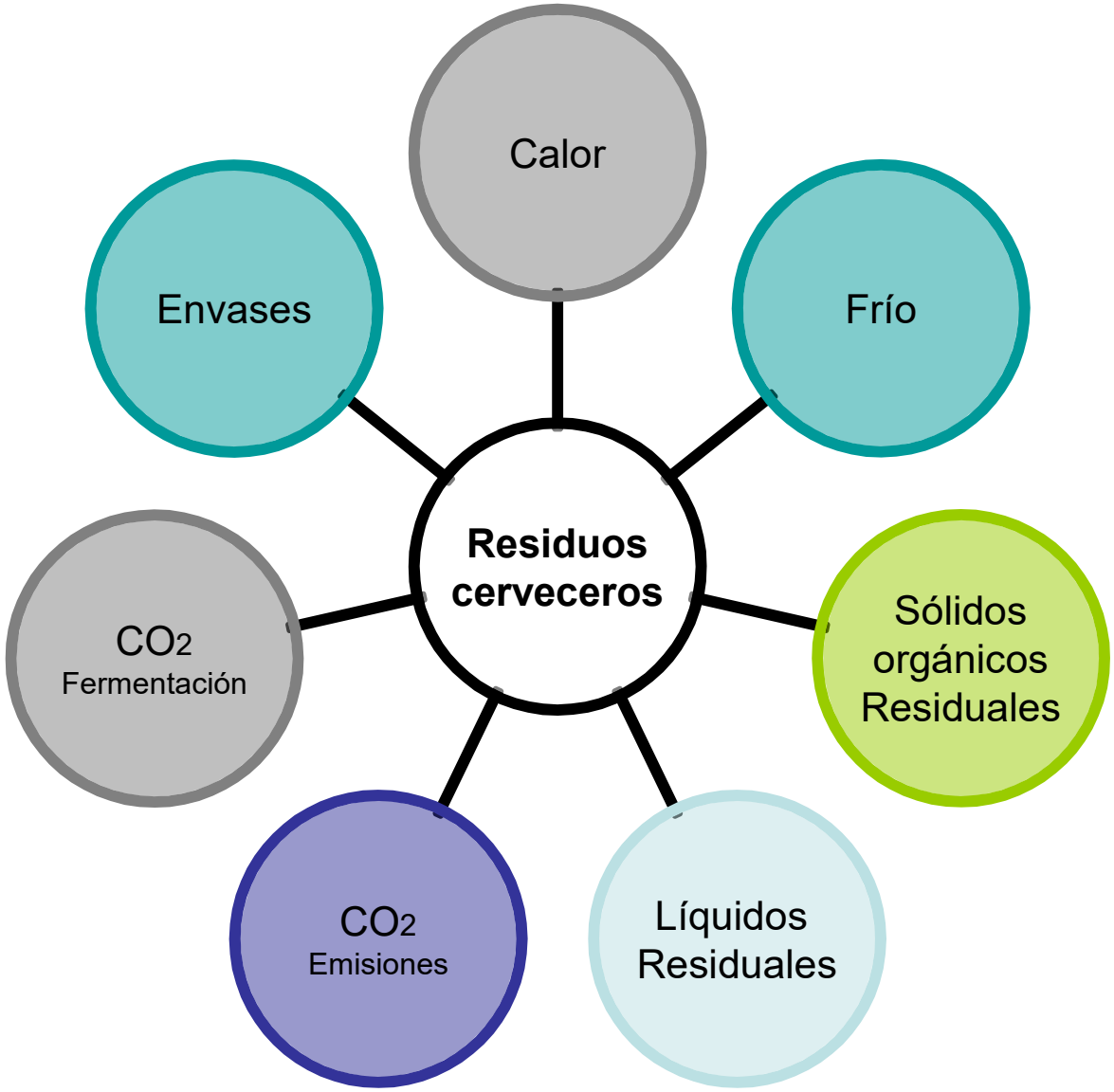




Sinergia de la eficiencia circular



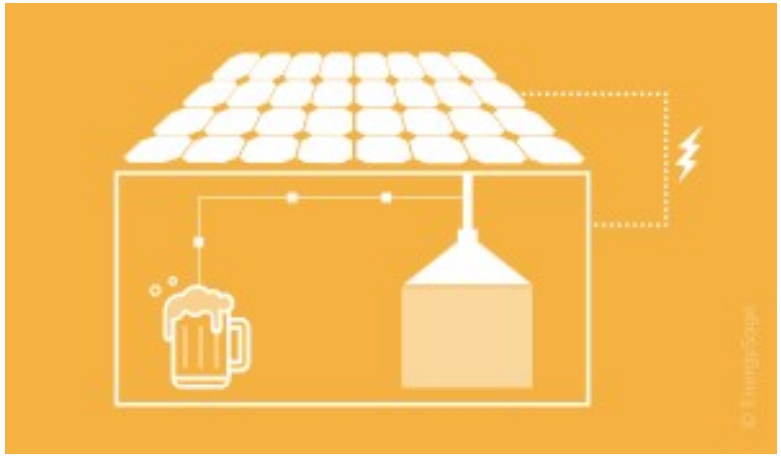
Residuo de un proceso debe ser insumo de otro proceso

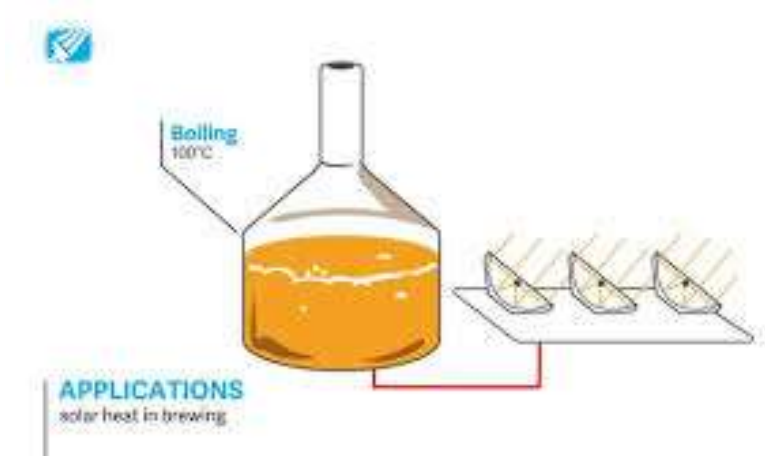

Calor
Envases
Frío
Residuos cerveceros
CO_2 Fermentación
Sólidos orgánicos Residuales
CO_2 Emisiones
Líquidos Residuales

Energía

Photo ©New Belgium Brewing Company

Cervecería Solar

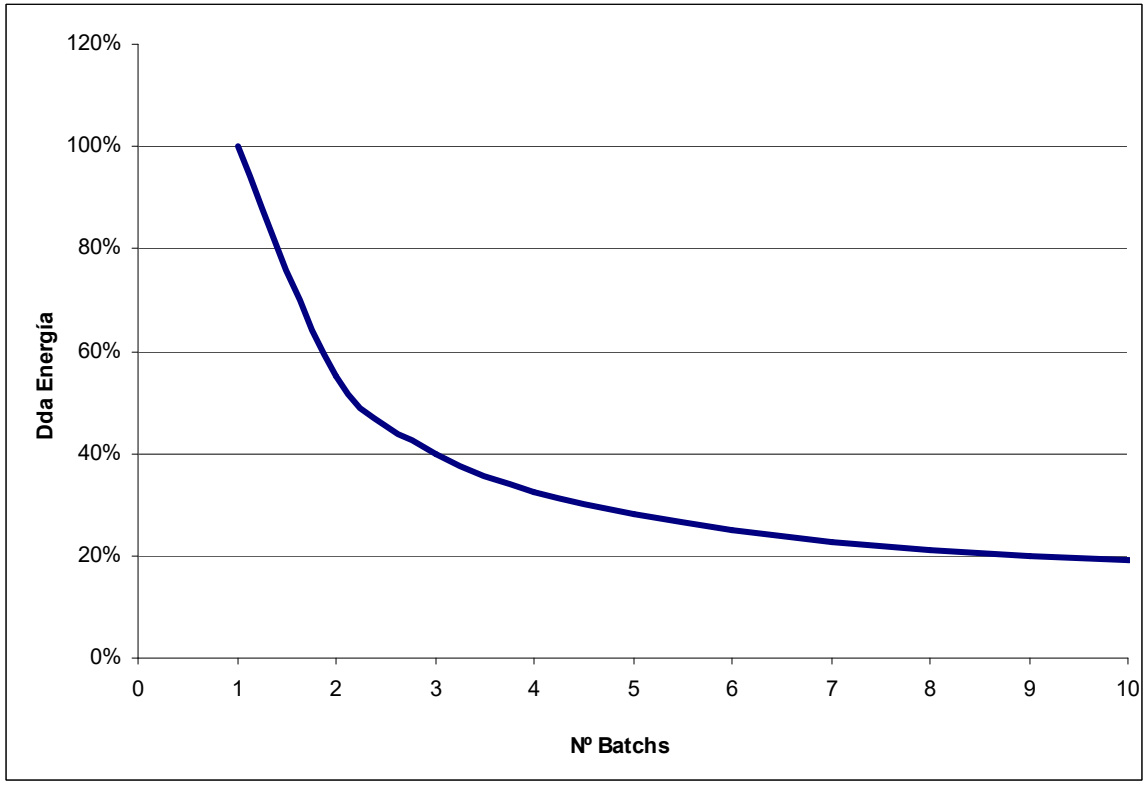




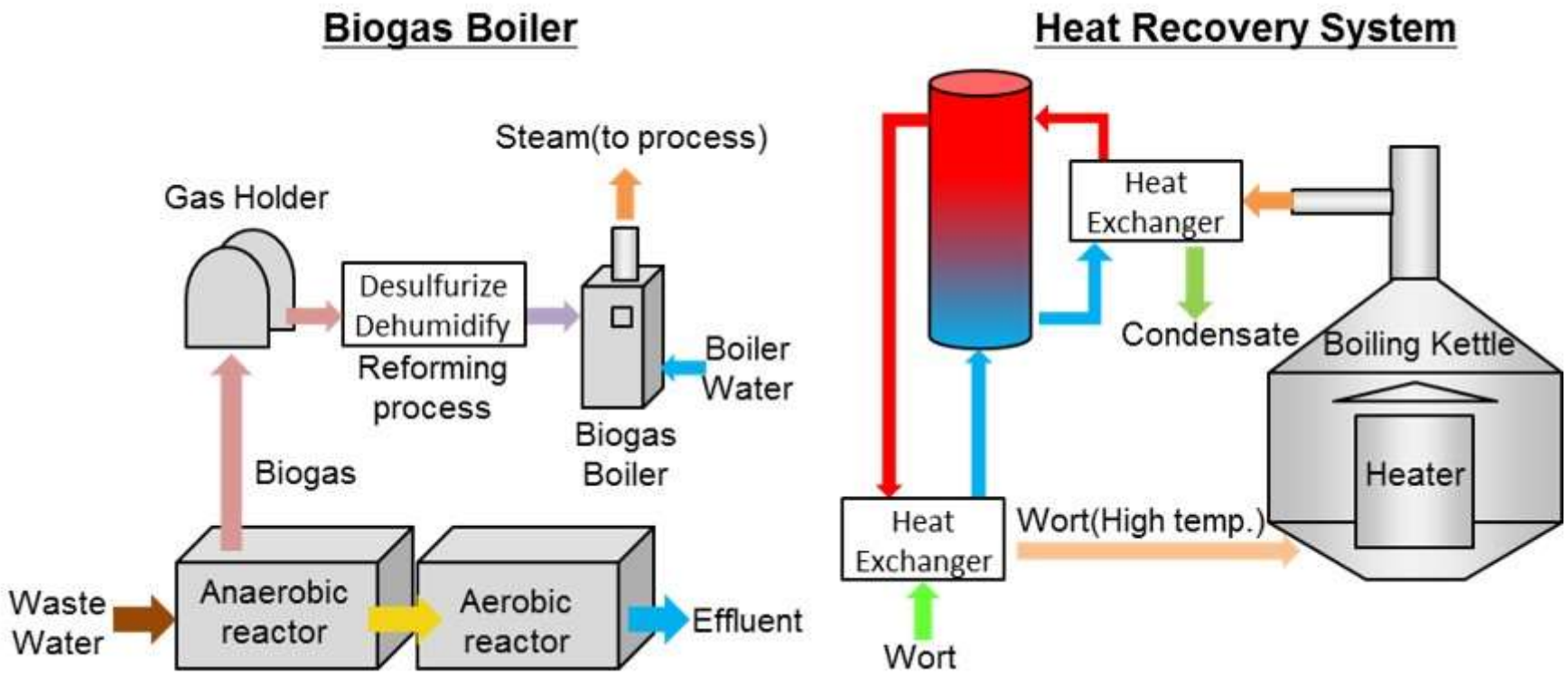
Calor Residual

Batchs secuenciales

Intercambiador de calor (ef:90%)

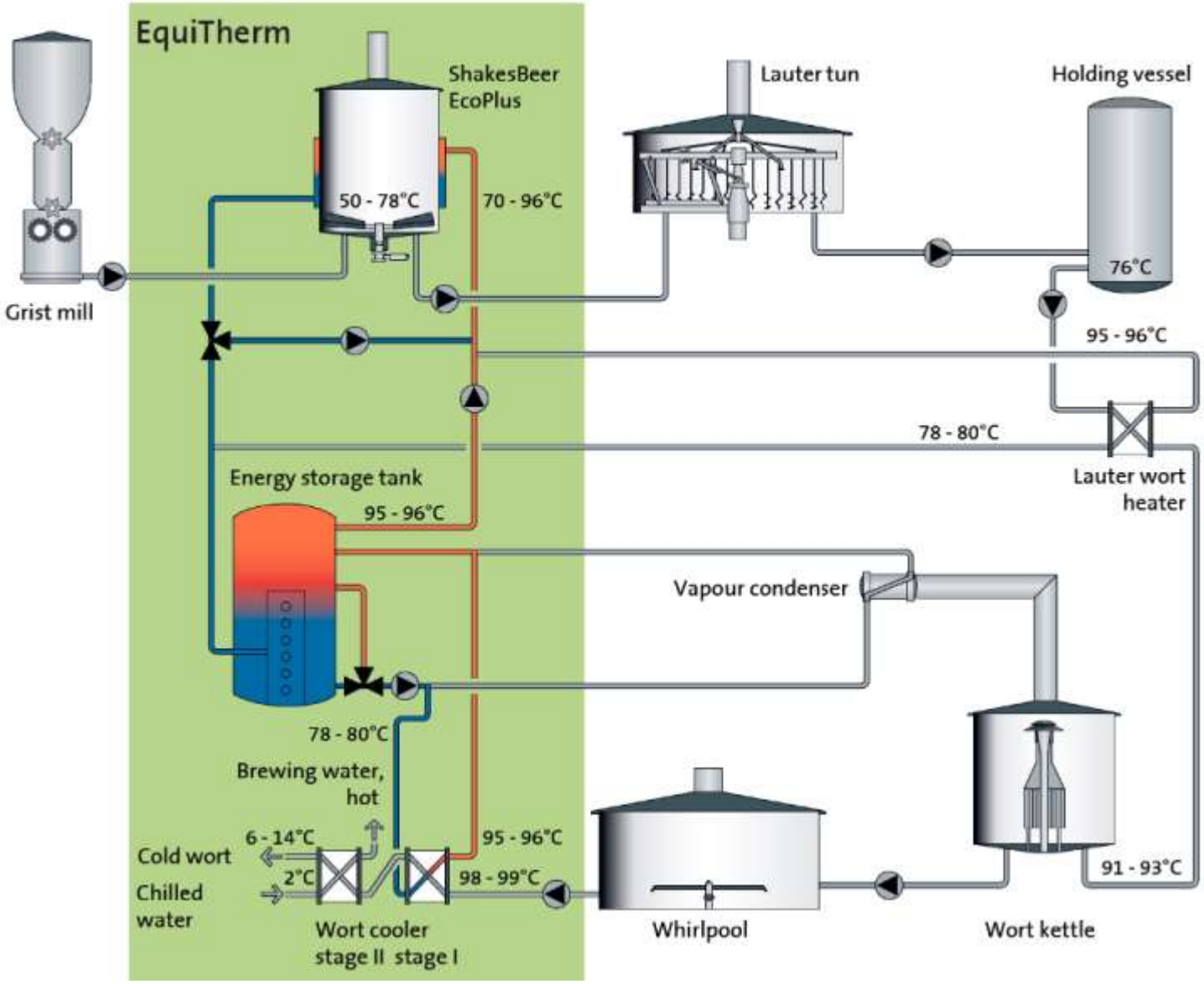


Introduction of Biogas Boiler and Waste Heat Recovery System to Beer Factory



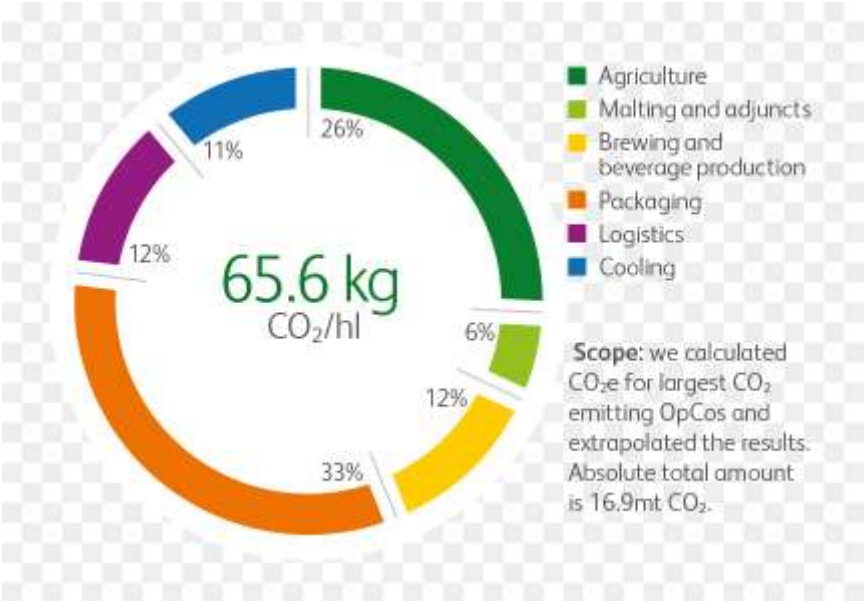
Improving beer quality with less energy consumption

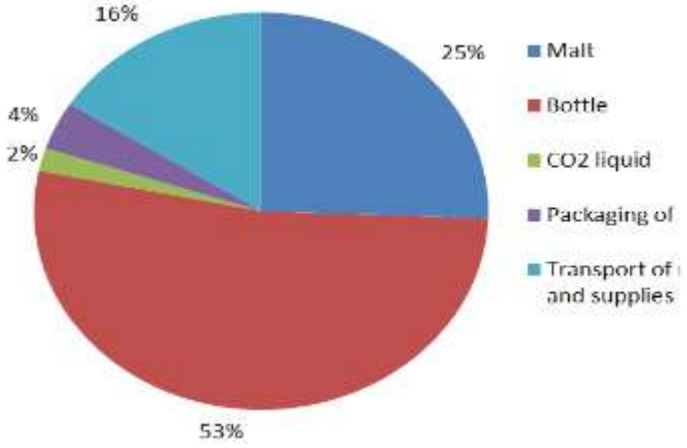
JULY 21, 2019 / LONG READS

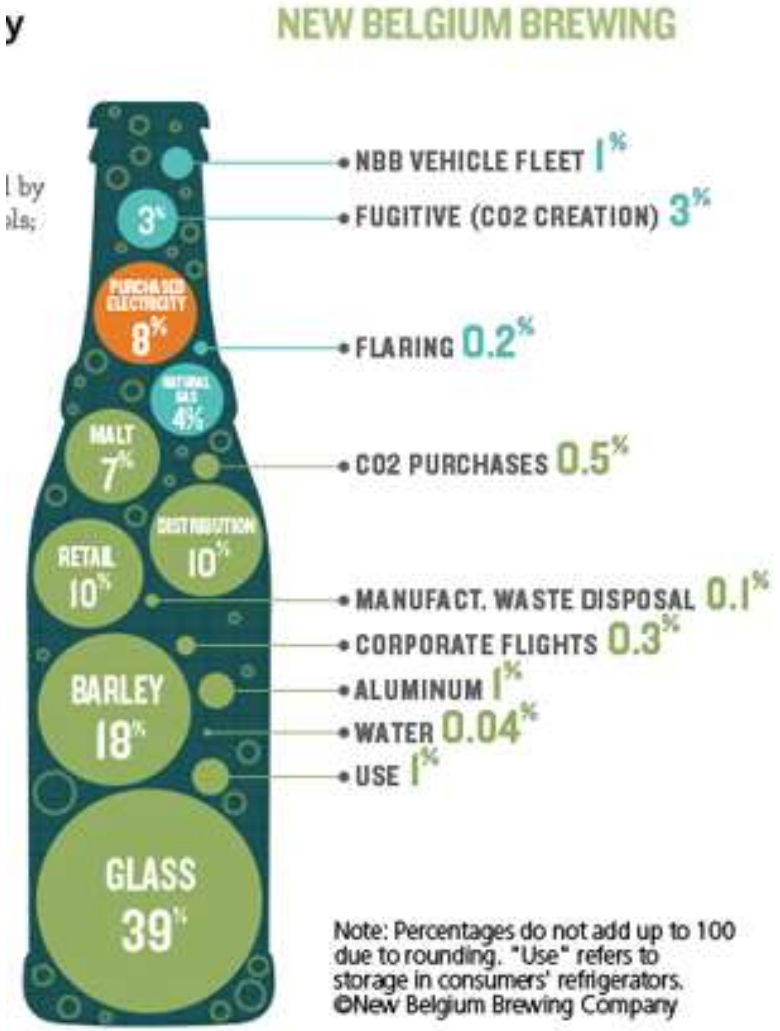


Pero cuales son los procesos con más huella de carbono?

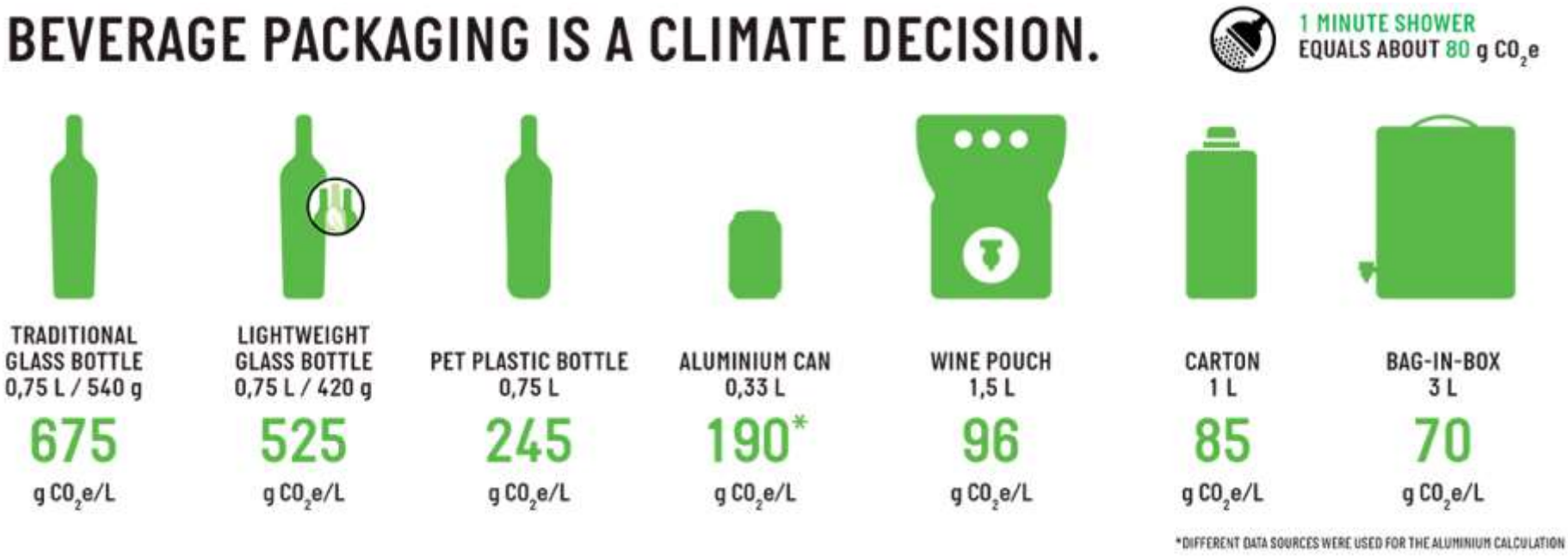
Carlsberg Hong Kong

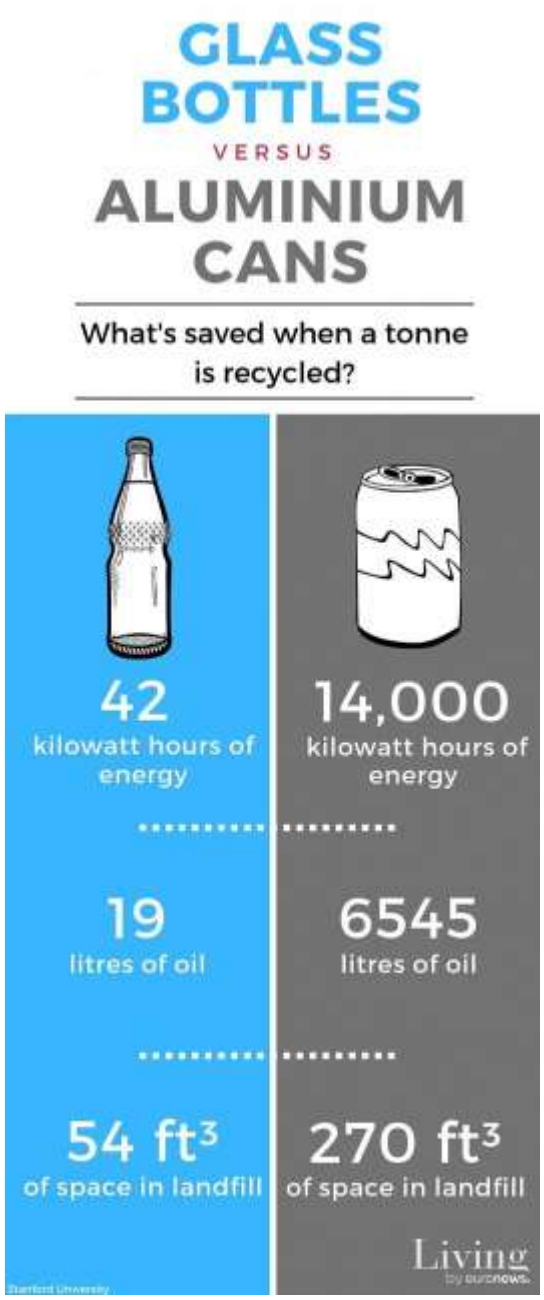

26%
11%
12%
6%
12%
33%
65.6 kg
CO_2/hl
Agriculture
Malting and adjuncts
Brewing and beverage production
Packaging
Logistics
Cooling
Scope: we calculated CO_2e for largest CO_2 emitting OpCos and extrapolated the results. Absolute total amount is 16.9mt CO_2.


16%
25%
4%
2%
53%
Malt
Bottle
CO2 liquid
Packaging of
Transport of and supplies


y
NEW BELGIUM BREWING
l by
NBB VEHICLE FLEET 1%
FUGITIVE (CO2 CREATION) 3%
FLARING 0.2%
CO2 PURCHASES 0.5%
MANUFACT. WASTE DISPOSAL 0.1%
CORPORATE FLIGHTS 0.3%
ALUMINUM 1%
WATER 0.04%
USE 1%
3%
PURCHASED ELECTRICITY 8%
NATURAL GAS 4%
MALT 7%
DISTRIBUTION 10%
RETAIL 10%
BARLEY 18%
GLASS 39%
Note: Percentages do not add up to 100 due to rounding. "Use" refers to storage in consumers' refrigerators.
©New Belgium Brewing Company

Sólo envases…





Aluminium

Environmental Impacts

Impacts include:

- aesthetics
- air quality (dust and pollutants)
- water discharge and runoff
- subsidence
- tailings (acidic, heavy metals)

CIRCULARITY IN OUR VALUE CHAIN

We are embedding more circularity in the various links of our value chain.

AGRICULTURE

We are introducing new barley varieties that are more climate-tolerant, **use less energy and water** in malting, and produce good yields for our farmers (as well as making our Carlsberg beer taste better!)

20%

less water is used to make our beer in 2014 than back in 2007.

MALTING

Danish Malting Group will start using wood chips to make its heating close to CO_2-**neutral** in the future.

BREWING

Brewer's grains, once spent, are **reused** for animal feed and **soil improvement** (putting a bit of beer back in the ground, so to speak)

We buy **renewable power** certificates for all our Western European breweries to stimulate demand for **renewable energy**.

PACKAGING

We use the cradle-to-cradle® methodology to create the next generation packaging for upcycling.

3 Cradle-to-Cradle®
certified products by 2017

CONSUMERS

In Denmark, consumers help us to achieve a near **100%** return of glass bottles.

A beer bottle can be reused

40 times

(but we need our consumers to help!)

Did you help to collect cans at one of last year's global music festivals? **Cheers for that!**

TOGETHER TOWARDS ZERO

Carlsberg Group

https://www.youtube.com/watch?v=bWmd1psRNm4

Forbes

BrewDog Is Officially The First Carbon Negative Beer Business

Emanuela Barbiroglio Senior Contributor

Green Tech

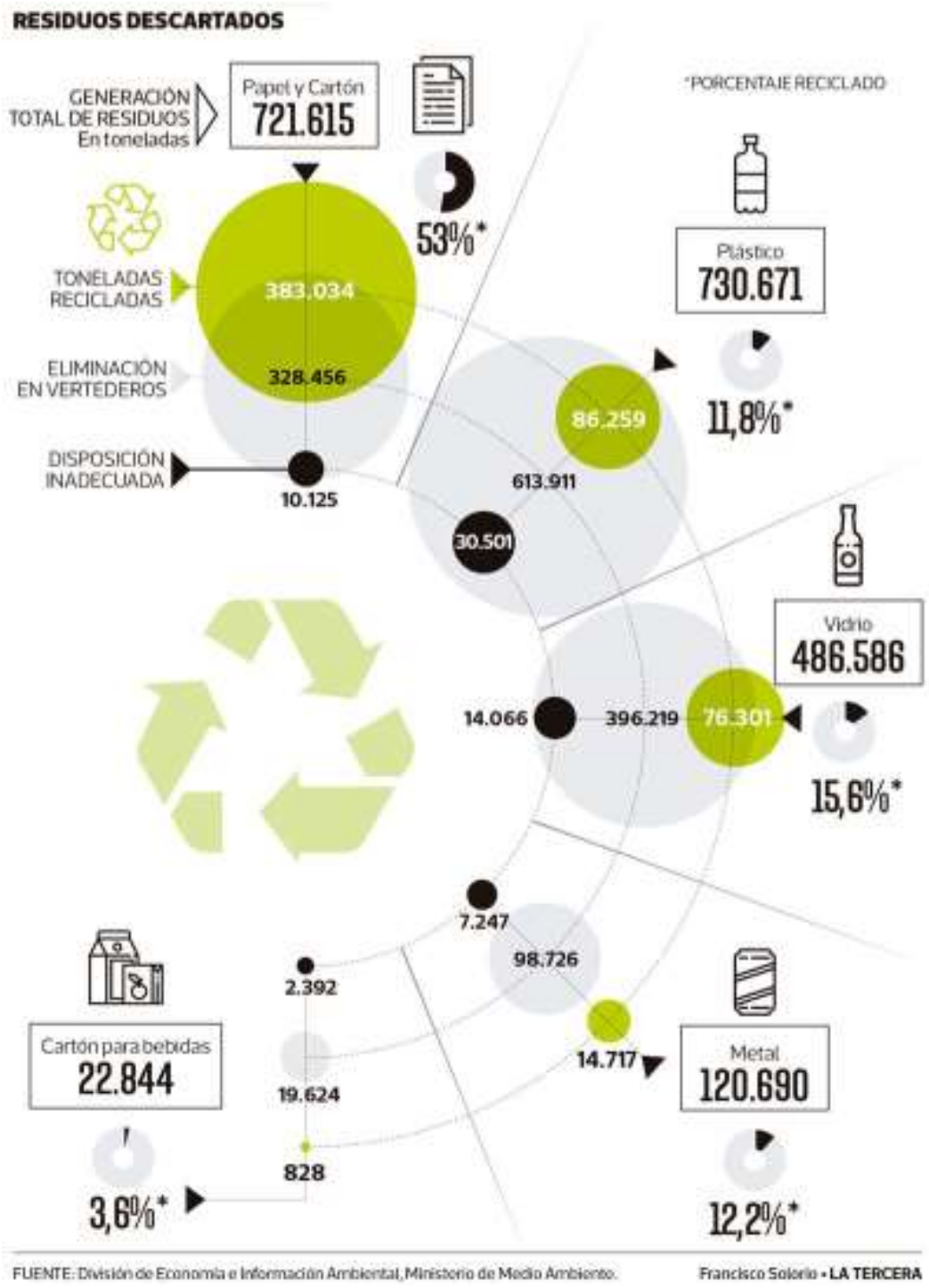
I write about sustainability and EU's environmental policies

Pero en Chile?

En Chile, solo el 10% de los residuos se reciclan. El vidrio es el elemento que cuenta con el **mayor porcentaje**, alcanzando el 16% del total.

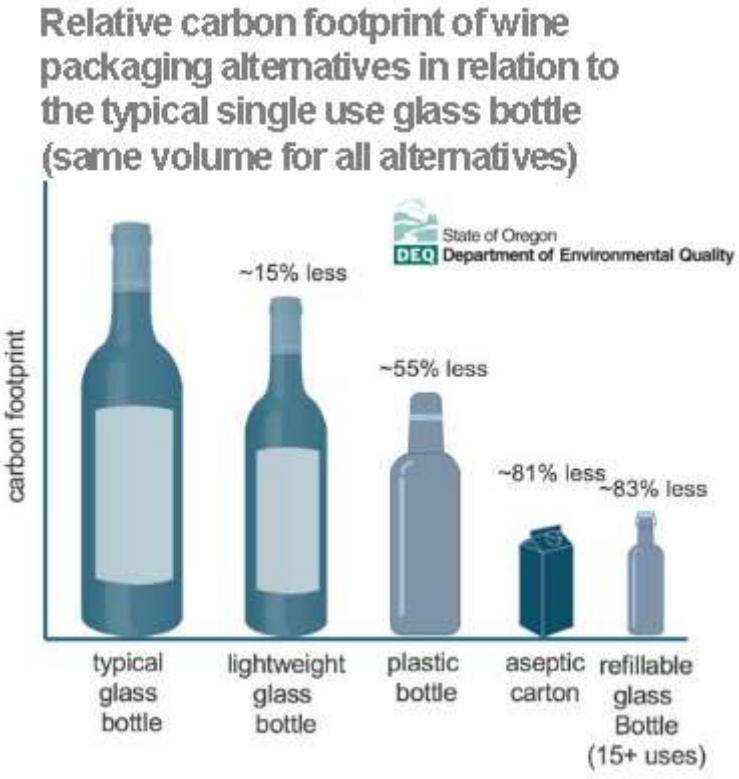
REP
http://retailchile.blogspot.com/2015/10/las-dudas-de-rep.html

CAPITAL


RESIDUOS DESCARTADOS
GENERACIÓN TOTAL DE RESIDUOS En toneladas
Papel y Cartón
721.615
53%*
TONELADAS RECICLADAS
383.034
ELIMINACIÓN EN VERTEDEROS
328.456
DISPOSICIÓN INADECUADA
10.125
*PORCENTAJE RECICLADO
Plástico
730.671
11,8%*
86.259
613.911
30.501
Vidrio
486.586
14.066
396.219
76.301
15,6%*
7.247
98.726
2.392
19.624
828
14.717
Cartón para bebidas
22.844
3,6%*
Metal
120.690
12,2%*
FUENTE: División de Economía e Información Ambiental, Ministerio de Medio Ambiente.
Francisco Solorio • LA TERCERA

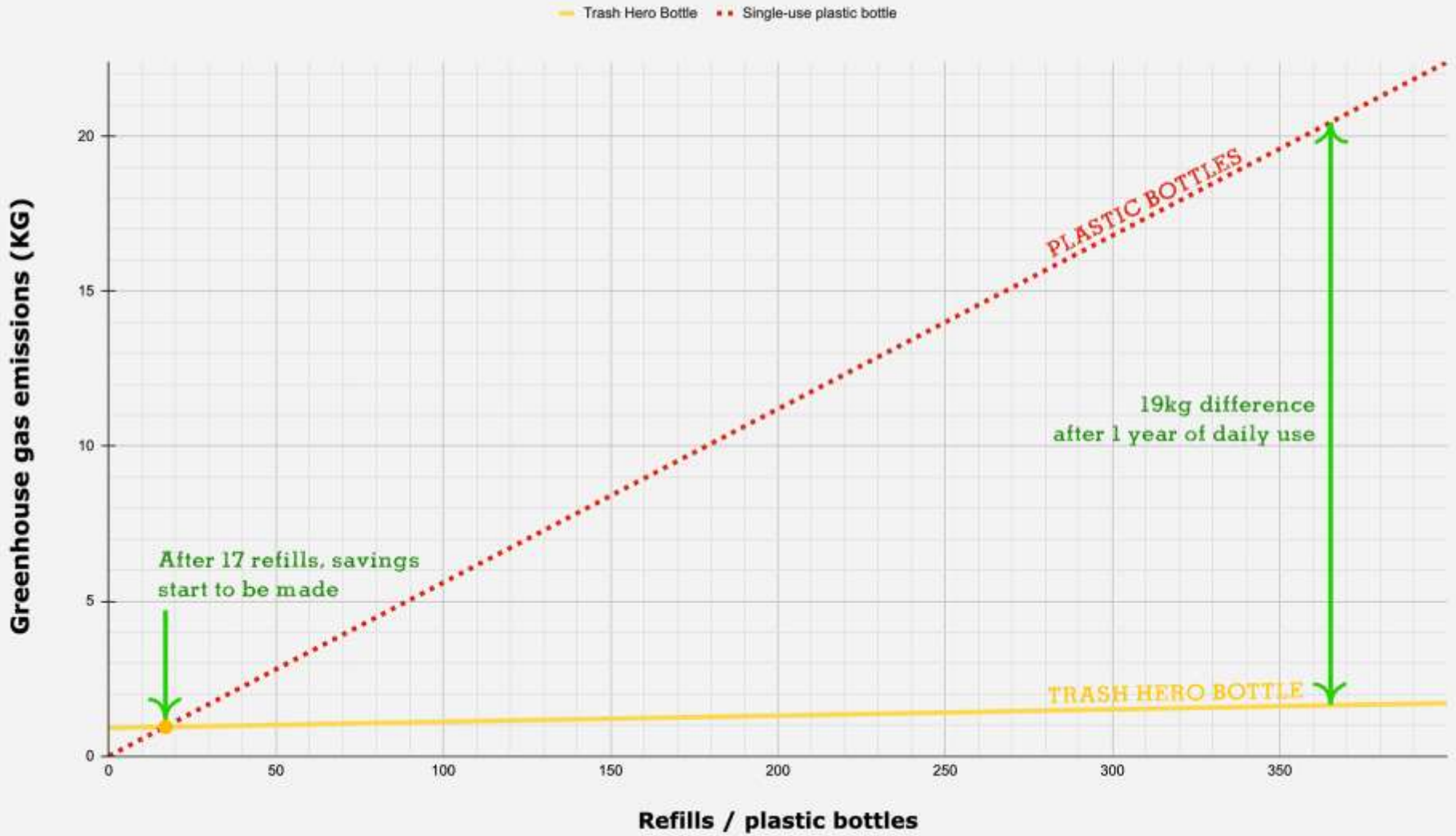
Por lo tanto…


ABInBev


Relative carbon footprint of wine packaging alternatives in relation to the typical single use glass bottle (same volume for all alternatives)
State of Oregon
DEQ Department of Environmental Quality
carbon footprint
~15% less
~55% less
~81% less
~83% less
typical glass bottle
lightweight glass bottle
plastic bottle
aseptic carton
refillable glass Bottle (15+ uses)

CLIMATE IMPACT OF TRASH HERO BOTTLE vs. SINGLE-USE PLASTIC BOTTLES

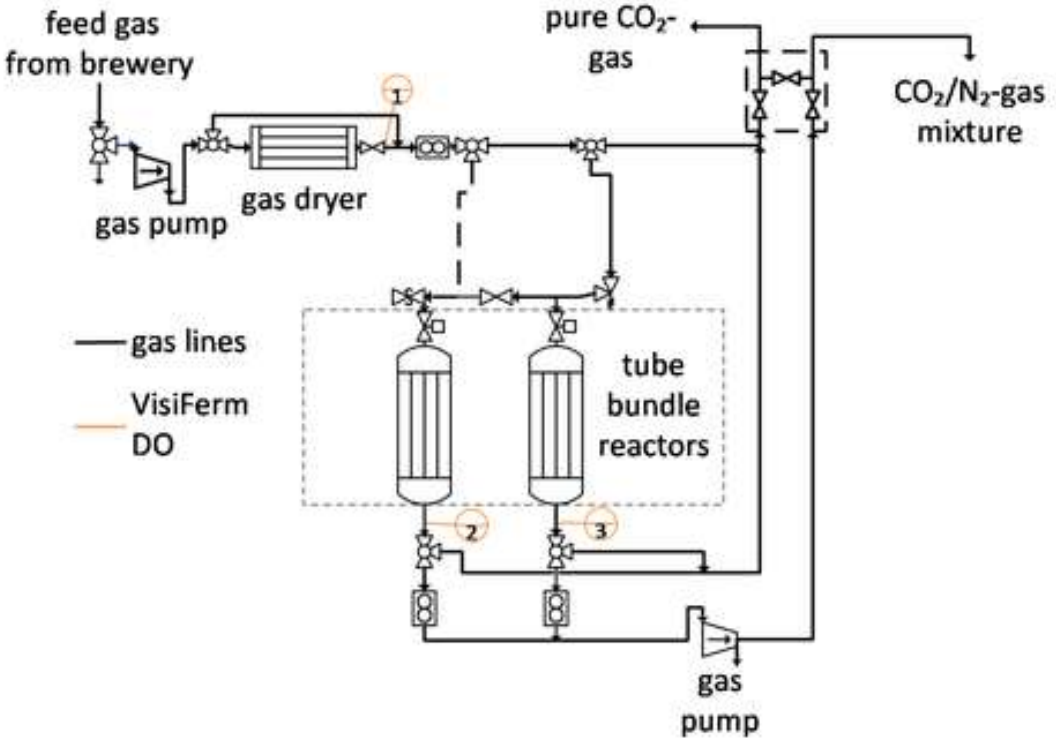
Graph compares CO2 emissions of consuming single-use plastic bottles vs. refilling the Trash Hero reusable bottle, once a day over a one year period




LA CASA DEL AHORRO
#LaConveniencia
Heineken
Coors
Corona Extra
STELLA ARTOIS
AUSTRAL
Kunstmann
4.190
4.190
4.190
SOL
Budweiser
CUSQUEÑA
GOLDEN LAGER
CRISTAL


Cerveza Artesanal
CARVA
Valdivia Chile
Cerveza Artesanal
VALDMOR
Pale Ale
V
LOS TORREONES
CERVEZA
BUNDOR

Recuperación Gas Carbónico



UNIVERSITÄT BAYREUTH

SCHULZ

Neumarkter Lammsbräu

https://www.hamiltoncompany.com/process-analytics/case-studies/app-note-recycling-carbon-dioxide-in-high-quality

Agricultura: cebada y lúpulo

0 Labranza

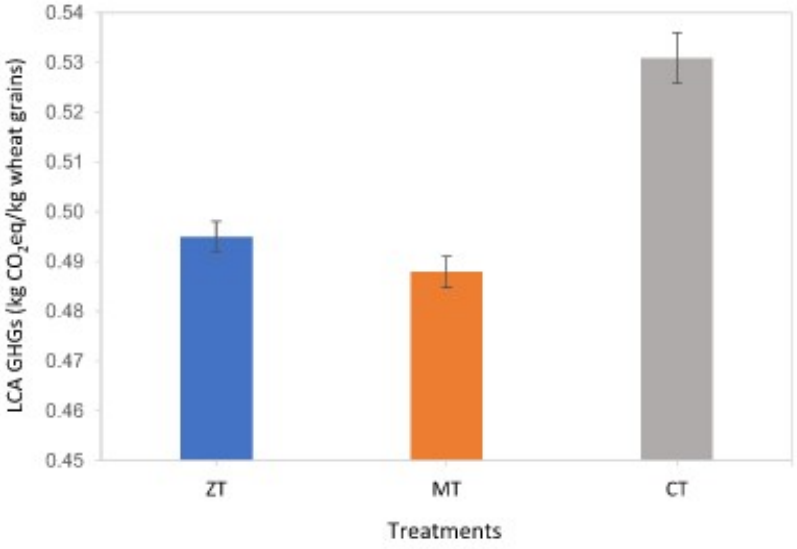


Fig. 6. Life cycle GHG emission within life cycle assessment (LCA) approach for wheat production ($p < 0.05$).

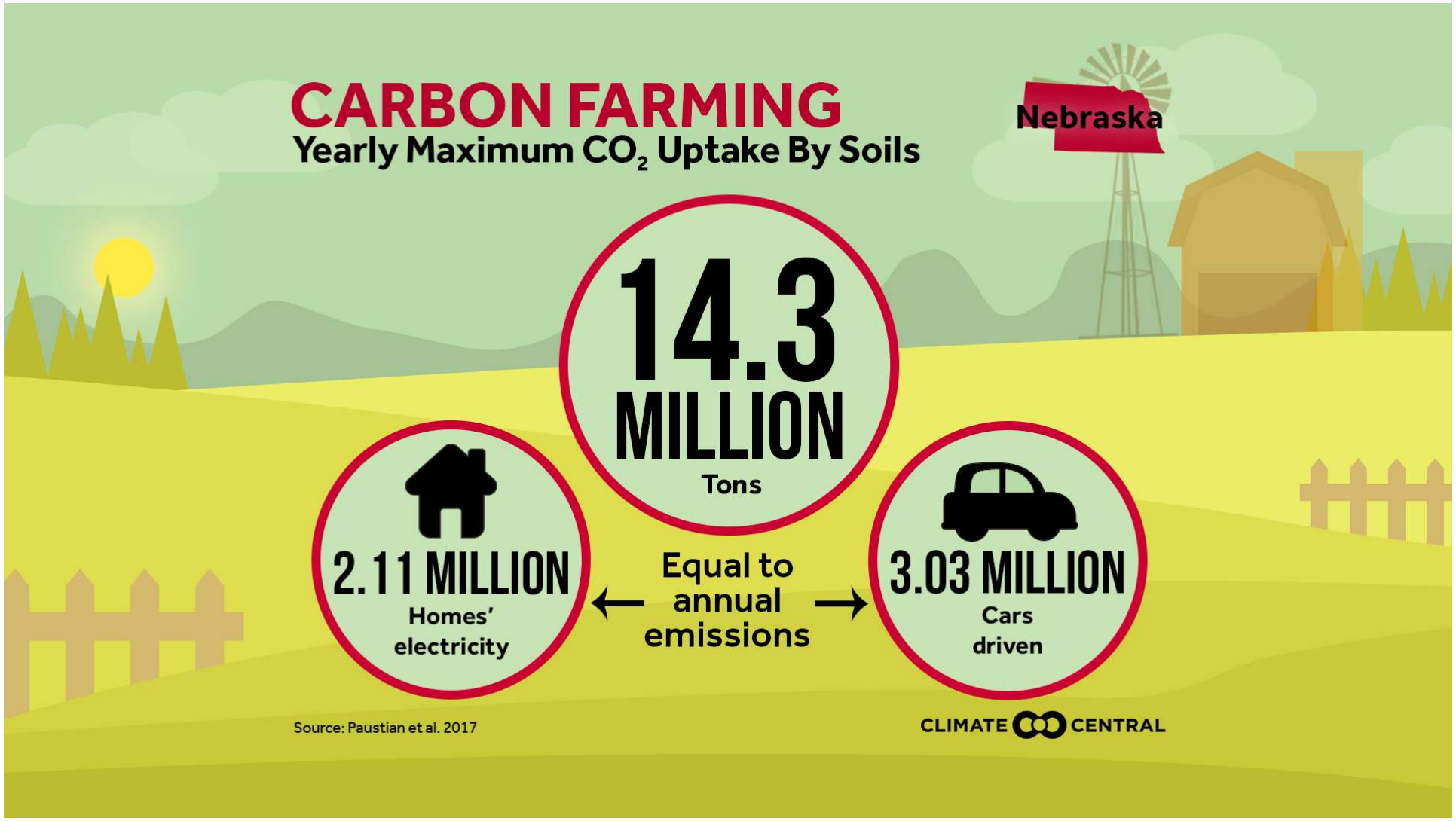
Fuente: Rahman et al., 2021

0 Labranza

Menor pérdida de:

- Suelo
- Agua
- Biología
- Energía
- Carbono
- Tiempo
- Dinero
  - Horas maquinaria
  - Combustible
  - Operarios

Agricultura del Carbono



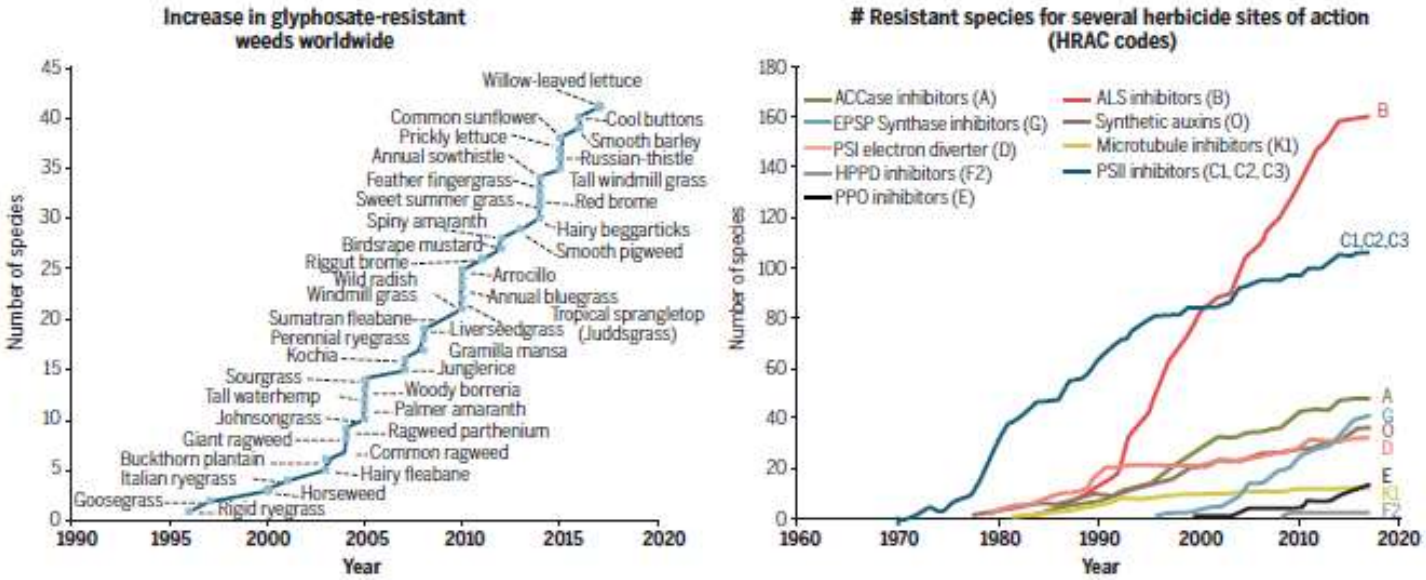


Fig. 1. Weed species with resistance to herbicides. (**Left**) Cumulative number of weed species with resistance to glyphosate. (**Right**) Cumulative number of weed species with resistance to herbicides in the major mechanism of action groupings.

Science

(Gould et al., 2018)

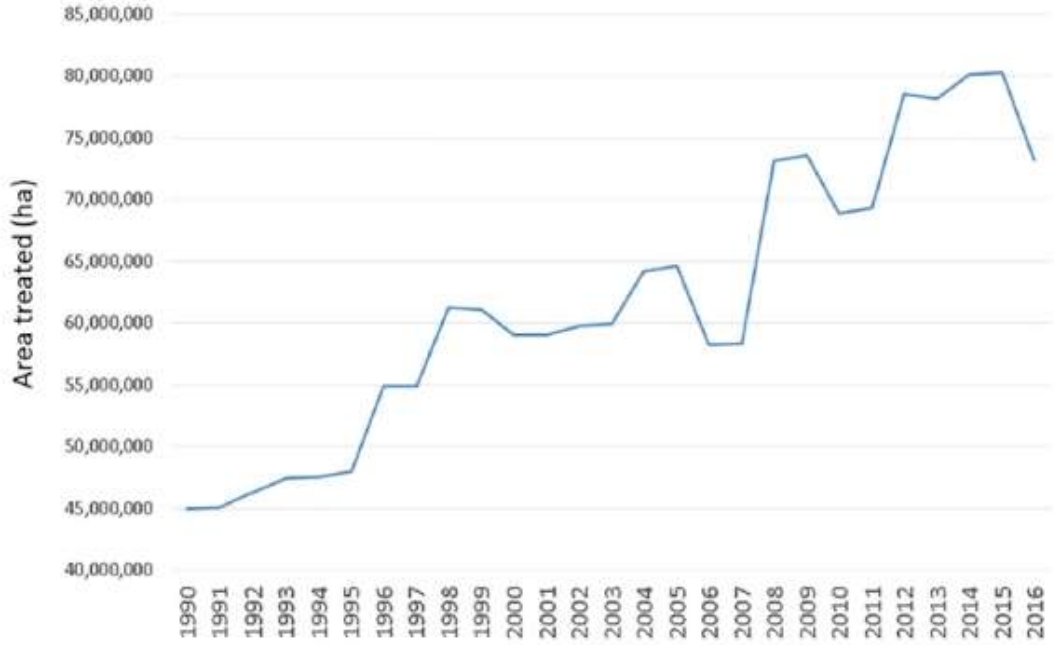


Figure 1. The Area of Farmland Treated with Pesticides Each Year in the UK

Fuente: Hallmann et al., 2017

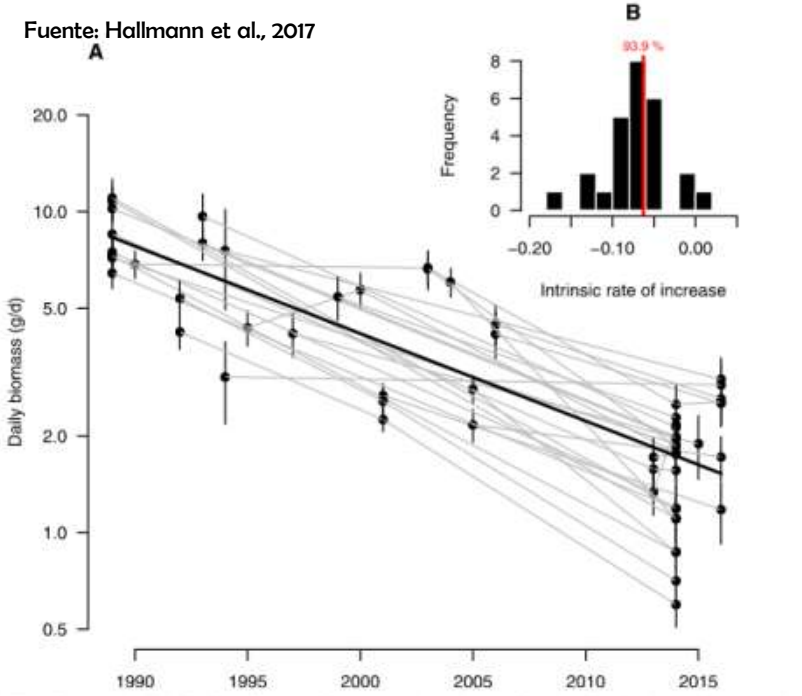


Fig 4. Temporal distribution of insect biomass at selected locations. (A) Daily biomass (mean ±1 se)

Fuente: Sánchez-Bayo y Wyckhuys, 2019

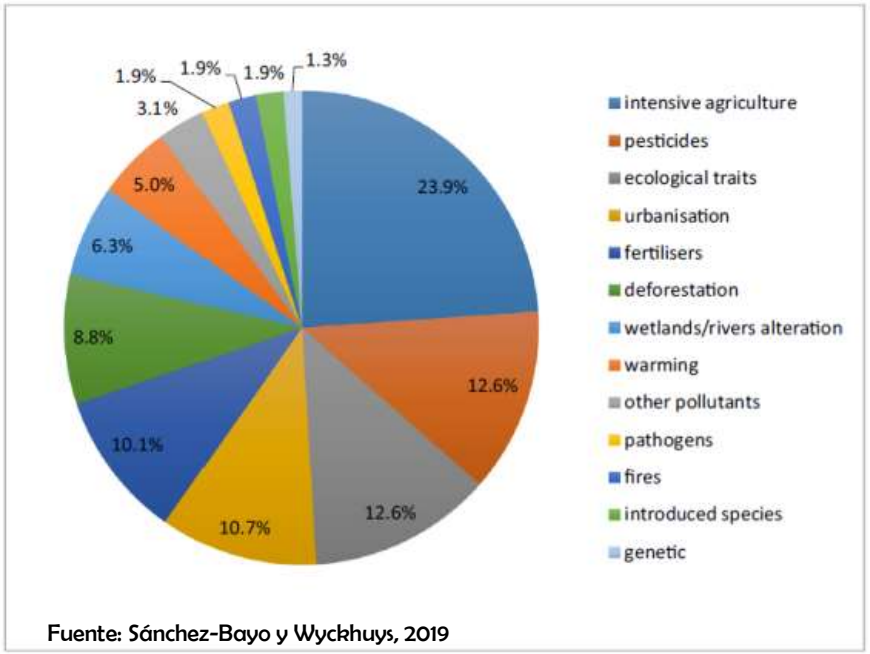
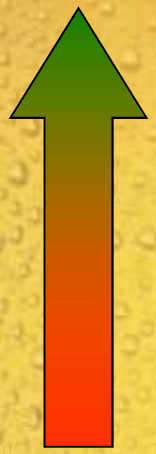


Fig. 6. Main factors associated with insect declines – see also Fig. 5.

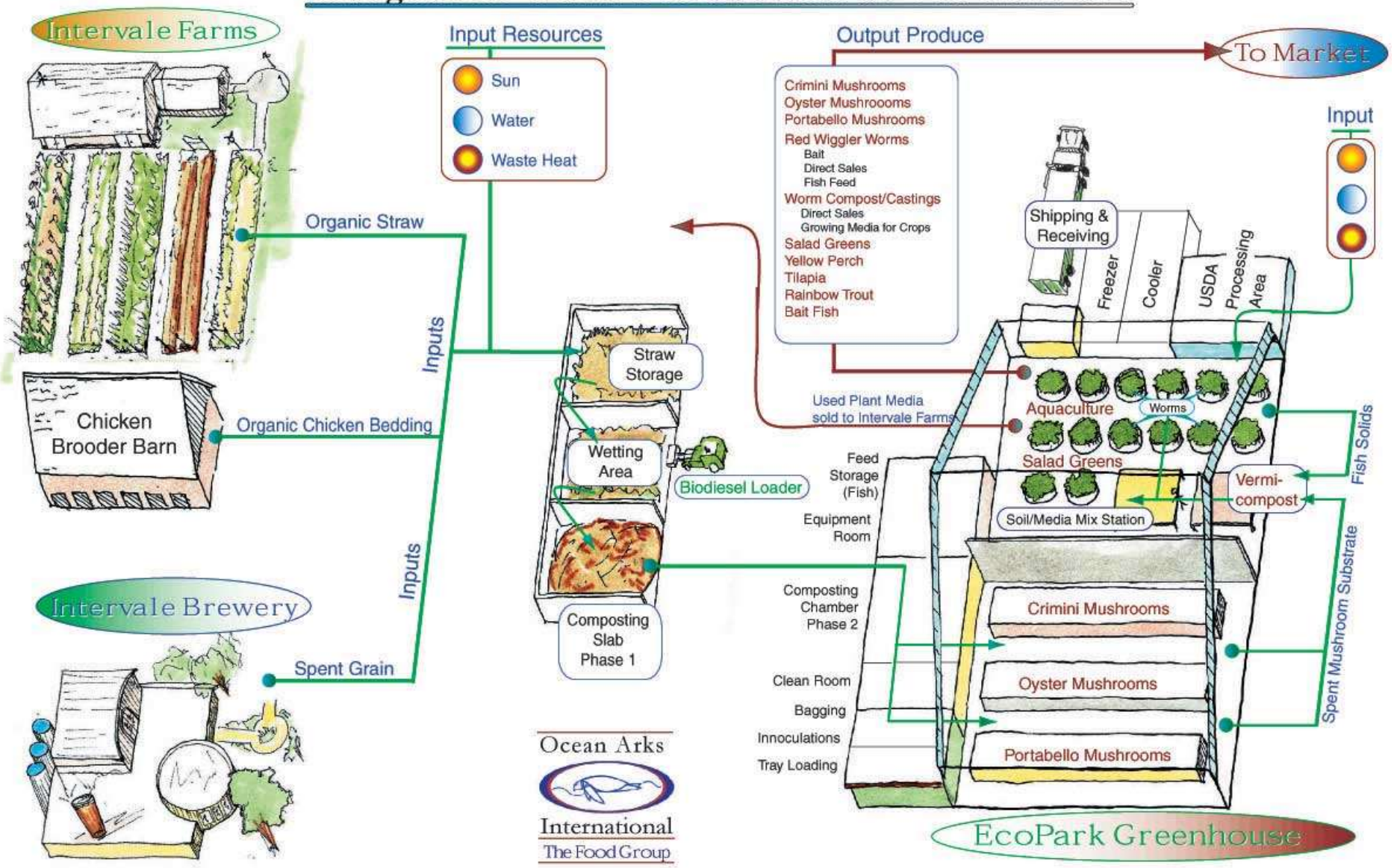
Hacia una cebada sustentable..



- Agroecología
- Cero labranza
- Agricultura orgánica
- Agricultura de conservación

Residuos orgánicos sólidos

Integrated Food Production at The EcoPark



February 8, 2002

Ecoeficiencia de uso

- Alimentación Humana: Proteina
- Alimentación Humana: Energía
- Alimentación Humana: fibra
- Alimentación animal: monogastricos
- Alimentación animal: Rumiantes
- Energía: Biogás
- Energía: Gas pobre/Biocarbón (pirólisis)
- Compost
- Energía: Combustión

Incineración Bagazo

Spent grain burns into clean energy

- Pérdida masiva de calor por evaporación: bajísima eficiencia
- PLT Combustión limpia es compleja y cara
- Destrucción de moléculas alimenticias (carbohidratos y proteínas)
- Volatilización Nitrógeno y Azufre

Yoo et al. Appl Biol Chem (2021) 64:10
https://doi.org/10.1186/s13765-020-00577-z

KSABC
The Korean Society for Applied Biological Chemistry

ARTICLE Open Access

Effects of brewer's spent grain biochar on the growth and quality of leaf lettuce (*Lactuca sativa* L. var. crispa.)

Jun-Hyuk Yoo[1], Deogratius Luyima[1], Jae-Han Lee[1], Seong-Yong Park[1], Jun-Woo Yang[1], Ji-Young An[1], Yeo-Uk Yun[2*] and Taek-Keun Oh[1*]

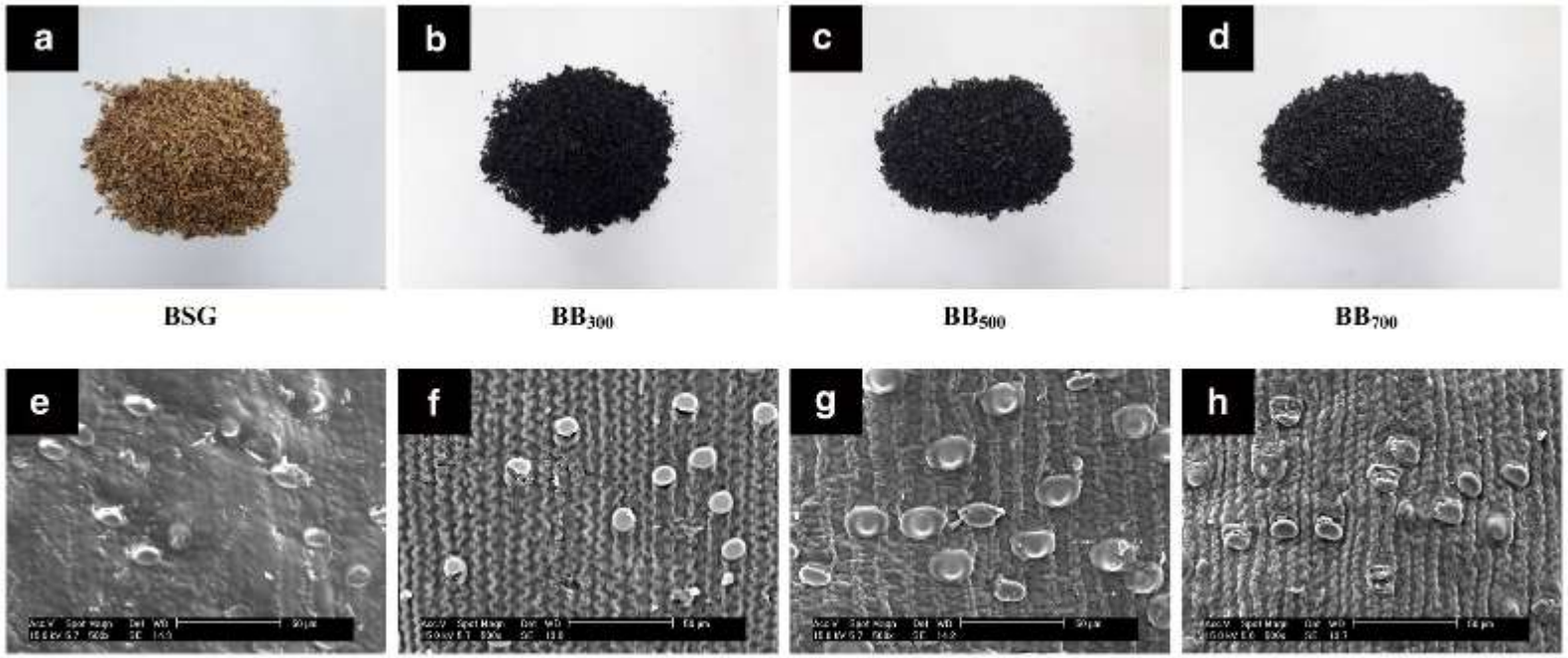


Fig. 1 Photographs of the brewer's spent grain and each of the biochars produced (**a**–**d**) and scanning electron microscope (SEM) images of **e** brewer's spent grain (BSG), **f** biochar produced at 300 °C (BB_{300}), **g** biochar produced at 500 °C (BB_{500}) and **h** biochar produced at 700 °C (BB_{700})

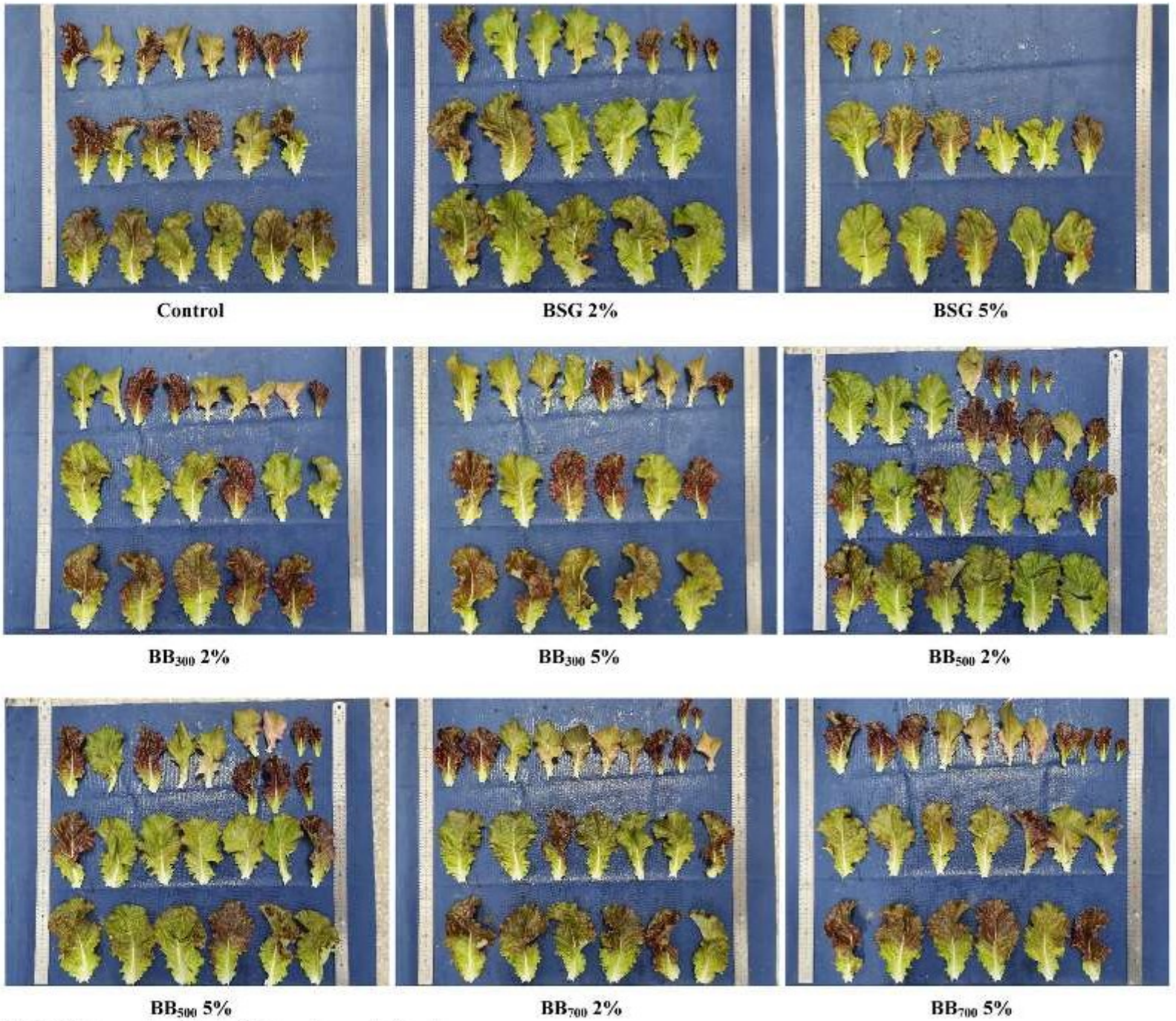
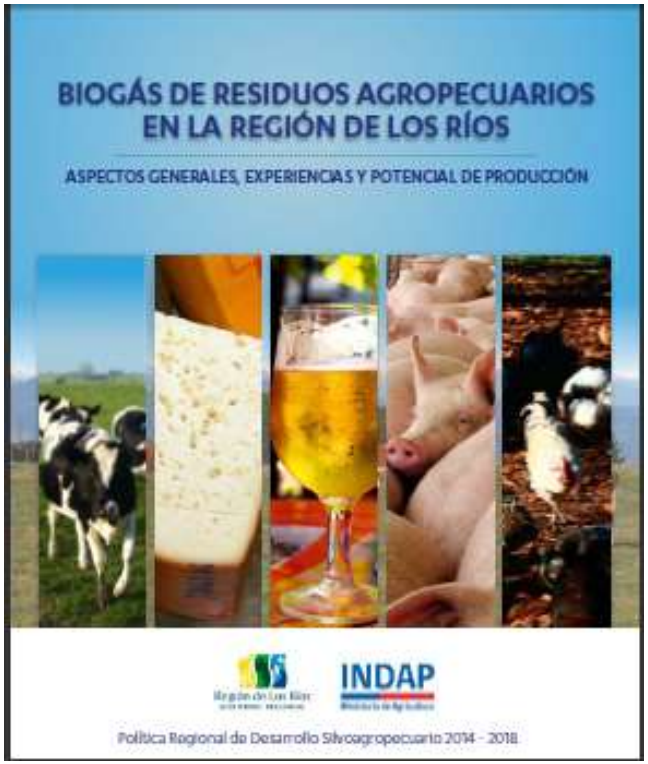


Fig. 2 Photographs of the leaf lettuce leaves obtained

Biodigestión



Energía Cocción

MS Bagazo	27%
Lts Biogas/kg Bag	110
Rel lt Cer/Kg Bagazo Hº	2,29245283
Lts	**1000**
Malta (Kg)	33
Bagazo (Kg)	**436,2**
Biogas (lts)	**47984**
Energía Térmica (KWh)	312
Eq Diesel (lts)	28,8
Eq Gas Liq (Kg)	**20,6**
Eq Leña (m3)	0,18
Ef quemador	80%
Lts H2O hervida (15ºC)	**293,5**
Factor cocción*	0,5
Lts mosto cocido (15ºC)	147
Dda energía satisfecha	**15%**

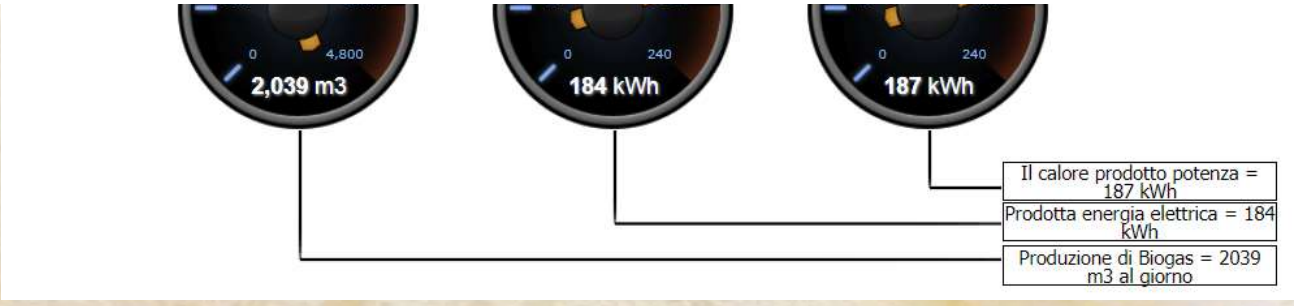
* % de la energía en hervir/total

Tabla 12: Producción de cerveza y bagazo para 4 empresas de la Región de Los Ríos

Empresas	Litros cerveza/año	Kg malta/año	Kg bagazo/año
A	204.000	51.000	86.400
B	16.800	4.800	8.132
C	7.680	2.400	4.066
D	14.400	4.800	8.132
Total	**242.880**	**63.000**	**106.730**

Fuente: *Elaboración propia.*

	Dda Energía
Sin mejora	**100%**
Con BG	**85%**
Con Batchs	**25%**
Con BG y Butchs	**-4%**



- 10000 kg de bagazo que se vendían como comida para cerdos, y 60000 L de efluentes líquidos por día.
- Yo adopté para los cálculos de biogas 23% MS y 75%oMS según varios artículos al respecto. El 80% de sólidos volatiles.
- 2000 m3 Biogás, Electricidad:187 KWh (casi 8 KW de potencia continua)

Electricidad

Agua Caliente

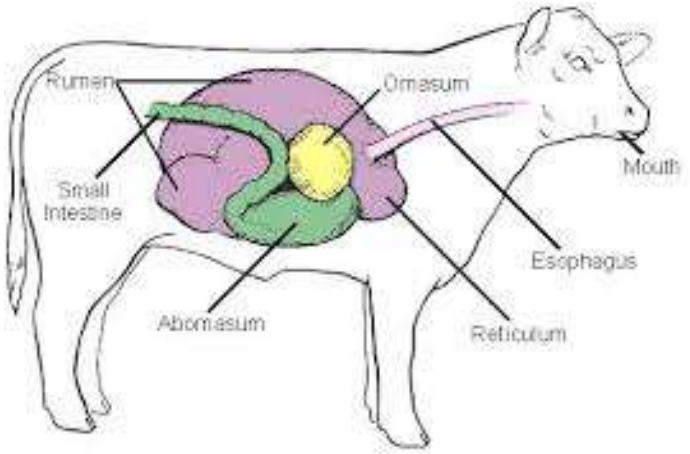
Frío

Biogás

Calefacción

Cocina


9423


Rumen
Omasum
Mouth
Small Intestine
Esophagus
Abomasum
Reticulum

Tenebrio, gusano de la harina como alimento proteico a partir de Bagazo Cervecero

Carla Pincheira Oróstica

Valdivia - Chile

Detalle	Monto
Galpón	15.000.000
1.000 cajas plásticas de 40 L	6.000.000
20 Pallet	20.800
Material Biológico (2.000 escarabajos)	250.000
Costo oportunidad de suelo (1/2 ha)	4.000.000
Deshidratador industrial	2.759.683
Turbocalefactor diesel (30 KW)	248.000
Anafe + Olla Industrial	30.990
Hamero de vibrado automático	405.490
Molinillo Industrial	1.200.000
Estufa de aire forzado	1.000.000
TOTAL	**30.914.963**

Definición del producto final

- El producto obtenido es Harina de tenebrio, la cual contiene
  - Proteína Cruda: 47 – 60% (~ 55%)
  - Grasas: 31 – 43 % (~ 40)
- También se puede dar el gusano deshidratado, todo dependerá de la especie de destino.

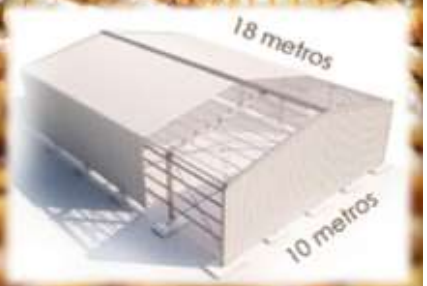
Conversión alimenticia

	Bagazo (kg MS)		Tenebrios (kg MS)		Proteína (kg)		Grasas (kg)
Conversión	3	=	1	=	1	=	0,4
caja	15	=	5	=	3	=	2
Pallet	840	=	280	=	140	=	112
Galpón	13.440	=	4.480	=	2.240	=	1.792
Anual	53.760	=	17.920	=	8.960	=	7.168

Equipamiento

- Material Biológico (larvas)
- Cajas plásticas de 40 L, apilables
- Pallets
- Harnero automático
- Anafe con olla industrial.
- Deshidratador industrial.
- Molinillo industrial
- Calefactor para el galpón.
- Estufa de 65 °C de aire forzado.
- Galpón de 180 m^2 aprox.

Galpón

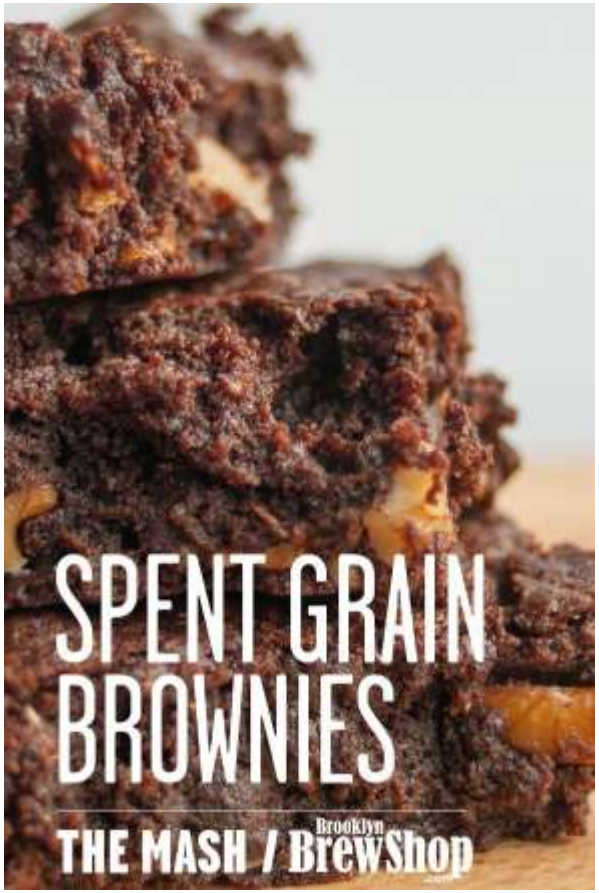


Tendencias

Criadero de insectos chileno fina-lista en Latinoamérica Verde

By #PrensaAgricola 2 años ago

Dípteros: forma más común de alimentación es el consumo de materia en descomposición.


SPENT GRAIN
BROWNIES
THE MASH / Brooklyn BrewShop


REGRAINED
EAT BEER.
HONEY CINNAMON IPA
SUSTAINABLE SUPERGRAIN BAR
REGRAINED
EAT BEER.
COFFEE CHOCOLATE STOUT
SUSTAINABLE SUPERGRAIN BAR

Diario UACh

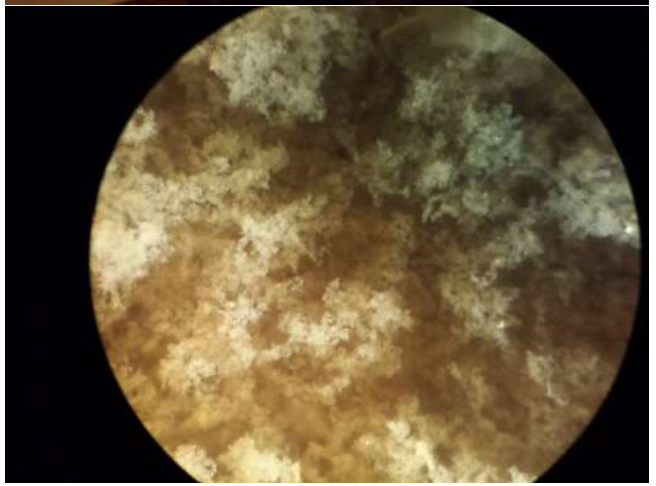
Museo del Hongo se presenta en el MAC Valdivia UACh

FFungi

Hogos a partir de digestato sólido

Residuos orgánicos líquidos

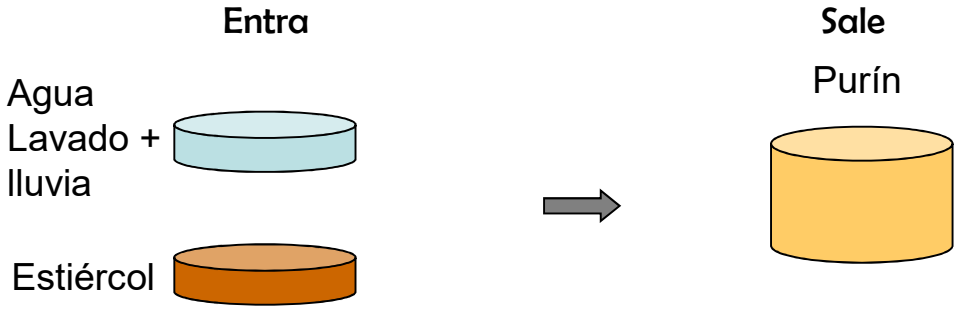
Riles

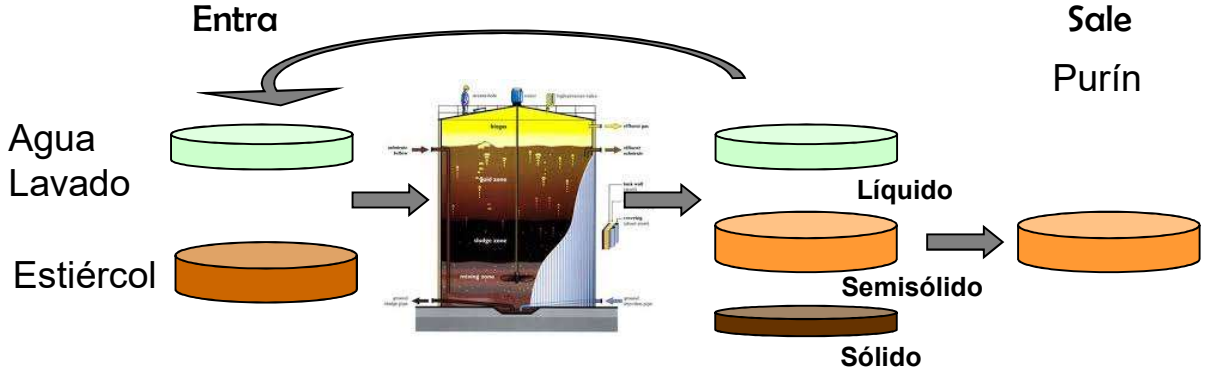


Biotecsur
www.biotecsur.cl
Diseño de Biodigestores

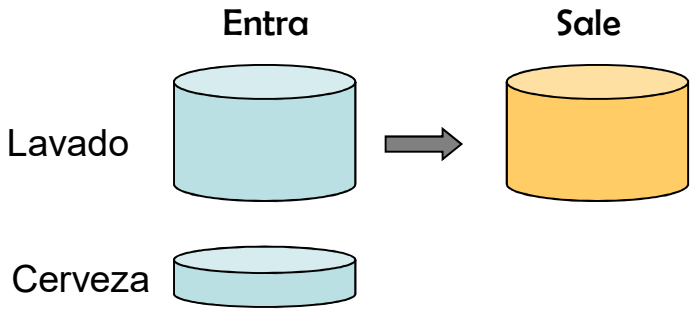
BOMBAS

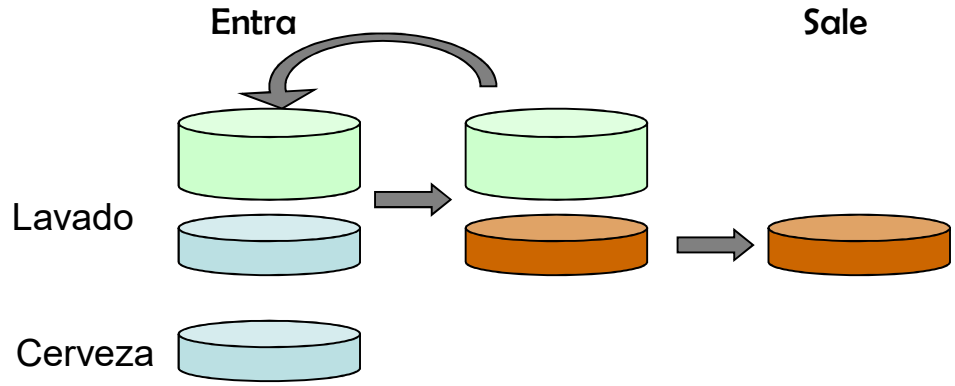
Extracción de purines, impulsión de digestato y recirculación de purines



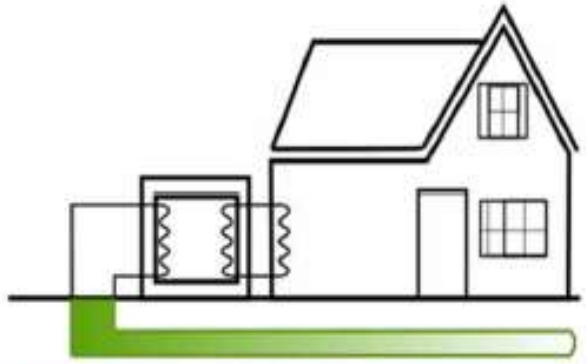


Descartado!

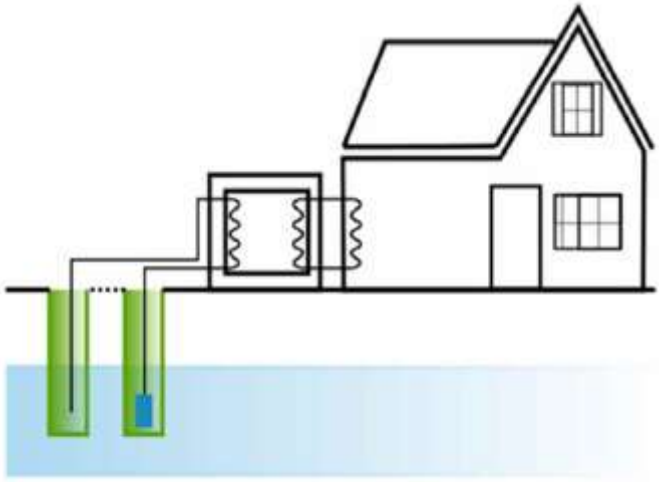




Bomba de calor



Fuente: EP



Fuente: EP

NAMA
CHILE

Conclusiones

- Grandes oportunidades de proceso gestión residuos INTEGRADO
  - Calor
  - Residuos orgánicos
- Aprovechar el calor residual
- Aprovechar las propiedades del bagazo
- Tema envases: Cuando cervecerías son pequeñas asociarse y consensuar un formato de botella retornable común.
- Enviar señales al mercado de la malta: subir estándares agrícolas


Gracias !