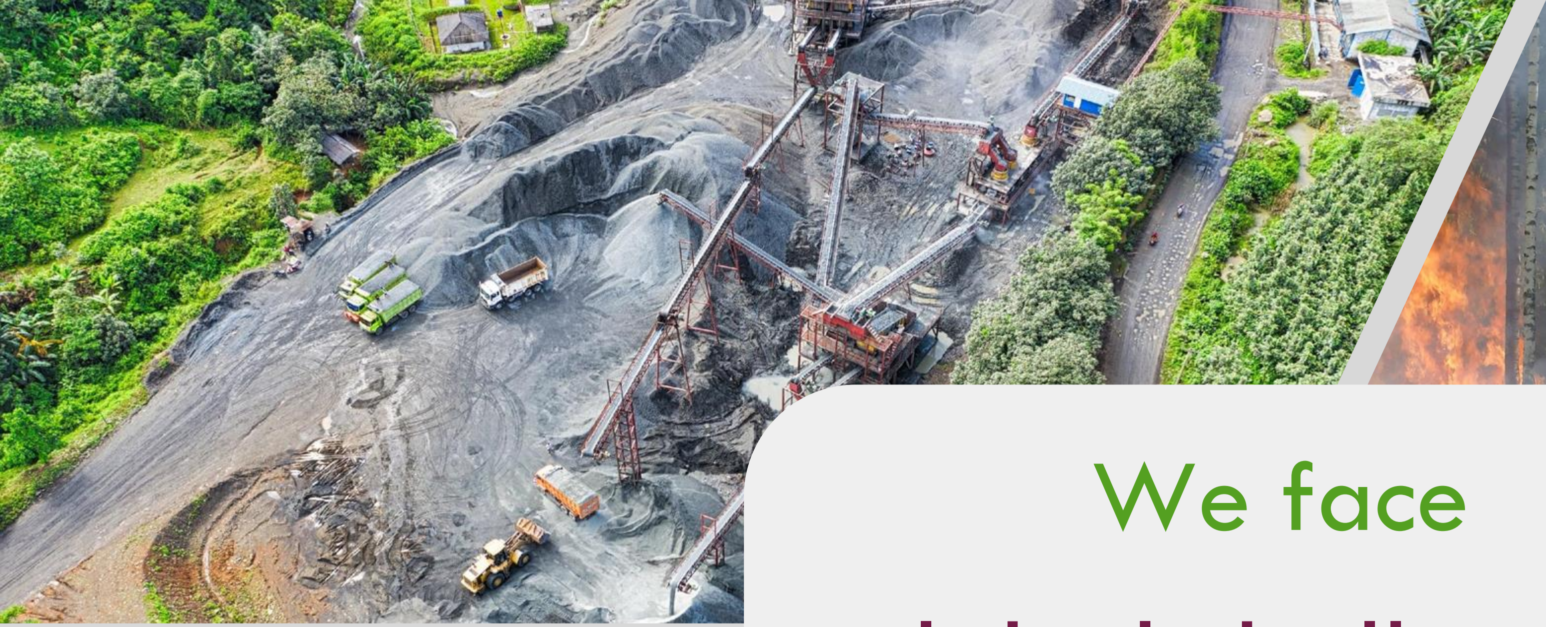
# Sustainability, Science and the Ways Technology Can Impact the World

Dr. Love-Ese Chile
Grey to Green
Sustainable Solutions

Faculty Women's Club

University of British Columbia

Tuesday Nov 5th, 2019




We face

global challenges.

No time to wait,
no time for waste.


# Alternative visions for **tomorrow**

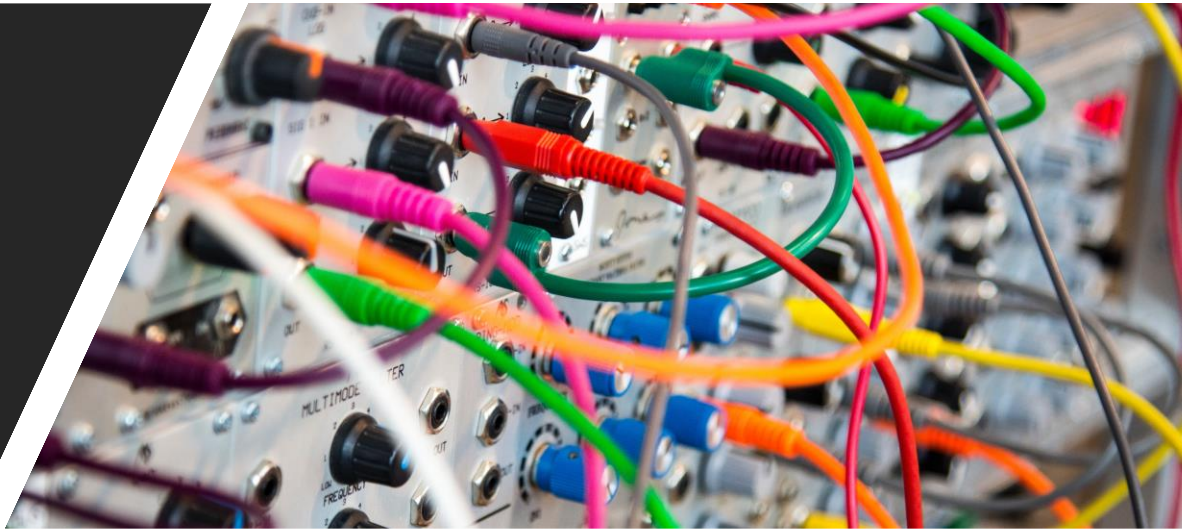
# Innovative technologies

- ➢ 5G technology and the Internet of Things
- ➢ 3D Printing and additive manufacturing
- ➢ Bioplastics and the circular bioeconomy

# Internet of Things

- **A system of interrelated computing devices**, mechanical and digital machines, objects, animals or people

- Provided with unique identifiers and the ability to **transfer data over a network without requiring human-to-human or human-to-computer interaction**



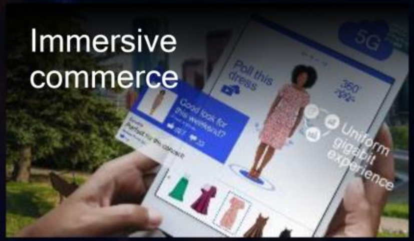
# 5G Technology

- The **fifth generation of wireless technology** which will be significantly faster than its predecessor the 4G technology that we are using today
- 5G uses **millimetre waves which have shorter range than microwaves**, therefore the antennas are a smaller size
- **These waves have trouble passing through building walls**, so a huge number of antennae would be needed to allow a large city to have this technology
- 4G has peak speeds of 50Mbps, **5G is expected to ascend to 20Gbps**
- **Potential heath concerns** of this small wavelength

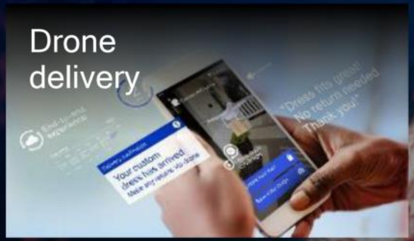
# Many potential applications!

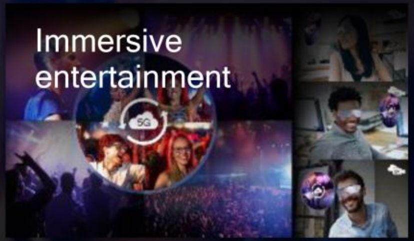






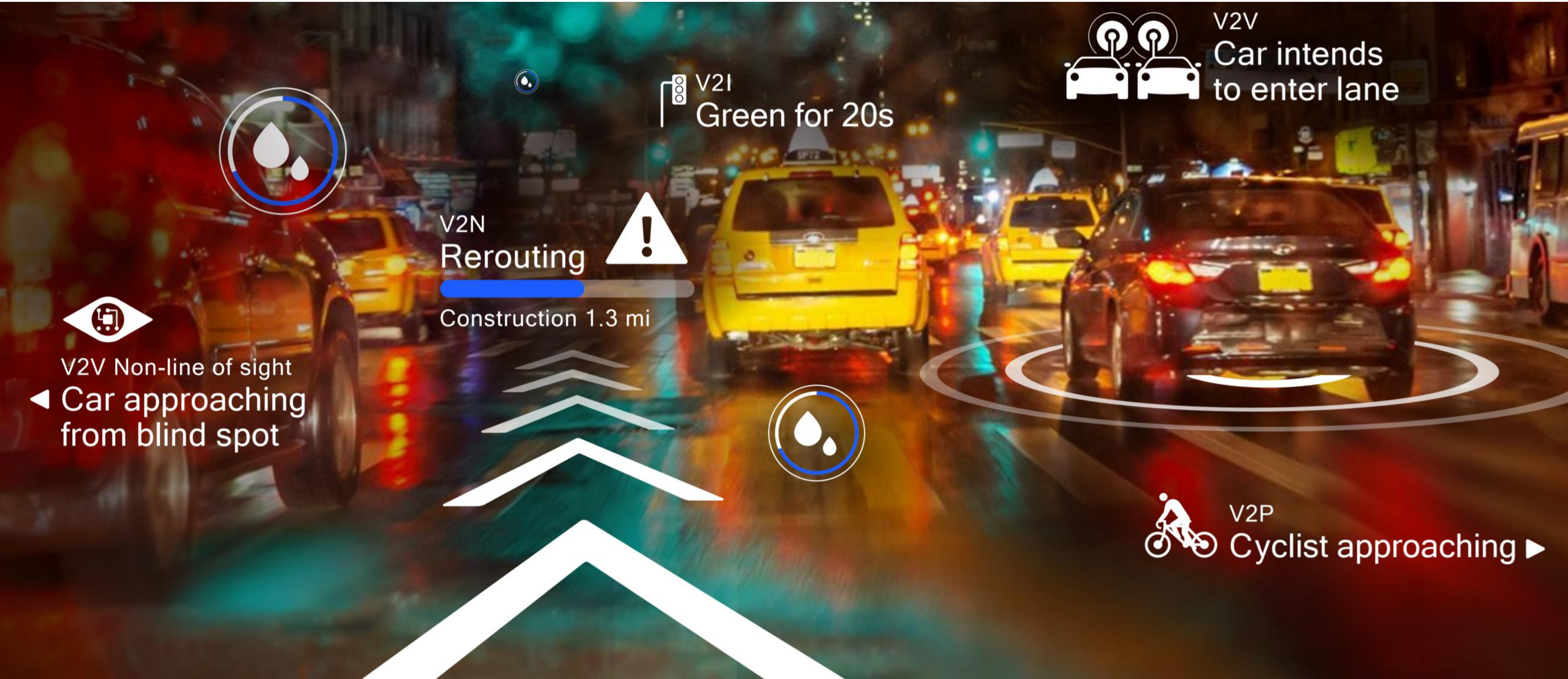



# Applications in Precision Agriculture

# Applications in Autonomous Vehicles



# Innovative technologies

- 5G technology and the Internet of Things
- 3D Printing and additive manufacturing
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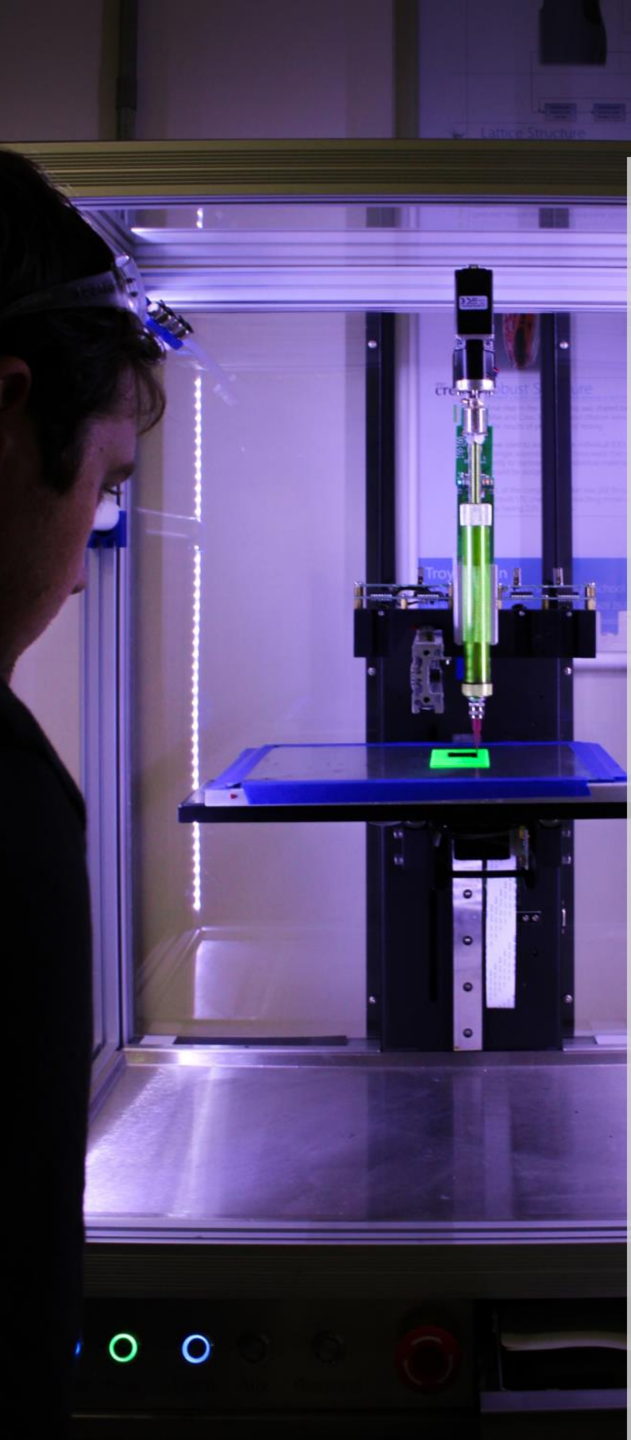
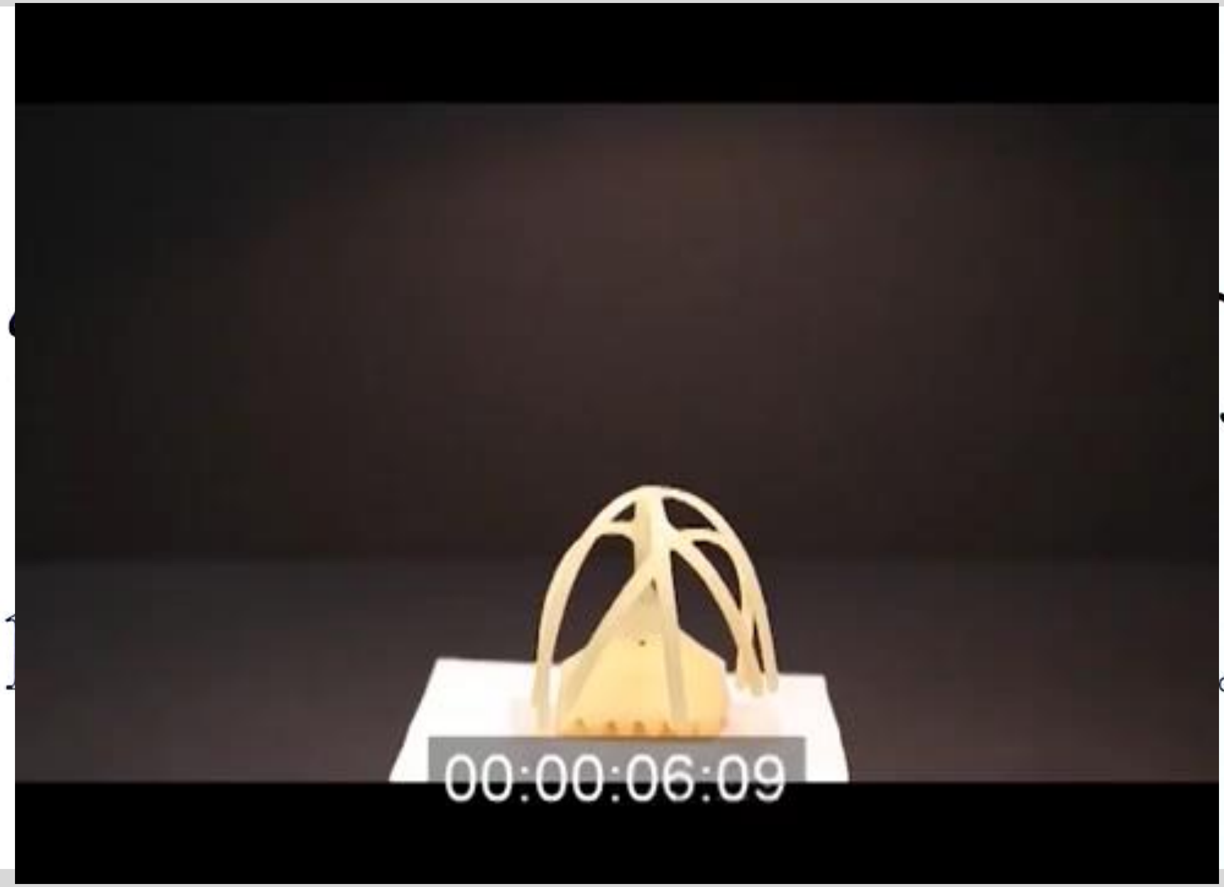
# 3D printing and additive manufacturing

- Conventional subtractive manufacturing **removes material by cutting or hollowing out of a piece of metal or plastic to create the shape**
- 3D printing **builds a three-dimensional object from a computer-aided design model**
- **Material layers are added successively** adding material layer by layer, which is why it is also called additive manufacturing
- 3D modelling **allows for design of complex shapes** which could not be made through conventional techniques



# Interesting applications

- The process begins with a **3D model designed on a computer or created from a 3D scan**
- Generated models have been used to create everything from jewellery to food
- **Even organs.** Windpipe created from own stem cells
- Architectural scale models, prosthetics, movie props, interior design (lamps, furniture, toys, etc.), reconstructing fossils in palaeontology, replicating ancient artefacts in archaeology, reconstructing bones and body parts in forensic pathology, reconstructing damaged evidence retrieved from crime scenes




# 4D Printing

- While 4D printing involves the same manufacturing process as 3D printing, it adds an extra dimension
- The materials can **change shape and form over time after they have been made**
- They may respond to **temperature, humidity, pressure, and even sound** in ways that their designers pre-determine

# Innovative technologies

- 5G technology and the Internet of Things
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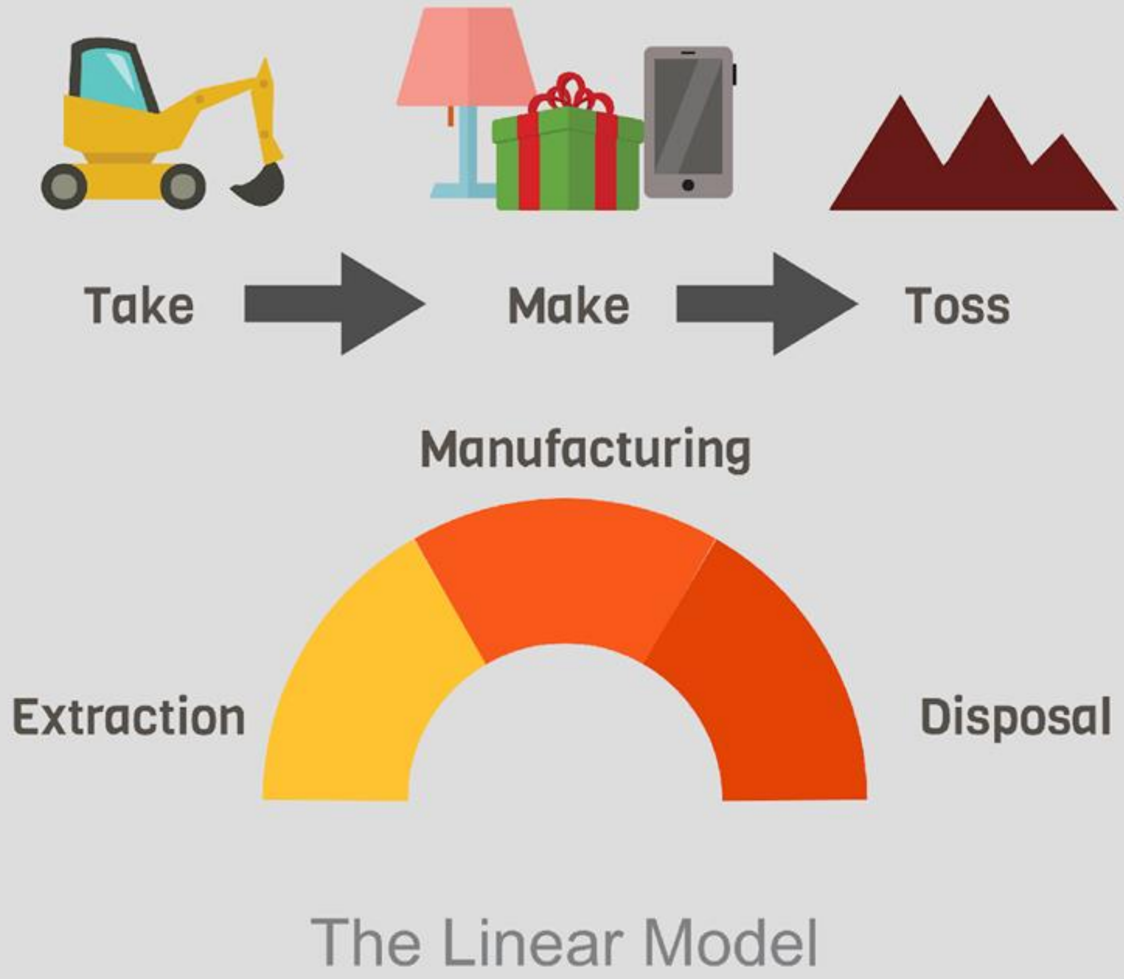
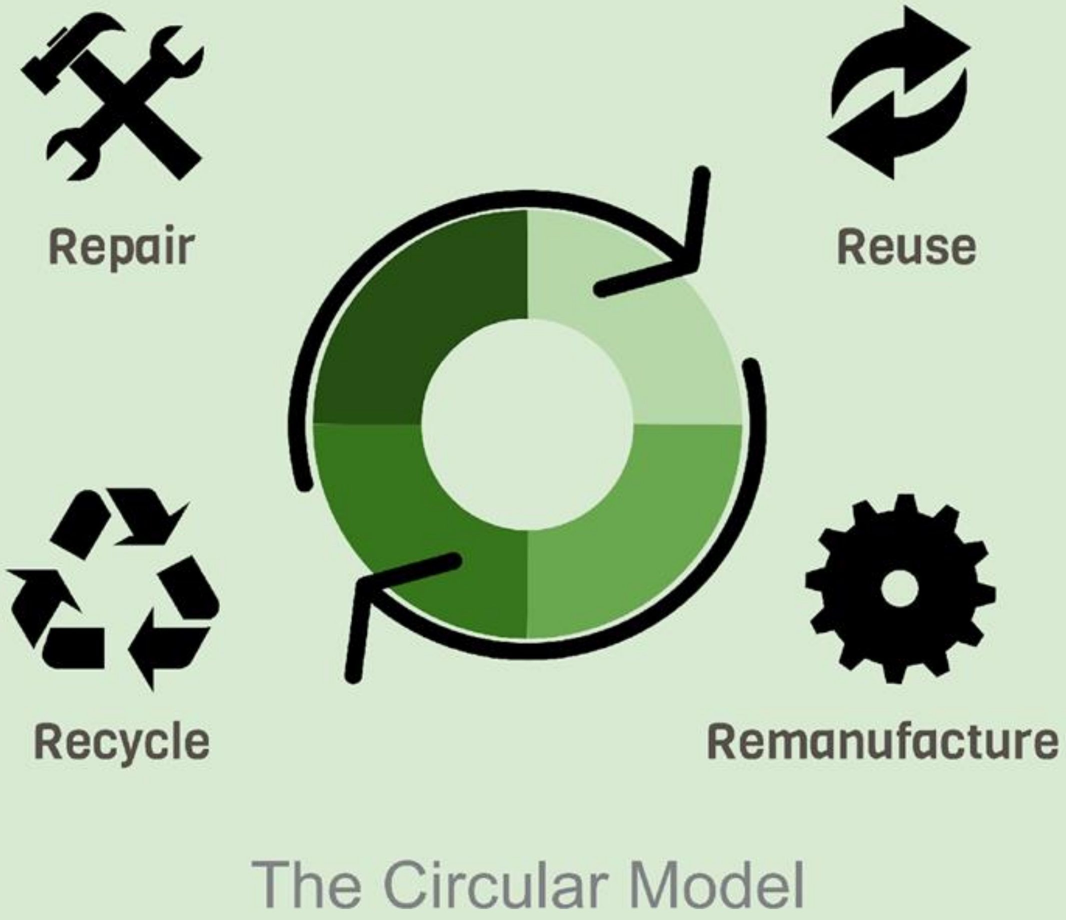
# Regenerative Systems

restore, renew or revitalize their own

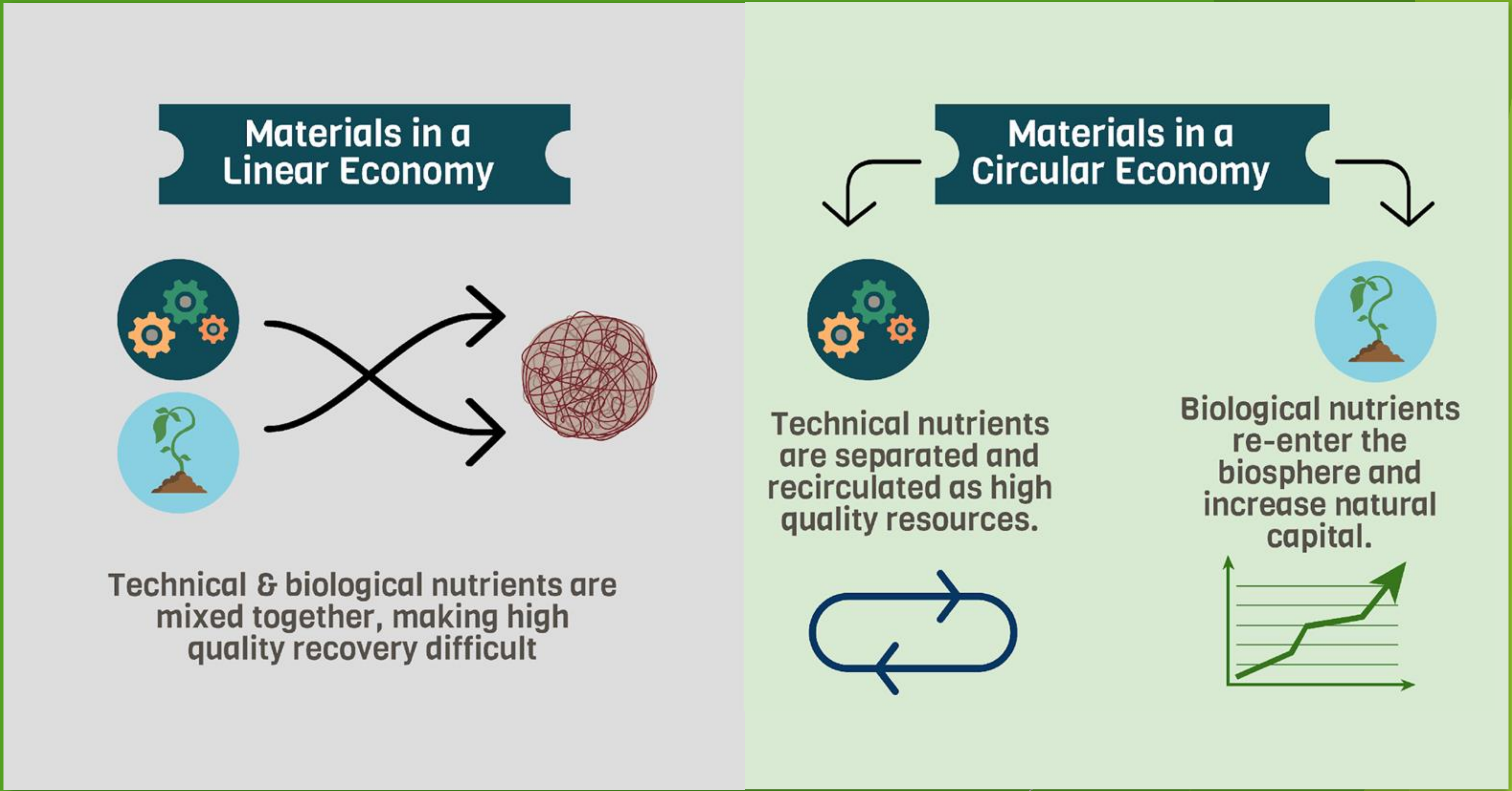
sources of energy and materials

# Linear Vs. Circular Economy




Recycling Council of BC: *Switching to the Circular Economy*


Materials in a Linear Economy
Technical & biological nutrients are mixed together, making high quality recovery difficult
Materials in a Circular Economy
Technical nutrients are separated and recirculated as high quality resources.
Biological nutrients re-enter the biosphere and increase natural capital.

# The Bioeconomy

*Sustainable use of biomass resources to achieve economic and social growth*

# The Bioeconomy

*Sustainable use of biomass resources to achieve economic and social growth*

Sustainably produced biomass

Harvesting

Processing bio-technology

Trade of bioproducts

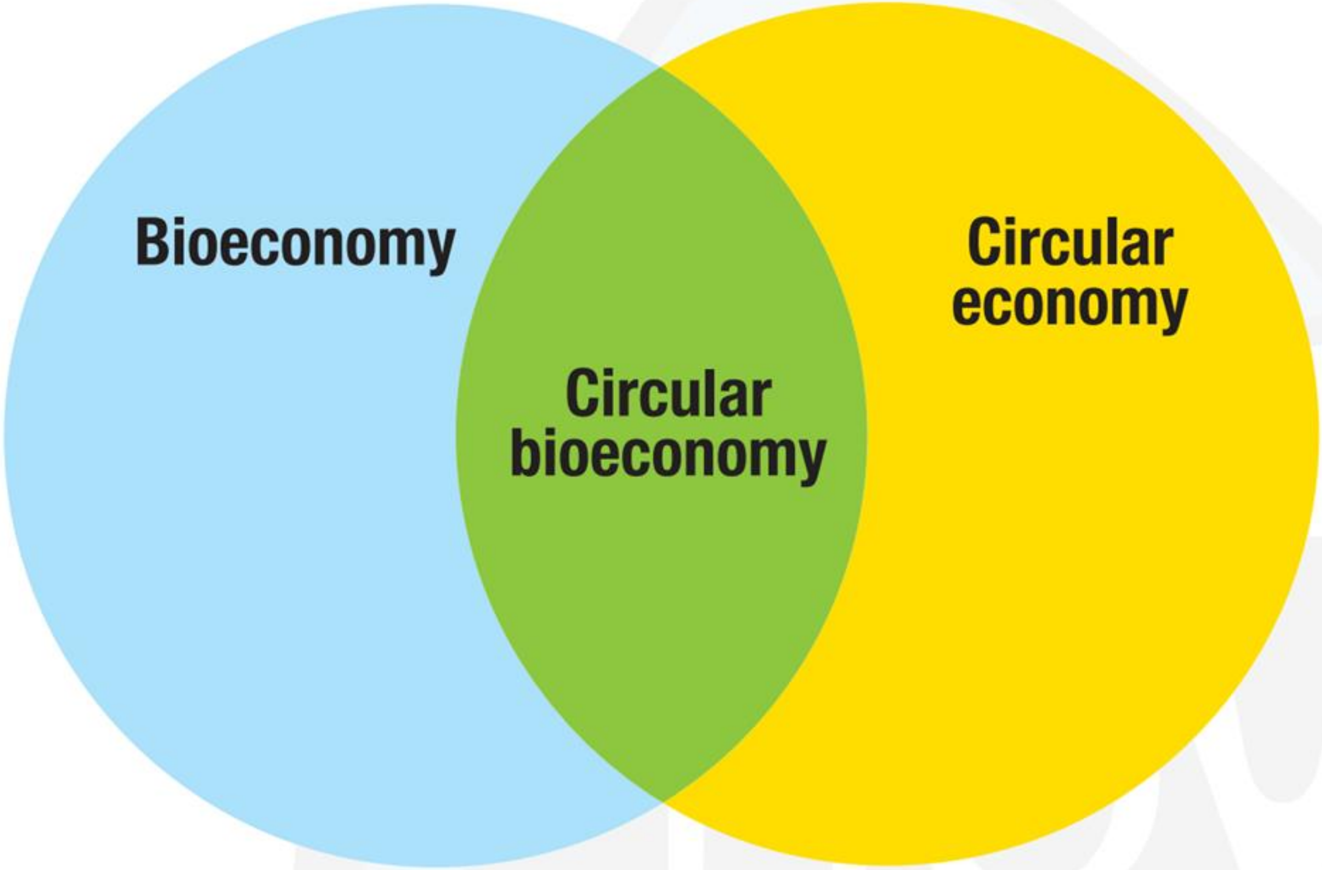
Consumer products & services

*Generating* ***value-added products:***

food, feed, bio-energy & bio-sourced products.

# The Circular Bioeconomy

*Creating value-added secondary raw materials from waste biomass*



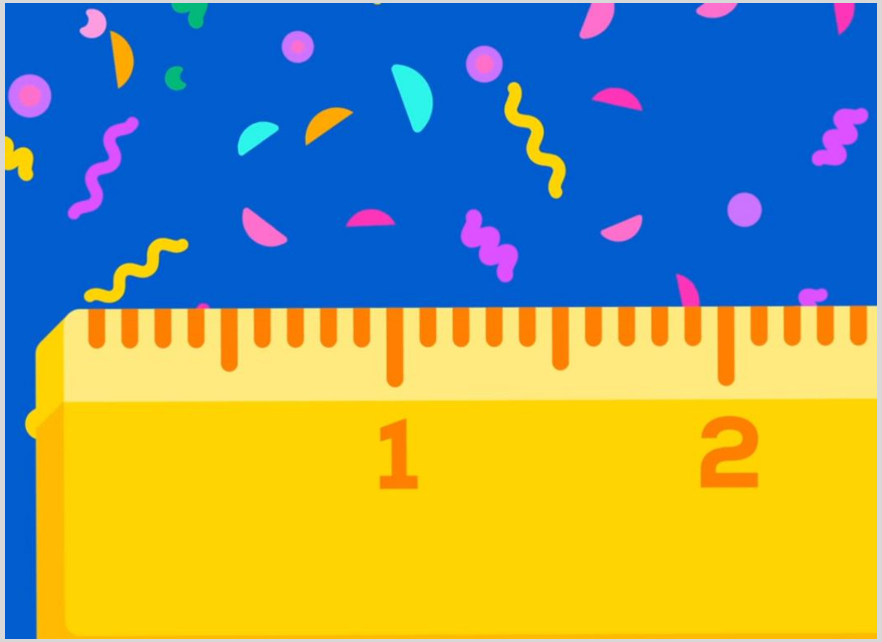

**Circular bioeconomy includes**

- Bio-based products
- Share, reuse, remanufacture, recycling
- Cascading use
- Utilization of organic waste streams
- Resource-efficient value chains
- Organic recycling, nutrient cycling

*Carus, M., Dammer, L. 2018: The "Circular Bioeconomy" – Concepts, Opportunities and Limitations, Hürth 2018-01. Download at bio-based.eu/nova-papers*


# Plastics

## have transformed how we live, work & eat


# Plastics have invaded the environment



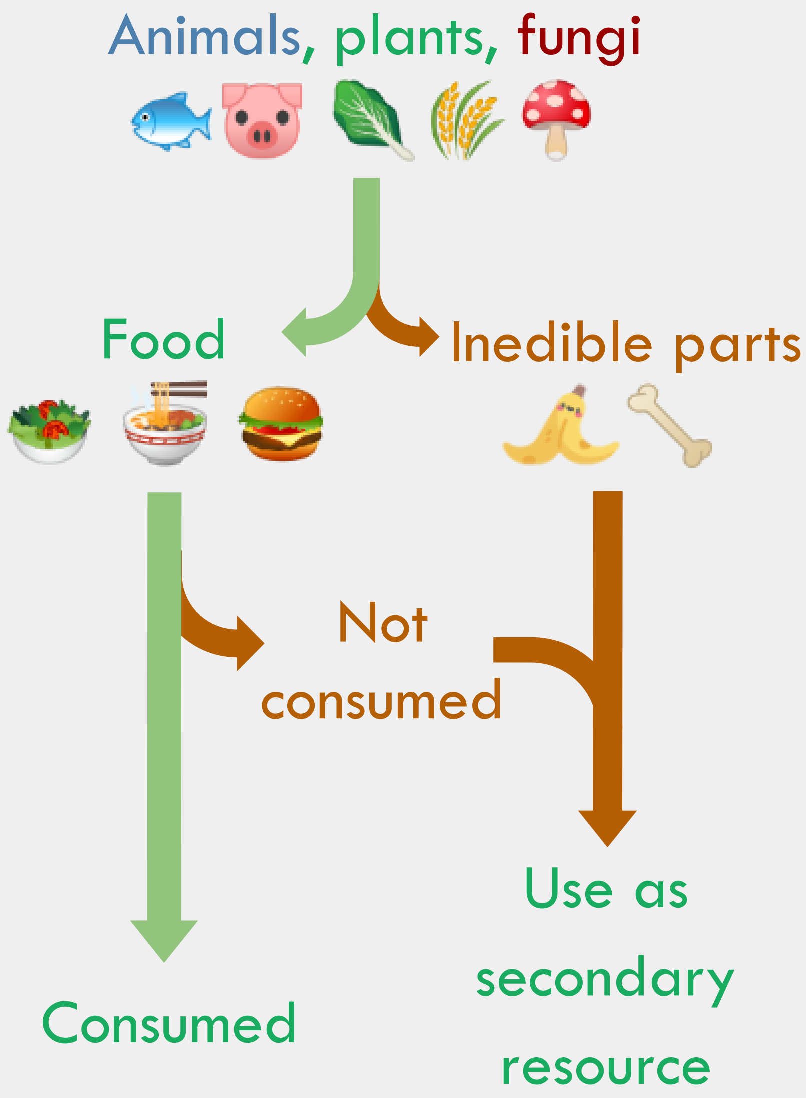
Plastic Pollution: How Humans are Turning the World into Plastic (YouTube)

# ...and now, **plastics** are even **invading** our **bodies**...

*Plastic Pollution: How Humans are Turning the World into Plastic* (YouTube)

# Bioplastics:
## solution or illusion?

# Feedstocks



Animals, plants, fungi
Food
Inedible parts
Not consumed
Consumed
Use as secondary resource

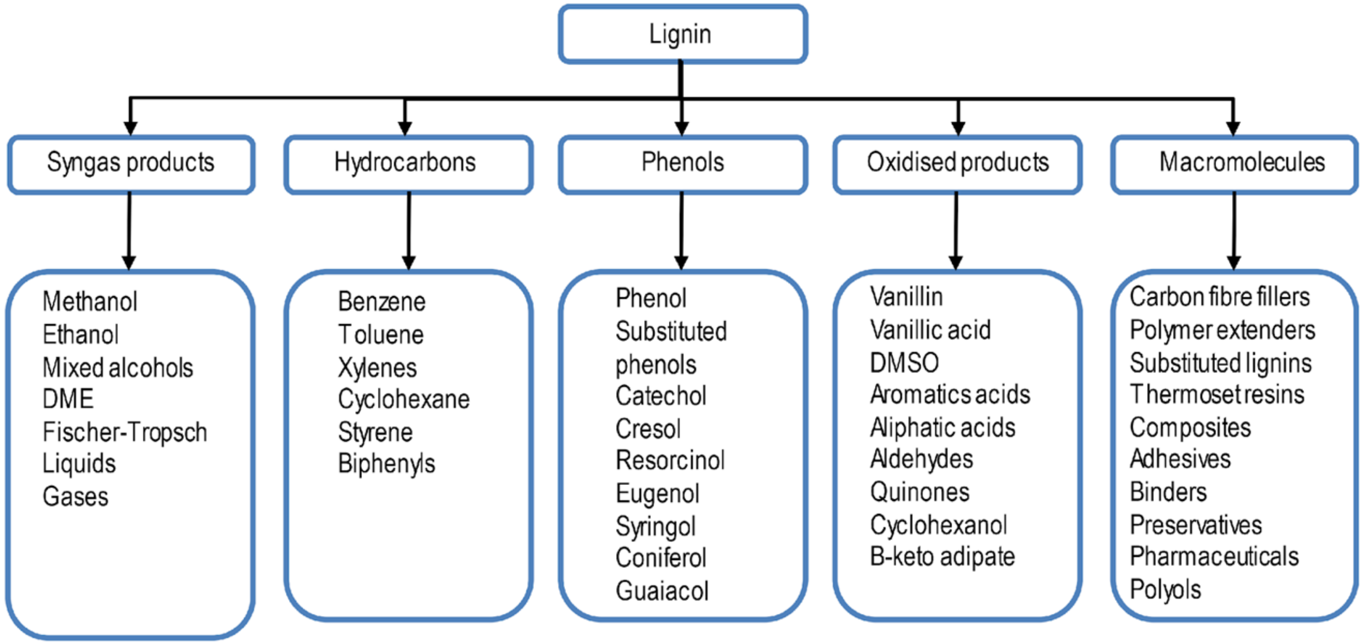
# Biorefinery

"The sustainable processing of biomass into a spectrum of marketable products (food, feed, materials, chemicals) and energy (fuel, power, heat)"


European bioplastics, https://european-bioplastics.org

# Incredible potential for bio-derived chemical feedstocks

Figure 8.3. **The potential for renewable aromatics production from lignin**

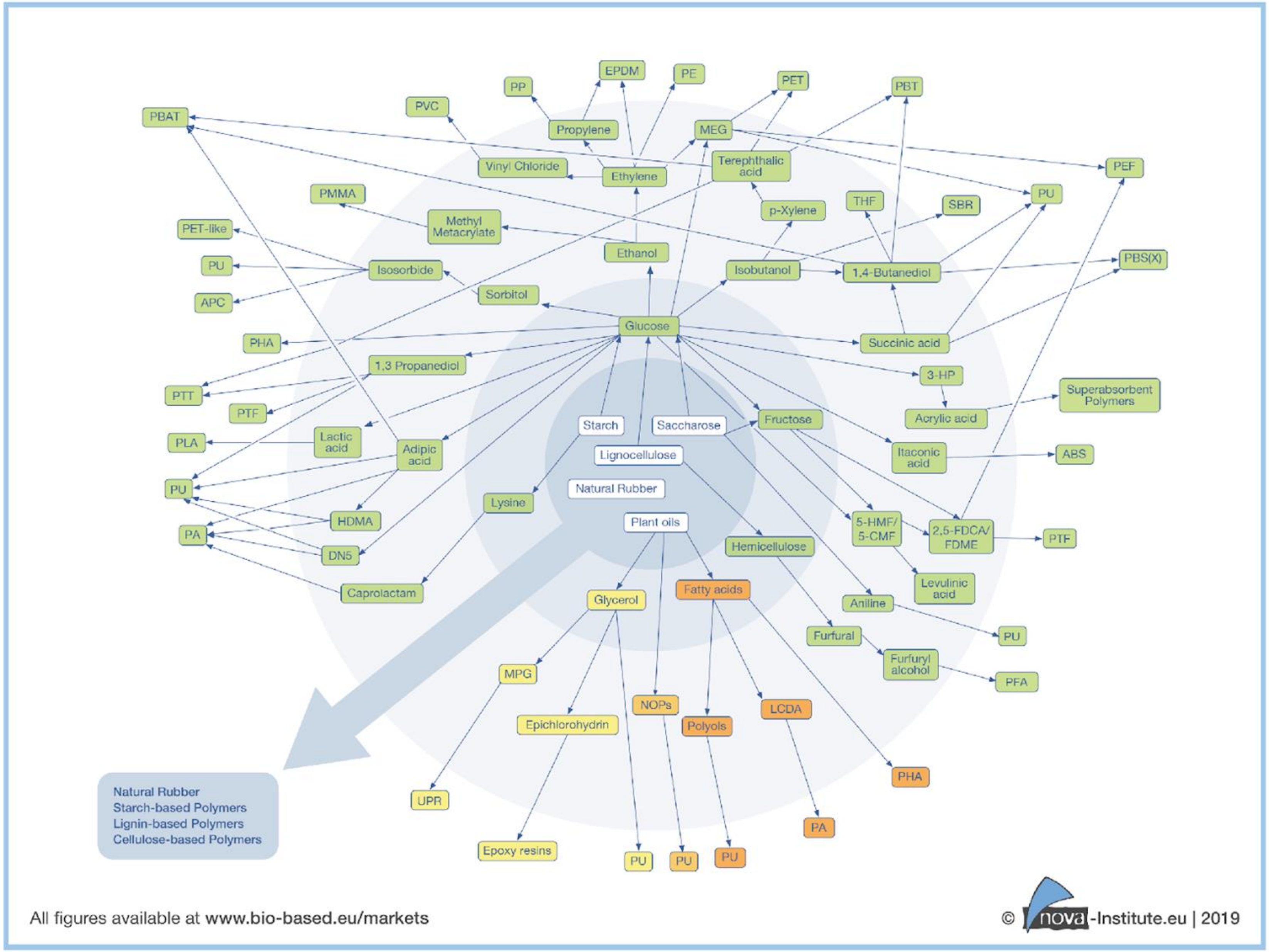



*Note*: DMSO = dimethyl sulfoxide.

*Source:* Redrawn from IEA Bioenergy Task 42 Biorefinery (2012), "Bio-based chemicals. Value added products from biorefineries", www.ieabioenergy.com/publications/bio-based-chemicals-value-added-products-from-biorefineries.

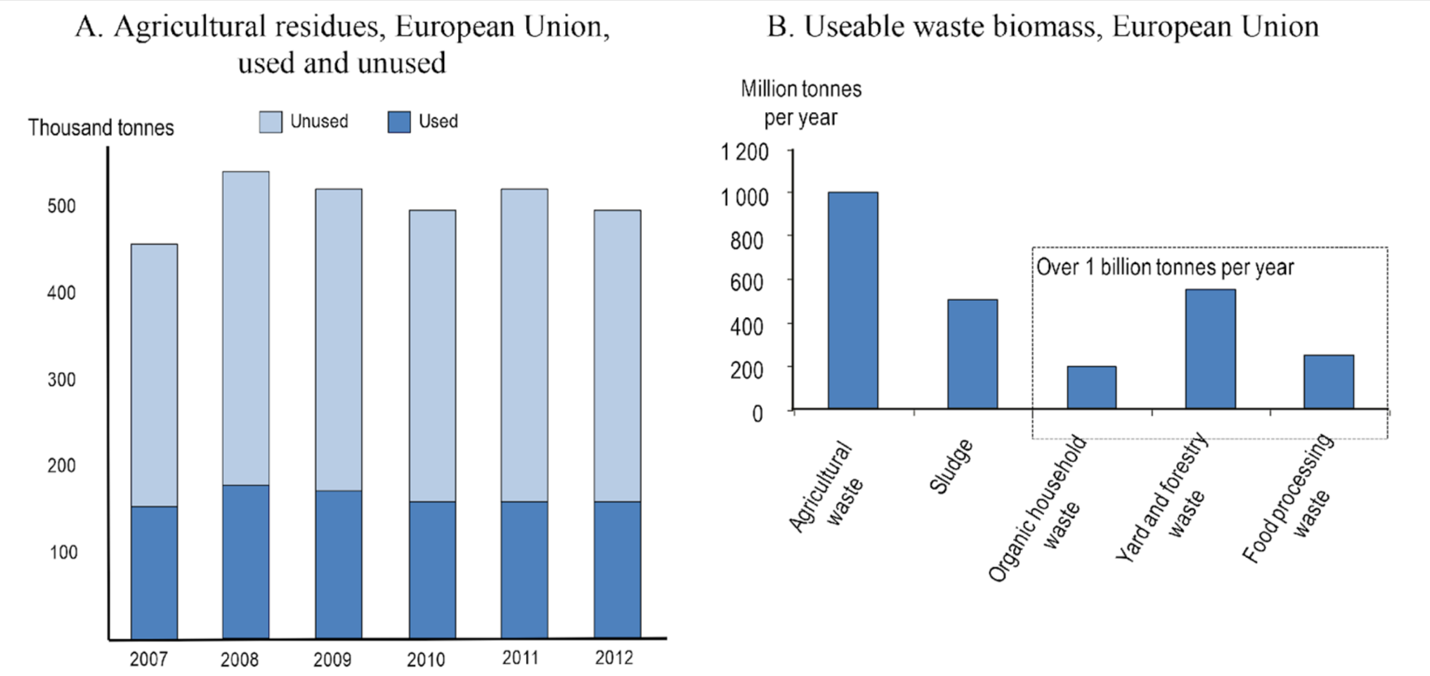
OECD (2018), Meeting Policy Challenges for a Sustainable Bioeconomy, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264292345-en

# Incredible potential for bio-derived chemical feedstocks




Bio-based Building Blocks and Polymers – Global Capacities, Production and Trends 2018 – 2023. Nova Institute 2019

# Incredible potential for bio-derived chemical feedstocks




**35.5 million metric tonnes**

Unplanned FW

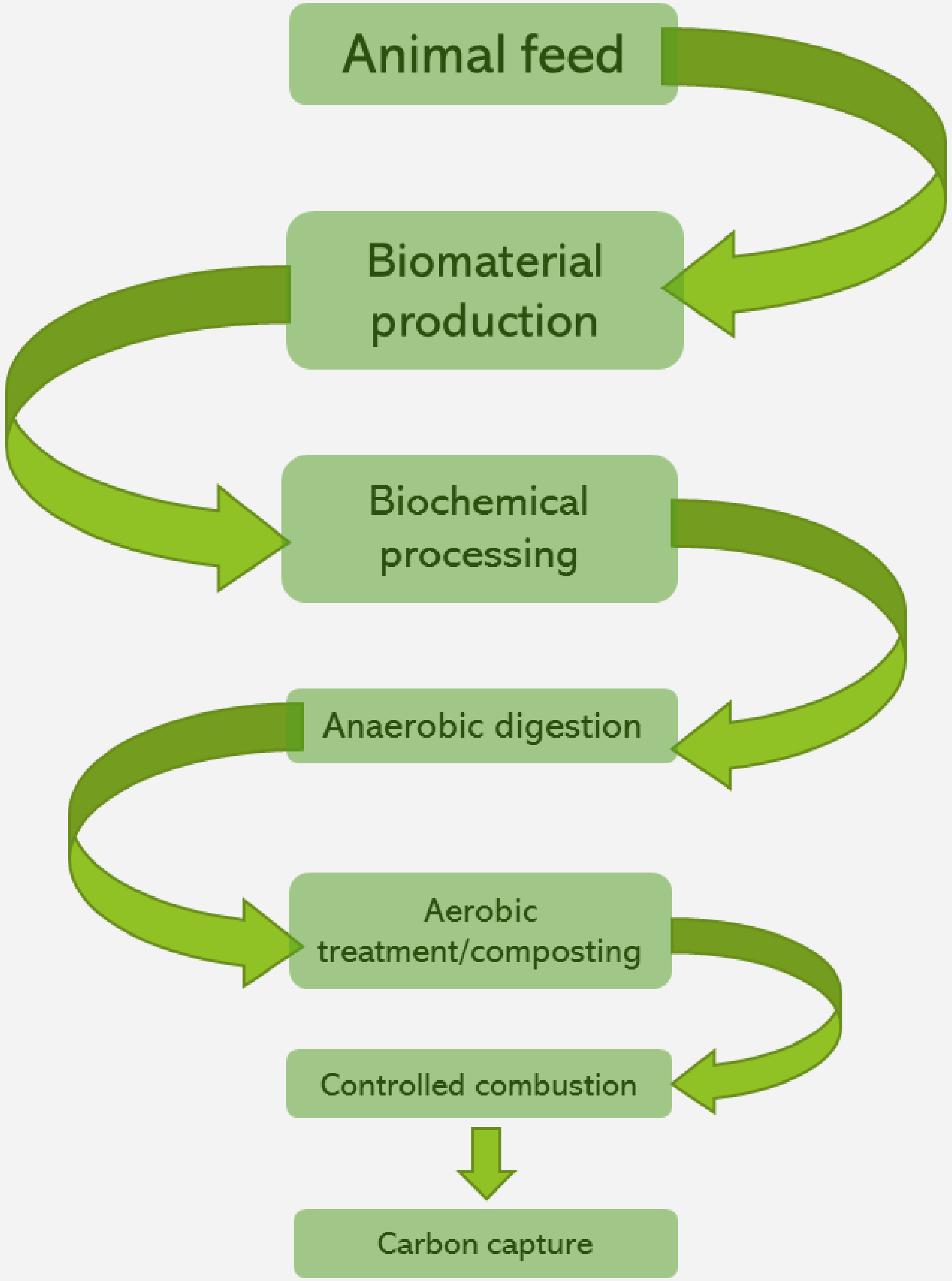
**32%**

Planned FW

**68%**


OECD (2018), Meeting Policy Challenges for a Sustainable Bioeconomy, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264292345-en

Gooch, M., Bucknell, D., LaPlain, D., Dent, B., Whitehead, P., Felfel, A., Nikkel, L., Maguire, M. (2019). The Avoidable Crisis of Food Waste: Technical Report; Value Chain Management International and Second Harvest; Ontario,



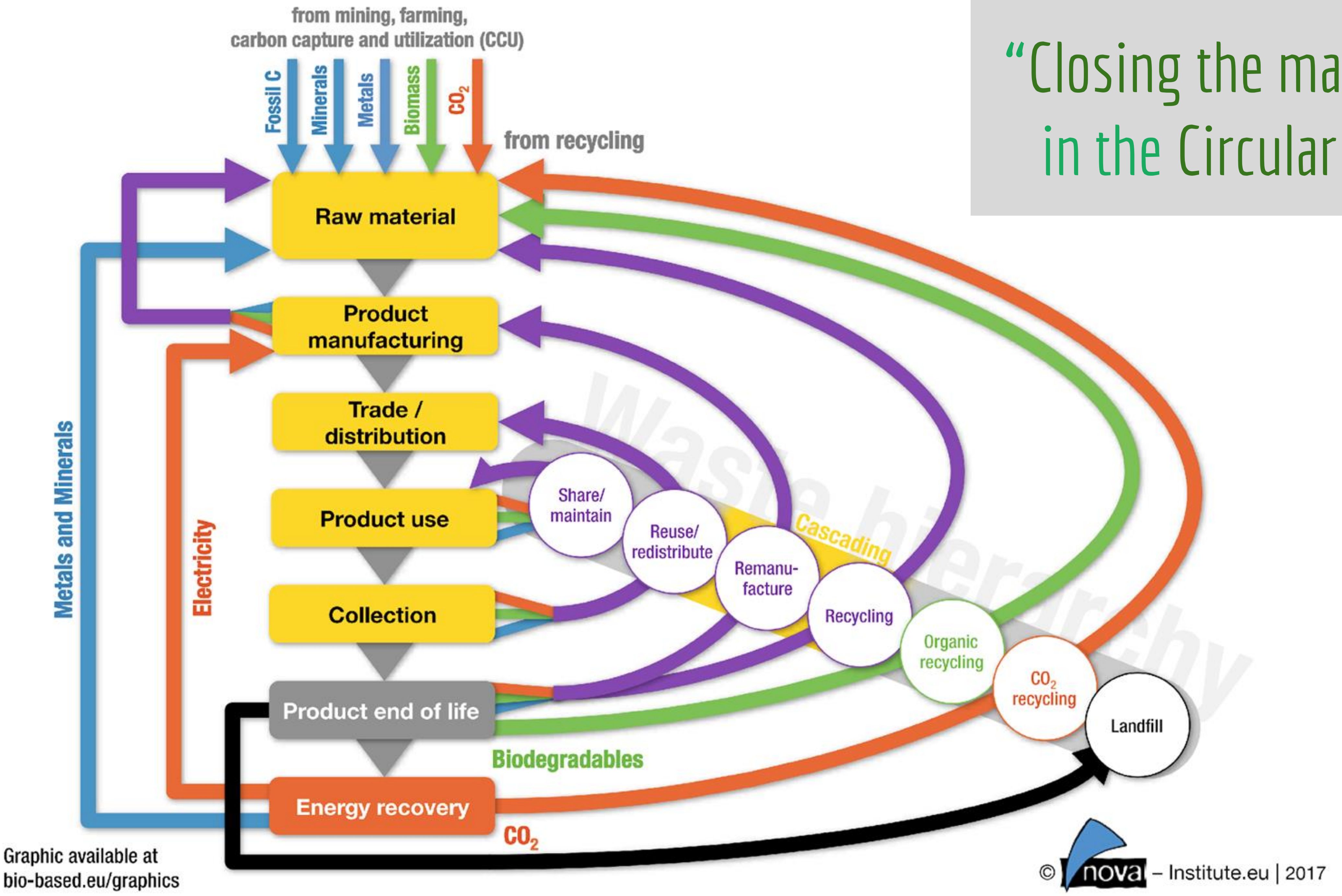

# Managing redistribution of waste

Cascading use of biomass:

- First, prioritize production of higher-added-value products. *(Added-value can indicate financial, environmental or social value.)*
- Lastly, use remaining biomass to generate energy

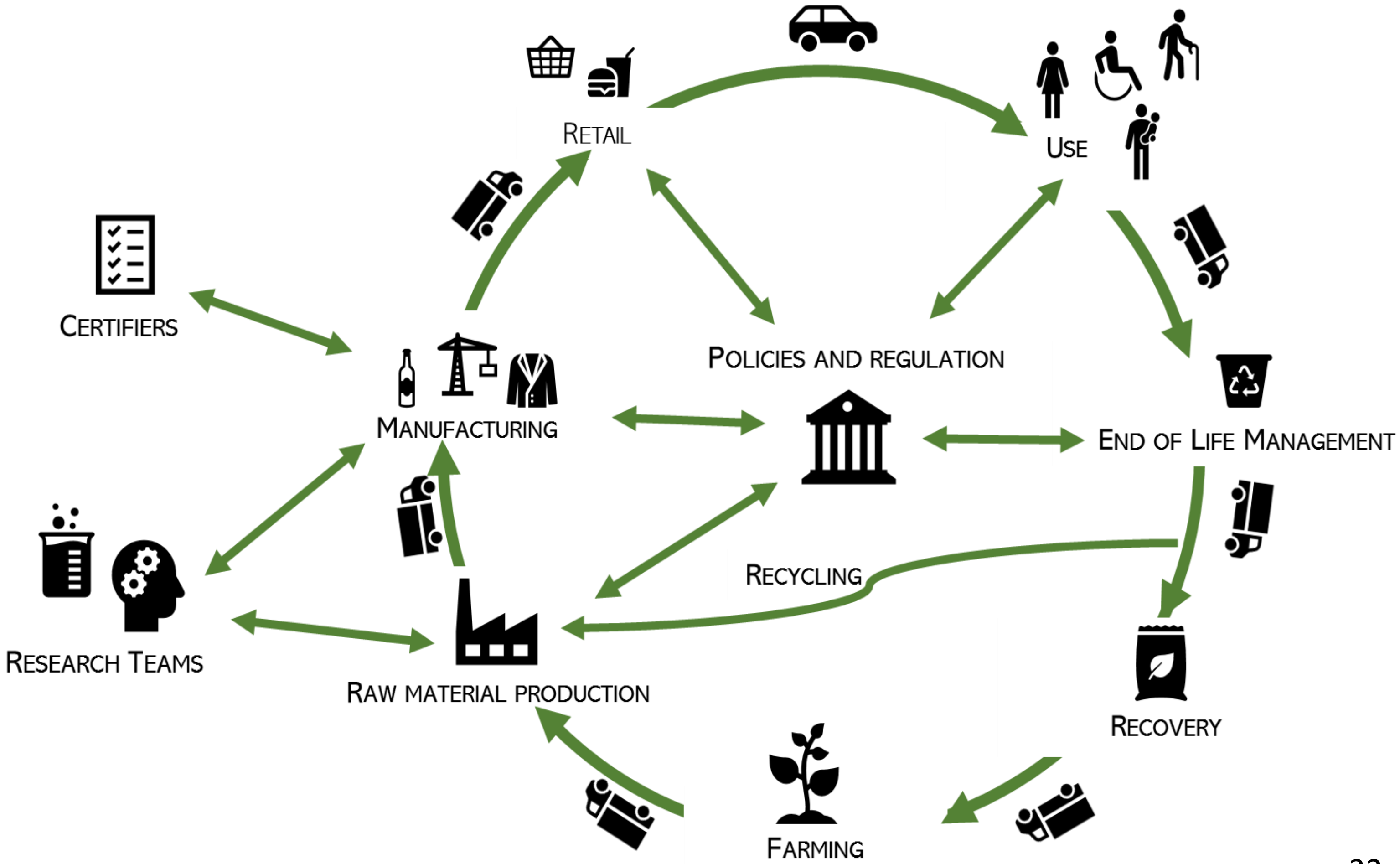
"Realising the circular bioeconomy" OECD Science, Technology and Industry Policy Papers November 2018 no. 60

# "Closing the material loop" in the Circular Economy



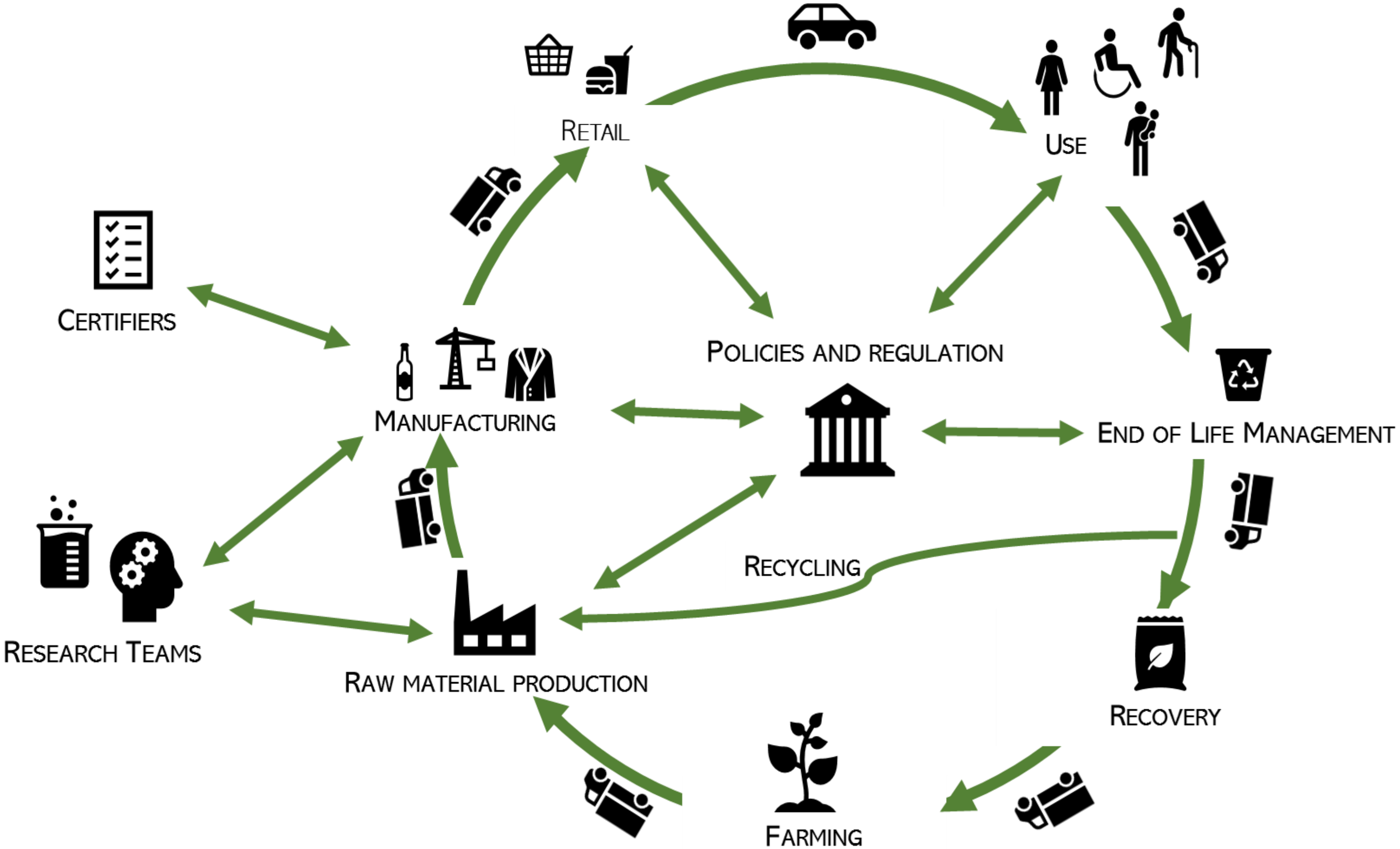

Carus, M., Dammer, L. 2018: The "Circular Bioeconomy" – Concepts, Opportunities & Limitations, Hürth 2018

- **Reuse, repair, remanufacturing**
- **Circular design & innovation:** end-of-life waste must flow into another product cycle. Waste streams = feedstocks!
- Consumer and industry **education & awareness**






# *Building the foundation:* Upstream Strategies

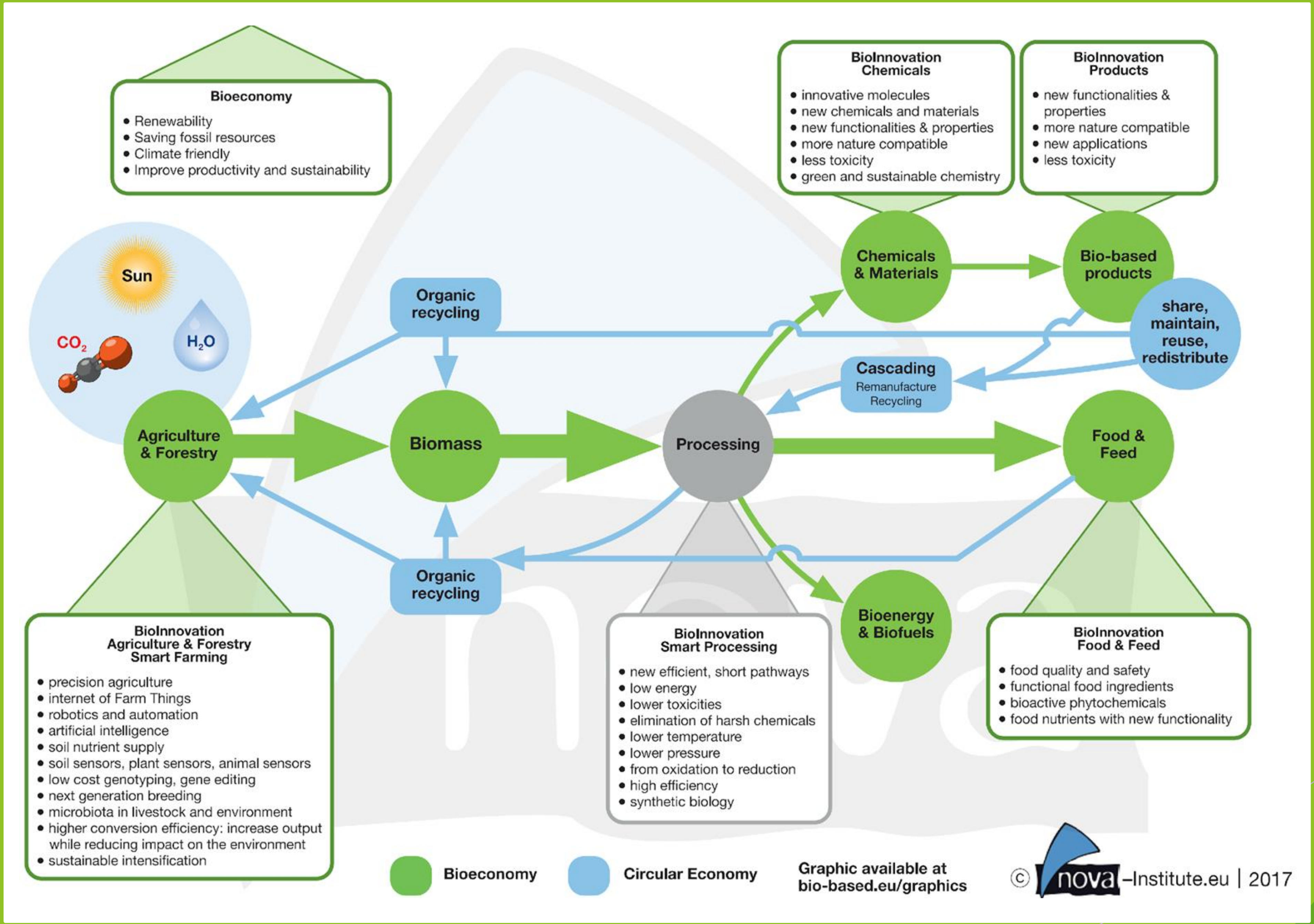



- Landfill diversion: apply **landfill bans + waste taxes**
- **Extended producer responsibility** & **progressive recycling** targets
- Waste-to-resource efforts: **industrial symbiosis programs**



# *Building the foundation:* Downstream strategies

# Circular Bioeconomy




Carus, M., Dammer, L. 2018: The "Circular Bioeconomy" – Concepts, Opportunities and Limitations, Hürth 2018-01.

# Alternative visions for tomorrow


Questions? Queries? Quandaries?
Dr. Love-Ese Chile
www.greytogreensolutions.com
www.loveesechile.com
If the future can be positive, why choose differently?
- Michael Braungart, Cradle to Cradle Design
Grey to Green
Sustainable Solutions

# About the speaker

My name is Ese, and I'm a Change-Maker, Researcher and Educator. With the help of community groups, I put together workshops and forums to start conversations about sustainability and green technologies.

To connect with me further and to help continue the discussion, find me at: www.loveesechile.com

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