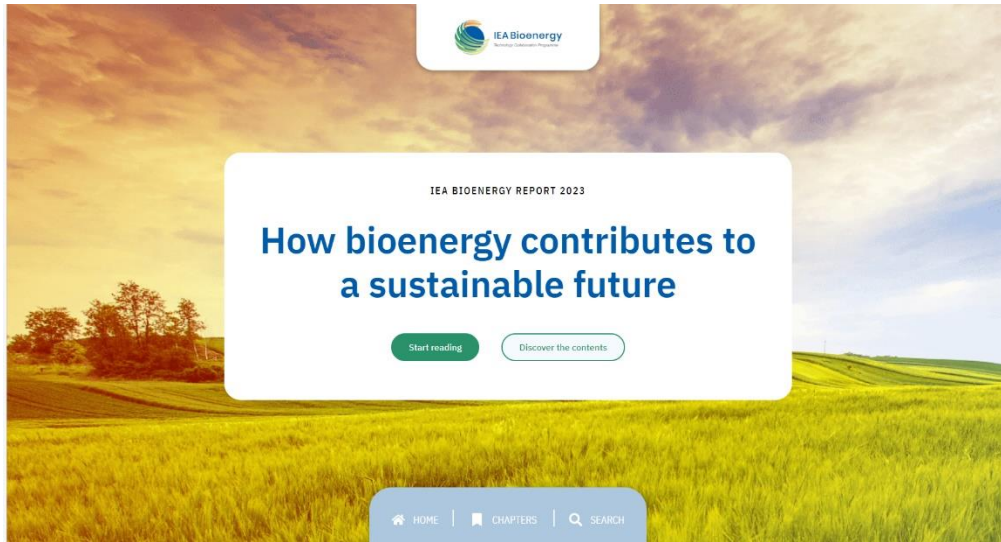




**IEA Bioenergy**  
Technology Collaboration Programme



# The Strategic Role of Bioenergy

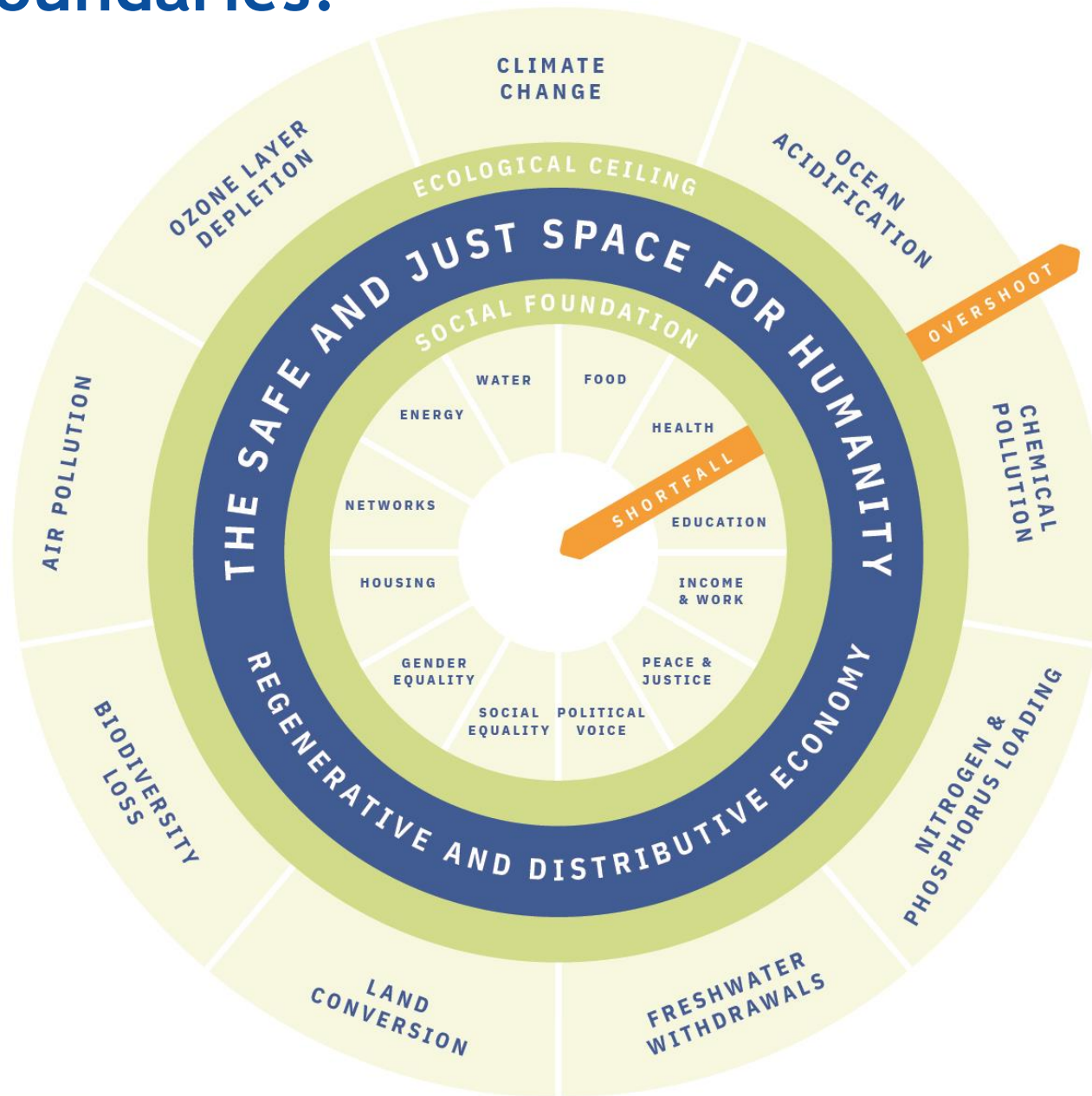
[www.ieabioenergyreview.org](http://www.ieabioenergyreview.org)

Dina Bacovsky, BEST, IEA Bioenergy Chair

ETIP Bioenergy SPM, October 27, 2023

*The IEA Bioenergy Technology Collaboration Programme (TCP) is organised under the auspices of the International Energy Agency (IEA) but is functionally and legally autonomous. Views, findings and publications of the IEA Bioenergy TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.*

# Planetary boundaries!



# Bioenergy ...

- is the largest source of renewable energy today
- is **versatile**: heat, power, transport services
- provides substantial **GHG emission savings** if done responsibly
- diversifies energy sources and improves **energy supply security**
- provides **income** through regional biomass supply chains

but

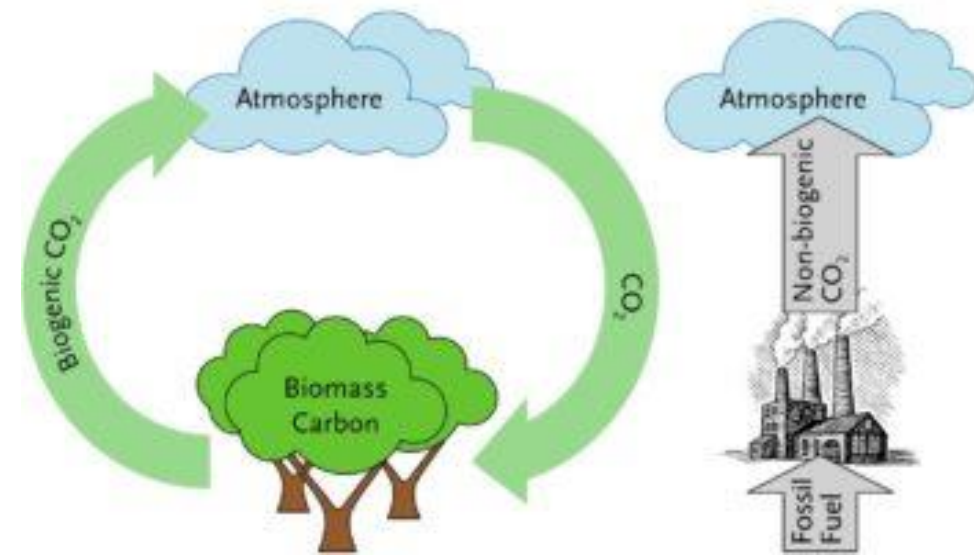
- cannot achieve decarbonisation of our energy system on its own

⇒ complements other renewable energy sources & increases in energy efficiency & reductions in energy demand

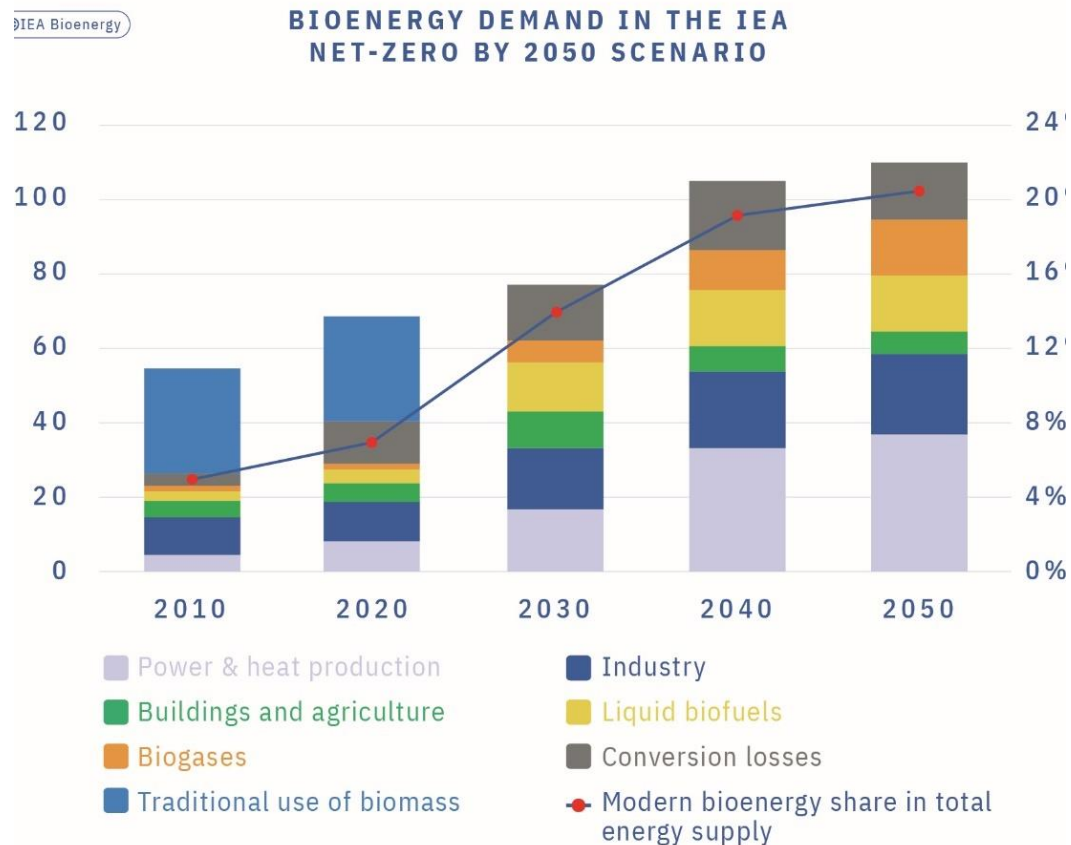
# Contribution to climate change mitigation

Bioenergy contributes to climate change mitigation when:

- Biomass is grown **sustainably** (*from sustainably managed landscapes*) and/or based on **waste/residues**
- **Converted** to energy products **efficiently** (often together with other biobased products)
- Used to **displace fossil fuels**
- **Bio-CCS/CCU** can add to that

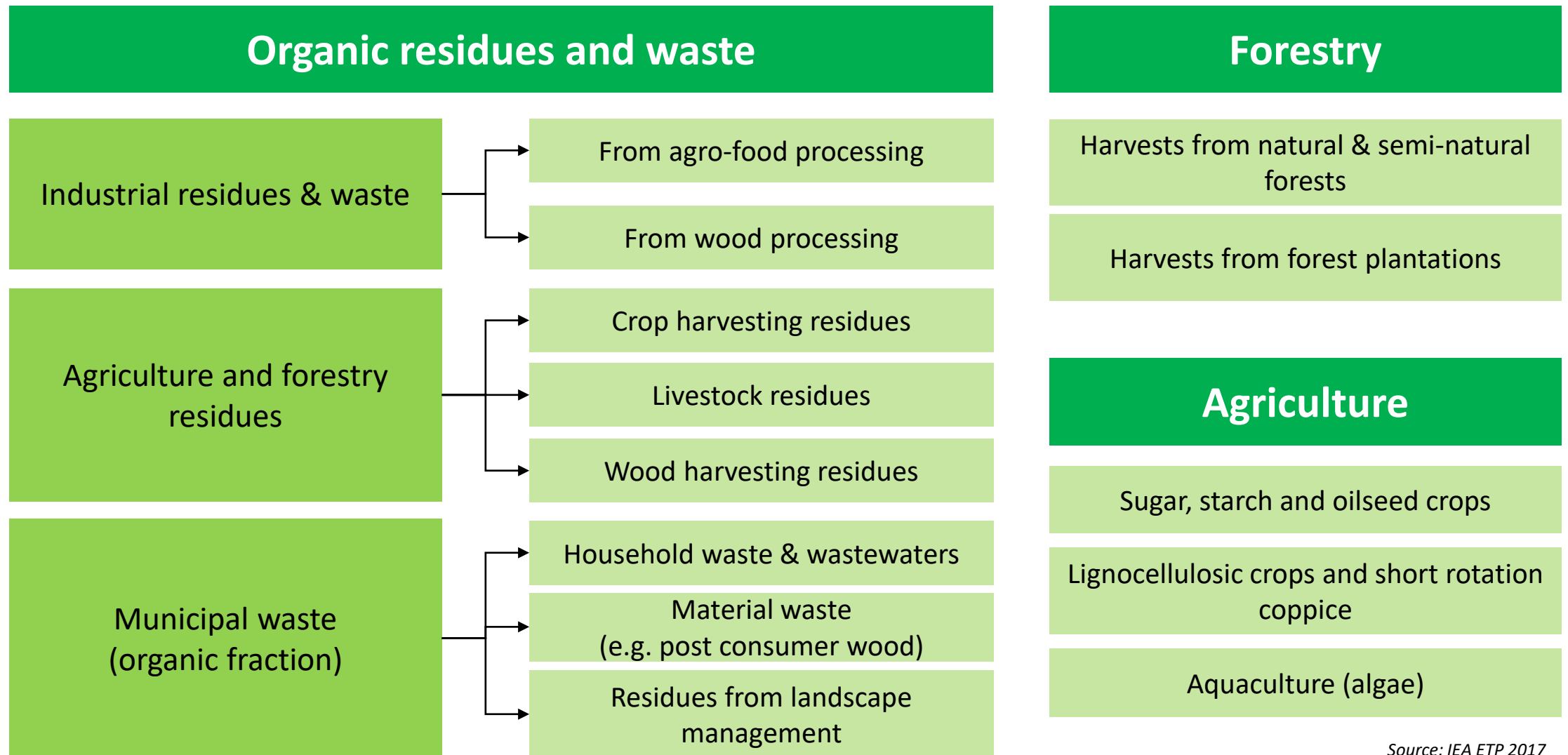


# Towards ,net zero‘ - important role of bioenergy



- bioenergy provides one-fifth of energy supply in IEA’s net-zero by 2050 scenario
- Traditional use of biomass to be phased out as soon as possible
- Modern bioenergy supply to triple from 2020 to 2050 (*partly replacing traditional use*)
- All decarbonisation scenarios have increased deployment of sustainable bioenergy
- Negative emissions through BECCS

# Multiple sources of biomass - *for energy & biobased economy*



Source: IEA ETP 2017

# Sustainability is key

Sustainable forest management  
Sustainable agricultural practice  
Sustainable landscape management

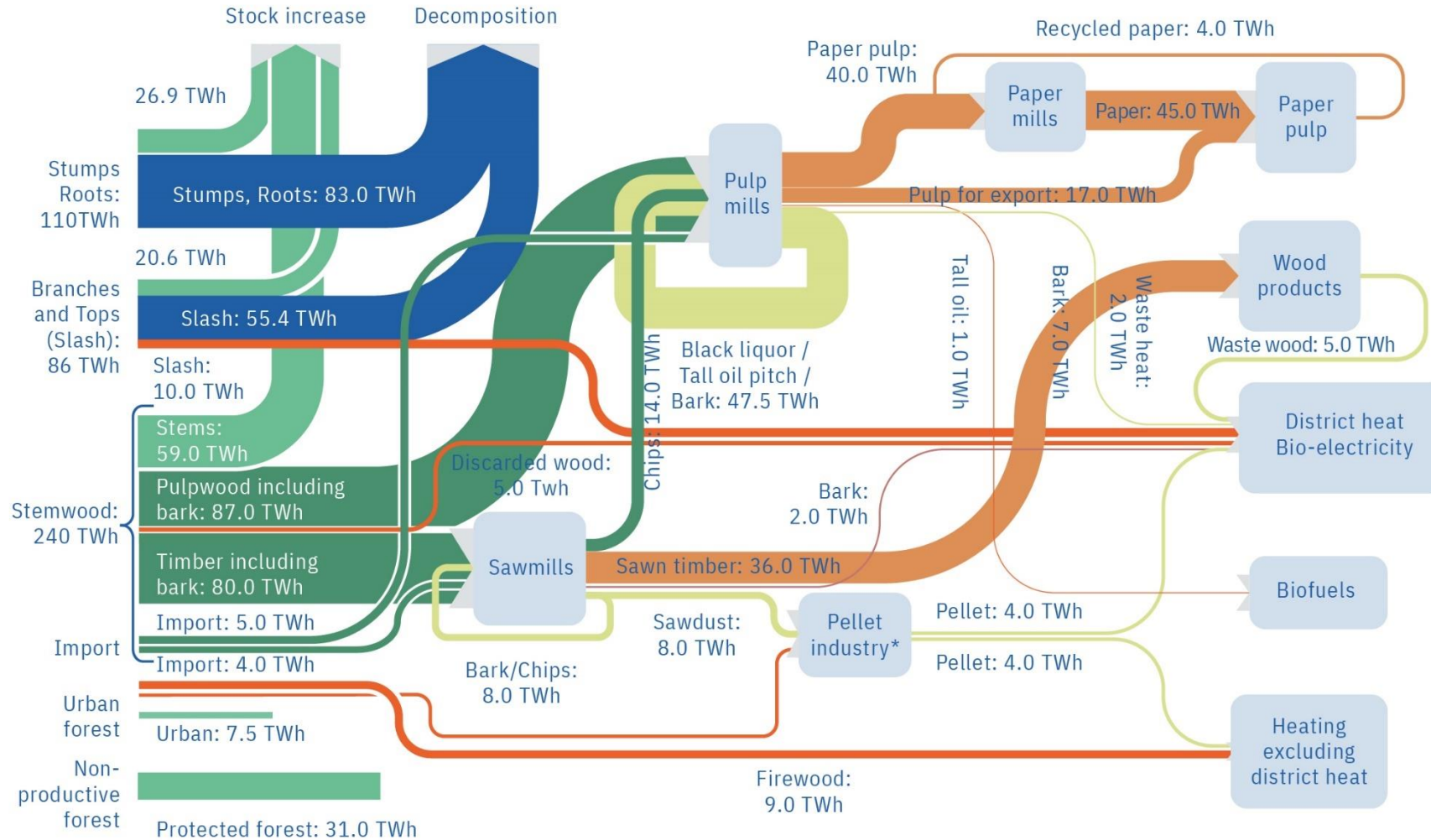


- Biodiversity safeguards
- Attention for carbon sinks, preserving carbon stocks
- Healthy soils (nutrients & organic matter)
- Social opportunities are part of sustainability

Waste treatment & valorisation

+ food/feed & higher value materials have higher priority than energy

# Biomass & energy flows from Swedish forests (2015)



- Wood from harvest used in sawmills and pulp mills
- Non harvested increment, remaining in forest

- Branches, tops and stumps from harvesting, remaining in the forest

- Other forest products than bioenergy
- Forest biomass used for energy
- Wood processing residues used for energy

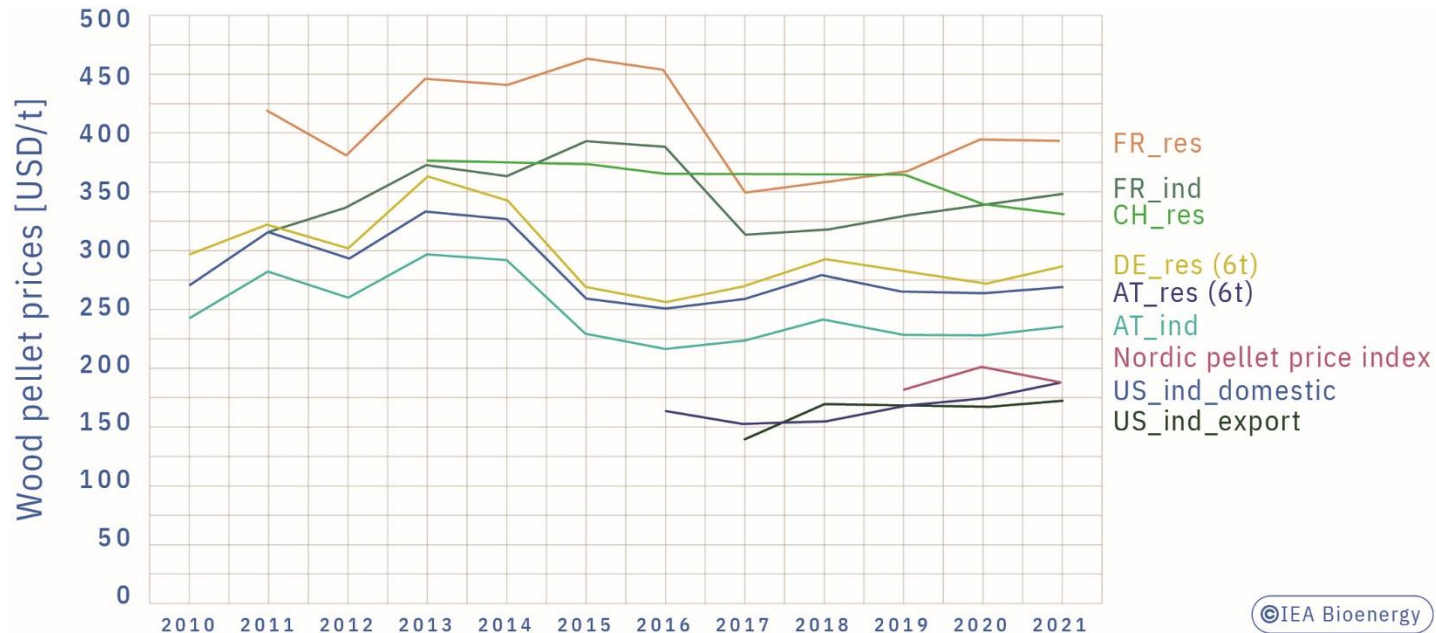
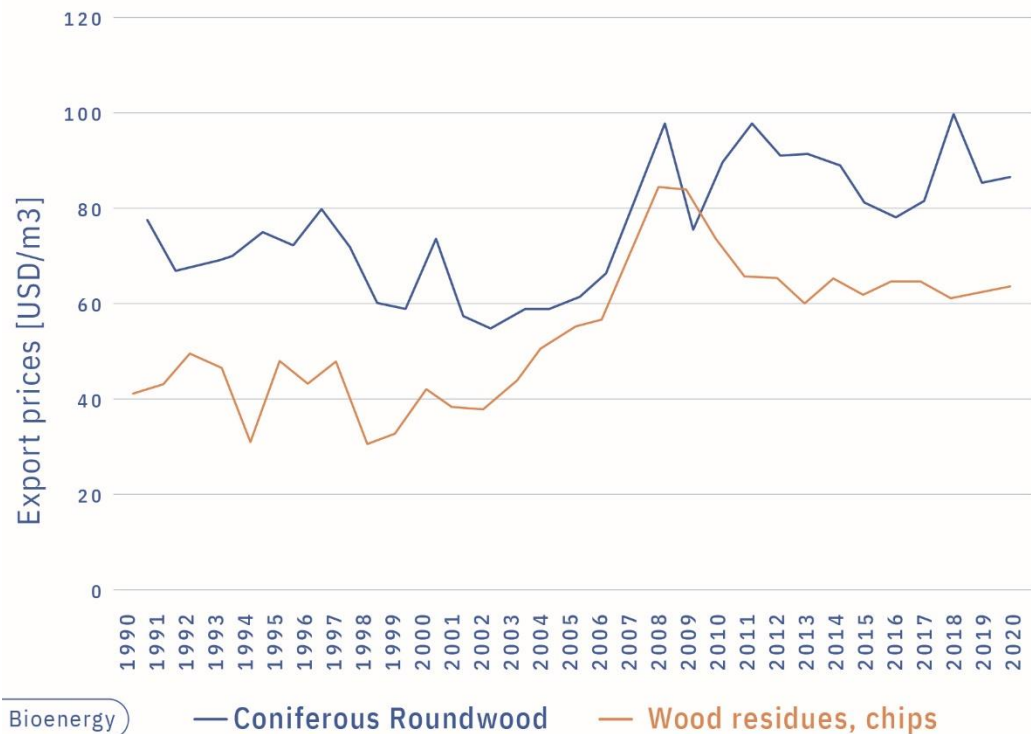
\*Pellets can also be reproduced from thin stems obtained in silviculture operations and felled wood that is not meeting quality requirements of other uses.



# Biomass from agricultural land

- Crops on arable land
  - Primarily for food/feed production
    - Either reduce pressure on land through increased yields & reduced food losses
    - Or use multi-cropping combinations
- Residues from crops on arable land
  - => no additional land needed
    - Leave part of the residues behind to maintain soil quality
- Crops on abandoned, degraded or marginal land
  - Can restore or improve soil quality, enhance carbon sequestration
  - But will be more costly to produce or provide lower yields

# Biomass feedstock costs



©IEA Bioenergy

Much more stable than fossil resources and agricultural commodities!

# Biomass mobilisation



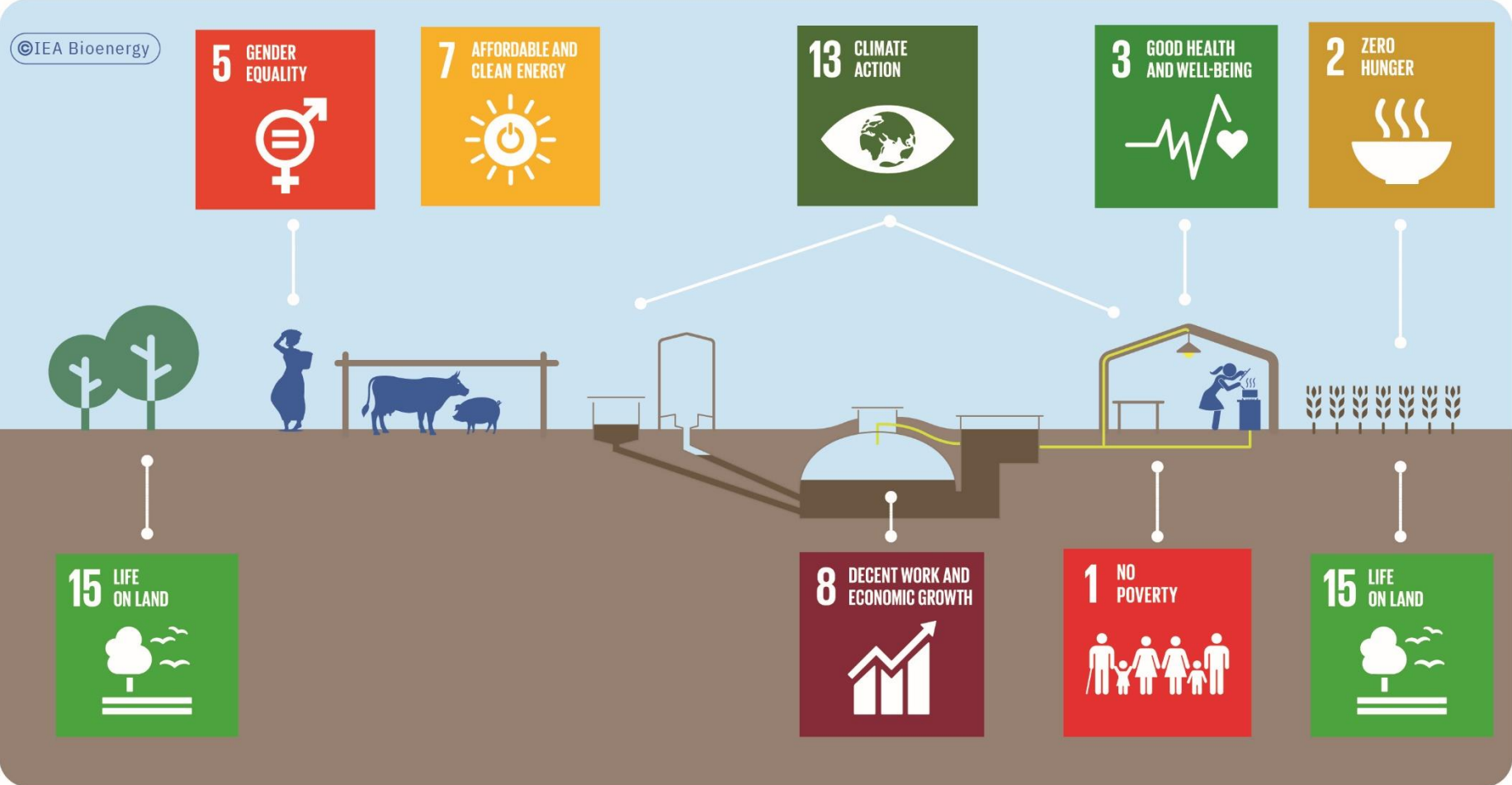
- **Legislative framework**
  - Encourage bioenergy
  - Safeguard sustainability
- **Technological innovation**
  - Precision farming
  - Mobile pre-treatment processes
- **Market creation**
  - Encourage waste collection
  - Establish bio-hubs

# Bioenergy & Sustainable Development Goals



- 15 of the 17 SDGs are directly or indirectly linked to the production and use of biomass
- 37 case studies from around the world show how bioenergy production can positively contribute to the SDGs

# Biodigester



# Bioenergy technologies are at various levels of development

## Mature technologies:

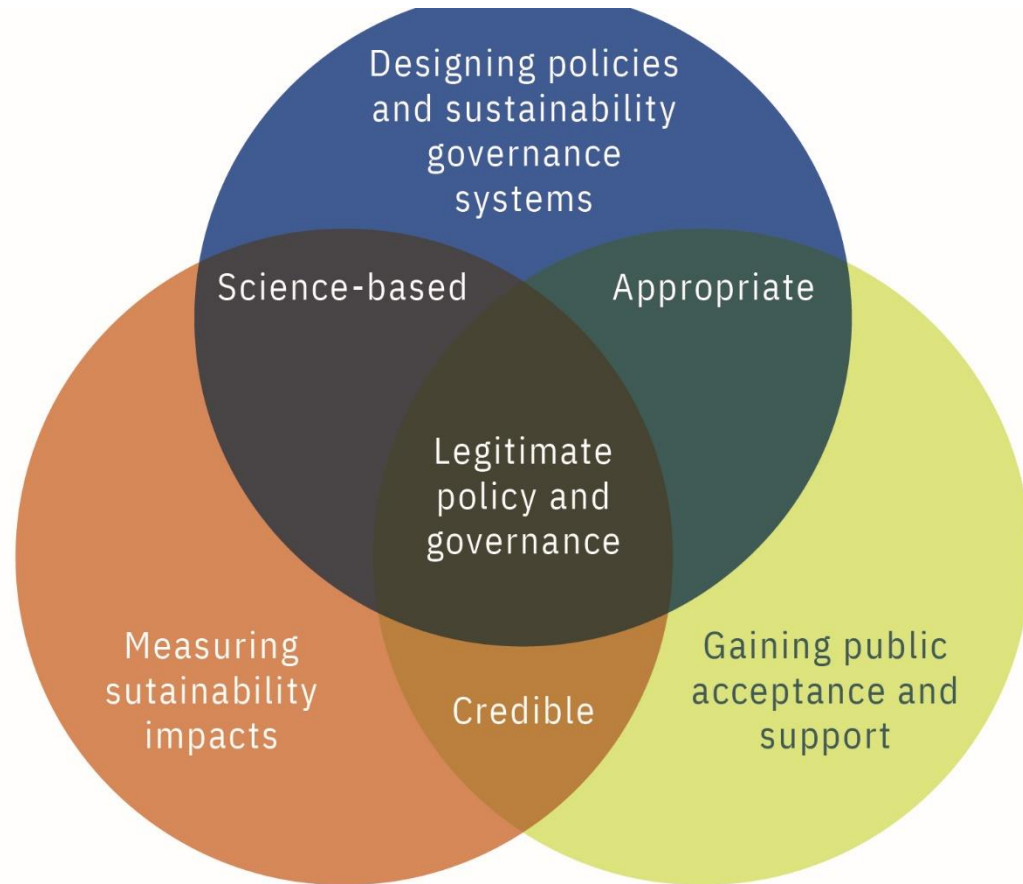
- Combustion for combined heat and power
- Gasification for combined heat and power
- Pyrolysis for combined heat and power
- Anaerobic digestion to produce biogas
- Oils, sugar and starch crops to biofuels (biodiesel, HVO, ethanol)
- Corresponding biorefineries

## Under development:

- Gasification + synthesis to biofuels
- Pyrolysis + upgrading to biofuels
- Lignocellulose / residues to biofuels
- Corresponding biorefineries
- Carbon capture and utilisation or storage at bioenergy facilities

<https://www.ieabioenergy.com/installations/>

# Deployment



Wider deployment depends on:

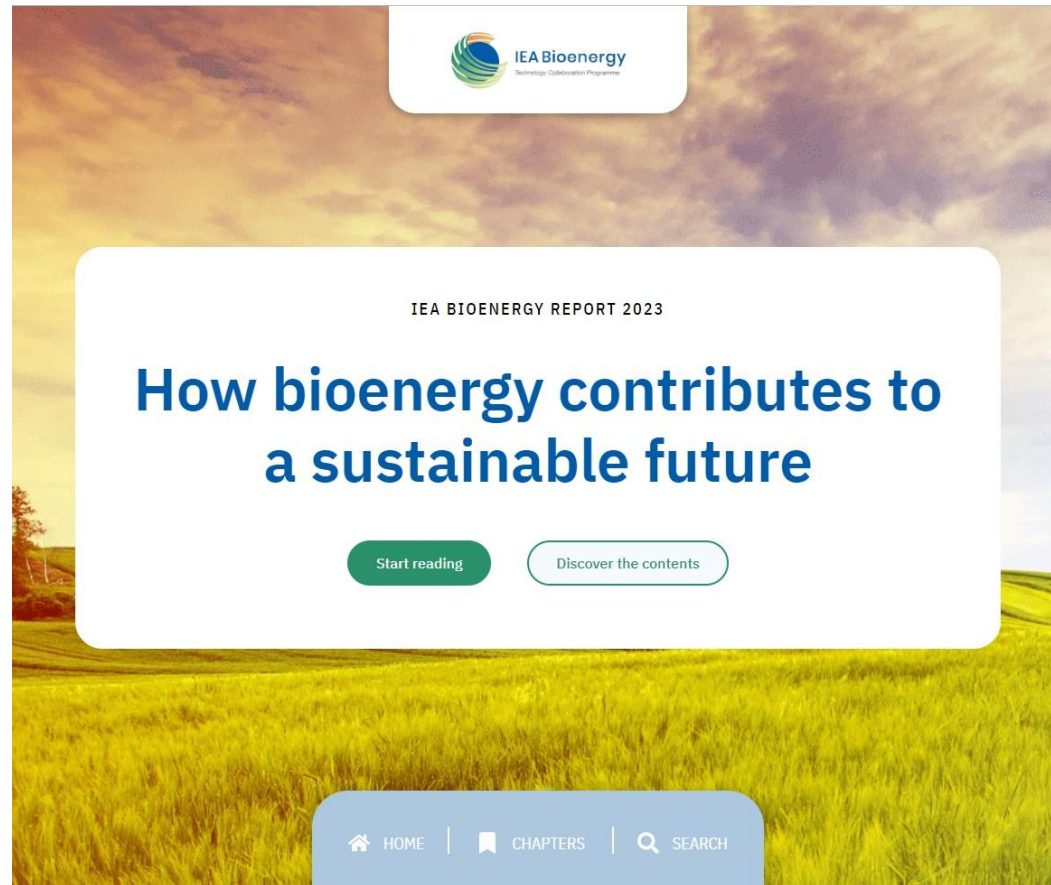
- Suitable regulatory frameworks that create market demand
- Further R&D to bring technologies that can use a wider range of feedstocks to maturity
- Trust in the governance system

# Key messages

- Bioenergy can provide heat, electricity and transport fuels.
- Substitution of fossil fuels through sustainable bioenergy leads to substantial GHG emission savings. Combination with CCS can provide negative emissions.
- Further benefits are diversification of energy supply, balancing of variable renewable energy, provision of regional income, access to energy.
- If done right, biomass production for bioenergy can also improve or maintain biodiversity, carbon sinks, and species abundance.
- As to reach net zero by 2050, one fifth of 2050 energy demand could and should be met by sustainable bioenergy.
- Main barriers for further deployment are biomass feedstock costs, biomass availability, the need for further R&D work and the need for appropriate governance systems.
- Bioenergy goes hand in hand with the biobased economy.



# BIOENERGY REVIEW



- Key information on bioenergy and bioenergy technologies
- Easy to read
- Accordeon structure - main points and deep dives
- Interactive and heavily hyperlinked
- Infographics

Go to: [www.ieabioenergyreview.org](http://www.ieabioenergyreview.org)

## ACKNOWLEDGEMENTS

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