The role of biomass towards deep decarbonisation

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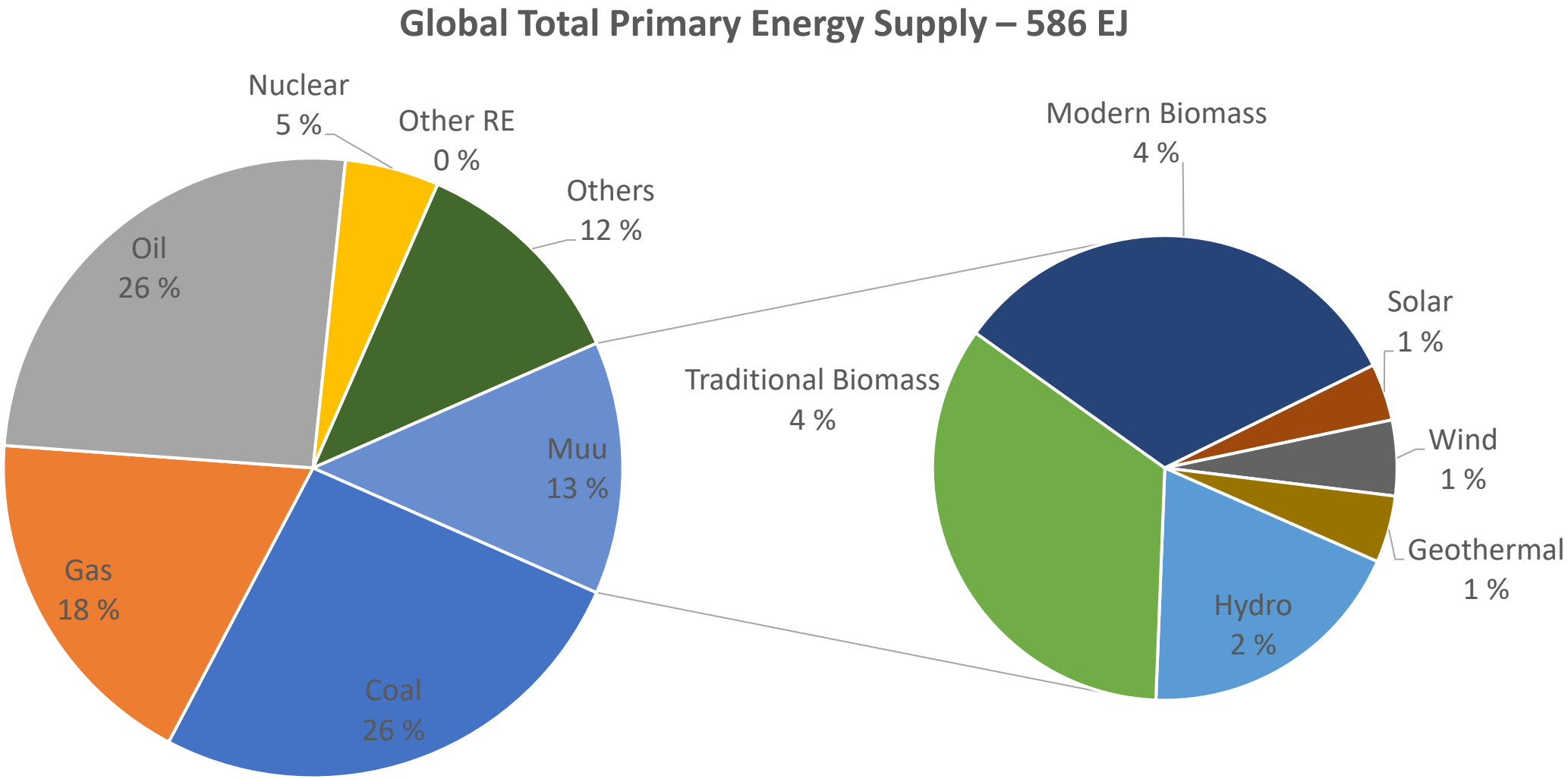
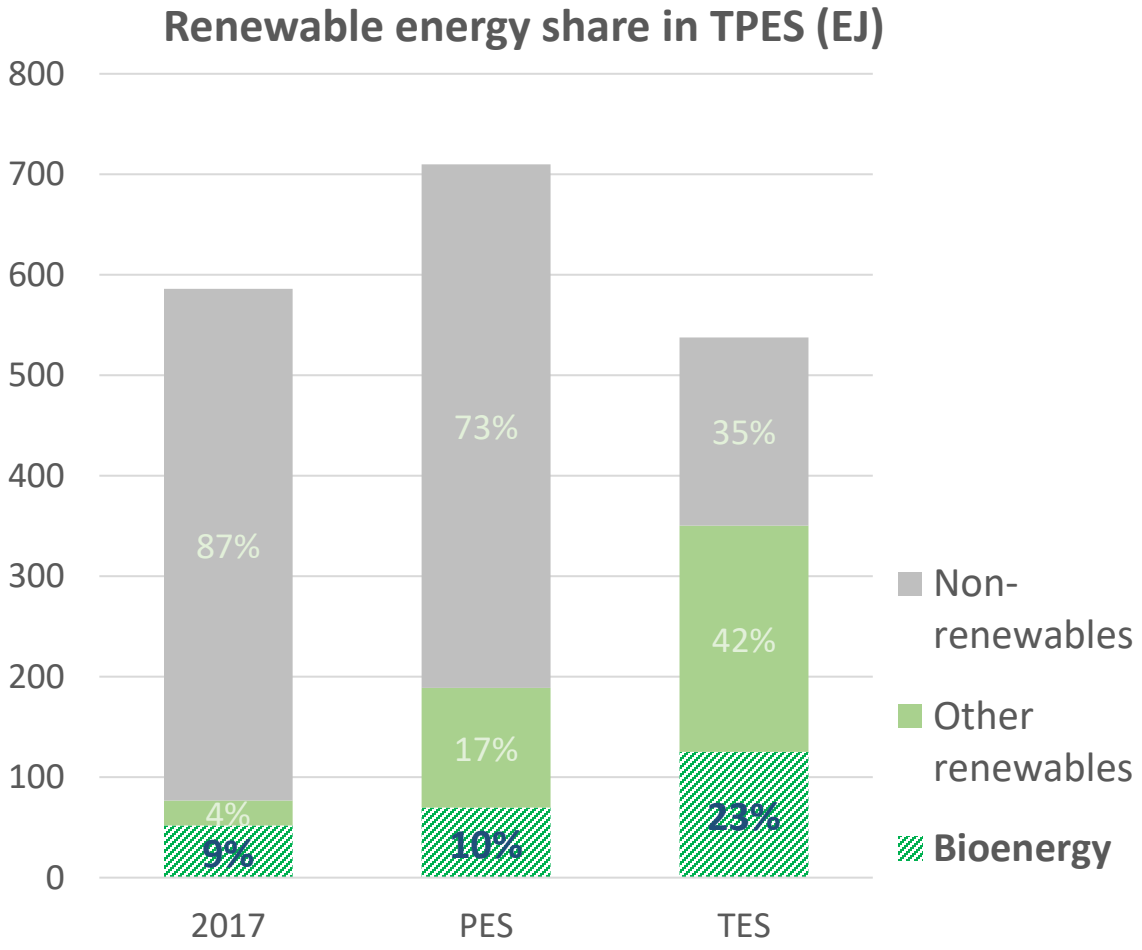
Bioenergy as the single largest source of renewable energy today

In 2017, 14 % of 586 EJ of Total primary energy supply came from renewable energy, of which 67% was from Biomass.

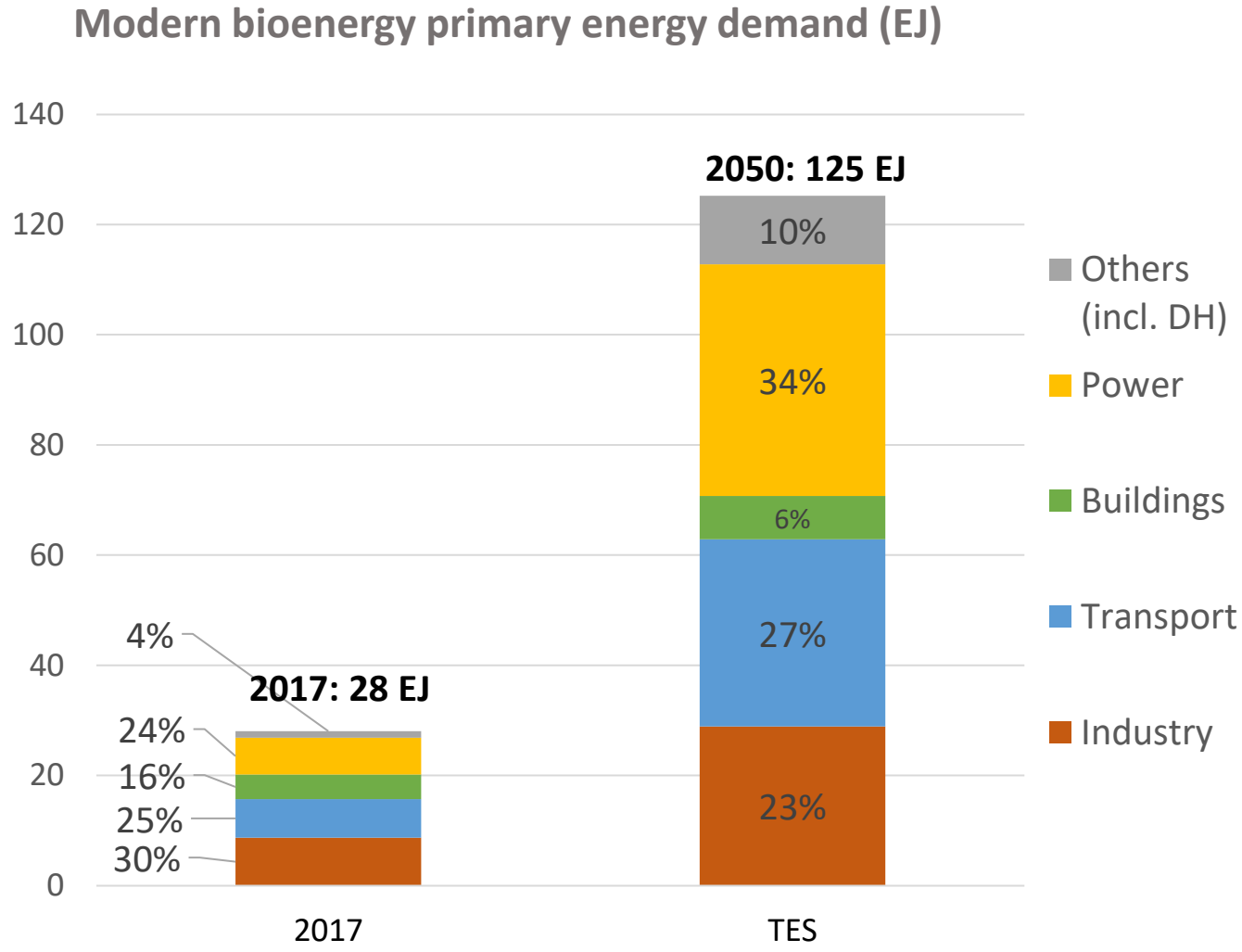


Bioenergy needs to be a core part of the energy transformation

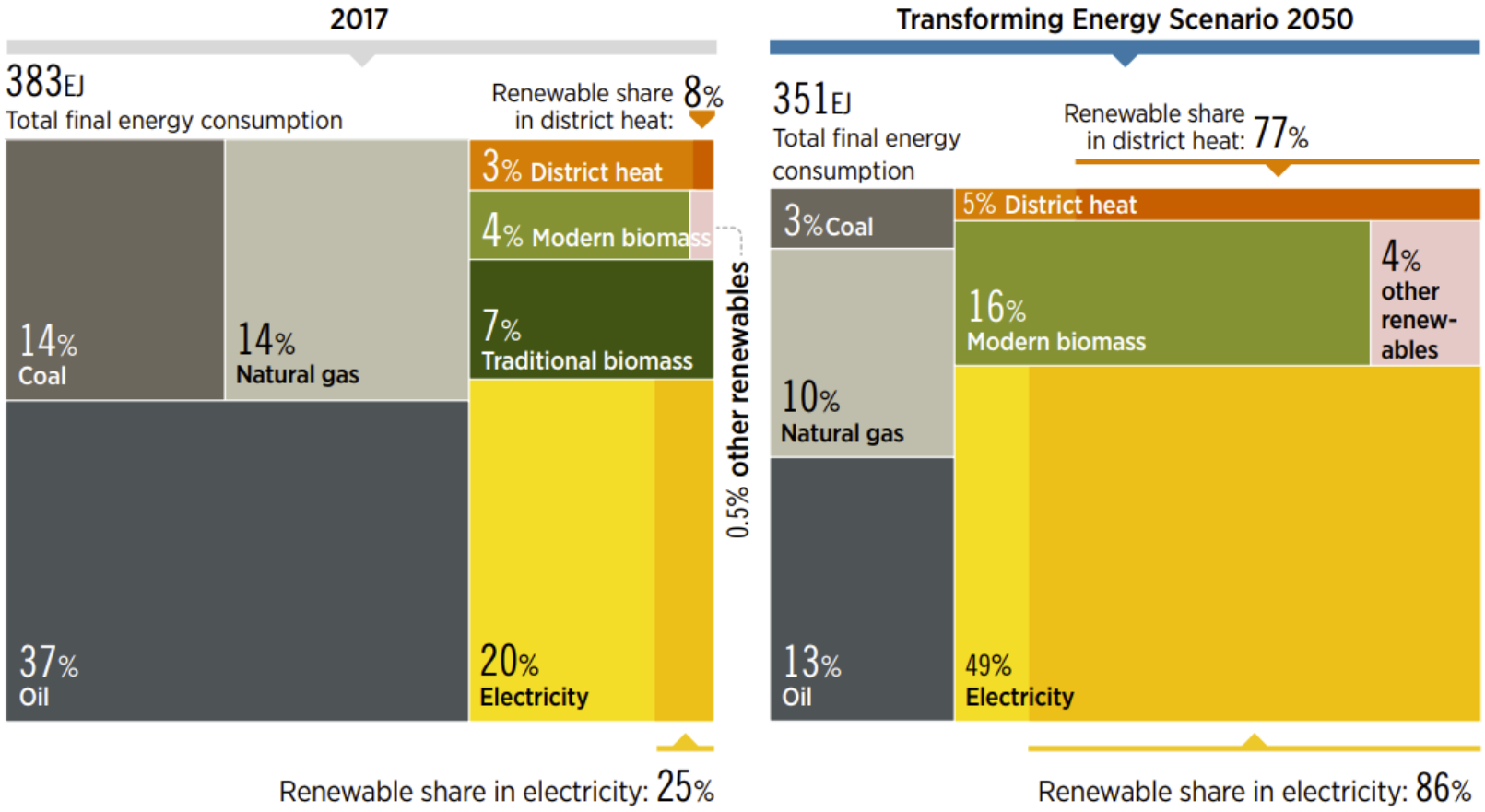
Bioenergy is expected to provide more than a third of the total renewable energy supply in 2050



PES: Planned Energy Scenario
TES: Transforming Energy Scenario

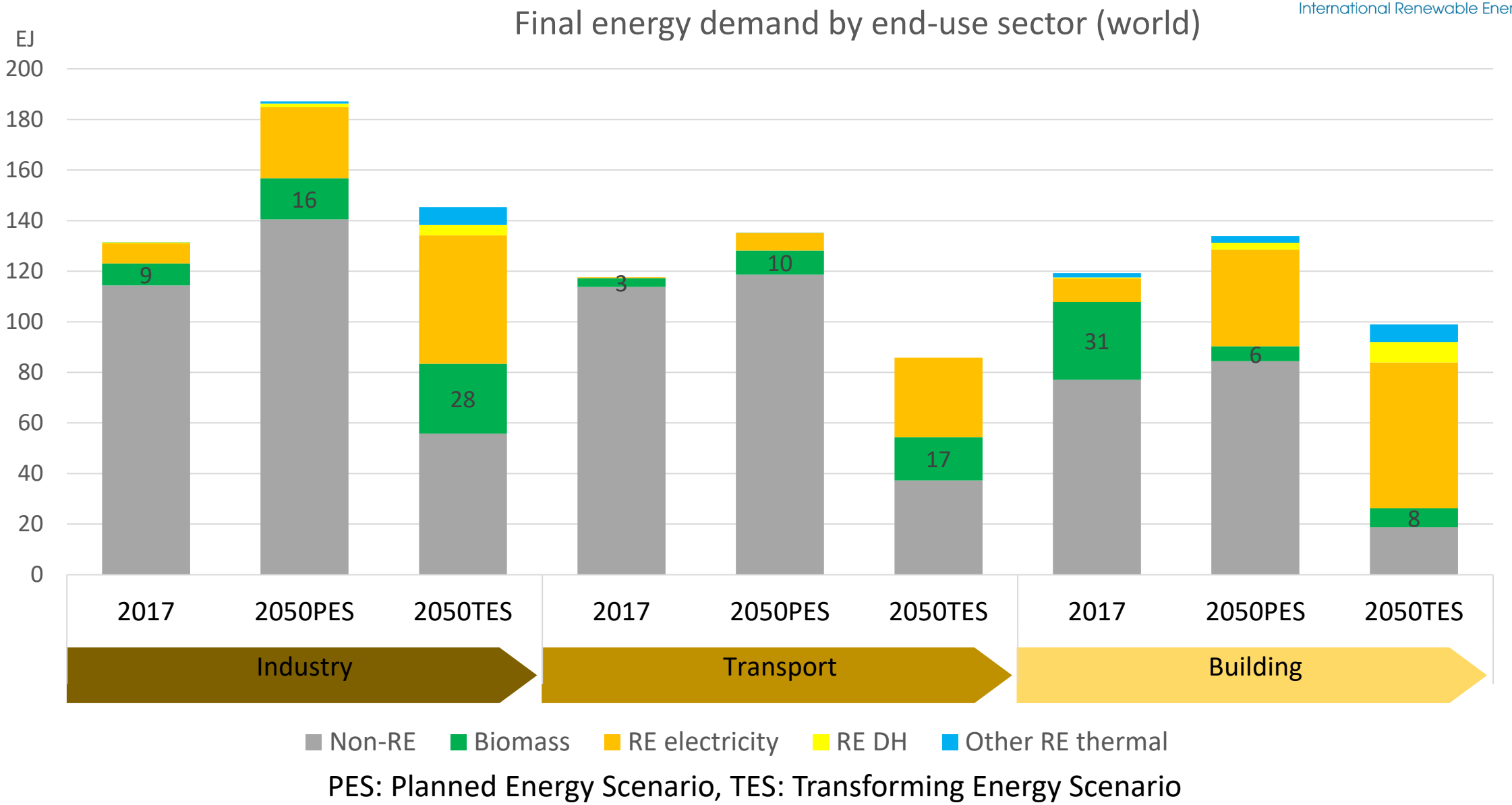


Bioenergy will play an important in the total final energy consumption by 2050



Renewable energy and energy efficiency can deliver 90% of energy-emissions reductions. Modern bioenergy use grows from 4% of final consumption in 2017 to 16% in 2050.

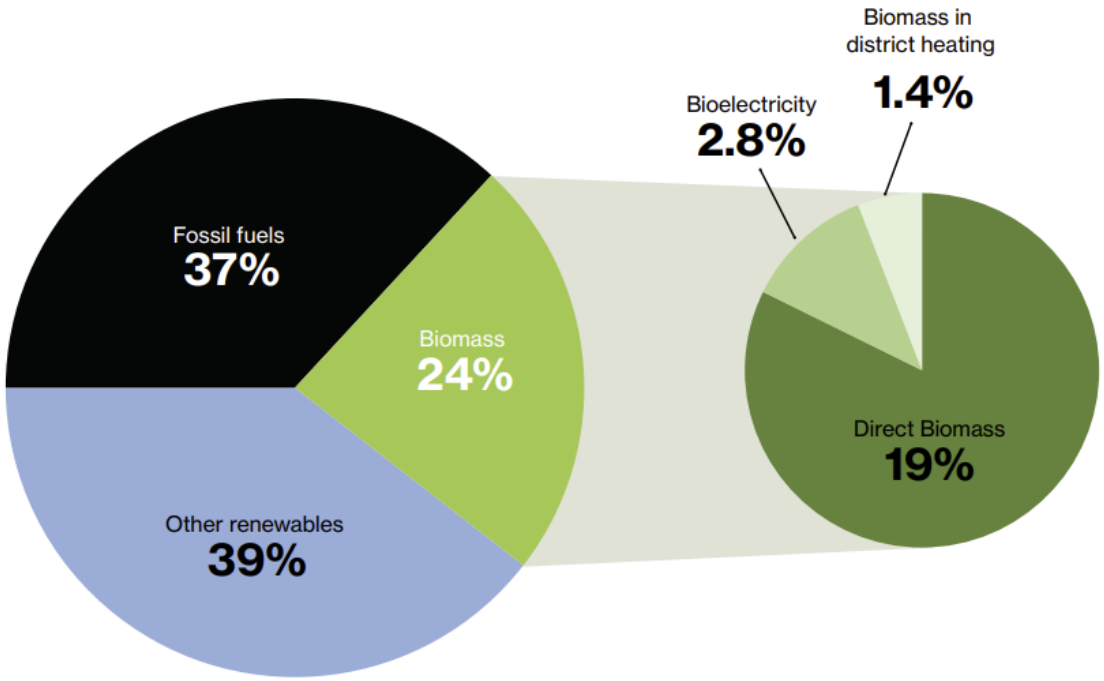
Bioenergy must play core role in the energy provision for industry and transport



PES: Planned Energy Scenario, TES: Transforming Energy Scenario

Increased use of biomass is essential for the energy transition in the industry sector

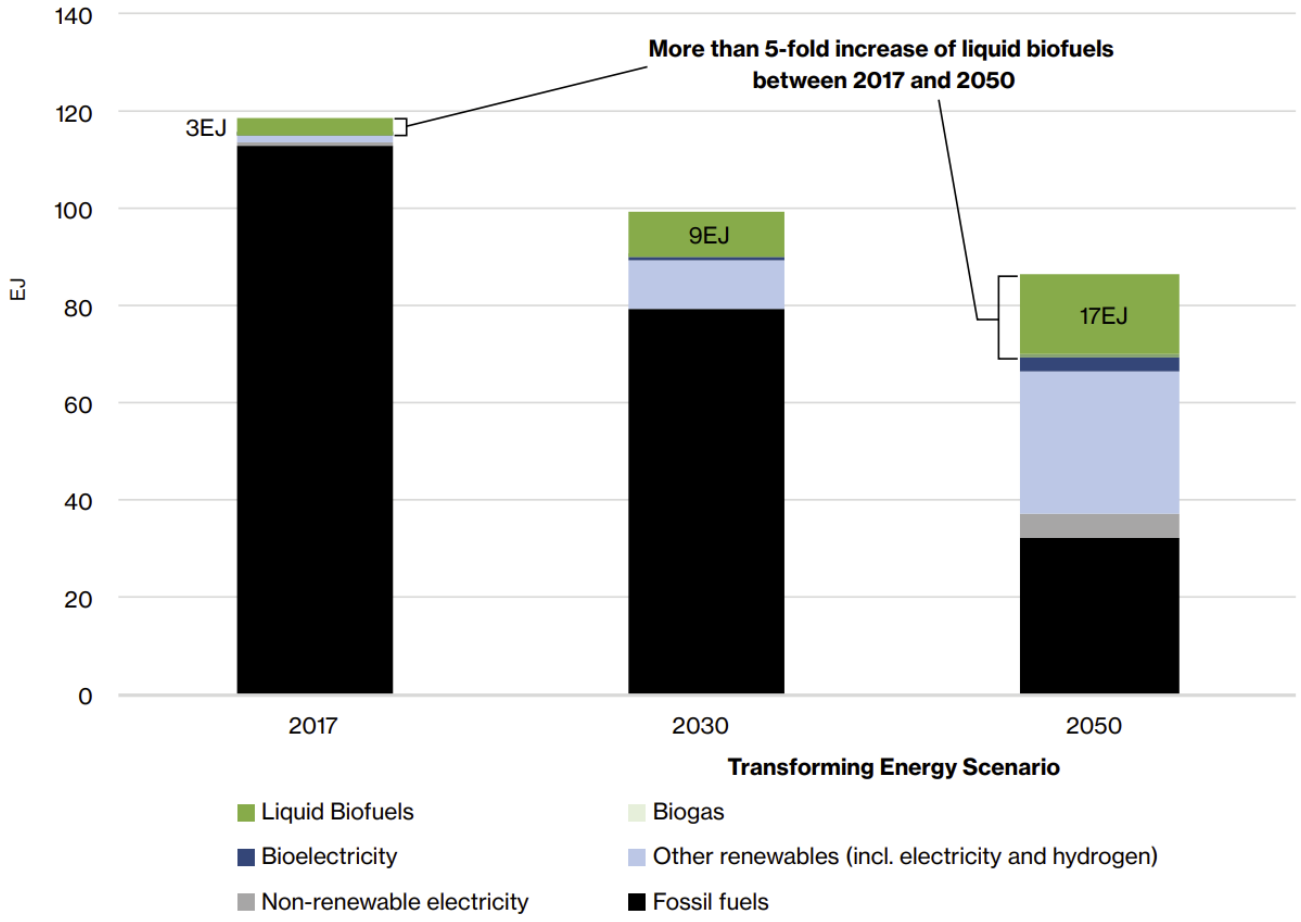
Renewable energy contribution to industry final energy consumption in the Transforming Energy Scenario (TES) in 2050



Biomass (direct use, bioelectricity and biomass in district heating) could contribute up to **one-fourth of total final energy consumption in industry by 2050**

Increased use of biomass is essential for the energy transition in the transport sector

Final energy consumption in the transport sector per energy carrier (2017 and 2030- 2050 TES)



- Biofuels and biogas consumption would grow to **nearly five times** 2017 levels by 2050 and **provide 20% of total transport final energy demand**

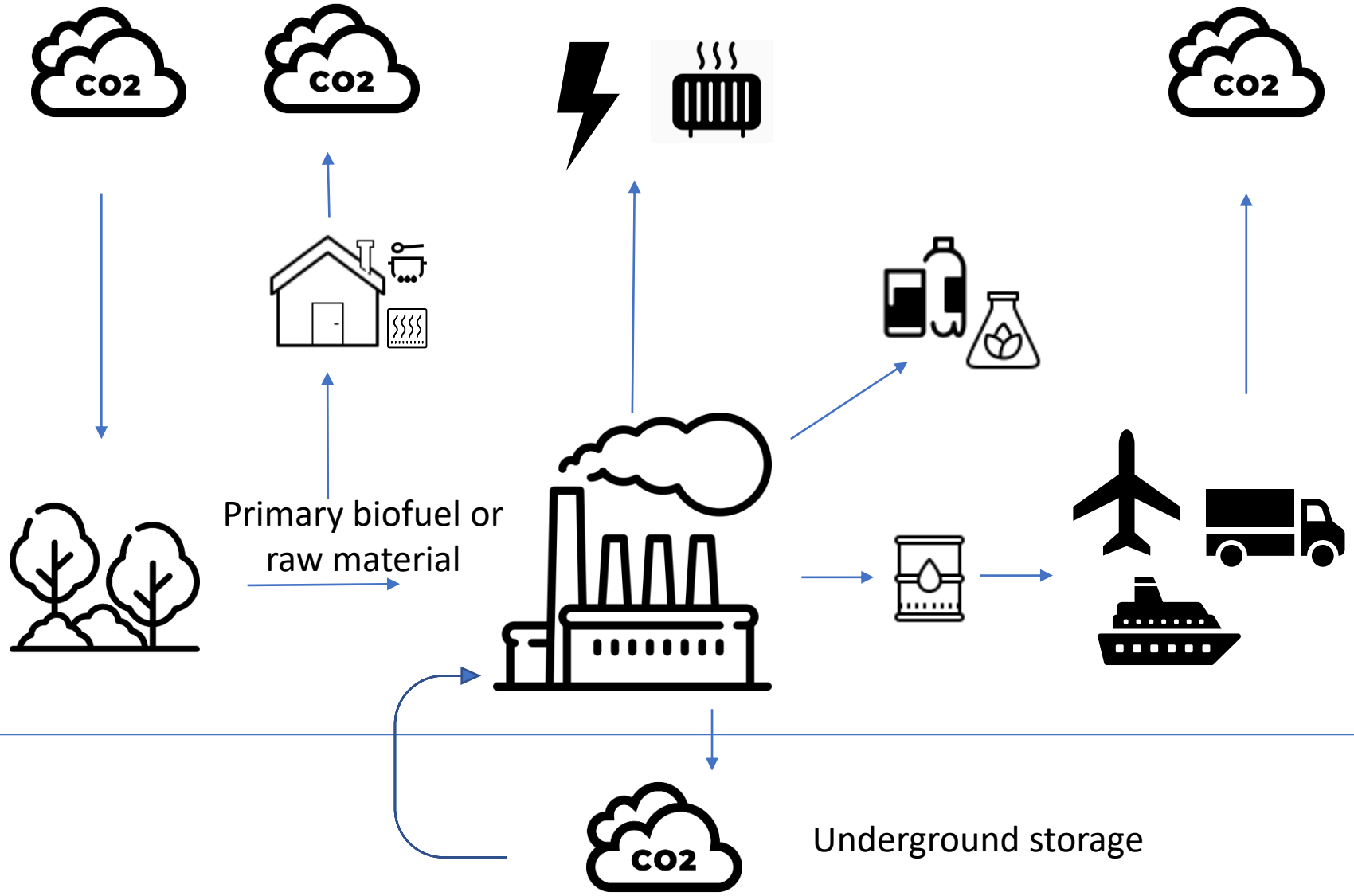
- Biofuels would play a particularly important role for the **decarbonisation of long-haul transport (aviation, marine and long-haul road freight).**

Meeting the Challenge Sustainably

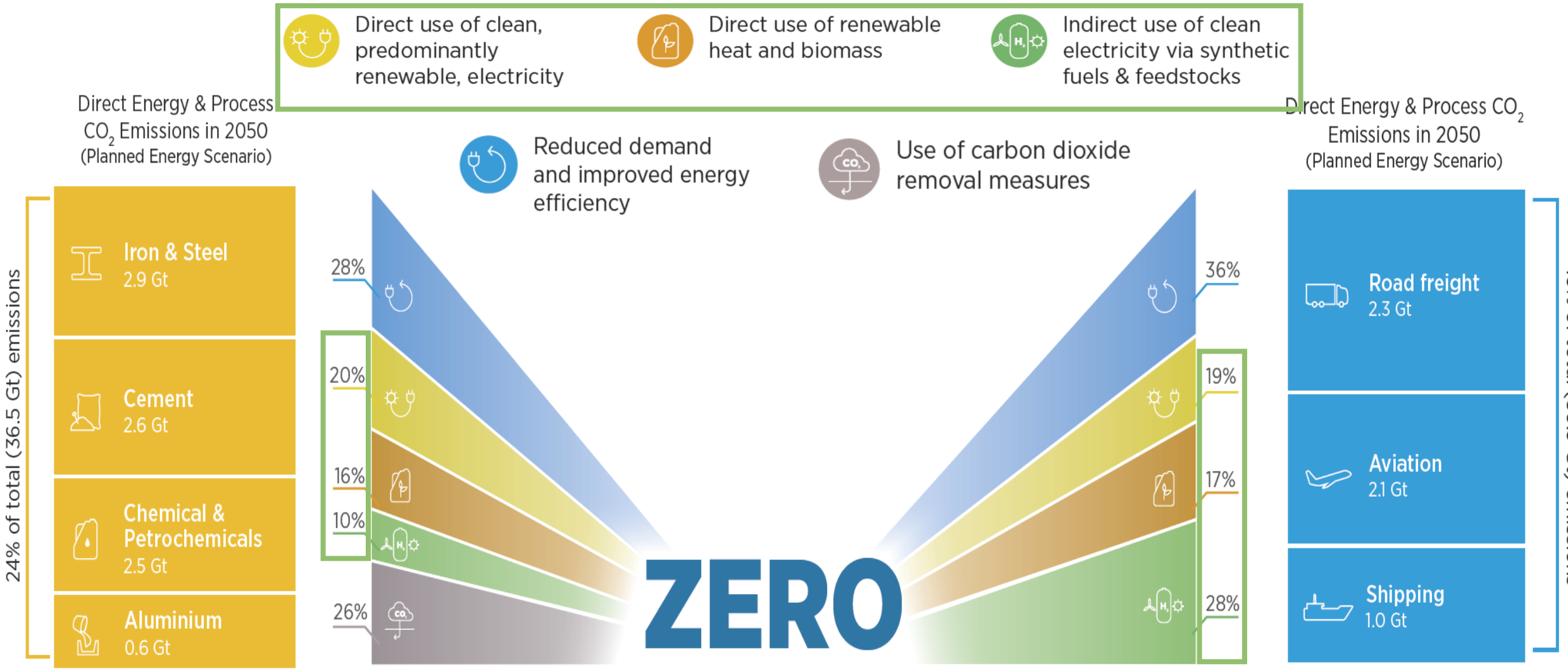
- Social Challenge: Food vs Fuel
  - Sustainable intensification: higher yields
  - Allows to produce more food AND fuel.
- Environmental Challenge: Land Use Change
  - Sustainable intensification: energy crops
  - Avoid forest loss, encourage forest expansion
  - Convert degraded land to productive use
- Economic Challenge: Low Price of Oil
  - Efficient use of biomass for cooking, heat, power
  - Competition not mainly with oil in these sectors
  - Count value of reducing atmospheric pollutants

Two IRENA reports outline the sustainable use of forestry biomass in Finland and Sweden

Biomass can play multiple roles in a circular economy



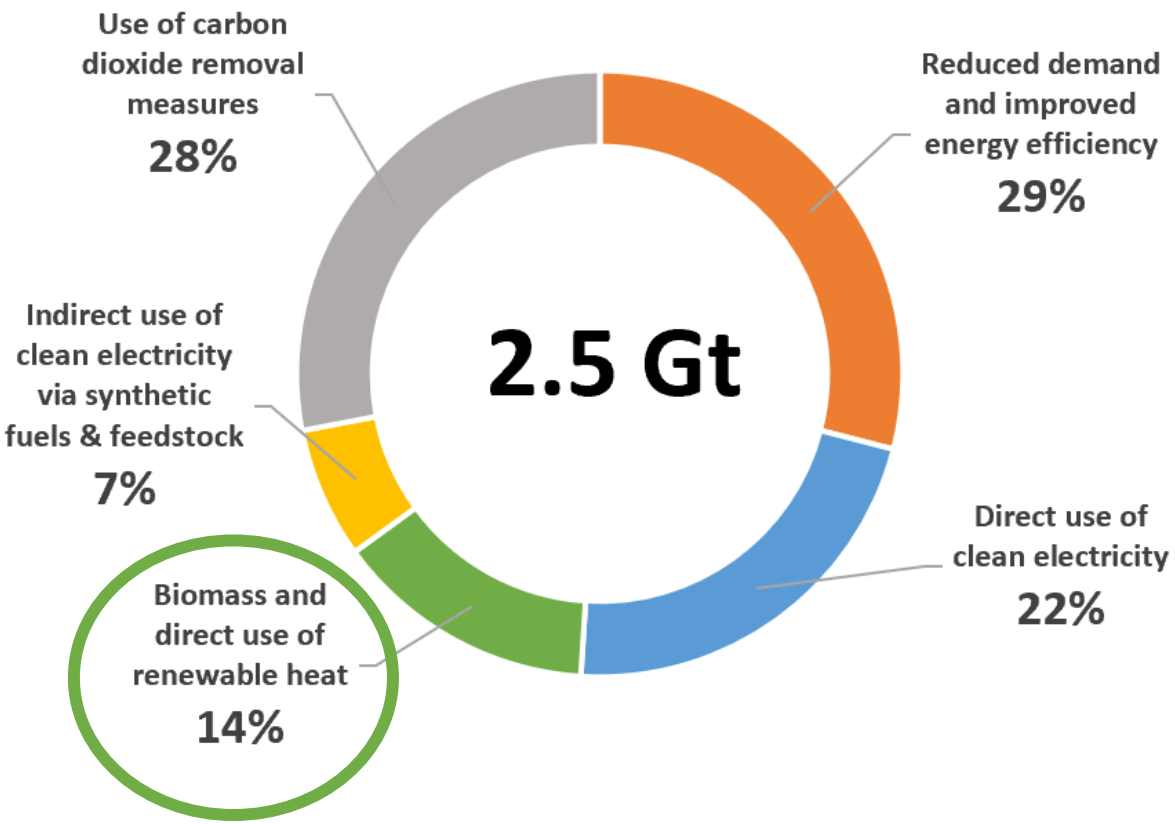
Deep decarbonization will require amplified role of bioenergy, more in hard-to-abate sectors.



Source: IRENA (2020) Reaching Zero with Renewables

Bioenergy has a key role for the decarbonization of the Chemical sector

Estimated role of key CO2 emissions reductions measures to reduce Planned Energy Scenario emissions to zero



- Biomass as an alternative to fossil fuels as: a **feedstock for chemical production**, **biomaterials** and as a **fuel for process heat**

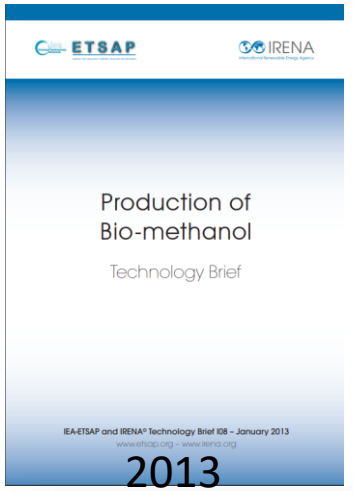
- **Biomaterials**:
  - there are approx. 500 Mt/year of synthetic organic materials and this amount is set to double or triple by 2050
  - Less than 2% of total supply of synthetic organic materials today
  - Technical potential is significant but economics are challenging

- **Biomethanol**
  - Substitute fossil based methanol

Clean methanol supply as a chemical and as a fuel

- Methanol is widely available and extensively used both in industry and transport.
  - Current methanol production relies on Natural gas and Coal
  - Renewable methanol – Biomethanol and E-methanol needs to be scaled up
    - Only approx.0.2 Mt of renewable methanol is annually produced out of 98Mt

- Biomethanol exists today and more in the pipeline
  - Biomethanol from gasification
    - MSW gasification in Edmonton and in Rotterdam (Enerkem)
  - Biomethanol from the pulping cycle
    - Mönsterås, Sweden (Sodra)
  - Biomethanol from biomethane
    - Texas, Netherlands (BioMCN)
- E-methanol at demonstration phase

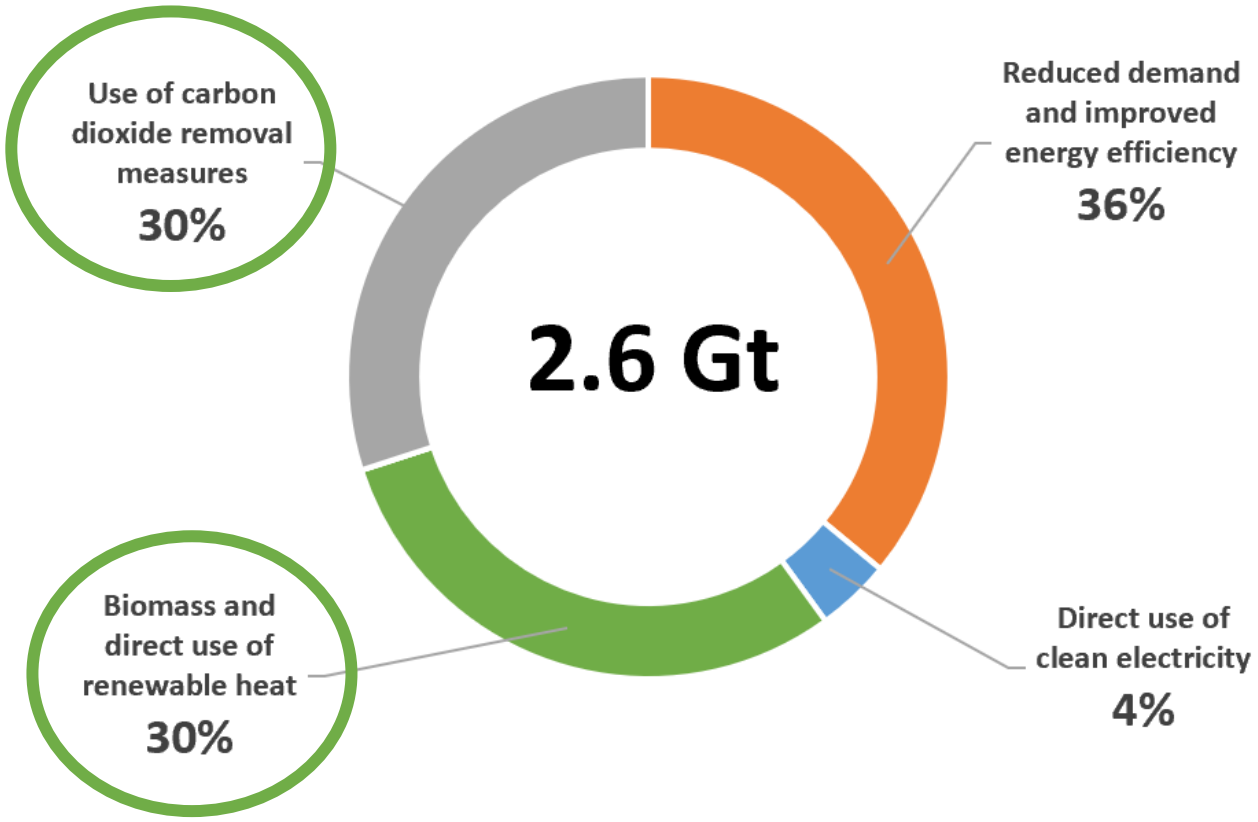


2013

2021

Bioenergy has a key role for the decarbonization of the Cement sector

Estimated role of key CO2 emissions reductions measures to reduce Planned Energy Scenario emissions to zero



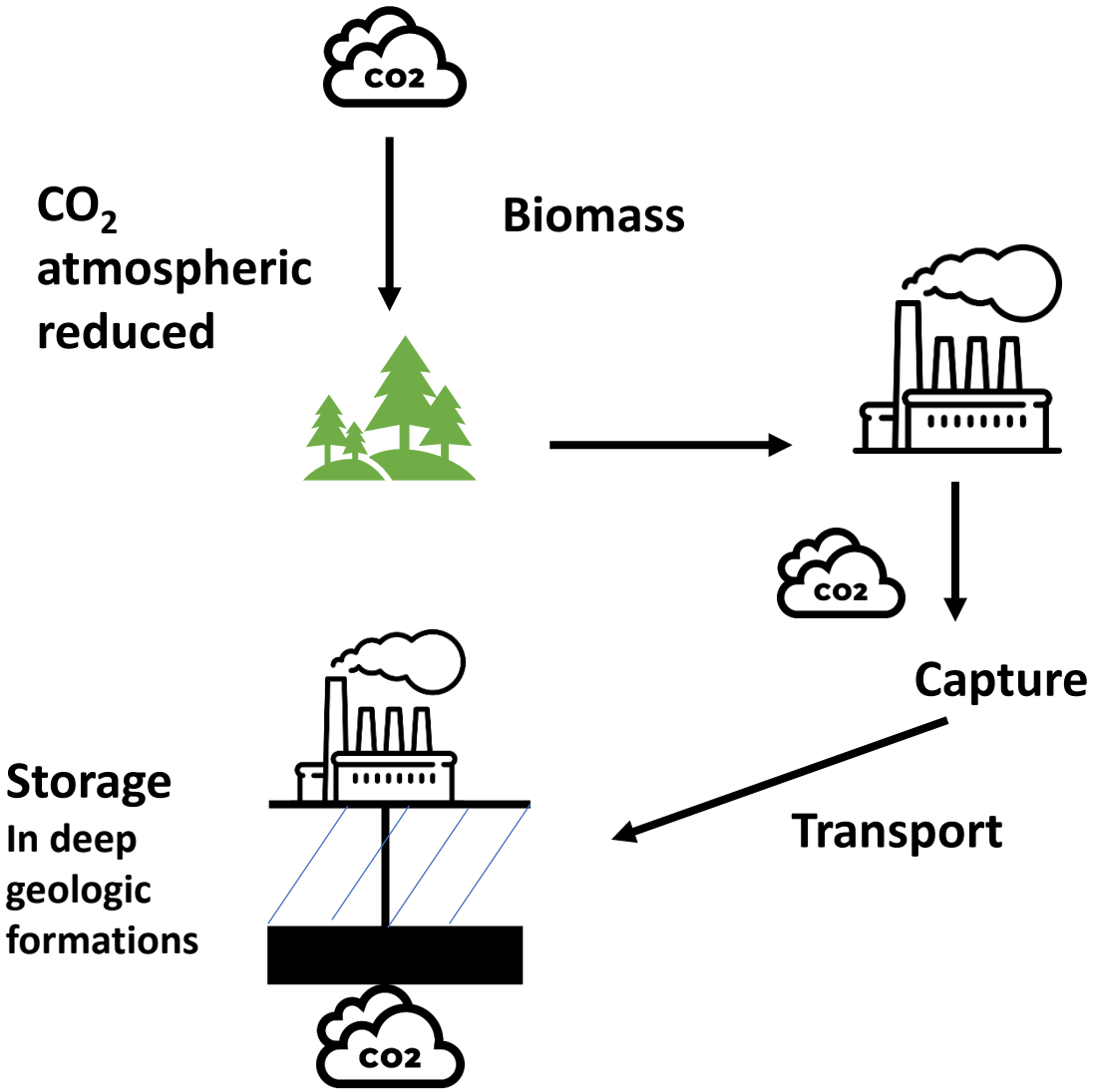
Biomass applications in the cement sector:

- As a substitute of clinker
- As an alternative material in the construction industry
- As a fuel for process heat generation

Bioenergy with Carbon Capture and Storage (BECCS) can be used to eliminate or offset the process emissions

- BECCS technologies studied have a lower rate of cement production as a result of co-firing biomass in existing boilers
- Application still at research stage
- Large-scale demonstration project in Norway is planned to start operation in 2024

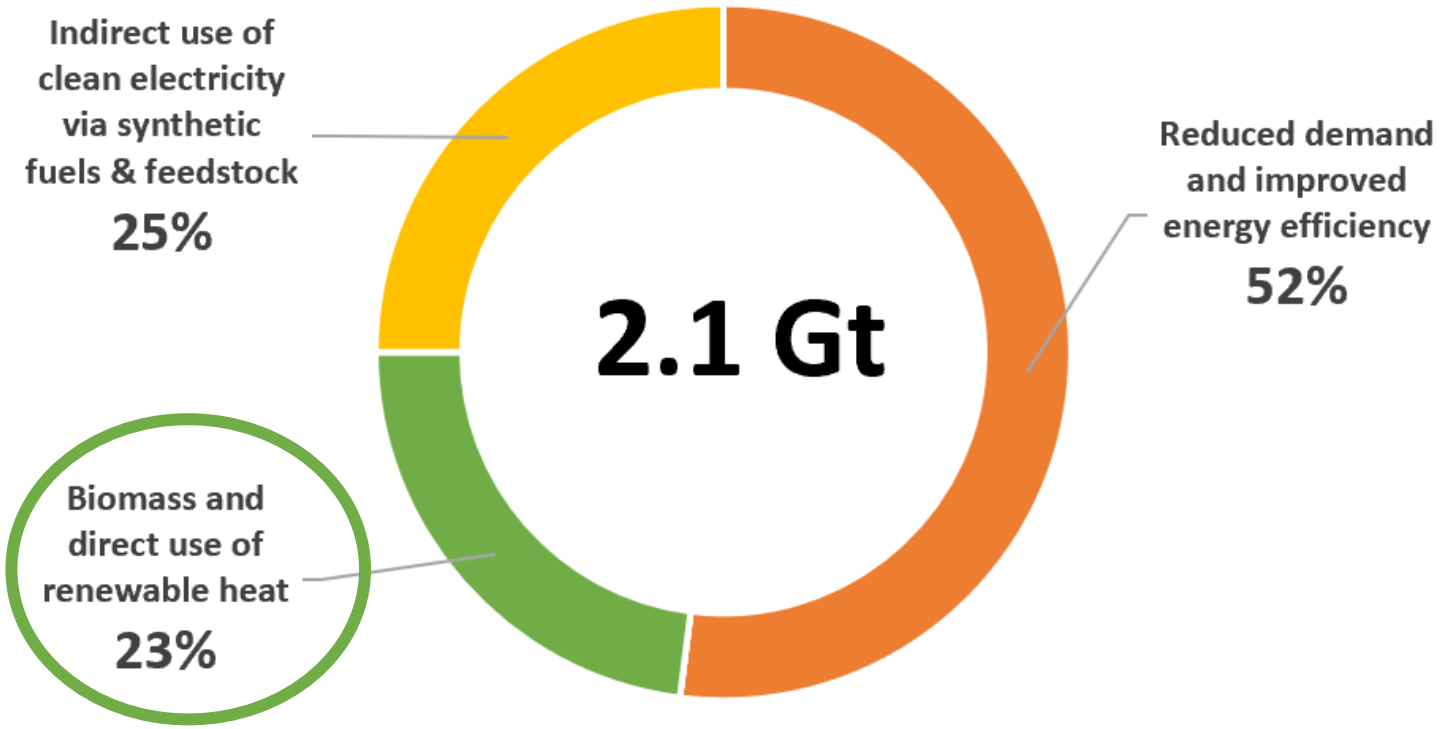
Bioenergy with Carbon Capture and Storage (BECCS)



- BECCS has a role to play in **decarbonising some emissions-intensive industries** and sectors and in enabling negative emissions.
- **Process economics favor large scale processes** (i.e. power plant, bagasse boilers, black liquor boilers/gasifiers, ethanol production plant, waste incinerators, cement kilns)
- Today its only used at **demonstration plant size**
  - 5 operating facilities capturing 1.5 Mt CO2
- **Significant cost involved** for capture, transportation and storage: 20-200 USD/t CO2
- **Long-term potential - several 100 Mt/Gt scale**

Bioenergy has a key role for the decarbonization of the Aviation sector

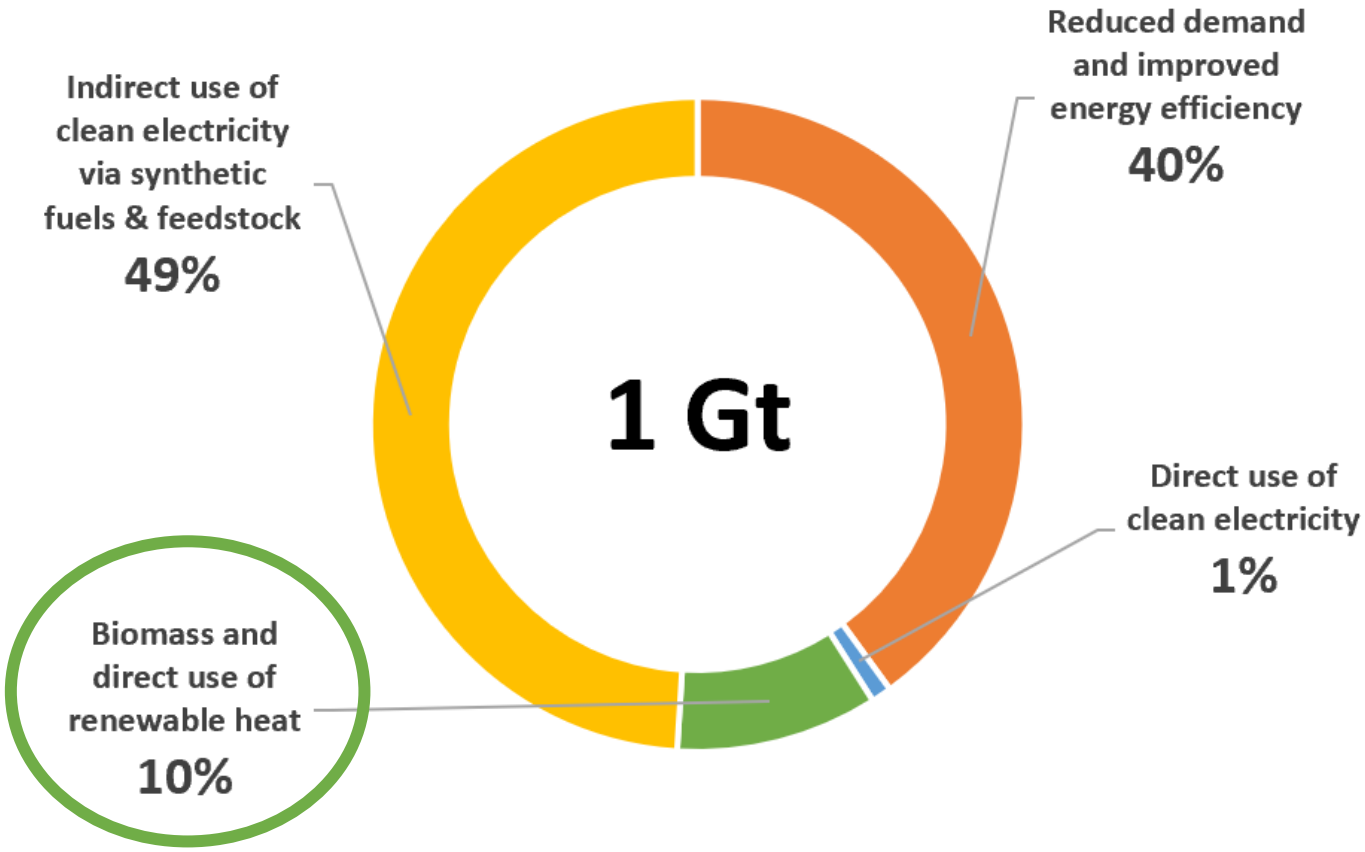
Estimated role of key CO2 emissions reductions measures to reduce Planned Energy Scenario emissions to zero



- **Bio-jet, is the only currently available option** for achieving significant reductions in aviation emissions.
  - Certified pathways (ASTM D-7566) : HEFA/HVO, FT, ATJ, DSHC/SIP
- **Large potential but current market for bio-jet is quite limited** (high costs and lack of regulatory framework)

Bioenergy has a key role for the decarbonization of the Shipping sector

Estimated role of key CO2 emissions reductions measures to reduce Planned Energy Scenario emissions to zero



- **Liquid biofuels** are an option for decarbonising the shipping sector and include:
  - **Biodiesel (FAME)**, produced from vegetable oils and fats,
  - **Renewable diesel (HVO),** produced from the hydrotreatment of vegetable oils and fats
  - **Bio-fuel oil (BFO),** produced from waste oil and crude tall oil through an upgrading process
  - **Liquefied biogas (LBG),** composed by biomethane
  - **Bio-methanol**
- **Technologically mature, but there are still three main barriers** to wider use: economics, availability and sustainability concerns

Multiple barriers risk preventing the full use of biomass and bioenergy's globally

- The use of biomass is underutilized and undervalued in current energy plans
- There are some widespread misconceptions and negative perceptions of biomass use among some policymakers and stakeholders
- Many bioenergy options have high costs compared to other renewables and fossil fuels and lack access to finance
- More recently, the abrupt decline in oil prices during the COVID-19 crisis is threatening the development and use of biofuels

=> <u>Addressing these barriers will be fundamental for a successful energy transition in many countries and regions</u>

Key actions

1. Make bioenergy a key component of national energy policy

⇒ Include the concept of circular economy and the goal of carbon neutrality as central guiding principles in national strategies, energy plans and Nationally Determined Contributions (NDCs)

⇒ Assess the full sustainable potential of bioenergy use in the national context and plan on that basis

2. Integrate bioenergy in energy system planning & investment strategies to maximise use bioenergy's potential

⇒ Set clear and stable national targets to exploit bioenergy's full potential

⇒ Develop financing and investments facilities in partnership with multilateral agencies for the design of specific funding lines and innovative financing solutions for bioenergy projects

3. Ensure sustainability of bioenergy

⇒ Strengthen sustainability governance schemes through measures, such as project-based certification mechanisms and improved monitoring of carbon stock changes

Key actions

4. Leverage synergies between bioenergy and the wider biomass sector

⇒ Create cross-departmental policy groups to fully explore how bioenergy and biomass management can be more closely integrated

⇒ Design agriculture and forestry policies to fully tap into the potential of their resources including for energy use. Doing so will have economic benefits including job creation.

5. Support key technologies e.g. biorefineries, bioplastics and BECCS

⇒ Develop strategies to incentivise and support pilot projects at a national level, alongside mechanisms to share learning between countries

6. Facilitate and promote international cooperation

⇒ Encourage international cooperation to exchange best practices, promote technology transfer and to develop cross-border trade mechanisms, particularly to ensure sustainable supplies

⇒ Increase senior-level (policy and decision making) engagement in initiatives for bioenergy development

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International Renewable Energy Agency

Thank you!