



Global development of the bioenergy sector – data and markets

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World Bioenergy Association



GLOBAL BIOENERGY STATISTICS 2022

World Bioenergy Association

BIOMASS SUPPLY CHAINS

HARVESTING & COLLECTION, PRE-TREATMENT AND UPGRADING, STORAGE, TRANSPORTATION & HANDLING

SUMMARY
Bioenergy plays a key role in mitigating climate change in all sectors of energy supply and the supply chains of biomass are crucial in order to realize the full potential of bioenergy. The technology offers a unique degree of flexibility compared to other renewable energy sources not only in the variety of feedstock, but also the various production pathways, and products and its use in end energy sectors of heating, cooling, electricity and transportation. The efficient operation of all components of supply chains including harvesting and collection, pre-treatment, upgrading, storage, transportation and handling is important to ensure a stable supply and reduce overall costs of the technology. This factsheet focuses on supply chains of feedstock sectors including forestry and agriculture. The first step in the biomass supply chain is the harvesting and collection of feedstock in the forest or the agriculture field which are described in the factsheet. In forestry, the system of felling trees with related machinery can be divided into two categories: Cut to length and tree length systems - each offering its own set of pros and cons. During harvesting of biomass from forest in conventional systems, it is important to leave out impurities to get higher energy content of the final feedstock. This will avoid challenges in the rest of the supply chain. For agriculture biomass, harvesting is usually done in easily accessible areas, but highly dependent on the seasonal variation of the agriculture sector. Once the biomass is harvested and collected, pre-treatment is done to ensure a high standard of fuel which include drying and/or densification to pellets etc. Such processes ensure proper specifications of biomass including higher energy content and lower moisture content so as to facilitate ease of transportation and storage of the fuel. Various modes of transportation including road, rail and sea are used depending on the feedstock volume and cost of the transportation. Feedstock costs associated with supply chains form the major share of the total cost of the technology. The overall cost is highly case dependent and the successful management of the supply chains is critical for the success of any investment. Thus, improving the supply chains in terms of efficient harvesting, collection, pre-treatment, storage, transport and handling will unlock the immense potential of the technology source.

INTRODUCTION
Bioenergy plays a key role in mitigating climate change, contributing more to the treasure we have than any



- Global industry association based in Stockholm
- Established in 2008
- **Mission:** Promoting the sustainable development of bioenergy
 - International advocacy
 - Platform for engagement
- Members – Pellet producers, utilities, research institutions, boilers/gasifier manufacturers, pellet mills, briquette manufacturers, heating companies etc.
- Coverage: Solid, liquid and gaseous fuels

14 Mar 11:00 AM WEBINAR FREE ATTENDANCE "A 5-POINT PLAN FOR RAPID SCALE UP OF BIOMETHANE PRODUCTION GLOBALLY"

Hosted by: Christian Rinken

Speakers:

- Pharoah Le Feuvre (Energy)
- Peter Zankowski (Energy)
- Giulia Cariani (Energy)
- Rob Bower (Energy)
- Jon Lindstrom (Energy)
- James Swindon (Energy)
- Christian Cunniff (Energy)
- K B Raghunath (Energy)
- Joao Schauf (Energy)
- Gourav Kedia (Energy)
- Jinbo Peng (Energy)

Organized by: WBA



Membership



Associations



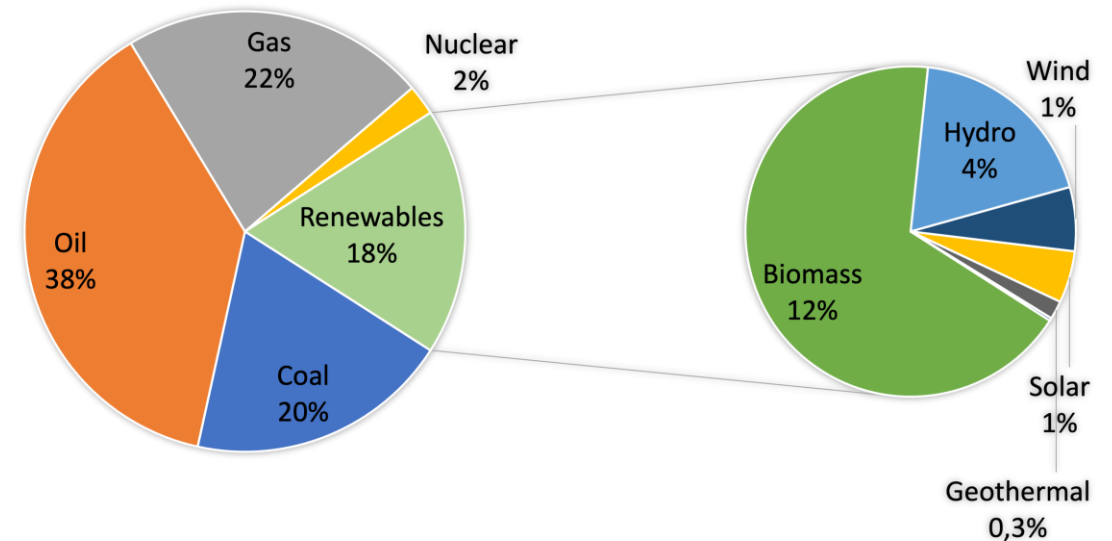
Companies





Energy Supply

- The reality is that our energy mix is dominated by fossil fuels – coal, oil and gas
- In terms of energy consumption (approx. 380 EJ), fossil fuels account for 80%
- Renewable share is constant (18%) since the start of the century – increased re deployment matched by increasing consumption
- **Bioenergy** is the largest renewable energy source globally
 - 50% traditional and 50% modern



Renewable energy in sectors

- Heating (Derived heat + final consumption) accounts for 50% of all energy consumption
- Penetration of RE varies among end use sectors
 - Decent share in **electricity** (25 – 30%) due to diverse options available
 - Long way to go in **heating** (8 – 10%) due to lack of policies and options
 - Woefully low in transport (3 – 5%)
- Bioenergy has major impact and potential in all end use sectors – with heating and transport more prominent

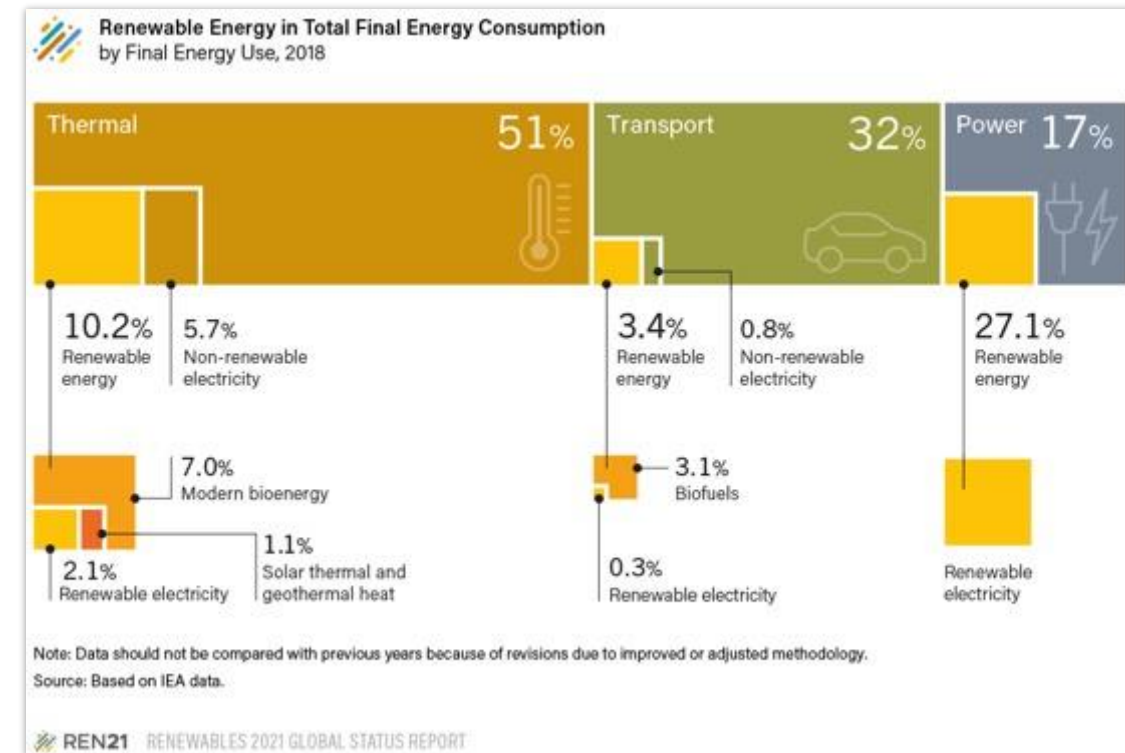


Figure: Renewable energy in TFEC (Source: REN21)



Where does feedstock come from?

- Biomass accounts for about 10% of the energy supply
- Currently, forestry sector (traditional and modern) accounts for about 85% of the biomass supply
- Agriculture/Animal sector accounts for approx. 10% of the supply – expected to grow further
- Minor share from MSW/Landfill gas

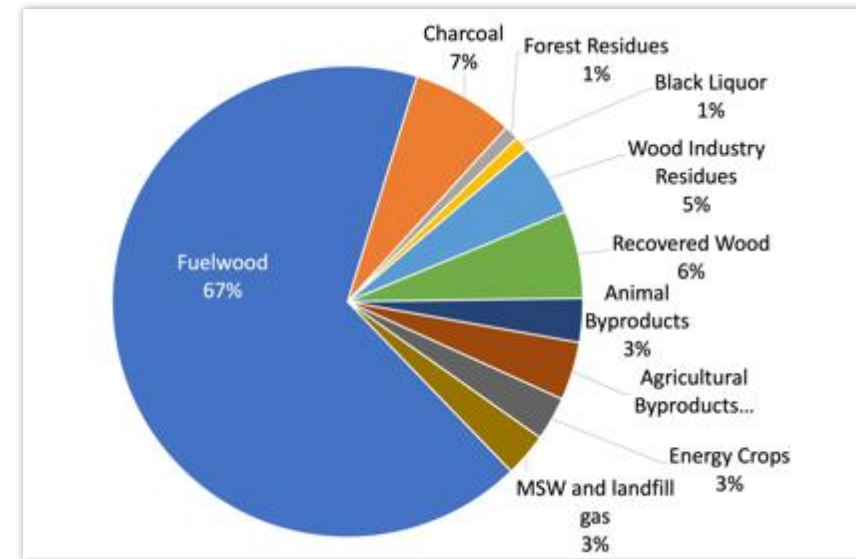
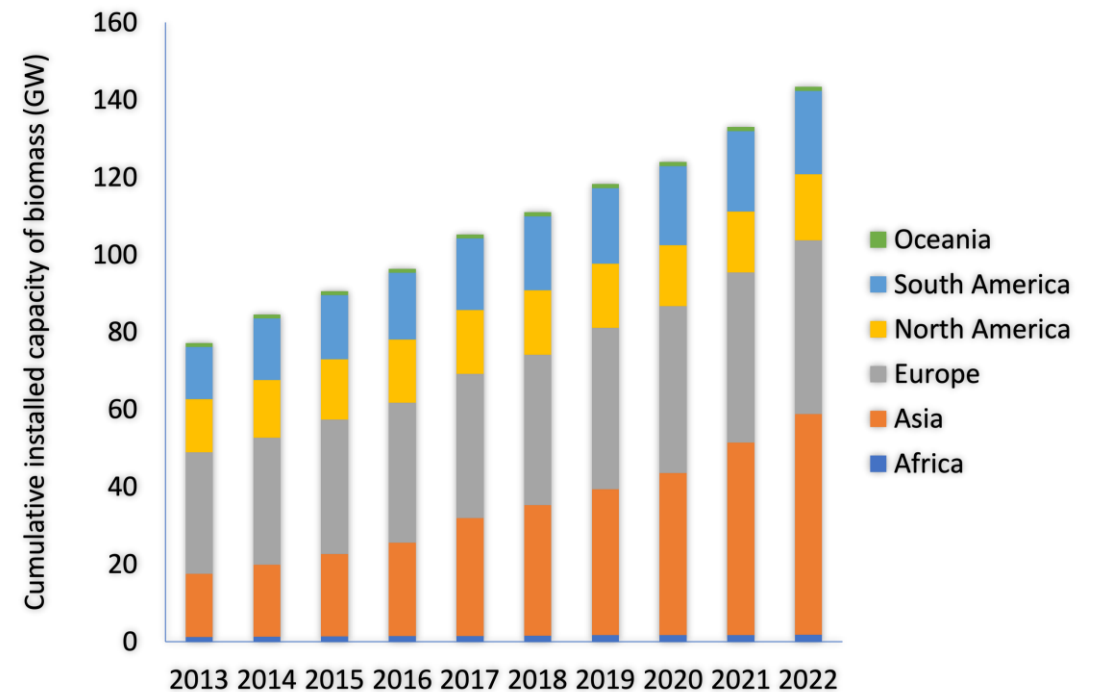


Figure: Biomass energy supply (Source: IPCC, IEA and WBA calculations)

Growth of biopower capacities

- Renewable energy sources account for 40% of total installed capacities
- Cumulative installed capacity of bioenergy – approx. 143 GW (5% of overall RE capacity)
- During 2021 – 2022, 10 GW of additional capacity was added: 4% of overall RE power addition
 - Asia accounted for largest increase y-o-y (+15%)
 - China + 5 GW
 - Indonesia, Japan + 1 GW
 - Europe experienced slowest y-o-y growth (2%)
- One of the slowest y-o-y growth in past decade



Biopower and Bioheat

Bio power

- 680 TWh of electricity was generated from biomass based sources – 9% of overall renewable power
- Installed capacity in 2022: 150 GW in 2022 (5.3%)
 - Bagasse co generation in Brazil, India
 - CHP facilities in Europe (DE, SW, UK)
 - Waste to energy in China, rest of Asia
 - Biopower generation in USA



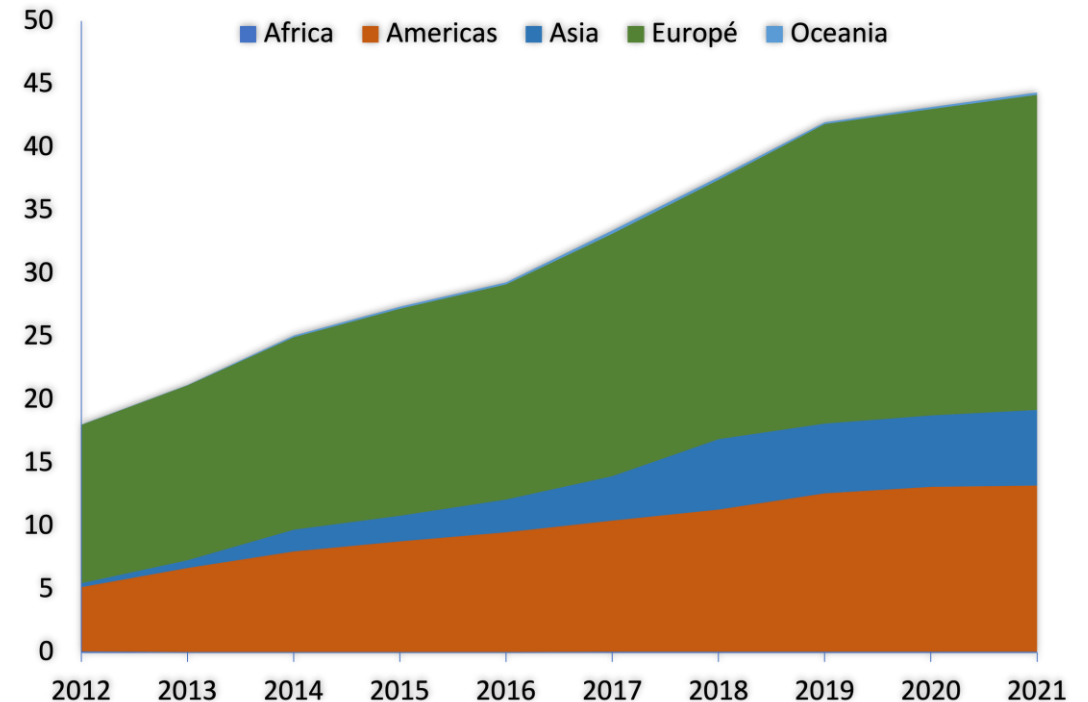
Biopower

- 1.26 EJ of biomass heat was generated – 96% of all renewable heat in buildings, industry, commercial, forestry etc.
- Europe accounts for more than 90% of all bioheat produced globally
 - Possible due to large scale CHP facilities with District heating networks
 - Residential heating with pellets/chips boilers and stoves
 - Not much growth in Asia – Pacific due to lack of need for residential heating, but focus on industry

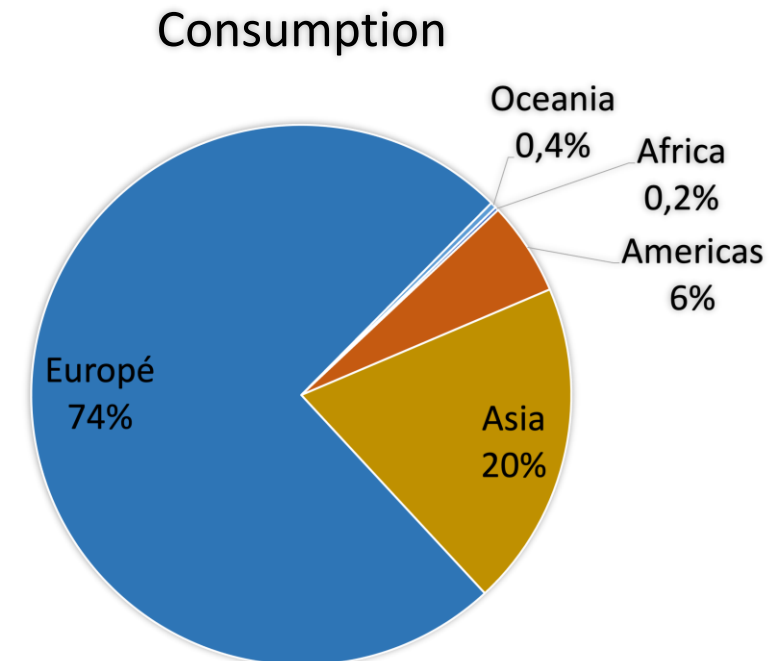
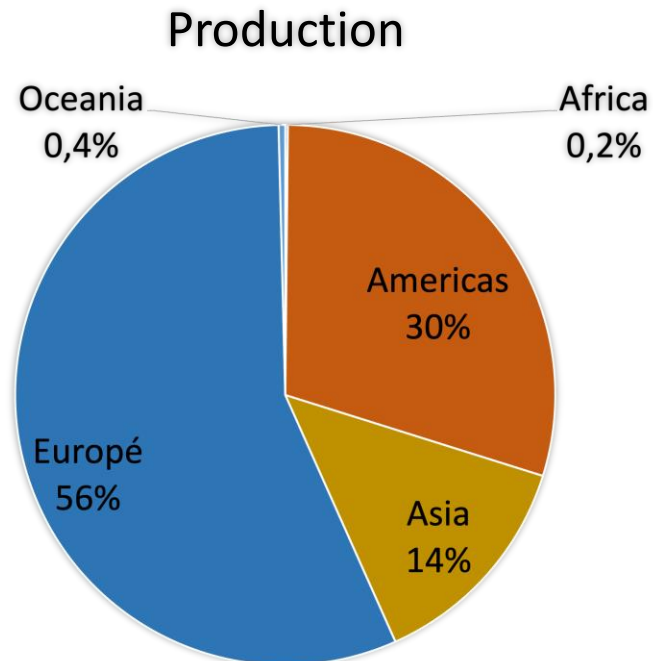


Pellets globally

- Pellets are one of the fastest growing commodities worldwide
- Global production of wood pellets has risen to 44 million tonnes
- Asia is a major player in consumption of wood pellets (e.g. Japan)
- Increasing focus on agriculture pellets for large power plants (e.g. India)
- Feedstock mobilization and densification technology critical



Production and consumption of pellets





IEA NZE Pathway

- Sustainable bioenergy delivers emissions reductions across a wide range of area:
 - Low emission fuels for aviation, shipping and other forms of transport
 - Replacing natural gas with biomethane and other fuels
 - Replacing coal with solid biomass fuels in large CHP facilities
 - Clean cooking solutions
- In NZE scenario, bioenergy will be the 2nd largest fuel in 2050!!

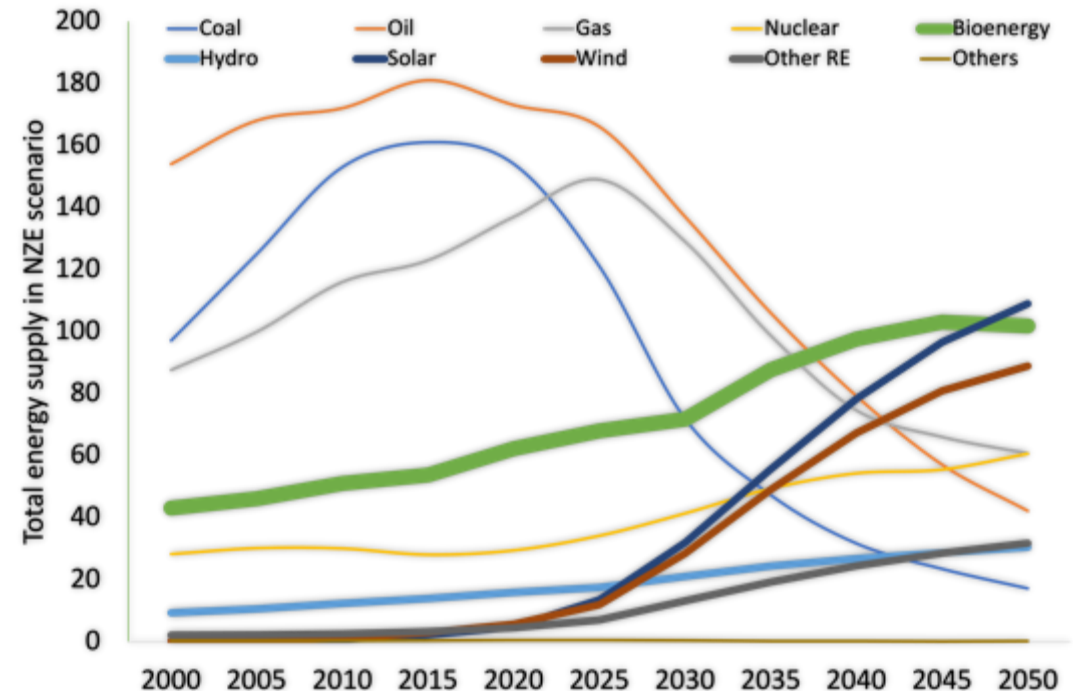
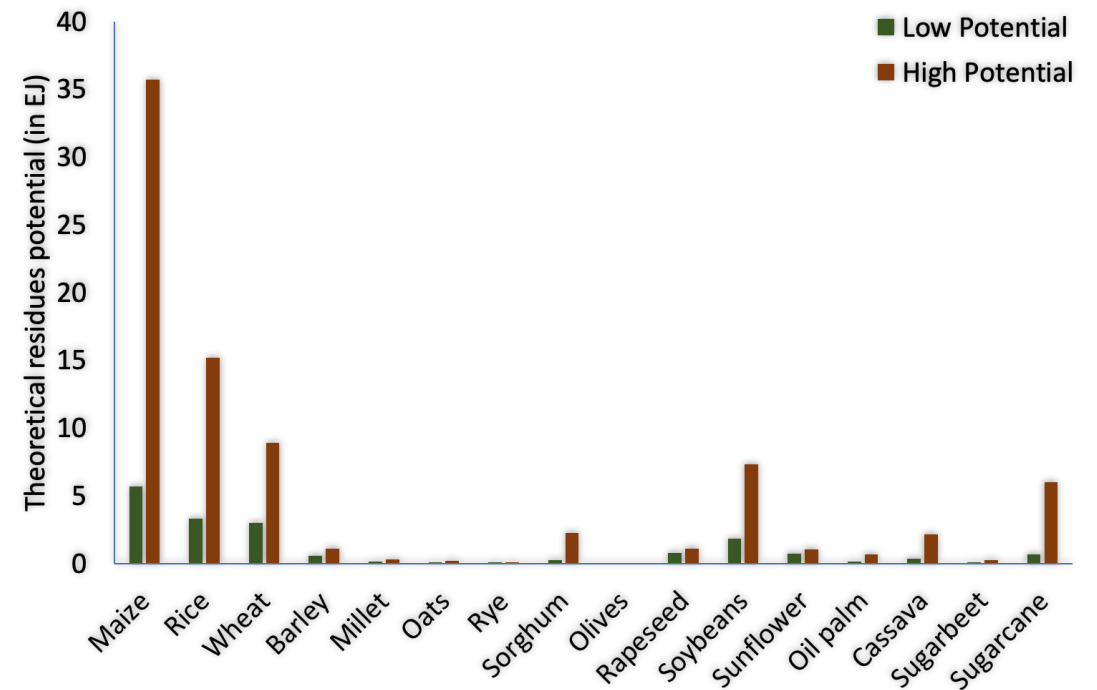


Figure: IEA Net Zero Emissions scenario (IEA NZE report)

Agricultural residues

- WBA study on theoretical potential of agricultural residues to energy
 - 50% left on the fields for soil etc.
- Estimated 60 – 100 EJ only from agro biomass
- Challenges remain
 - Aggregation (e.g. paddy straw vs. bagasse) – Focus on sugar and rice mills
 - Cost of collection, transport and storage
 - Technical limitations with agro biomass



Case of China

- Climate neutral pledge by 2060
- According to the recent 5 year plan,
 - Need to replace : 650 000 industrial boilers (3.5 TW – 85% coal)
- Rate of transformation is impressive
 - E.g. 500 MW coal fired power plant replaced with straw pellets in Northern China
 - 6 – 8 months for conversion
- COVID restrictions a major hindrance, signs of easing up



Fig: Coal to pellets fired power plant. Heat to a automotive company.

Case of India

- Aim to co fire 5% of biomass in thermal power plants
- Pellets are targeted as key feedstock: both torrefied and non torrefied pellets are promoted
- Primary feedstock: paddy straw
- Current status:
 - 39 power plants
 - 85 477 MT of pellets (0,6%)
- Increased to 7% from 2024 onwards

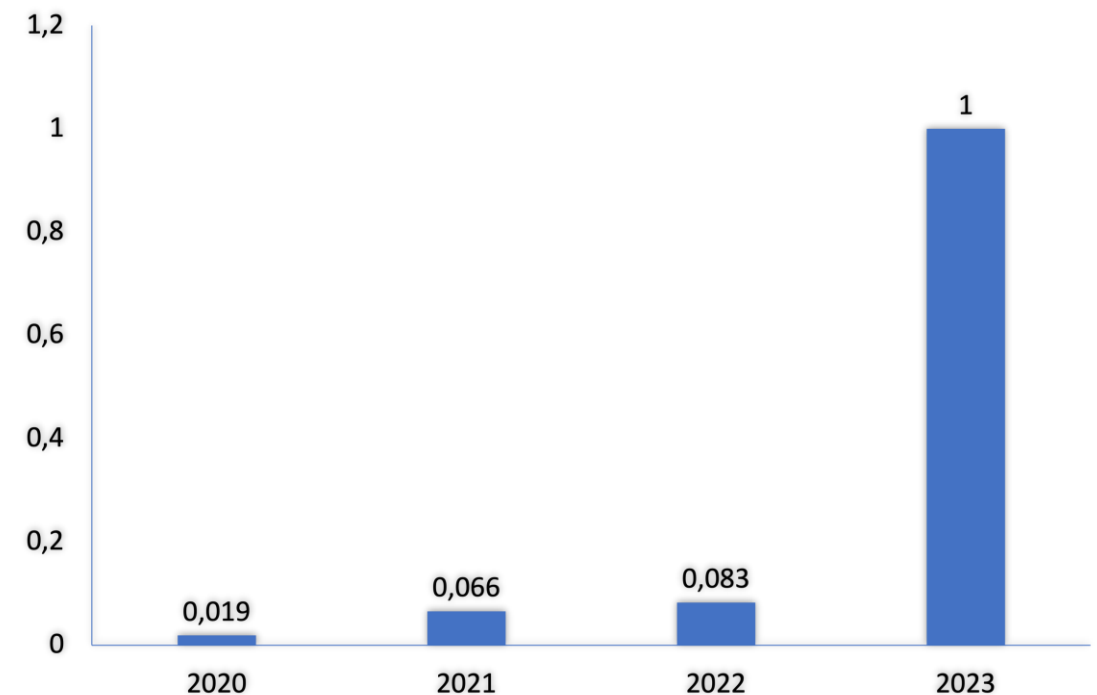


Fig: Paddy straw torrefaction unit in Haryana, India



Case of India

- 5% of co firing with coal translates to roughly **8 million tonnes** annual consumption
- Order already placed for 4.3 million MT by 35 power plants
- Focus on local production and use of local equipment
- Financial incentives available:
 - One time grant on capital investment: 16 000 Euros per t/hr (non torrefied) and 38 000 Euros per t/hr (torrefied)



Opportunity – Industrial decarbonization

- 1) Heineken / BE-CIS, Indonesia
 - 7 MW facility for producing steam
 - Replaced natural gas fired boiler – an cost saving example of gas to biomass in industry
 - Feedstock: rice husk and wood chips
- 2) Serum Institute / Thermax, India
 - Largest vaccine manufacturer
 - Shifted from gas to biomass for cost savings



Industrial decarbonization is a major sector for rapid deployment of biomass solutions



Major campaigns against bioenergy

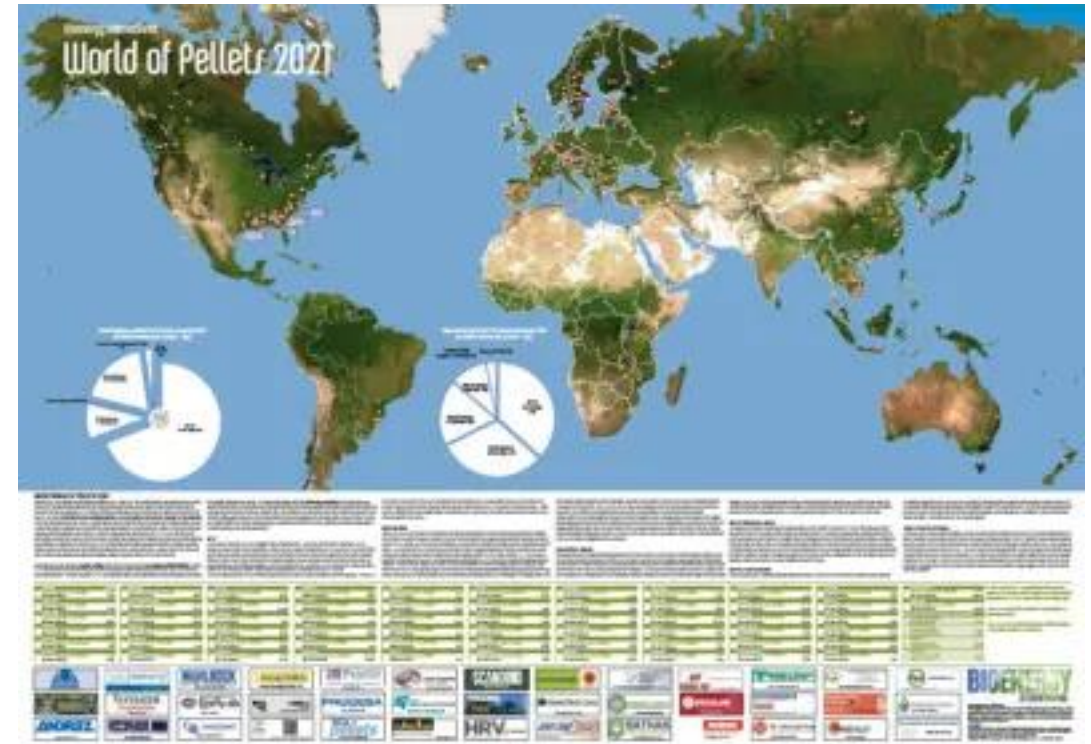
- Increased opposition against the use of biomass for energy purposes
- Opposition has various advantages – massive resources and simple narrative
- Some sectors are impacted more than others:
 - Biofuels: e vehicles, food vs. fuel
 - Pellets: Deforestation, carbon debt
- **Important for the community to gather together, utilize the science and present good success stories**
- WBA initiative – Glasgow Declaration on sustainable Bioenergy (Join Us)





Bioenergy International

- Bioenergy International is the leading English language trade publication covering all bioenergy sectors
- Bio Int is the official magazine of WBA
- Recently launched the World Of Pellets Map – details list of major pellet production from around the world
- Homepage:
<https://bioenergyinternational.com/>



Thank you!

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23/05: Biomass pellets and briquettes (CPM, Kahl, Andritz, C F Nielsen..)



22/06: Conversion technologies (Polytechnik, Justsen, ..)



19/10 – ...: WBA General Assembly (Hanoi, Vietnam + Beijing, China)