

# Sustainable Bioenergy for the Energy Transition

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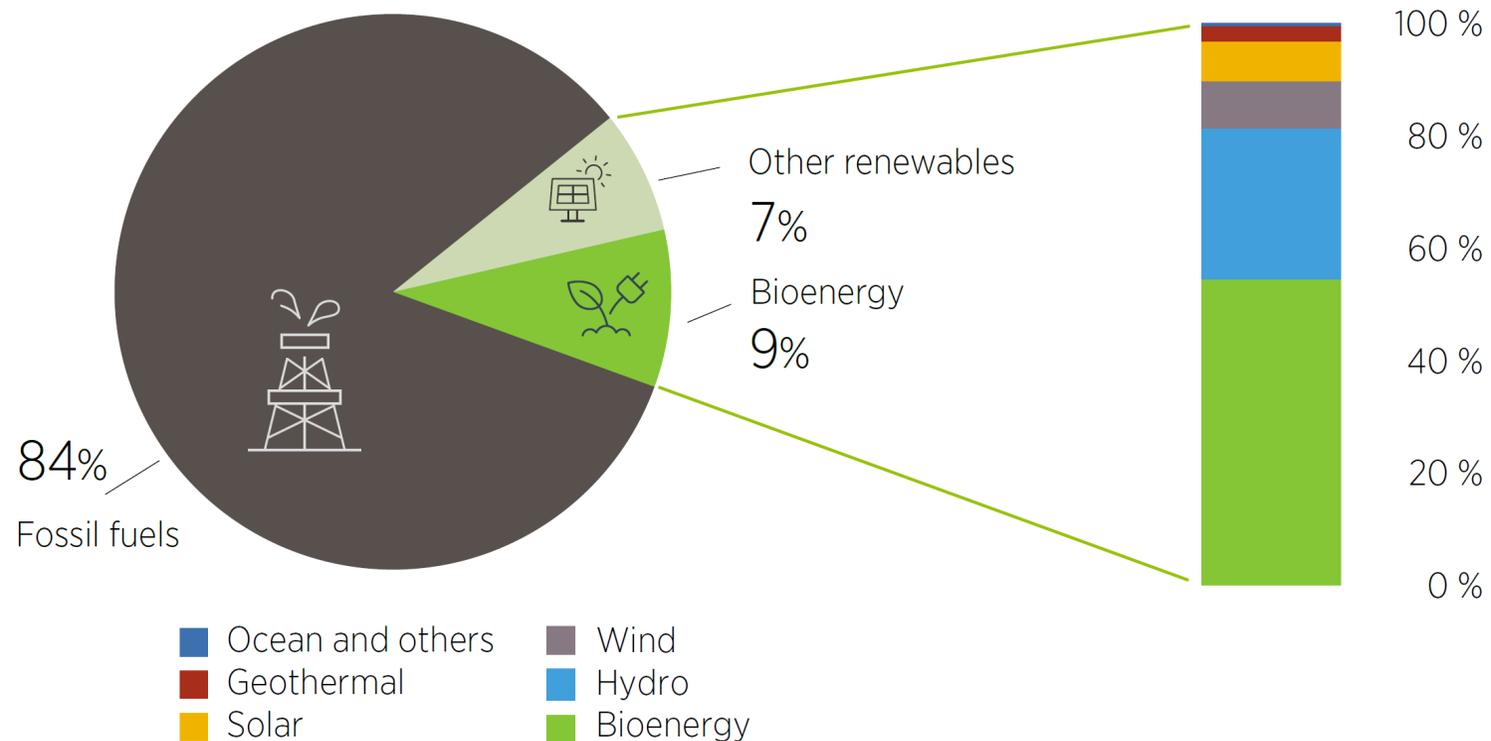
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# Bioenergy contributes the largest share of renewable energy consumption

Share of bioenergy and other renewables in global total final energy consumption, 2019

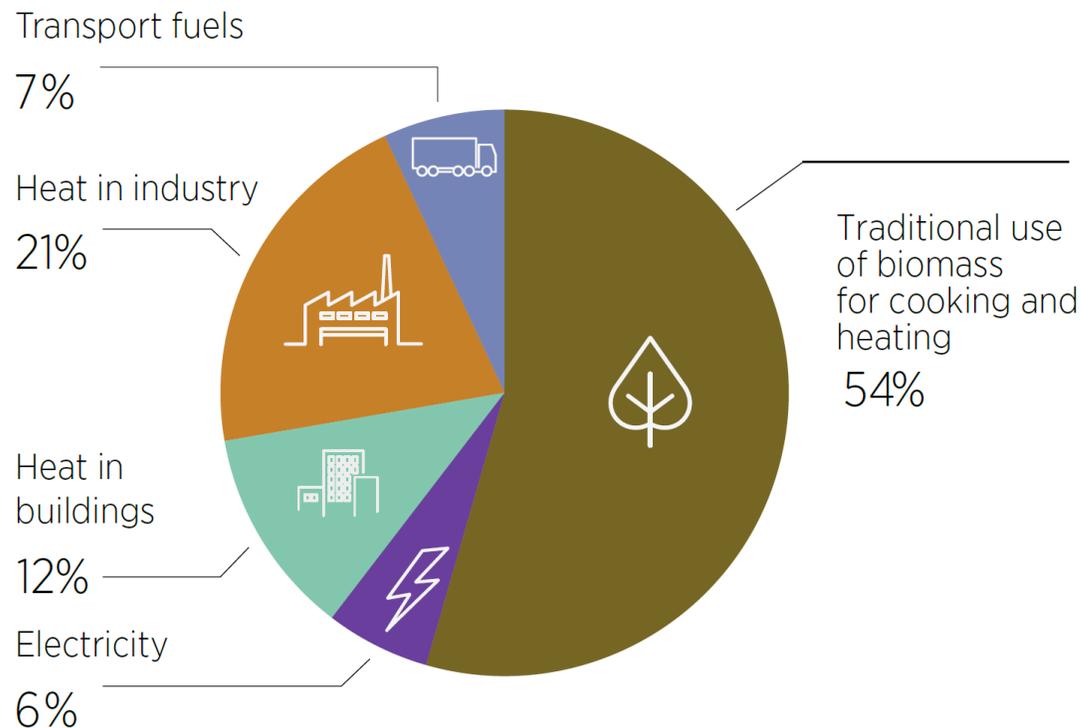


Source: IRENA



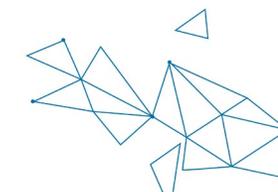
Bioenergy provided around 9% of global energy demand in 2019.

Share of global bioenergy consumption by end use, 2020



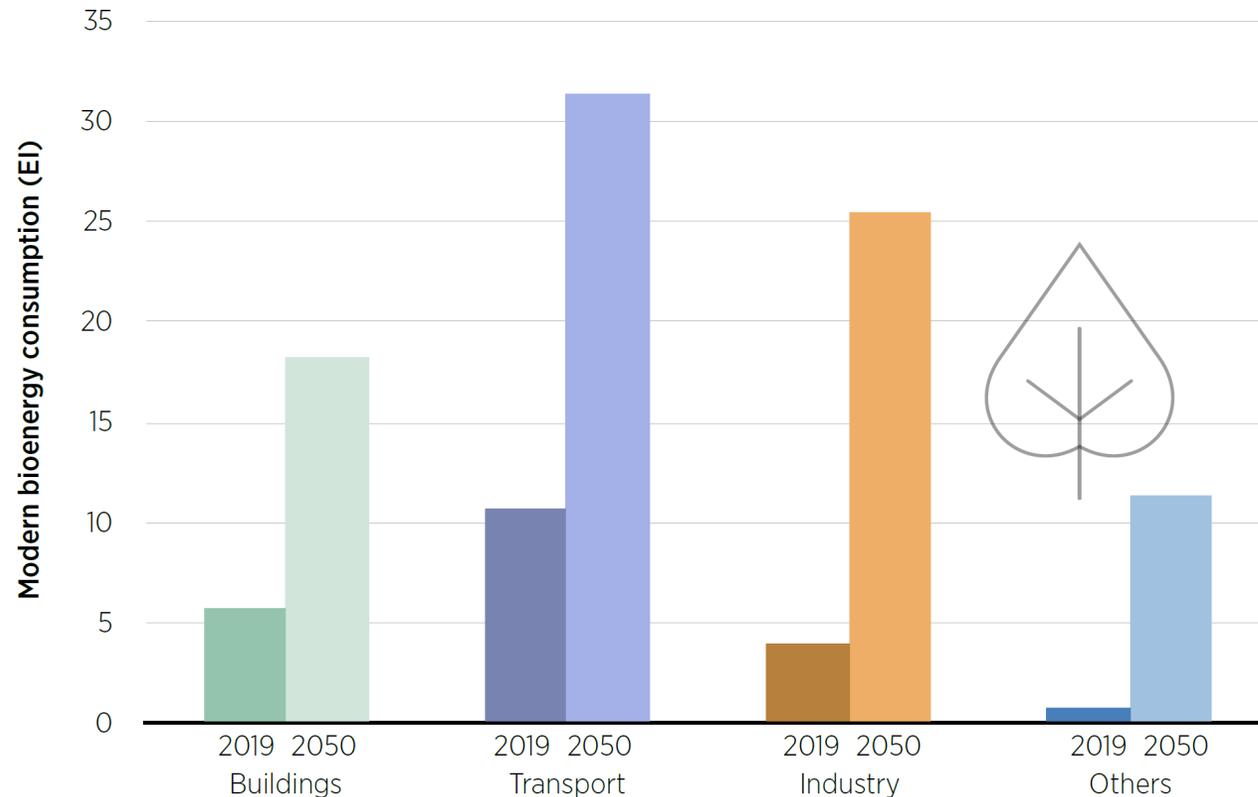
Source: IRENA, IEA

In 2020, more than 80% of bioenergy is used for cooking and heating in buildings and industry, providing 19% of total heat consumption.



# Modern bioenergy plays an important role in the global energy transition

Modern bioenergy consumption in 2019 and 2050 in IRENA's 1.5°C Scenario, by sector

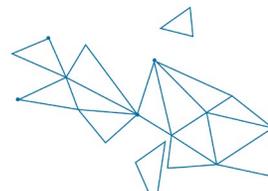


Modern bioenergy can support the decarbonisation of all sectors.

By 2050, it could provide 20% of total energy use in industry and is one of few renewable options for aviation.

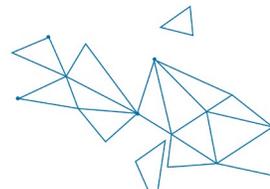
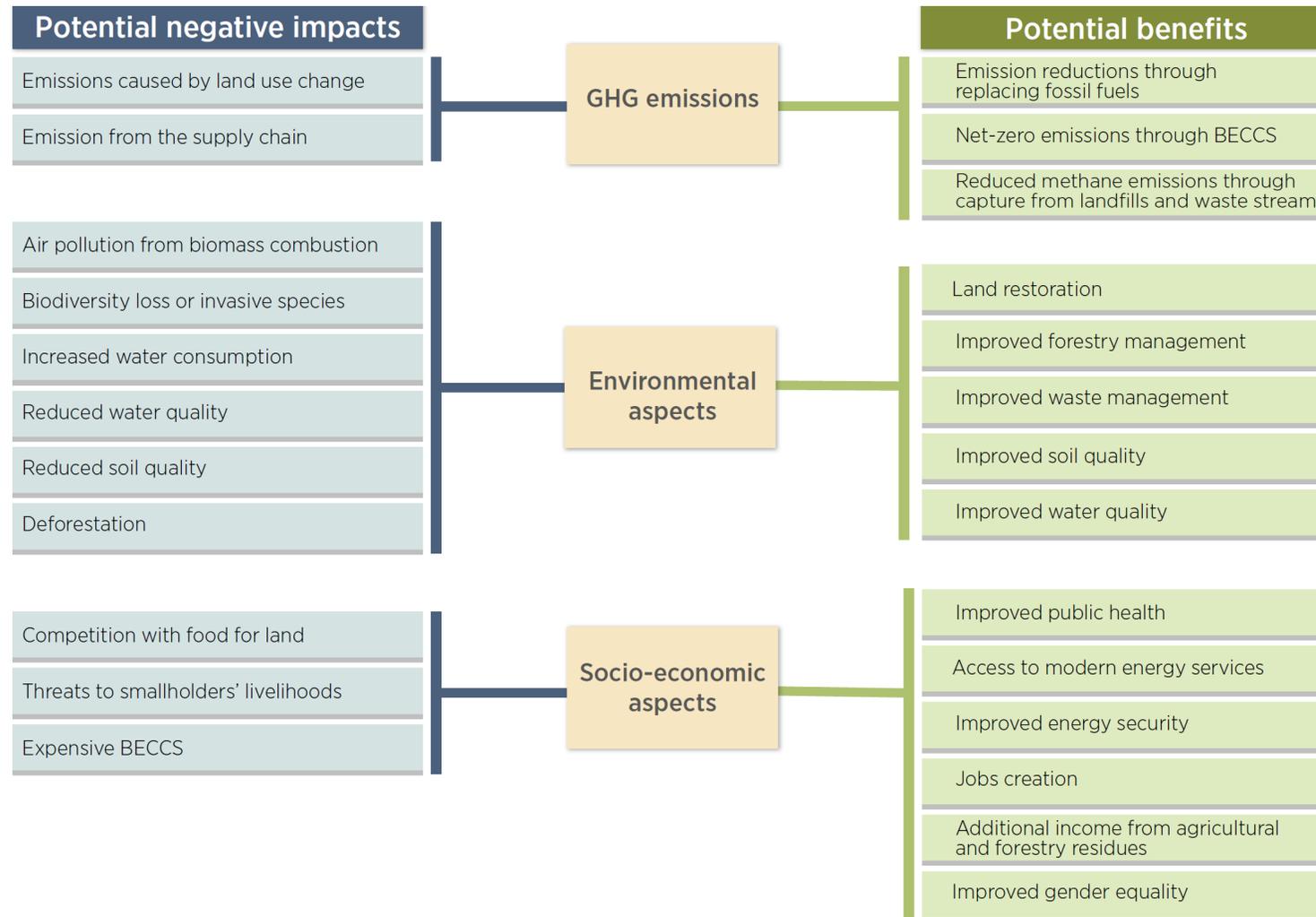
*Note: "Others" includes bioenergy for non-energy use and as chemical feedstock; EJ = exajoule.*

Source: IRENA



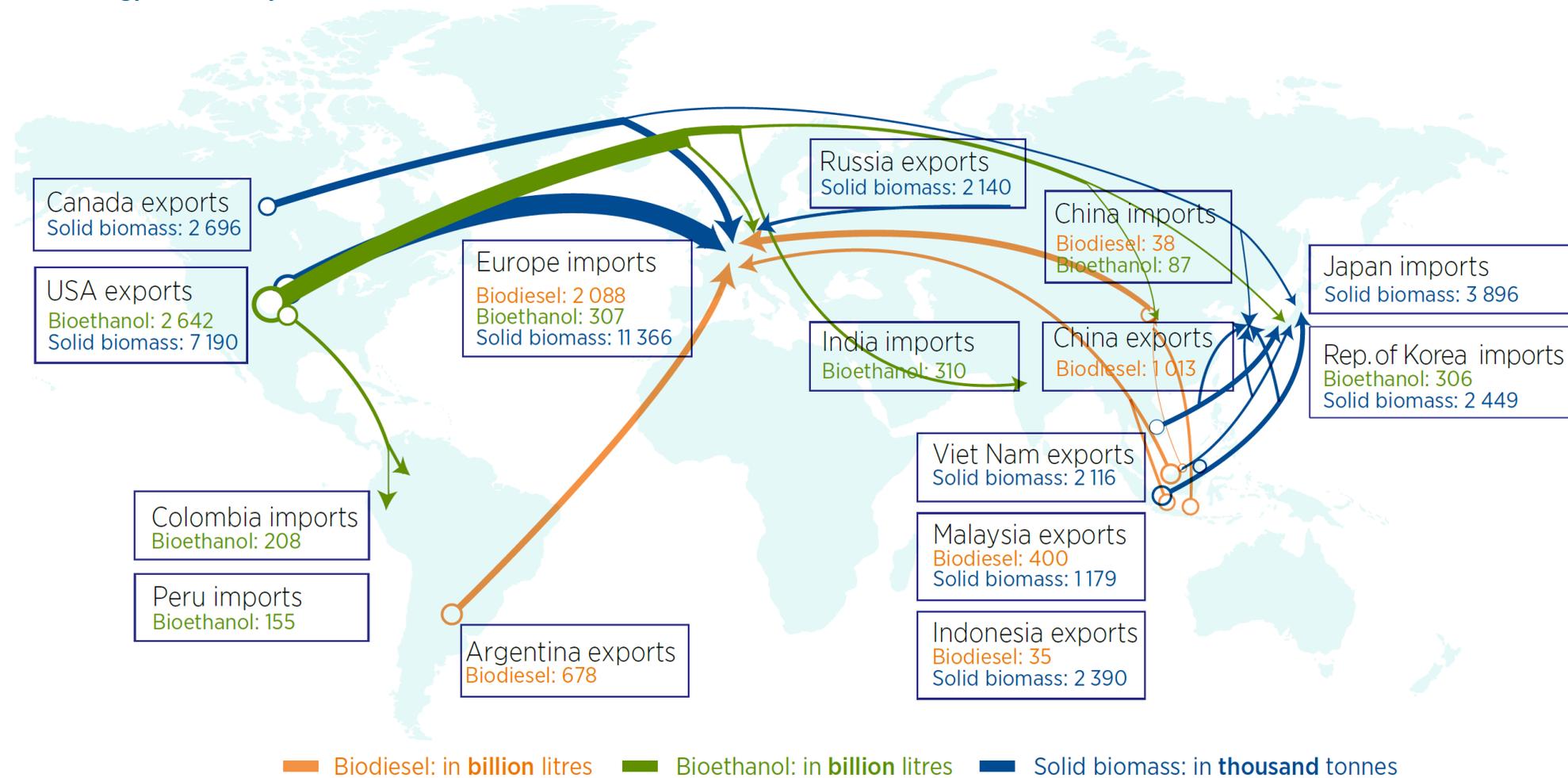
# Bioenergy sustainability is a complex topic

## Potential aspects related to bioenergy sustainability



# Wood pellets, biodiesel and bioethanol are major bioenergy commodities

Global bioenergy trade in major markets, 2020

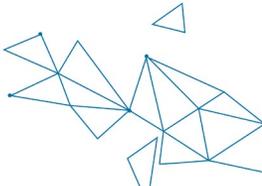
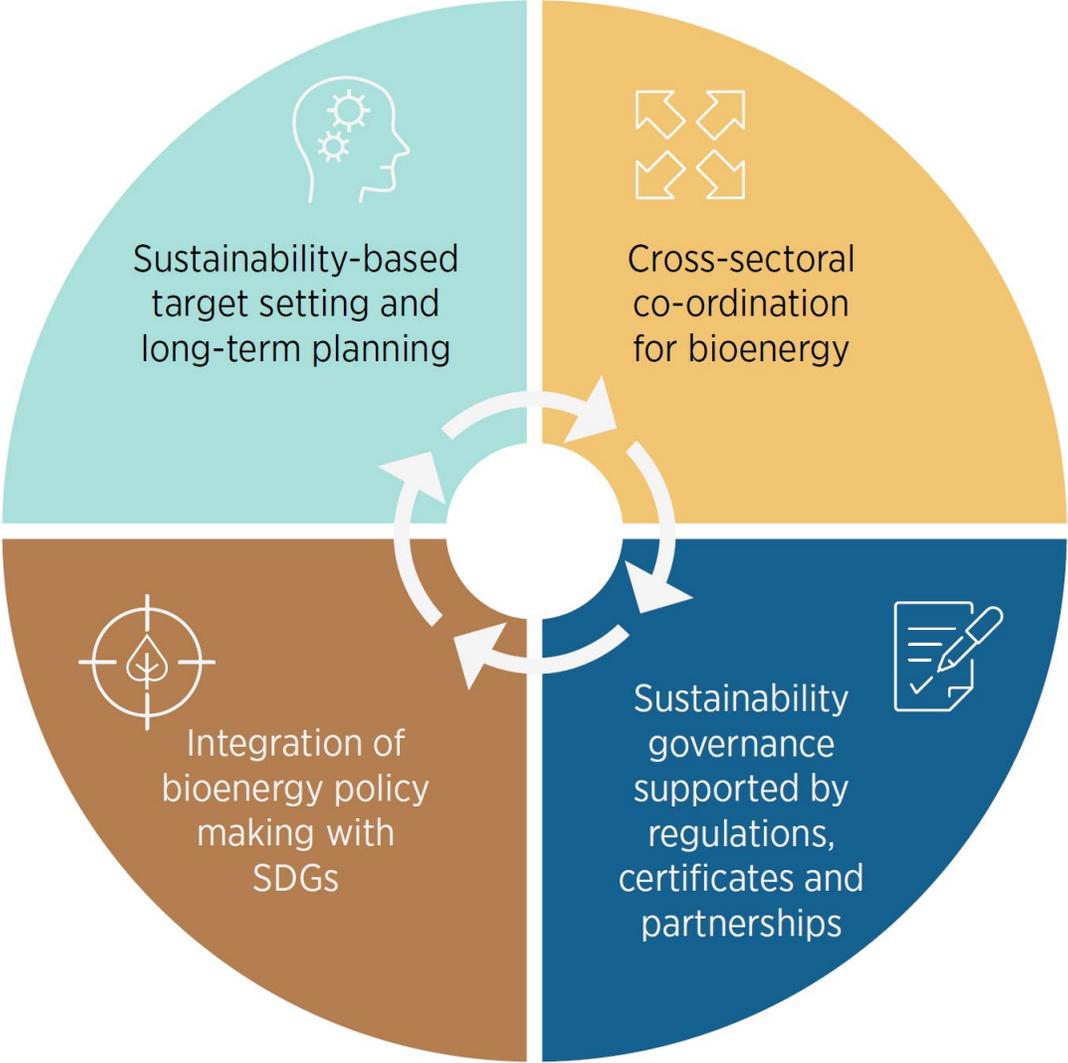


Note: The figure does not include all bioenergy trade due to limited data. Other international trade of bioenergy may exist but is not shown in this figure.

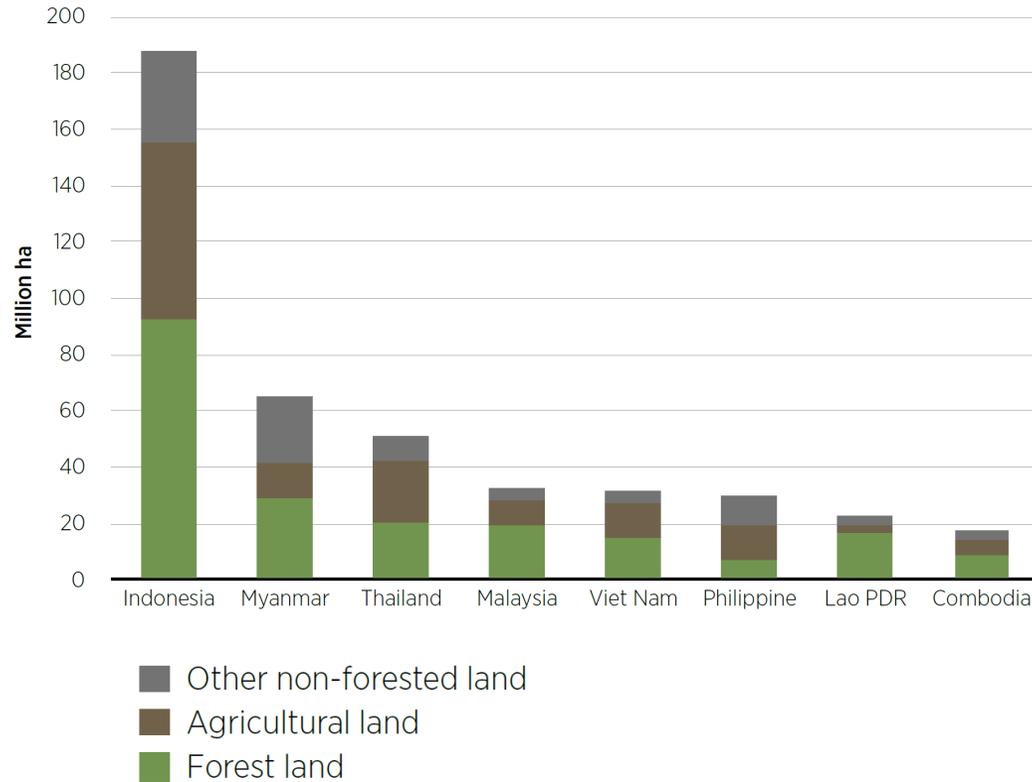
Source: IRENA analysis based on Argus, Japanese Forestry Agency, UNComtrade, and USDA



# A comprehensive policy framework is necessary to ensure sustainability

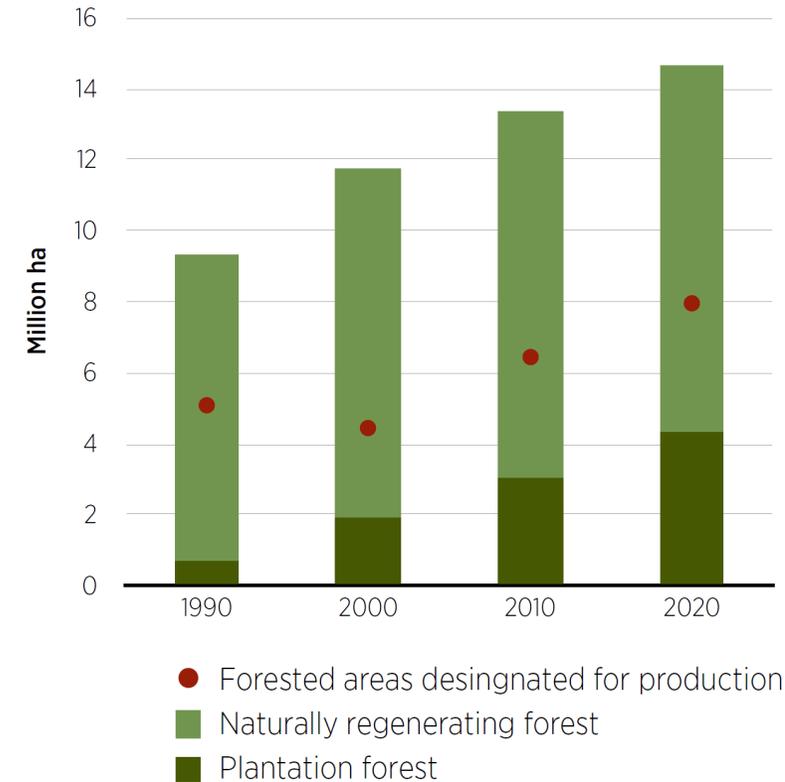


An overview of land use in some Southeast Asian countries



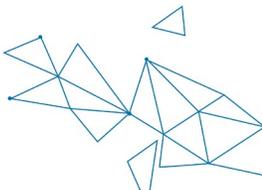
Source: FAO

Changes in forested areas in Viet Nam in 1990-2020



Source: FAO

The agriculture and forestry sectors of Southeast Asia can generate a considerable volume of residues and waste.



## Political and institutional barriers

- Policy uncertainty
- Weak institutional structures



## Financial and economic barriers

- Fossil fuel subsidies
- High cost
- Lack of access to affordable finance



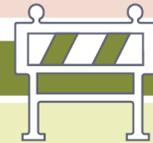
## Technical and infrastructure-related barriers

- Low-level technology readiness
- Reliability of technologies
- Lack of infrastructure



## Supply chain-related barriers

- Lack of stable feedstock
- Lack of qualified workers and skills
- Sustainability risks



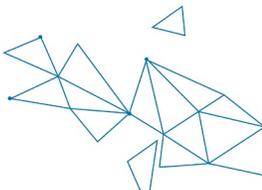
## Information and public awareness-related barriers

- Lack of reliable information
- Low public awareness



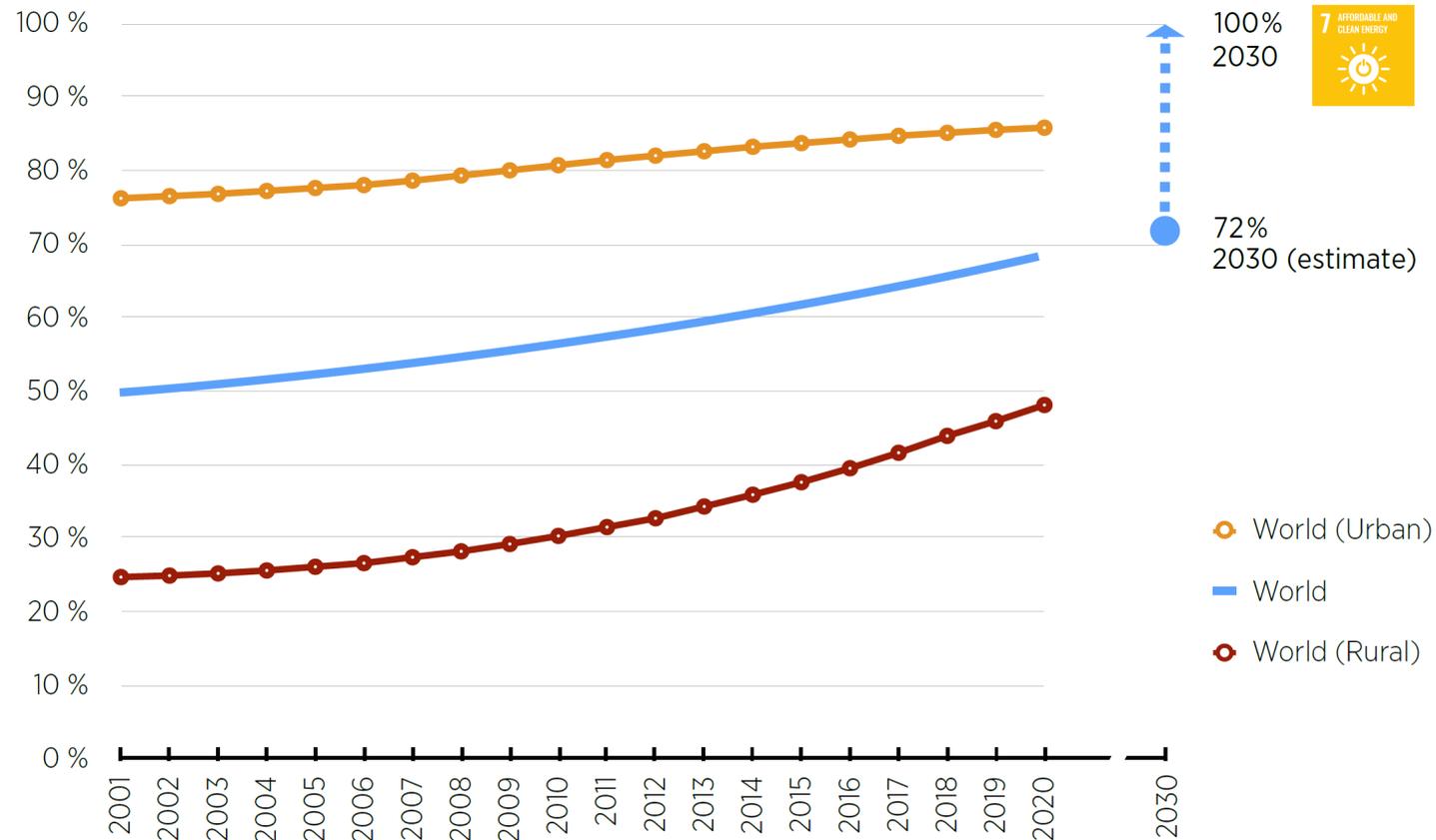
Policy uncertainty has been a main barrier to developing renewables, including bioenergy, due to the lack of long-term policy commitments and targets.

Weak supply chains are another major barrier for large-scale bioenergy projects. They also can be a reason for high production costs



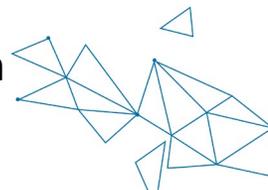
# Modern bioenergy solutions can narrow the global gap of clean cooking

Global clean cooking access rates from 2001 to 2020 and forecast to 2030



Source: IRENA, WHO

Biogas digesters have played a significant role in helping people transition from inefficient biomass to clean cooking solutions, with successful examples in China, India, Nepal and Viet Nam.



## Major pathways for modern bioenergy use in buildings

### Feedstocks

- Agricultural residues
- Forestry residues
- Processing waste
- Municipal solid waste
- Food waste
- Manures
- Sewage and other waste water

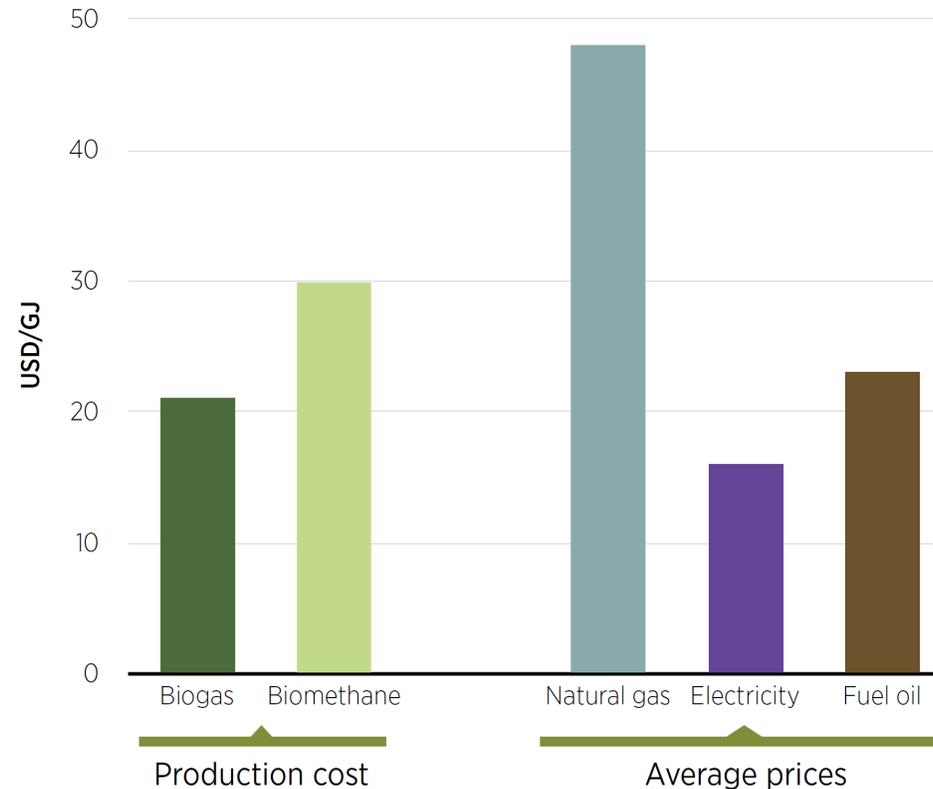
### Technologies

- Modern biomass boilers
- Small-scale biogas digesters
- Medium and large-scale biogas projects
- Biomethane injected into gas networks

### Infrastructure

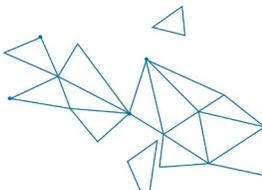
- District heating networks
- Other transportation and distribution infrastructures

Biogas and biomethane production cost and average prices of natural gas, electricity and fuel oil for residential consumers in OECD countries, 2018

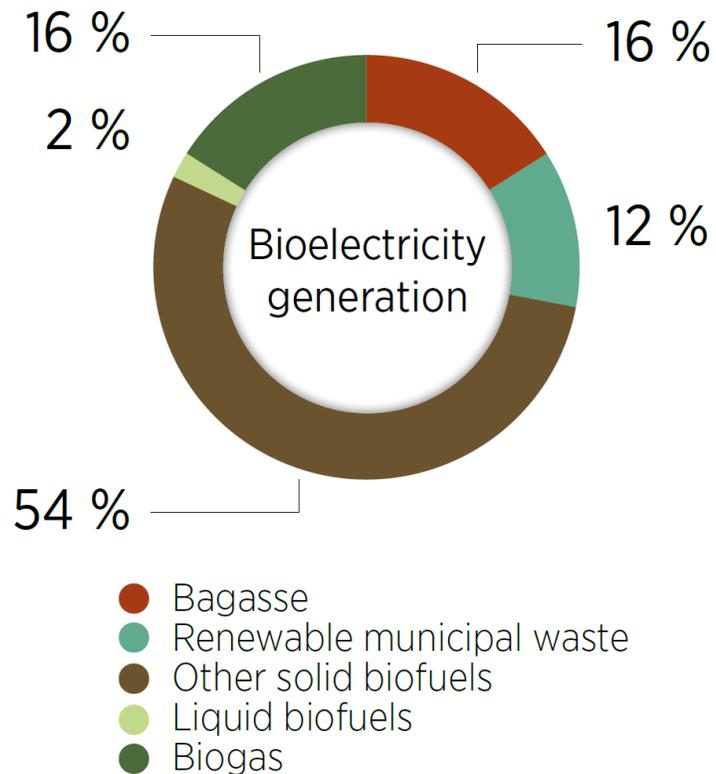


Source: IRENA, IEA, REN21

Biogas and biomethane-based heat can be competitive with fossil fuel options if low-cost feedstocks (*e.g.*, residues and waste) are available.

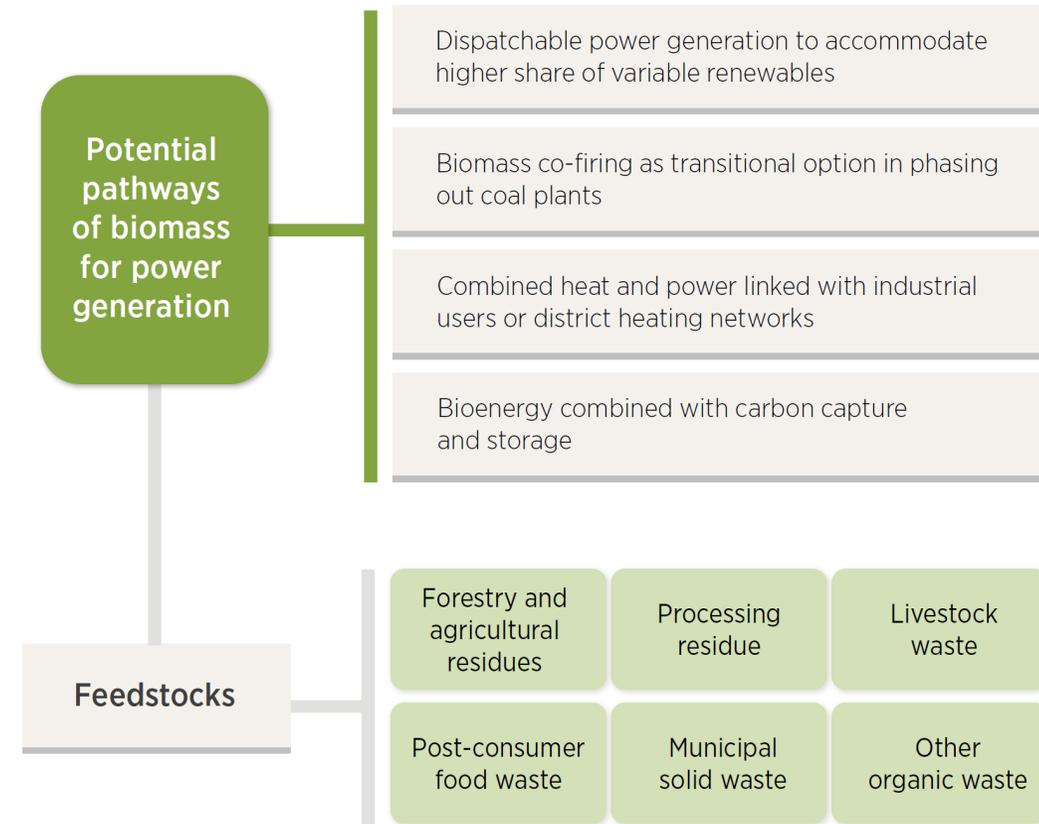


Share of biomass feedstock in total bioelectricity, 2020

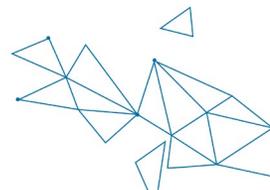


Source: IRENA, IEA

Conditions that bioenergy power generation projects need to meet to ensure prioritised use of limited biomass feedstock



Bioelectricity projects should be limited to those using low-cost residues and waste, provide dispatchable electricity, combined with heat or BECCS, or some co-firing plants.



## Potential opportunities of bioenergy for industrial decarbonisation



### Biomass to provide heat for industry

- MSW to provide heat for cement industry
- Biomass heat for biomass-based industries, including pulp and paper, sugar, food and wood production
- Bioenergy heat for other industrial processes



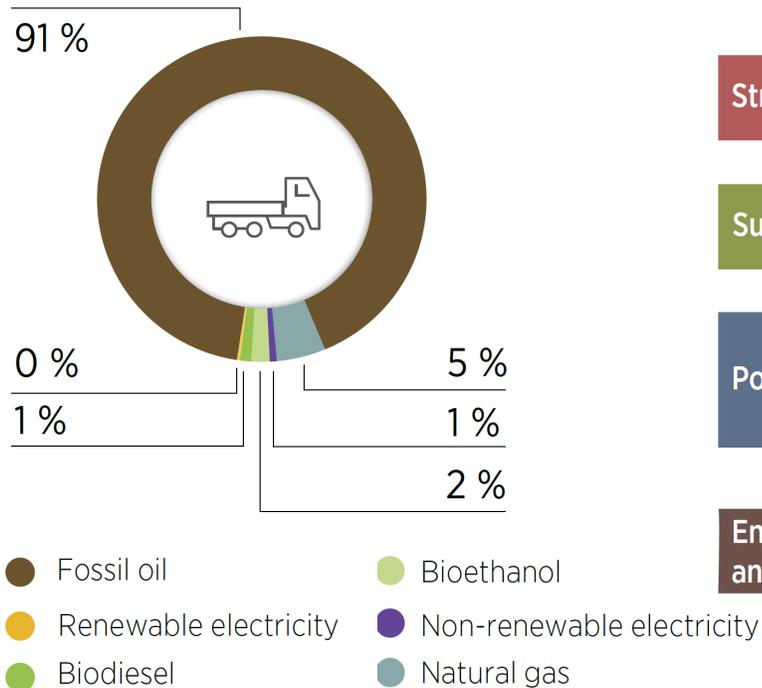
### Biomass as a feedstock for chemical and petrochemical industry

- Biomass-based plastic
- Biomethanol production
- Other high-value chemicals based on biomass-feedstocks

Bioplastic will increase from less than 1% in 2020, to around 20% of global plastic production by 2050 in the 1.5°C Scenario.

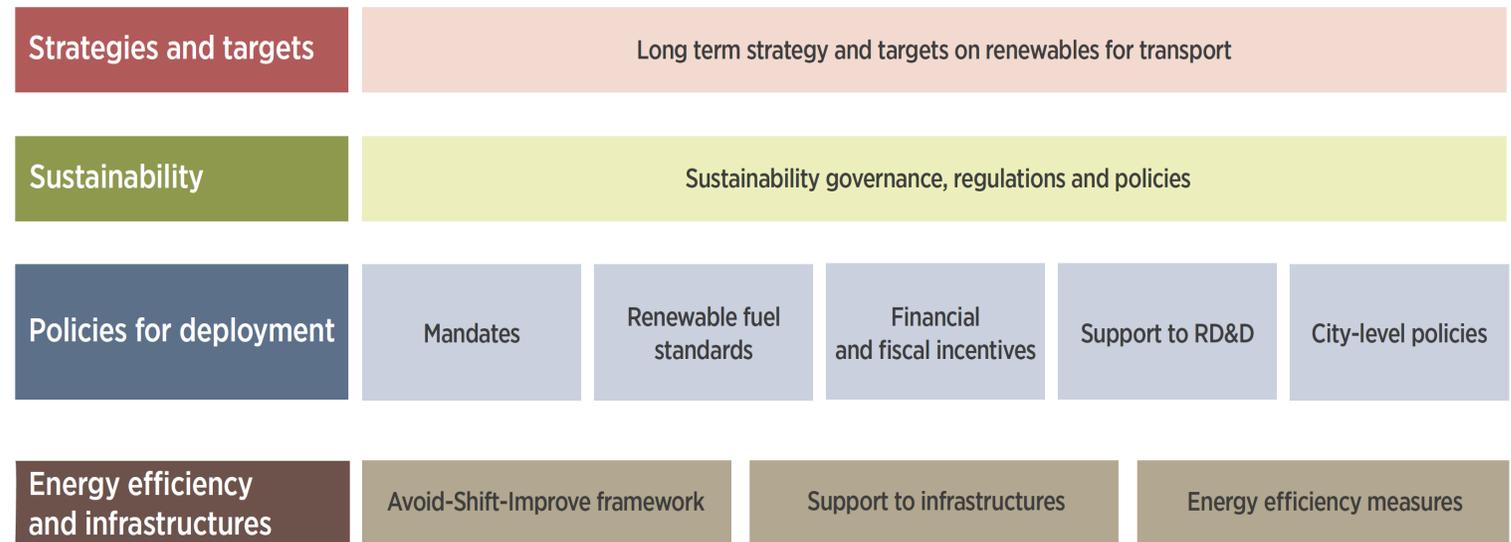


Total energy demand in transport, by fuel, 2020

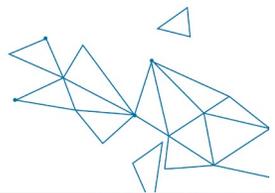


Source: IEA, REN21

Overall policy framework for deployment of renewables in transport



Bioenergy's role in the decarbonisation of transport will need to be co-ordinated with other options such as electric vehicles, green hydrogen or green ammonia.





**THANK YOU**