

Better Use of Biomass for Energy

Joint IEA RETD / IEA Bioenergy Project
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**“Greenhouse gas emissions from bioenergy systems:
impacts of timing, issues of responsibility”**

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IEA Bioenergy

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Main challenges and opportunities:

- Bioenergy for better greenhouse gas reduction
- Climate policies for better bioenergy development

Details: see Position Paper (available)

Background Report Spring 2010

Substantial options for better supply and conversion

“Good” bioenergy

- diversifies energy supply, reduces GHG emissions
- improves trade balances

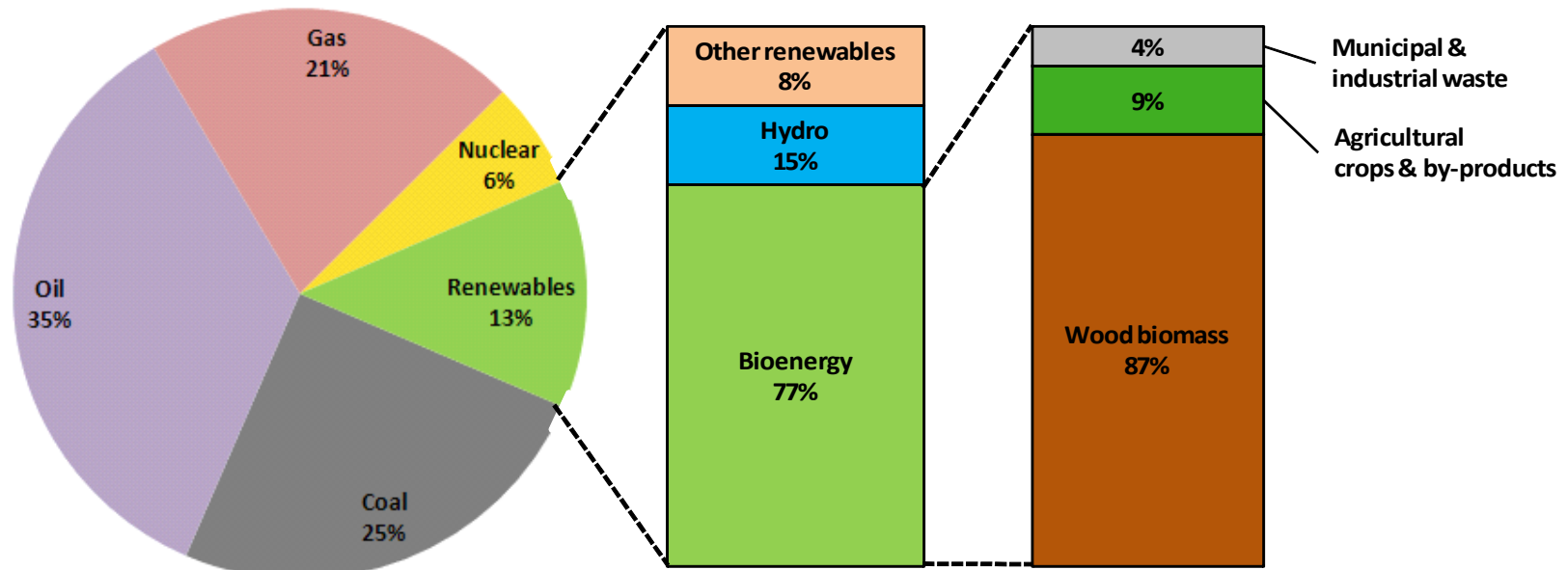
”Bad” bioenergy if **no safeguards** against

- GHG emissions, biodiversity loss
- food insecurity, overuse of water and soil

“Better” bioenergy

- increases sustainable energy
- contributes to climate change mitigation

Key: increased efficiency for cost and GHG reduction

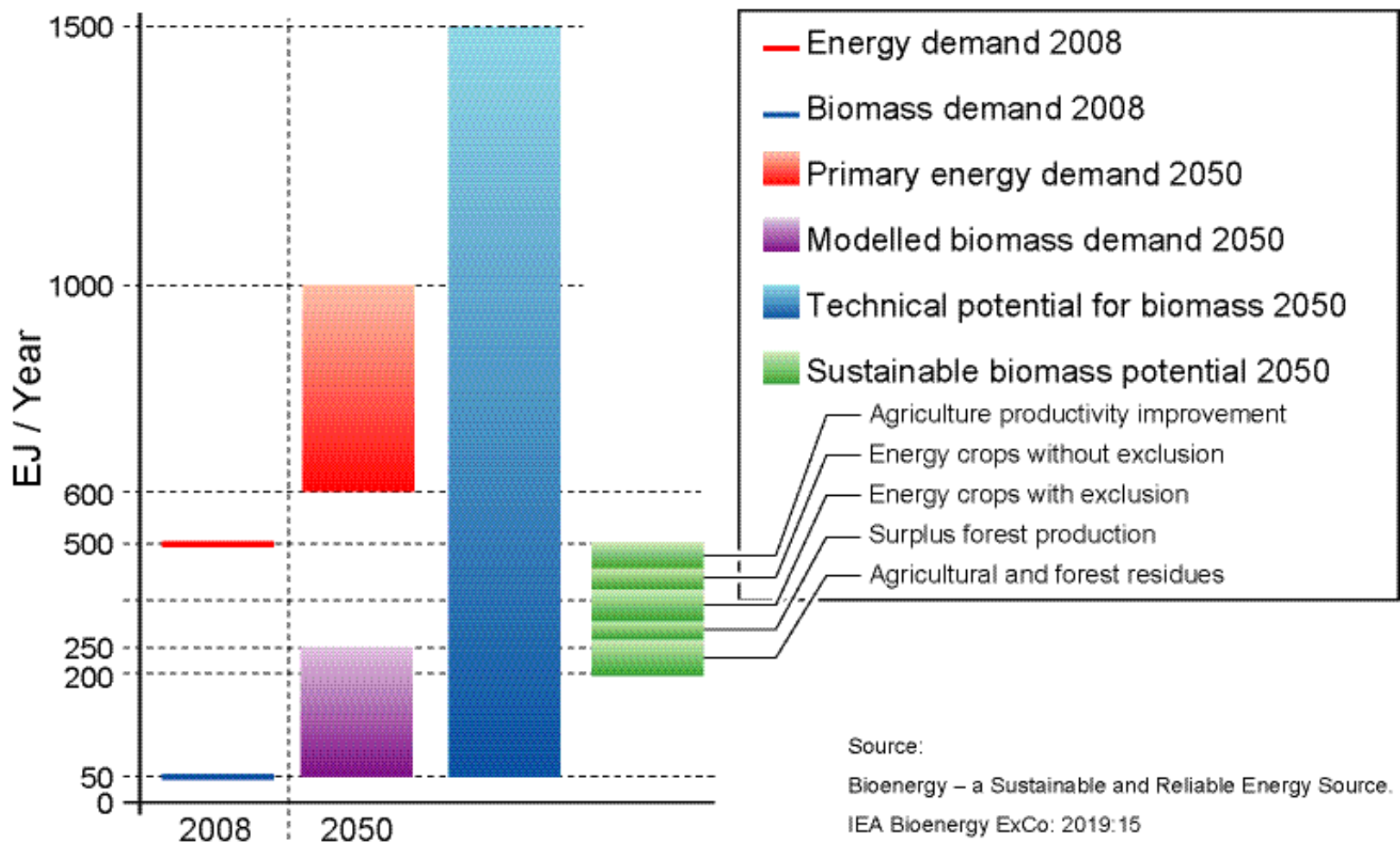


Share of Bioenergy in Today's World Primary Energy Mix

Source:
Bioenergy – a Sustainable and Reliable Energy Source. IEA Bioenergy ExCo:2009:05

Biomass supply can be increased, sustainability should be improved.

- All countries underuse bioenergy
 - global potential w/o degrading biodiversity, soils, & water: about 25 - 33% of global energy demand in 2050
- Improve sustainability: costs, GHG reduction and social impacts
 - Perennials, multiple cropping systems, agroforestry:
 - high yield, less agro-chemical inputs, biodiversity gains, improved water productivity, reduced erosion
 - Oil-bearing/lignocellulose plants on **degraded** lands
 - Land-based micro-algae need RT&D



Source:
Bioenergy – a Sustainable and Reliable Energy Source.
IEA Bioenergy ExCo: 2019:15

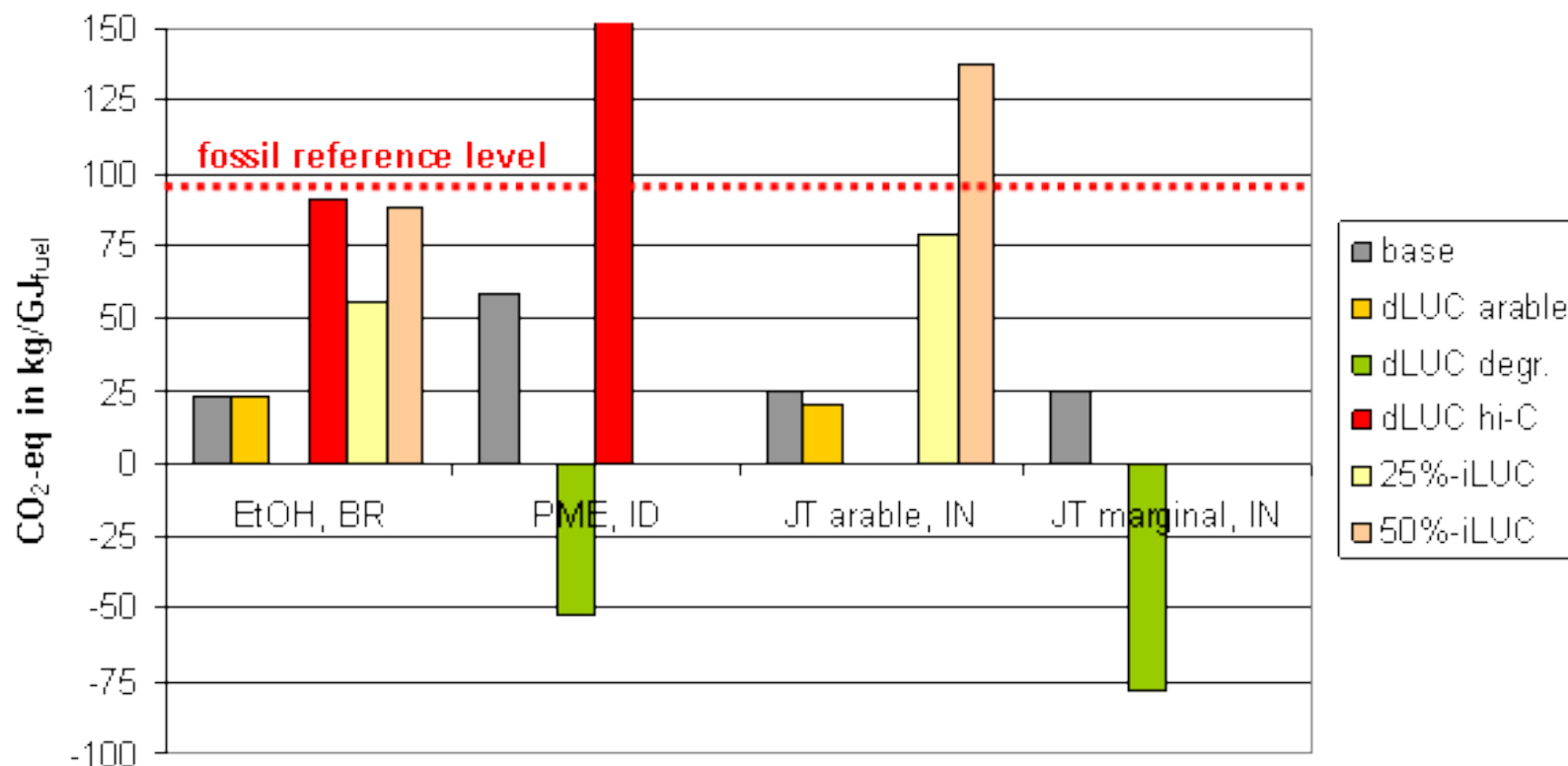
Reduce Direct and Indirect Land Use Changes

Direct land use change (LUC) effects:

- GHG certification required
- Participation of export countries required
- Progress in remote sensing, LUC monitoring

Indirect land use changes (ILUC) effects:

- Extent under debate
- May lead to significant GHG emissions
- May contribute to food insecurity
- Overall **framework for sustainable land use** needed



EtOH= bioethanol; **BR**= Brazil; **PME**= palmoil-methyl ester; **ID**= Indonesia; **JT**= Jatropha-oil; **IN**= India; **dLUC**= direct land use change; **iLUC** = direct + indirect LUC; **degr.**= degraded land with low carbon stock; **hi-C**= land with high carbon stocks

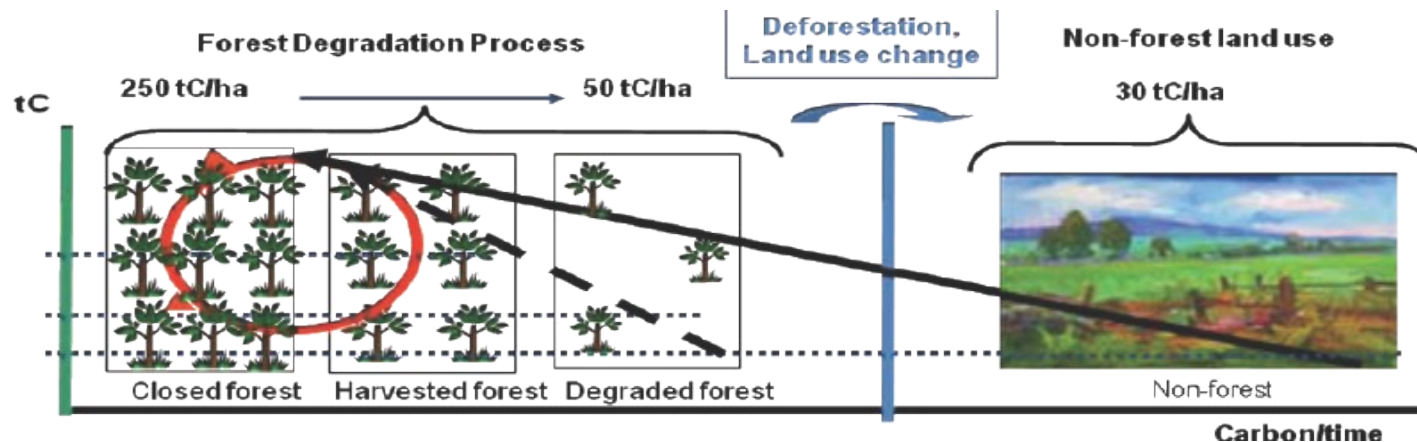
Source: Review of Bioenergy Life-Cycles: Results of Sensitivity Analysis for Biofuel GHG Emissions; UNEP DTIE, Paris 2009;

Bioenergy indirect LUC effects = direct LUC effects in food/feed/fiber/wood

- **Short-term:** minimize ILUC effects
 - use residues and wastes
 - favor high-efficient production + conversion systems
 - cultivate on underutilized, abandoned or degraded land (no competition with food, feed, fiber)
- **Medium-term:** reduce ILUC through REDD
- **Long-term:** comprehensive policy
 - Global GHG cap in UNFCCC incl. all LUC emissions
 - GHG certification for all biomass incl. direct LUC

REDD: Financial rewards for reduced emissions from deforestation and degradation

- If financially viable, deforestation could be reduced significantly
- Could reduce GHG emissions from ILUC if implemented effectively



Bioenergy can be used to aim for maximum GHG reduction

- In most countries: **best in electricity and heat**, less for transport fuels
- Up to 2050, strict climate targets might require
 - shifting to biofuels for trucks, ships and aviation
 - bioenergy with CCS to reduce atmospheric CO₂
- Cultivation of perennial crops on low-carbon land:
 - sequester atmospheric C in soils
 - reduce deforestation pressures (development alternatives, access to modern energy)

Biomass use for energy can be an important contributor to climate change mitigation

- Reduces GHG emissions
 - from land use changes and fossil fuel use
- Improves access to modern energy
- Reduces atmospheric CO₂
- Reduces sources of GHG and enhances sinks
- **Stringent climate policies drive better biomass use**
- **Better biomass use drives climate change mitigation**

- **Improve efficiency of biomass resources use**
 - Increase fossil fuels replaced
 - Increase efficiency of traditional stoves and heating, CHP
 - Invest in improved energy efficiency
- **Maximize GHG emission reduction**
 - Demand minimum GHG reduction
 - Provide incentives to reduce more emissions
 - Favor waste and residues, prevent/limit use of arable and grassland
- **Optimize biomass contribution to security of supply**
 - Reduced oil dependence: next generation biofuels + electric vehicles
 - If aim is secure gas supply: biomethane
 - Reduce risks/impacts of fluctuating biomass price and availability
- **Avoid competition with food, feed and fiber**
 - Cultivation on land set free from higher agricultural yields
 - Cascade use of residues and wastes
 - Develop bioenergy and global food security strategies jointly

Critical milestones mark key “breakthroughs” needed to forward better use

Near-term: regulation and incentives

- Harmonizing sustainability standards for biomass trade (GHG incl. LUC, biodiversity, social)
- Shifting towards advanced cropping systems (perennials on abandoned/degraded lands, agroforestry)
- Waste recycling, “cascading” use of biomaterials

Medium/longer-term: RT&D

- Next generation conversion, biorefineries, CCS for bioenergy plants
- Improve land-based algae production and conversion
- E-vehicles with bioelectricity

Better policy is needed to establish and disseminate better practices

- **Policy support *only* when demonstrating**
 - reducing net GHG emissions
 - maintaining biodiversity
 - energy security
 - and low social tradeoffs
- **Performance-based incentives**
 - proportional to the benefits delivered



THANK YOU

For additional information on the BUBE project:

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