

Biomass under the Energy Taxation Directive

Working paper

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Concerns: pricing in external costs from biomass burning through the Energy Taxation Directive

1. Problem statement

Since the introduction of the Renewable Electricity Directive (2001), EU Member States (MS) **have increasingly relied on the burning of solid biomass (mostly wood)** for renewable energy production. Especially the increased use of wood for heating in the last years has exceeded MS projections.¹ Today, wood burning represents around 40 per cent of the EU's renewables mix.

Biomass is an atypical form of renewable energy, in the sense that it relies on burning carbon and a limited natural resource. As such, **it is associated with relatively high external costs**, notably from greenhouse-gas emissions, and air pollution and related health costs (see Annex A).² At the moment, **these external costs are not effectively mitigated through existing policies, 'priced in'** (e.g. through the EU Emissions Trading System / the carbon accounting framework) **or considered in state aid assessments**.³ A review of the National Energy and Climate Plans (NECPs) has also shown MS do not adequately assess the negative costs of increased biomass use.⁴ At the same time, the current EU Energy Taxation Directive allows for biomass to benefit from certain tax exemptions.⁵ This reveals an important discrepancy in EU policy, which contradicts the polluter-pays principle and may cause that **external costs from biomass burning come at the expense of citizens**, both in terms of direct impacts and costs (e.g. individual health) as indirectly by increased costs or pressure on national budgets (additional to possible public support for biomass use). Not pricing in externalities **may also cause distortions** in the energy- or raw materials market.

The Commission is now reviewing a set of climate-regulations in the light of the EU's increased ambition to reduce greenhouse-gas emissions towards 2030, including the Renewable Energy Directive (REDII), the Effort Sharing Regulation, the EU Emissions Trading System (EU-ETS) and the Land Use- Land Use Change- and Forestry (LULUCF) Regulation. In this context, the Commission is urged to, in line with NGO asks, revise the REDII to restrict biomass use in terms of scale, feedstock

¹ National Renewable Energy Action Plan and ETC/CME 7/2020, [Renewable Energy in Europe 2020](#) – recent growth and knock-on effects.

² Report on [External costs \(EU Commission \(Trinomics\), 2020\)](#).

³ L. Zuidema (EUI Cadmus, 2020), [State aid for solid biomass, the case for improved scrutiny](#); R. Matthews (Forest Research, 2020), the LULUCF Regulation: [Help or hindrance to sustainable forest biomass use?](#)

⁴ (forthcoming) Report *Analysis on biomass in National Energy and Climate Plans* (Trinomics, 2021).

⁵ Notably under Article 15 and 16 of the Energy Taxation Directive.

use and end-use, and ensure biomass emissions are fully accounted for under the LULUCF framework.⁶

However, while it should be a priority for the Commission to ensure bioenergy sustainability through the REDII and radically restrict the use of primary wood for energy, we'd like to point the Commission to the need of **deploying the Energy Taxation Directive to ensure that all external costs from remaining bioenergy use are effectively priced-in.**

2. Scope for revision Energy Taxation Directive

In the light of the ongoing revision of the Energy Taxation Directive, we advise the Commission to:

- **Discontinue all non-CO₂ tax exemptions** (e.g., energy content tax) **for biomass energy** or boilers, to ensure that the tax rate is consistent for biomass and other forms of energy, in respectively heating and electricity.
- **Include a differentiation for CO₂ tax based on relative carbon payback times and likelihood of distortion** in the raw material market*, taking into consideration type of feedstock used and end-use efficiencies. The tax may be lower when there are no significant distortions in the market or no loss of forest carbon sink. A higher tax rate should be applied to the use of primary wood and those secondary resources that are used for material products, which have a higher risk of leading to negative impacts on forest carbon sinks and distortion in the raw material market, respectively.
- **Prioritise the polluter-pays principle** to effectively price in other external costs, notably those associated with air pollution and health costs, to make the industry internalize these costs and prevent they are borne by society at large.

**Justification for differentiation based on carbon payback times and likelihood of competition.*

Burning wood leads to more CO₂ emissions compared to burning coal per unit of energy generated. There is scientific consensus that in the case of forest biomass, the assumption of carbon neutrality is not valid, and that its use can increase greenhouse gas emissions for a substantial amount of time (beyond timeframes relevant for climate change mitigation).⁷ The net carbon impacts may vary dependent on a variety of factors, including feedstock used and end use efficiencies.⁸ In particular the use of primary wood is associated with higher emissions because of possible negative impacts on forest carbon sinks. The use of secondary resources generally has a better climate outcome but is associated with a higher competition in the forest-based sector.⁹ NB the biogenic emissions (harvest/combustion) or emissions from possible 'leakage effects' are not taken into consideration by the GHG savings methodology enshrined in the REDII.

⁶ See, e.g., '[A new EU sustainable bioenergy policy, proposal to regulate bioenergy production and use in the EU's renewable energy policy framework 2020-2030](#)' (2016).

⁷ [Impact Assessment Sustainability of Bioenergy](#) SWD(2016) 418; EASAC Commentary on carbon neutrality (2018).

⁸ [Review of literature on biogenic carbon and LCA of forest bioenergy](#) (Forest Research, 2014).

⁹ [Biomass production, supply, uses and flows in the EU](#) (European Union, Joint Research Centre, 2018).

Annex A – external costs biomass

A. Estimated external costs RES

B. Greenhouse gas emissions

C. Air pollution

A. Estimated external costs RES

Even without the full consideration of biogenic carbon emissions (those associated with the harvesting or burning of biomass resource – see Figures 1 and 2 below), the external costs associated with solid biomass use are significantly higher than those from other forms of renewable energy and nuclear, and comparable to those of gas (see table 1).

Table 1: EU27 average (production weighed) external cost of electricity and heating per technology in EUR2018/MWh

Technology	EUR/MWh
Electricity	
Natural gas	68
Nuclear	15
Biomass	52
Solar PV	14
Wind offshore	3
Hydropower	3
Geothermal	8
Heating	
Domestic gas boiler	36
Domestic oil boiler	51
Domestic wood pellet boiler	174
Domestic heat pump	36
Domestic solar thermal	24
CHP gas	35
CHP biomass	38

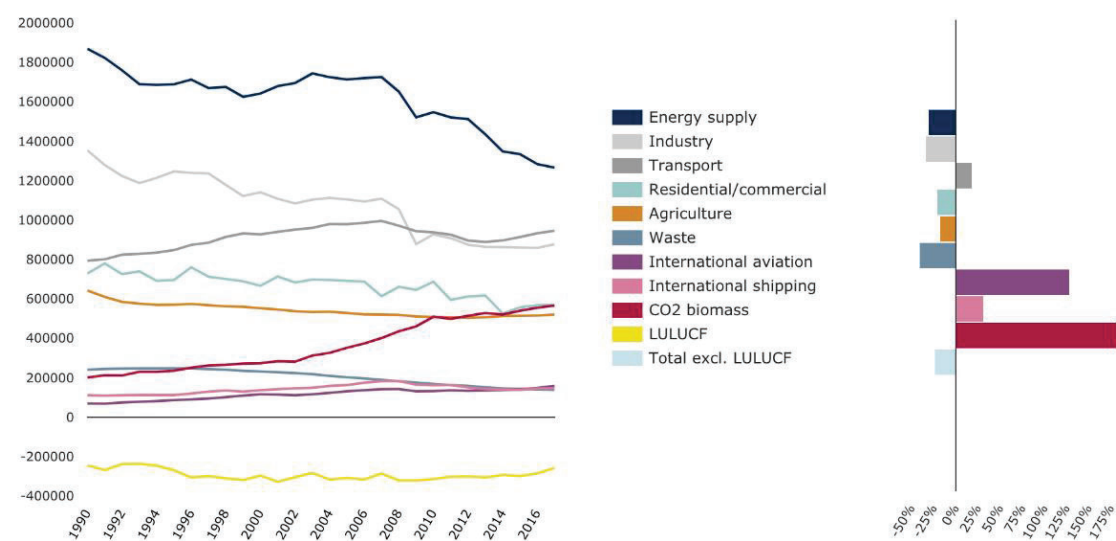
Source: Trinomics (2020)¹⁰

B. Greenhouse gas emissions

Emissions in the energy sector (reported as a memo item) from biomass combustion between 1990 and 2016 are shown in Figure 1. Between 2005 and 2016 these emissions increased from 352 MtCO₂ to 566 MtCO₂, exceeding emission levels from the agricultural sector. This data includes all biomass use for heating, electricity, and transport, but excludes small CHP and domestic use, and can therefore not easily be compared to the emissions reduction from avoided fossil use. However, from the latest United Nations Framework Convention on Climate Change (UNFCCC) report we conclude that most of this increase was due to the growth in biomass use in the public electricity and heating sector – close to 200 MtCO₂eq between 1990 and 2018 (see correlating lines in Figure 1 and Figure 2).

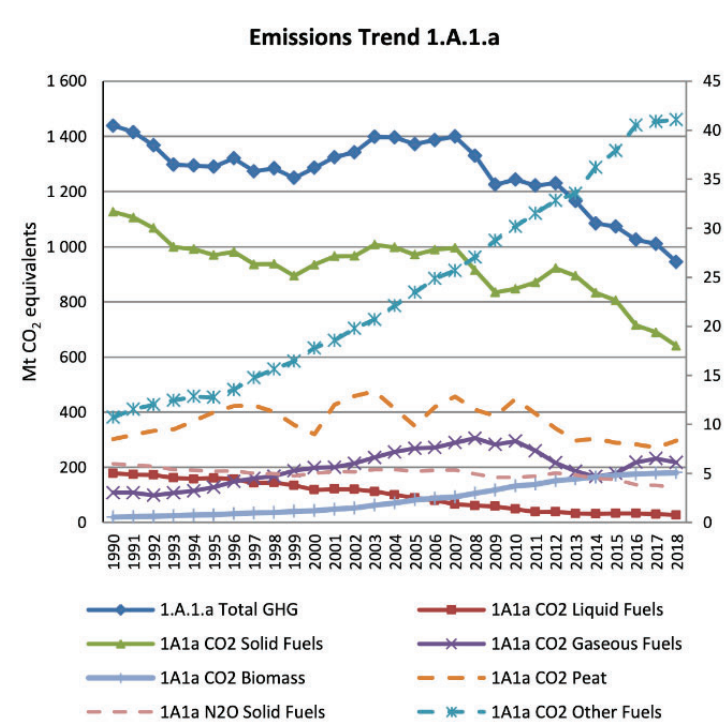
¹⁰ Report on [External costs \(EU Commission \(Trinomics\), 2020\)](#).

Figure 1: Greenhouse gas emissions by aggregated sector in kilotonnes of CO₂eq



Source: European Environment Agency (EEA, Report No 15/2019).

Figure 2: Public Electricity and Heat production: Total, CO₂ and N₂O emission trends



Source: Annual EU greenhouse-gas inventory 1990-2018 and inventory report 2020, submission to the UNFCCC (EEA, 2020).

C. Air pollution

Burning wood leads to significant air pollution. While renewables overall improved air quality, biomass burning increased pollution since 2005.¹¹ This is concerning, since air pollution is considered the biggest environmental risk to health in the EU and associated with significant costs.

The RED (2009) does not provide for a specific mitigation policy for air pollution from biomass and relies on existing ambient air quality standards, national emission reduction commitments and emission and energy efficiency standards for key sources of pollution (requirements for eco-design and combustion plants). While these may certainly mitigate pollution, it is unlikely to be adequate, considering the effect of the RED's incentives for increased biomass use. The EEA speaks of a policy gap and a trade-off between climate and air pollution policies, pointing at the negative impact on air quality from the increased combustion of biomass without adequate emission controls.¹² A report by the Court of Auditors indicates that the RED does not sufficiently reflect the importance of air pollution."¹³

The Impact Assessment for the REDII recognises that the impact of biomass burning on air pollution is a matter of scale of deployment but indicates that *"given the fact that air pollution from biomass is specifically addressed through other EU measures and regulations, it is not considered appropriate to set specific requirements in the context of this policy initiative."*

Electricity

Particulate matter from solid biomass burning for electricity increased 77 per cent between 2005 and 2018 (see Figure 3).¹⁴

Figure 3: Annual life cycle impacts associated with gross electricity production

¹¹ EEA briefing No 13/2019: Renewable Energy in Europe: key for climate objectives but air pollution needs attention.

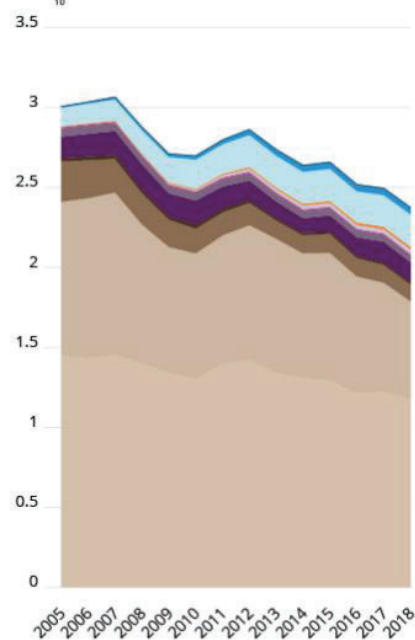
¹² Report by the European Environmental Agency (2019). Air quality in Europe – 2019 report. (EEA, Report No 10/2019).

¹³ European Court of Auditors (2018). Air pollution: Our health still insufficiently protected (European Court of Auditors, Special Report No 23/2018).

¹⁴ From 0.115MtPM_{10e} in 2005 to 0.203MtPM_{10e} in 2018.

Particulate matter formation potential

MtPM₁₀e



Biodegradable municipal solid waste
 Non-biodegradable municipal solid waste
 Biogas
 Biomass
 Geothermal
 Offshore wind
 Onshore wind
 Concentrated solar power
 Solar PV
 Hydro
 Nuclear
 Natural gas
 Peat
 Oil
 Hard coal
 Brown coal

Source: European Environmental Agency, [briefing](#) (2021).

Heating

In the heating sector, where biomass has a dominant role, all key air pollutant emissions have increased, except SO₂. This is predominantly contributable to burning solid biomass which accounts for around 80 per cent of renewable heating in the EU.

Table 2:

Table 8	Estimated effect on NO _x emissions in the EU (kt)						
	2005	2010	2015	2016	2017	2018	Proxy 2019
RES-E	0,0	-25,6	-49,4	-52,2	-57,2	-61,6	-67,9
RES-H/C	0,0	24,9	19,8	19,3	21,7	18,0	19,4
All RES	0,0	-0,8	-29,6	-32,9	-35,5	-43,7	-48,6
National Total (EEA, July 2020)	10 504	8 409	7 037	6 828	6 707	6 444	N.A.

Sources: ETC/CME, (IIASA 2017), (Eurostat 2020a), (Eurostat 2020e).

Table 9 Estimated effect on PM10 emissions in the EU (kt)

	2005	2010	2015	2016	2017	2018	Proxy 2019
RES-E	0,0	-1,2	-2,4	-2,4	-2,4	-2,4	-2,6
RES-H/C	0,0	127,7	116,7	125,6	134,5	124,2	128,8
All RES	0,0	126,5	114,3	123,2	132,0	121,8	126,3
National Total (EEA, July 2020)	2 397	2 178	1 883	1 855	1 857	1 812	N.A.

Sources: ETC/CME, (IIASA 2017), (Eurostat 2020a), (Eurostat 2020e).

Table 10 Estimated effect on PM2.5 emissions in the EU (kt)

	2005	2010	2015	2016	2017	2018	Proxy 2019
RES-E	0,0	-0,6	-1,7	-1,7	-1,8	-1,8	-1,9
RES-H/C	0,0	124,6	114,1	122,9	131,6	121,7	126,2
All RES	0,0	124,0	112,4	121,2	129,8	119,9	124,3
National Total (EEA, July 2020)	1 551	1 440	1 214	1 197	1 199	1 147	N.A.

Sources: ETC/CME, (IIASA 2017), (Eurostat 2020a), (Eurostat 2020e).

Table 12 Estimated effect on VOC emissions in the EU (kt)

	2005	2010	2015	2016	2017	2018	Proxy 2019
RES-E	0,0	4,0	13,3	13,6	13,6	13,4	13,5
RES-H/C	0,0	232,8	223,9	242,0	255,1	233,4	242,3
All RES	0,0	236,8	237,1	255,5	268,7	246,8	255,9
National Total (EEA, July 2020)	8 785	7 400	6 333	6 306	6 362	6 208	N.A.

Sources: ETC/CME, (IIASA 2017), (Eurostat 2020a), (Eurostat 2020e).

Source: ETC/CME 7/2020.