System KZR INiG /8.1

Default values and disaggregated default values for biofuels and bioliquids and biomass fuels

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1. Default values and disaggregated default values for biofuels and bioliquids

1.1. Default values for biofuels and bioliquids

Biofuel production pathway	Greenhouse gas emissions saving – typical value	Greenhouse gas emissions saving – default value
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	67 %	59 %
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	77 %	73 %
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant (*))	73 %	68 %
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant (*))	79 %	76 %
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant (*))	58 %	47 %
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant (*))	71 %	64 %
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	48 %	40 %
corn (maize) ethanol, (natural gas as process fuel in CHP plant (*))	55 %	48 %
corn (maize) ethanol (lignite as process fuel in CHP plant (*))	40 %	28 %
corn (maize) ethanol (forest residues as process fuel in CHP plant (*))	69 %	68 %
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	47 %	38 %
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant (*))	53 %	46 %
other cereals excluding maize ethanol (lignite as process fuel in CHP plant (*))	37 %	24 %
other cereals excluding maize ethanol (forest residues as process fuel in CHP plant (*))	67 %	67 %
sugar cane ethanol	70 %	70 %
the part from renewable sources of ethyl-tert-butyl-ether (ETBE)	Equal to that of the ethanol production pathway used	
the part from renewable sources of tertiary-amyl-ethyl-ether (TAEE)	Equal to that of the ethanol production pathway used	
rape seed biodiesel	52 %	47 %
sunflower biodiesel	57 %	52 %
soybean biodiesel	55 %	50 %
palm oil biodiesel (open effluent pond)	32 %	19 %
palm oil biodiesel (process with methane capture at oil mill)	51 %	45 %
waste cooking oil biodiesel	88 %	84 %
animal fats from rendering biodiesel (**)	84 %	78 %
hydrotreated vegetable oil from rape seed	51 %	47 %
hydrotreated vegetable oil from sunflower	58 %	54 %
hydrotreated vegetable oil from soybean	55 %	51 %

hydrotreated vegetable oil from palm oil (open effluent pond)	34 %	22 %
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	53 %	49 %
hydrotreated oil from waste cooking oil	87 %	83 %
hydrotreated oil from animal fats from rendering (**)	83 %	77 %
pure vegetable oil from rape seed	59 %	57 %
pure vegetable oil from sunflower	65 %	64 %
pure vegetable oil from soybean	63 %	61 %
pure vegetable oil from palm oil (open effluent pond)	40 %	30 %
pure vegetable oil from palm oil (process with methane capture at oil mill)	59 %	57 %
pure oil from waste cooking oil	98 %	98 %
(*) Default values for processes using CHP are valid only if all the process heat is supplied by CHP. (**)Applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009 of the European Parliament and of the Council (1), for which emissions related to hygenisation as part of the rendering are not considered.		

ESTIMATED TYPICAL AND DEFAULT VALUES FOR FUTURE BIOFUELS THAT WERE NOT ON THE MARKET OR WERE ON THE MARKET ONLY IN NEGLIGIBLE QUANTITIES IN 2016, IF PRODUCED WITH NO NET CARBON EMISSIONS FROM LAND-USE CHANGE

Biofuel production pathway	**Greenhouse gas emissions saving - typical value**	**Greenhouse gas emissions saving - default value**
wheat straw ethanol	85 %	83 %
waste wood Fischer-Tropsch diesel in free-standing plant	85 %	85 %
farmed wood Fischer-Tropsch diesel in free-standing plant	82 %	82 %
waste wood Fischer-Tropsch petrol in free-standing plant	85 %	85 %
farmed wood Fischer-Tropsch petrol in free-standing plant	82 %	82 %
waste wood dimethylether (DME) in free-standing plant	86 %	86%
farmed wood dimethylether (DME) in free-standing plant	83 %	83 %
waste wood methanol in free-standing plant	86 %	86 %
farmed wood methanol in free-standing plant	83 %	83 %
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	89 %	89 %
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	89 %	89 %
dimethylether (DME) from black-liquor gasification integrated with pulp mill	89 %	89 %
methanol from black-liquor gasification integrated with pulp mill	89 %	89 %
the part from renewable sources of methyl-tertio-butyl-ether (MTBE)	Equal to that of the methanol production pathway used	

1.2. Disaggreagted default values for biofuels and bioliquids

Disaggregated default values for cultivation: 'e_{ec}' including soil N_2O emissions

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO2eq/MJ)	Default greenhouse gas emissions (gCO2eq/MJ)
sugar beet ethanol	9,6	9,6
corn (maize) ethanol	25,5	25,5
other cereals excluding corn (maize) ethanol	27,0	27,0
sugar cane ethanol	17,1	17,1
the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	
rape seed biodiesel	32,0	32,0
sunflower biodiesel	26,1	26,1
soybean biodiesel	21,2	21,2
palm oil biodiesel	26,2	26,2
waste cooking oil biodiesel	0	0
animal fats from rendering biodiesel (*)	0	0
hydrotreated vegetable oil from rape seed	33,4	33,4
hydrotreated vegetable oil from sunflower	26,9	26,9
hydrotreated vegetable oil from soybean	22,1	22,1
hydrotreated vegetable oil from palm oil	27,4	27,4
hydrotreated oil from waste cooking oil	0	0
hydrotreated oil from animal fats from rendering (*)	0	0
pure vegetable oil from rape seed	33,4	33,4
pure vegetable oil from sunflower	27,2	27,2
pure vegetable oil from soybean	22,2	22,2
pure vegetable oil from palm oil	27,1	27,1
pure oil from waste cooking oil	0	0
*Applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.		

Disaggregated default values for cultivation: 'e_{ec}' – for soil N2O emissions only (these are already included in the disaggregated values for cultivation emissions in the 'e_{ec}' table)

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO2eq/MJ)	Default greenhouse gas emissions (gCO2eq/MJ)
sugar beet ethanol	4,9	4,9
corn (maize) ethanol	13,7	13,7
other cereals excluding corn (maize) ethanol	14,1	14,1
sugar cane ethanol	2,1	2,1
the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	
rape seed biodiesel	17,6	17,6
sunflower biodiesel	12,2	12,2
soybean biodiesel	13,4	13,4

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO2eq/MJ)	Default greenhouse gas emissions (gCO2eq/MJ)
palm oil biodiesel	16,5	16,5
waste cooking oil biodiesel	0	0
animal fats from rendering biodiesel (*)	0	0
hydrotreated vegetable oil from rape seed	18,0	18,0
hydrotreated vegetable oil from sunflower	12,5	12,5
hydrotreated vegetable oil from soybean	13,7	13,7
hydrotreated vegetable oil from palm oil	16,9	16,9
hydrotreated oil from waste cooking oil	0	0
hydrotreated oil from animal fats from rendering (*)	0	0
pure vegetable oil from rape seed	17,6	17,6
pure vegetable oil from sunflower	12,2	12,2
pure vegetable oil from soybean	13,4	13,4
pure vegetable oil from palm oil	16,5	16,5
pure oil from waste cooking oil	0	0
*Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.		

Disaggregated default values for processing: e_p, as defined in formula 5 section 4.2.4.1

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO2eq/MJ)	Default greenhouse gas emissions (gCO2eq/MJ)
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	18,8	26,3
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	9,7	13,6
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant (*))	13,2	18,5
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant (*))	7,6	10,6
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant (*))	27,4	38,3
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant (*))	15,7	22,0
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	20,8	29,1
corn (maize) ethanol (natural gas as process fuel in CHP plant (*))	14,8	20,8
corn (maize) ethanol (lignite as process fuel in CHP plant (*))	28,6	40,1
corn (maize) ethanol (forest residues as process fuel in CHP plant (*))	1,8	2,6
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	21,0	29,3
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant (*))	15,1	21,1
other cereals excluding maize ethanol (lignite as process fuel in CHP plant (*))	30,3	42,5

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO2eq/MJ)	Default greenhouse gas emissions (gCO2eq/MJ)
other cereals excluding maize ethanol (forest residues as process fuel in CHP plant (*))	1,5	2,2
sugar cane ethanol	1,3	1,8
the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	
rape seed biodiesel	11,7	16,3
sunflower biodiesel	11,8	16,5
soybean biodiesel	12,1	16,9
palm oil biodiesel (open effluent pond)	30,4	42,6
palm oil biodiesel (process with methane capture at oil mill)	13,2	18,5
waste cooking oil biodiesel	9,3	13,0
animal fats from rendering biodiesel **	13,6	19,1
hydrotreated vegetable oil from rape seed	10,7	15,0
hydrotreated vegetable oil from sunflower	10,5	14,7
hydrotreated vegetable oil from soybean	10,9	15,2
hydrotreated vegetable oil from palm oil (open effluent pond)	27,8	38,9
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	9,7	13,6
hydrotreated oil from waste cooking oil	10,2	14,3
hydrotreated oil from animal fats from rendering (**)	14,5	20,3
pure vegetable oil from rape seed	3,7	5,2
pure vegetable oil from sunflower	3,8	5,4
pure vegetable oil from soybean	4,2	5,9
pure vegetable oil from palm oil (open effluent pond)	22,6	31,7
pure vegetable oil from palm oil (process with methane capture at oil mill)	4,7	6,5
pure oil from waste cooking oil	0,6	0,8
* Default values for processes using CHP are valid only if all the process heat is supplied by CHP. (**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.		

Disaggregated default values for oil extraction only (these are already included in the disaggregated values for processing emissions in the 'ep' table)

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
rape seed biodiesel	3,0	4,2
sunflower biodiesel	2,9	4,0
soybean biodiesel	3,2	4,4
palm oil biodiesel (open effluent pond)	20,9	29,2
palm oil biodiesel (process with methane capture at oil mill)	3,7	5,1
waste cooking oil biodiesel	0	0
animal fats from rendering biodiesel **	4,3	6,1
hydrotreated vegetable oil from rape seed	3,1	4,4
hydrotreated vegetable oil from sunflower	3,0	4,1

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
hydrotreated vegetable oil from soybean	3,3	4,6
hydrotreated vegetable oil from palm oil (open effluent pond)	21,9	30,7
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	3,8	5,4
hydrotreated oil from waste cooking oil	0	0
hydrotreated oil from animal fats from rendering (**)	4,3	6,0
pure vegetable oil from rape seed	3,1	4,4
pure vegetable oil from sunflower	3,0	4,2
pure vegetable oil from soybean	3,4	4,7
pure vegetable oil from palm oil (open effluent pond)	21,8	30,5
pure vegetable oil from palm oil (process with methane capture at oil mill)	3,8	5,3
pure oil from waste cooking oil	0	0
* Default values for processes using CHP are valid only if all the process heat is supplied by CHP. (**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.		

Disaggregated default values for the transport and distribution, 'e_{td}', as defined in formula 5 section 4.2.4.1

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	2,3	2,3
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	2,3	2,3
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant(*))	2,3	2,3
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant(*))	2,3	2,3
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant(*))	2,3	2,3
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant(*))	2,3	2,3
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	2,2	2,2
corn (maize) ethanol (natural gas as process fuel in CHP plant(*))	2,2	2,2
corn (maize) ethanol (lignite as process fuel in CHP plant(*))	2,2	2,2
corn (maize) ethanol (forest residues as process fuel in CHP plant(*))	2,2	2,2
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	2,2	2,2
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant(*))	2,2	2,2
other cereals excluding maize ethanol (lignite as process fuel in CHP plant(*))	2,2	2,2

Biofuel and bioliquid production pathway	**Typical greenhouse gas emissions (gCO_2eq/MJ)**	**Default greenhouse gas emissions (gCO_2eq/MJ)**
other cereals excluding maize ethanol (forest residues as process fuel in CHP plant(*))	2,2	2,2
sugar cane ethanol	9,7	9,7
the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	
rape seed biodiesel	1,8	1,8
sunflower biodiesel	2,1	2,1
soybean biodiesel	8,9	8,9
palm oil biodiesel (open effluent pond)	6,9	6,9
palm oil biodiesel (process with methane capture at oil mill)	6,9	6,9
waste cooking oil biodiesel	1,9	1,9
animal fats from rendering biodiesel **	1,7	1,7
hydrotreated vegetable oil from rape seed	1,7	1,7
hydrotreated vegetable oil from sunflower	2,0	2,0
hydrotreated vegetable oil from soybean	9,2	9,2
hydrotreated vegetable oil from palm oil (open effluent pond)	7,0	7,0
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	7,0	7,0
hydrotreated oil from waste cooking oil	1,7	1,7
hydrotreated oil from animal fats from rendering (**)	1,5	1,5
pure vegetable oil from rape seed	1,4	1,4
pure vegetable oil from sunflower	1,7	1,7
pure vegetable oil from soybean	8,8	8,8
pure vegetable oil from palm oil (open effluent pond)	6,7	6,7
pure vegetable oil from palm oil (process with methane capture at oil mill)	6,7	6,7
pure oil from waste cooking oil	1,4	1,4
* Default values for processes using CHP are valid only if all the process heat is supplied by CHP. (**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.		

Disaggregated default values for transport and distribution of final fuel only. These are already included in the table of 'transport and distribution emissions etd' as defined in Part C of this Annex, but the following values are useful if an economic operator wishes to declare actual transport emissions for crops or oil transport only).

Biofuel and bioliquid production pathway	**Typical greenhouse gas emissions (gCO_2eq/MJ)**	**Default greenhouse gas emissions (gCO_2eq/MJ)**
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	1,6	1,6
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	1,6	1,6
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant (*))	1,6	1,6

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant (*))	1,6	1,6
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant (*))	1,6	1,6
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant (*))	1,6	1,6
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	1,6	1,6
corn (maize) ethanol (natural gas as process fuel in CHP plant (*))	1,6	1,6
corn (maize) ethanol (lignite as process fuel in CHP plant (*))	1,6	1,6
corn (maize) ethanol (forest residues as process fuel in CHP plant (*))	1,6	1,6
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	1,6	1,6
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant (*))	1,6	1,6
other cereals excluding maize ethanol (lignite as process fuel in CHP plant (*))	1,6	1,6
other cereals excluding maize ethanol (forest residues as process fuel in CHP plant (*))	1,6	1,6
sugar cane ethanol	6,0	6,0
the part from renewable sources of ETBE	Will be consider to be equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Will be consider to be equal to that of the ethanol production pathway used	
rapeseed biodiesel	1,3	1,3
sunflower biodiesel	1,3	1,3
soybean biodiesel	1,3	1,3
palm oil biodiesel (open effluent pond)	1,3	1,3
palm oil biodiesel (process with methane capture at oil mill)	1,3	1,3
waste cooking oil biodiesel	1,3	1,3
animal fats from rendering biodiesel **	1,3	1,3
hydrotreated vegetable oil from rape seed	1,2	1,2
hydrotreated vegetable oil from sunflower	1,2	1,2
hydrotreated vegetable oil from soybean	1,2	1,2
hydrotreated vegetable oil from palm oil (open effluent pond)	1,2	1,2
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	1,2	1,2
hydrotreated oil from waste cooking oil	1,2	1,2
hydrotreated oil from animal fats from rendering (**)	1,2	1,2
pure vegetable oil from rape seed	0,8	0,8
pure vegetable oil from sunflower	0,8	0,8
pure vegetable oil from soybean	0,8	0,8
pure vegetable oil from palm oil (open effluent pond)	0,8	0,8
pure vegetable oil from palm oil (process with methane capture at oil mill)	0,8	0,8
pure oil from waste cooking oil	0,8	0,8
* Default values for processes using CHP are valid only if all the process heat is supplied by CHP.		

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
(**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.		

Total for cultivation, processing, transport and distribution

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler)	30,7	38,2
sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler)	21,6	25,5
sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant (*))	25,1	30,4
sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant (*))	19,5	22,5
sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant (*))	39,3	50,2
sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant (*))	27,6	33,9
corn (maize) ethanol (natural gas as process fuel in conventional boiler)	48,5	56,8
corn (maize) ethanol (natural gas as process fuel in CHP plant (*))	42,5	48,5
corn (maize) ethanol (lignite as process fuel in CHP plant (*))	56,3	67,8
corn (maize) ethanol (forest residues as process fuel in CHP plant (*))	29,5	30,3
other cereals excluding maize ethanol (natural gas as process fuel in conventional boiler)	50,2	58,5
other cereals excluding maize ethanol (natural gas as process fuel in CHP plant (*))	44,3	50,3
other cereals excluding maize ethanol (lignite as process fuel in CHP plant (*))	59,5	71,7
other cereals excluding maize ethanol (forest residues as process fuel in CHP plant (*))	30,7	31,4
sugar cane ethanol	28,1	28,6
the part from renewable sources of ETBE	Equal to that of the ethanol production pathway used	
the part from renewable sources of TAEE	Equal to that of the ethanol production pathway used	
rape seed biodiesel	45,5	50,1
sunflower biodiesel	40,0	44,7
soybean biodiesel	42,2	47,0
palm oil biodiesel (open effluent pond)	63,5	75,7
palm oil biodiesel (process with methane capture at oil mill)	46,3	51,6
waste cooking oil biodiesel	11,2	14,9
animals fats from rendering biodiesel **	15,3	20,8
hydrotreated vegetable oil from rape seed	45,8	50,1
hydrotreated vegetable oil from sunflower	39,4	43,6
hydrotreated vegetable oil from soybean	42,2	46,5

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
hydrotreated vegetable oil from palm oil (open effluent pond)	62,2	73,3
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	44,1	48,0
hydrotreated oil from waste cooking oil	11,9	16,0
hydrotreated oil from animal fats from rendering (**)	16,0	21,8
pure vegetable oil from rape seed	38,5	40,0
pure vegetable oil from sunflower	32,7	34,3
pure vegetable oil from soybean	35,2	36,9
pure vegetable oil from palm oil (open effluent pond)	56,3	65,4
pure vegetable oil from palm oil (process with methane capture at oil mill)	38,4	57,2
pure oil from waste cooking oil	2,0	2,2

* Default values for processes using CHP are valid only if all the process heat is supplied by CHP.
(**) Note: applies only to biofuels produced from animal by-products classified as category 1 and 2 material in accordance with Regulation (EC) No 1069/2009, for which emissions related to hygenisation as part of the rendering are not considered.

Estimated disaggregated default values for future biofuels and bioliquids that were not on the market or were only on the market in negligible quantities in 2016

Disaggregated default values for cultivation: 'e_{ec}' as defined in formula 5 section 4.2.4.1

including N2O emissions (including chipping of waste or farmed wood)

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
wheat straw ethanol	1,8	1,8
waste wood Fischer-Tropsch diesel in free-standing plant	3,3	3,3
farmed wood Fischer-Tropsch diesel in free-standing plant	8,2	8,2
waste wood Fischer-Tropsch petrol in free-standing plant	8,2	8,2
farmed wood Fischer-Tropsch petrol in free-standing plant	12,4	12,4
waste wood dimethylether (DME) in free-standing plant	3,1	3,1
farmed wood dimethylether (DME) in free-standing plant	7,6	7,6
waste wood methanol in free-standing plant	3,1	3,1
farmed wood methanol in free-standing plant	7,6	7,6
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	2,5	2,5
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	2,5	2,5

dimethylether (DME) from black-liquor gasification integrated with pulp mill	2,5	2,5
Methanol from black-liquor gasification integrated with pulp mill	2,5	2,5
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

Disaggregated default values for soil N_2O emissions (included in disaggregated default values for cultivation emissions in the 'e_{ec}' table)

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
wheat straw ethanol	0	0
waste wood Fischer-Tropsch diesel in free-standing plant	0	0
farmed wood Fischer-Tropsch diesel in free-standing plant	4,4	4,4
waste wood Fischer-Tropsch petrol in free-standing plant	0	0
farmed wood Fischer-Tropsch petrol in free-standing plant	4,4	4,4
waste wood dimethylether (DME) in free-standing plant	0	0
farmed wood dimethylether (DME) in free-standing plant	4,1	4,1
waste wood methanol in free-standing plant	0	0
farmed wood methanol in free-standing plant	4,1	4,1
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	0	0
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	0	0
dimethylether (DME) from black-liquor gasification integrated with pulp mill	0	0
methanol from black-liquor gasification integrated with pulp mill	0	0
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

Disaggregated default values for processing e_p as defined in formula 5 section 4.2.4.1

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
wheat straw ethanol	4,8	6,8
waste wood Fischer-Tropsch diesel in free-standing plant	0,1	0,1
farmed wood Fischer-Tropsch diesel in free-standing plant	0,1	0,1
waste wood Fischer-Tropsch petrol in free-standing plant	0,1	0,1
farmed wood Fischer-Tropsch petrol in free-standing plant	0,1	0,1

waste wood dimethylether (DME) in free-standing plant	0	0
farmed wood dimethylether (DME) in free-standing plant	0	0
waste wood methanol in free-standing plant	0	0
farmed wood methanol in free-standing plant	0	0
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	0	0
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	0	0
dimethylether (DME) from black-liquor gasification integrated with pulp mill	0	0
methanol from black-liquor gasification integrated with pulp mill	0	0
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

Disaggregated default values for transport and distribution, '*etd*', as defined in formula 5 section 4.2.4.1

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
wheat straw ethanol	7,1	7,1
waste wood Fischer-Tropsch diesel in free-standing plant	10,3	10,3
farmed wood Fischer-Tropsch diesel in free-standing plant	8,4	8,4
waste wood Fischer-Tropsch petrol in free-standing plant	10,3	10,3
farmed wood Fischer-Tropsch petrol in free-standing plant	8,4	8,4
waste wood dimethylether (DME) in free-standing plant	10,4	10,4
farmed wood dimethylether (DME) in free-standing plant	8,6	8,6
waste wood methanol in free-standing plant	10,4	10,4
farmed wood methanol in free-standing plant	8,6	8,6
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	7,7	7,7
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	7,9	7,9
dimethylether (DME) from black-liquor gasification integrated with pulp mill	7,7	7,7
methanol from black-liquor gasification integrated with pulp mill	7,9	7,9
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

Disaggregated default values for transport and distribution of final fuel only. These are already included in the table of 'transport and distribution emissions e_{td}', but the following values are useful if an economic operator wishes to declare actual transport emissions for feedstock transport only).

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
wheat straw ethanol	1,6	1,6
waste wood Fischer-Tropsch diesel in free-standing plant	1,2	1,2
farmed wood Fischer-Tropsch diesel in free-standing plant	1,2	1,2
waste wood Fischer-Tropsch petrol in free-standing plant	1,2	1,2
farmed wood Fischer-Tropsch petrol in free-standing plant	1,2	1,2
waste wood dimethylether (DME) in free-standing plant	2,0	2,0
farmed wood dimethylether (DME) in free-standing plant	2,0	2,0
waste wood methanol in free-standing plant	2,0	2,0
farmed wood methanol in free-standing plant	2,0	2,0
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	2,0	2,0
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	2,0	2,0
dimethylether (DME) from black-liquor gasification integrated with pulp mill	2,0	2,0
methanol from black-liquor gasification integrated with pulp mill	2,0	2,0
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

Total for cultivation, processing, transport and distribution

Biofuel and bioliquid production pathway	Typical greenhouse gas emissions (gCO_2eq/MJ)	Default greenhouse gas emissions (gCO_2eq/MJ)
wheat straw ethanol	13,7	15,7
waste wood Fischer-Tropsch diesel in free-standing plant	13,7	13,7
farmed wood Fischer-Tropsch diesel in free-standing plant	16,7	16,7
waste wood Fischer-Tropsch petrol in free-standing plant	15,6	15,6
farmed wood Fischer-Tropsch petrol in free-standing plant	16,7	16,7
waste wood dimethylether (DME) in free-standing plant	13,5	13,5
farmed wood dimethylether (DME) in free-standing plant	16,2	16,2
waste wood methanol in free-standing plant	13,5	13,5
farmed wood methanol in free-standing plant	16,2	16,2
Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill	10,2	10,2
Fischer-Tropsch petrol from black-liquor gasification integrated with pulp mill	10,4	10,4
dimethylether (DME) from black-liquor gasification integrated with pulp mill	10,2	10,2

methanol from black-liquor gasification integrated with pulp mill	10,4	10,4
the part from renewable sources of MTBE	Equal to that of the methanol production pathway used	

2. Default values and disaggregated default values for biomass fuels

2.1. Default values for biomass fuels

Typical and default values of greenhouse gas emissions savings for biomass fuels if produced with no net-carbon emissions from land-use change

WOODCHIPS					
Biomass fuel production system	**Transport distance**	**Greenhouse gas emissions saving – typical value**		**Greenhouse gas emissions saving – default value**	
		Heat	**Electricity**	**Heat**	**Electricity**
Woodchips from forest residues	1 to 500 km	93%	89%	91%	87%
	500 to 2500 km	89%	84 %	87%	81%
	2500 to 10000 km	82%	73%	78%	67%
	above 10000 km	67%	51%	60%	41%
Woodchips from short rotation coppice (Eucaliptus)	2500 to 10000 km	77%	65%	73%	60%
Woodchips from short rotation coppice (Poplar - Fertilised)	1 to 500 km	89%	83%	87%	81%
	500 to 2500 km	85%	78%	84%	76%
	2500 to 10000 km	78%	67%	74%	62%
	above 10000 km	63%	45%	57%	35%
Woodchips from short rotation coppice (Poplar – No fertlisation)	1 to 500 km	91%	87%	90%	85%
	500 to 2500 km	88%	82%	86%	79%
	2500 to 10000 km	80%	70%	77%	65%
	above 10000 km	65%	48%	59%	39%
Woodchips from stemwood	1 to 500 km	93%	89%	92%	88%
	500 to 2500 km	90%	85%	88%	82%
	2500 to 10000 km	82%	73%	79%	68%
	above 10000 km	67%	51%	61%	42%
Woodchips from industry residues	1 to 500 km	94%	92%	93%	90%
	500 to 2500 km	91%	87%	90%	85%
	2500 to 10000 km	83%	75%	80%	71%
	above 10000 km	69%	54%	63%	44%

WOOD PELLETS (*)						
Biomass fuel production system		**Transport distance**	**Greenhouse gas emissions saving – typical value**		**Greenhouse gas emissions saving – default value**	
			Heat	**Electricity**	**Heat**	**Electricity**
Wood briquettes or pellets from forest residues	Case 1	1 to 500 km	58 %	37%	49%	24%
		500 to 2500 km	58%	37%	49%	25%
		2500 to 10000 km	55%	34%	47%	21%
		above 10000 km	50%	26%	40%	11%

	Case 2a	1 to 500 km	77%	66%	72%	59%
		500 to 2500 km	77%	66%	72%	59%
		2500 to 10000 km	75%	62%	70%	55%
		above 10000 km	69%	54%	63%	45%
	Case 3a	1 to 500 km	92%	88%	90%	85%
		500 to 2500 km	92%	88%	90%	86%
		2500 to 10000 km	90%	85%	88%	81%
		above 10000 km	84%	76%	81%	72%
Wood briquettes or pellets from short rotation coppice (Eucalyptus)	Case 1	2500 to 10 000 km	52%	28%	43%	15%
	Case 2a	2500 to 10 000 km	70%	56%	66%	49%
	Case 3a	2500 to 10 000 km	85%	78%	83%	75%
Wood briquettes or pellets from short rotation coppice (Poplar – Fertilized)	Case 1	1 to 500 km	54%	32%	46%	20%
		500 to 10000 km	52%	29%	44%	16%
		above 10000 km	47%	21%	37%	7%
	Case 2a	1 to 500 km	73%	60%	69%	54%
		500 to 10000 km	71%	57%	67%	50%
		above 10000 km	66%	49%	60%	41%
	Case 3a	1 to 500 km	88%	82%	87%	81%
		500 to 10000 km	86%	79%	84%	77%
		above 10000 km	80%	71%	78%	67
Wood briquettes or pellets from short rotation coppice (Poplar – No fertilization)	Case 1	1 to 500 km	56%	35%	48%	23
		500 to 10000 km	54%	32%	46%	20
		above 10000 km	49%	24%	40%	10
	Case 2a	1 to 500 km	76%	64%	72%	58
		500 to 10000 km	74%	61%	69%	54
		above 10000 km	68%	53%	63%	45
	Case 3a	1 to 500 km	91%	86%	90%	85
		500 to 10000 km	89%	83%	87%	81
		above 10000 km	83%	75%	81%	71
Stemwood	Case 1	1 to 500 km	57%	37%	49%	24
		500 to 2500 km	58%	37%	49%	25
		2500 to 10000 km	55%	34%	47%	21
		above 10000 km	50%	26%	40%	11
	Case 2a	1 to 500 km	77%	66%	73%	60
		500 to 2500 km	77%	66%	73%	60
		2500 to 10000 km	75%	63%	70%	56
		above 10000 km	70%	55%	64%	46
	Case 3a	1 to 500 km	92%	88%	91%	86
		500 to 2500 km	92%	88%	91%	87
		2500 to 10000 km	90%	85%	88%	83
		above 10000 km	84%	77%	82%	73
Wood briquettes or pellets from wood industry residues	Case 1	1 to 500 km	75%	62%	69%	55
		500 to 2500 km	75%	62%	70%	55
		2500 to 10000 km	72%	59%	67%	51
		above 10000 km	67%	51%	61%	42
	Case 2a	1 to 500 km	87%	80%	84%	76
		500 to 2500 km	87%	80%	84%	77
		2500 to 10000 km	85%	77%	82%	73
		above 10000 km	79%	69%	75%	63
	Case 3a	1 to 500 km	95%	93%	94%	91
		500 to 2500 km	95%	93%	94%	92
		2500 to 10000 km	93%	90%	92%	88
		above 10000 km	88%	82%	85%	78

(*) Case 1 refers to processes in which a natural gas boiler is used to provide the process heat to the pellet mill. Electricity for the pellet mill is supplied from the grid;
Case 2a refers to processes in which a woodchips boiler, fed with pre-dried chips, is used to provide process heat. Electricity for the pellet mill is supplied from the grid;
Case 3a refers to processes in which a CHP, fed with pre-dried woodchips, is used to provide electricity and heat to the pellet mill.

AGRICULTURE PATHWAYS					
Biomass fuel production system	**Transport distance**	**Greenhouse gas emissions saving – typical value**		**Greenhouse gas emissions saving – default value**	
		Heat	**Electricity**	**Heat**	**Electricity**
Agricultural Residues with density <0,2t/m^3(*)	1 to 500 km	95%	92%	93%	90%
	500 to 2500 km	89%	83%	86%	80%
	2500 to 10000 km	77%	66%	73%	60%
	above 10000 km	57%	36%	48%	23%
Agricultural Residues with density >0,2t/m^3(**)	1 to 500 km	95%	92%	93%	90%
	500 to 2500 km	93%	89%	92%	87%
	2500 to 10000 km	88%	82%	85%	78%
	above 10000 km	78%	68%	74%	61%
Straw pellets	1 to 500 km	88%	82%	85%	78%
	500 to 10 000 km	86%	79%	83%	74%
	above 10 000 km	80%	70%	76%	64%
Bagasse briquettes	500 to 10 000 km	93%	89%	91%	87%
	above 10 000 km	87%	81%	85%	77%
Palm Kernel Meal	above 10 000 km	20%	-18%	11%	-33%
Palm Kernel Meal (no CH_4 emissions from oil mill)	above 10 000 km	46%	20%	42%	14%

(*) This group of materials includes agricultural residues with a low bulk density and it comprises materials such as straw bales, oat hulls, rice husks and sugar cane bagasse bales (not exhaustive list).
(**) The group of agricultural residues with higher bulk density includes materials such as corn cobs, nut shells, soybean hulls, palm kernel shells (not exhaustive list).

BIOGAS FOR ELECTROCITY (*)				
Biogas production system		Technological option	**Greenhouse gas emissions saving – typical value**	**Greenhouse gas emissions saving – default value**
Wet manure ([1])	Case 1	Open digestate ([2])	146 %	94 %
		Close digestate ([3])	246 %	240 %
	Case 2	Open digestate	136 %	85 %
		Close digestate	227 %	219 %
	Case 3	Open digestate	142 %	86 %
		Close digestate	243 %	235 %
Maize whole plant ([4])	Case 1	Open digestate	36 %	21 %
		Close digestate	59 %	53 %
	Case 2	Open digestate	34 %	18 %
		Close digestate	55 %	47 %
	Case 3	Open digestate	28 %	10 %
		Close digestate	52 %	43 %
Biowaste	Case 1	Open digestate	47 %	26 %
		Close digestate	84 %	78 %
	Case 2	Open digestate	43 %	21 %
		Close digestate	77 %	68 %

	Case 3	Open digestate	38 %	14 %
		Close digestate	76 %	66 %

(*) Case 1 refers to pathways in which electricity and heat required in the process are supplied by the CHP engine itself. Case 2 refers to pathways in which the electricity required in the process is taken from the grid and the process heat is supplied by the CHP engine itself. In some Member States, operators are not allowed to claim the gross production for subsidies and case 1 is the more likely configuration. Case 3 refers to pathways in which the electricity required in the process is taken from the grid and the process heat is supplied by a biogas boiler. This case applies to some installations in which the CHP engine is not on-site and biogas is sold (but not upgraded to biomethane).

(1) The values for biogas production from manure include negative emissions for emissions saved from raw manure management. The value of e_{sca} considered is equal to – 45 g CO_2eq/MJ manure used in anaerobic digestion.

(2) Open storage of digestate accounts for additional emissions of CH_4 and N_2O. The magnitude of those emissions changes with ambient conditions, substrate types and the digestion efficiency.

(3) Close storage means that the digestate resulting from the digestion process is stored in a gas-tight tank and that the additional biogas released during storage is considered to be recovered for production of additional electricity or biomethane. No greenhouse gas emissions are included in that process.

(4) Maize whole plant means maize harvested as fodder and ensiled for preservation.

BIOGAS FOR ELECTROCITY-Mixture of manure and maize				
Biogas production system		Technological option	**Greenhouse gas emissions saving – typical value**	**Greenhouse gas emissions saving – default value**
Manure – Maize 80% - 20%	Case 1	Open digestate	72 %	45%
		Close digestate	120 %	114%
	Case 2	Open digestate	67%	40%
		Close digestate	111%	103%
	Case 3	Open digestate	65%	35%
		Close digestate	114%	106%
Manure – Maize 70% - 30%	Case 1	Open digestate	60%	37%
		Close digestate	100%	94%
	Case 2	Open digestate	57%	32%
		Close digestate	93%	85%
	Case 3	Open digestate	53%	27%
		Close digestate	94%	85%
Manure – Maize 60% - 40%	Case 1	Open digestate	53%	32%
		Close digestate	88%	82%
	Case 2	Open digestate	50%	28%
		Close digestate	82%	73%
	Case 3	Open digestate	46%	22%
		Close digestate	81%	72%

BIOMETHANE FOR TRANSPORT (*)			
Biogas production system	**Technological option**	**Greenhouse gas emissions saving – typical value**	**Greenhouse gas emissions saving – default value**
Wet manure	Open digestate, no off-gas combustion	117%	72%
	Open digestate, off gas combustion	133%	94%
	Close digestate, no off-gas combustion	190%	179%
	Close digestate, off gas combustion	206%	202%

Maize whole plant (4)	Open digestate, no off-gas combustion	35%	17%
	Open digestate, off gas combustion	51%	39%
	Close digestate, no off-gas combustion	52%	41%
	Close digestate, off gas combustion	68%	63%
Biowaste	Open digestate, no off-gas combustion	43%	20%
	Open digestate, off gas combustion	59%	42%
	Close digestate, no off-gas combustion	70%	58%
	Close digestate, off gas combustion	86%	80%
(*) The greenhouse gas emissions savings for biomethane only refer to compressed biomethane relative to the fossil fuel comparator for transport of 94 g gCO_2eq/MJ.			

BIOMETHANE – MIXTURES OF MANURE AND MAIZE (*)			
Biomethane production system	**Technological options**	**Greenhouse gas emissions savings – typical value**	**Greenhouse gas emissions savings – default value**
Manure – Maize 80 % - 20 %	Open digestate, no off-gas combustion [1]	62 %	35 %
	Open digestate, off-gas combustion [2]	78 %	57 %
	Close digestate, no off-gas combustion	97 %	86 %
	Close digestate, off-gas combustion	113 %	108 %
Manure – Maize 70 % - 30 %	Open digestate, no off-gas combustion	53 %	29 %
	Open digestate, off-gas combustion	69 %	51 %
	Close digestate, no off-gas combustion	83 %	71 %
	Close digestate, off-gas combustion	99 %	94 %
Manure – Maize 60 % - 40 %	Open digestate, no off-gas combustion	48 %	25 %
	Open digestate, off-gas combustion	64 %	48 %
	Close digestate, no off-gas combustion	74 %	62 %
	Close digestate, off-gas combustion	90 %	84 %

[1] This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Swing Adsorption (PSA), Pressure Water Scrubbing (PWS), Membranes, Cryogenic, and Organic Physical Scrubbing (OPS). It includes an emission of 0,03 MJ CH4/MJ biomethane for the emission of methane in the off-gases

[2] This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Water Scrubbing (PWS) when water is recycled, Pressure Swing Adsorption (PSA), Chemical Scrubbing, Organic Physical Scrubbing (OPS), Membranes and Cryogenic upgrading. No methane emissions are considered for this category (the methane in the off-gas is combusted, if any).

(*) The greenhouse gas emissions savings for biomethane only refer to compressed biomethane relative to the fossil fuel comparator for transport of 94 g CO_2eq/MJ.

2.2. Disaggregated default values for biomass fuels

Wood briquettes or pellets

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)				Greenhouse gas emissions – default value (g CO_2eq/MJ)			
		Cultivation	Processing	Transport	Non-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport	Non-CO_2 emissions from the fuel in use
Wood chips from forest residues	1 to 500 km	0,0	1,6	3,0	0,4	0,0	1,9	3,6	0,5
	500 to 2500	0,0	1,6	5,2	0,4	0,0	1,9	6,2	0,5
	2500 to 10000 km	0,0	1,6	10,5	0,4	0,0	1,9	12,6	0,5
	Above 10000 km	0,0	1,6	20,5	0,4	0,0	1,9	24,6	0,5
Wood chips from SRC (Eucalyptus)	2500-10000 km	4,4	0,0	11,0	0,4	4,4	0,0	13,2	0,5
Wood chips from SRC (Poplar - fertilised)	1 to 500 km	3,9	0,0	3,5	0,4	3,9	0,0	4,2	0,5
	500 to 2500	3,9	0,0	5,6	0,4	3,9	0,0	6,8	0,5
	2500 to 10000 km	3,9	0,0	11,0	0,4	3,9	0,0	13,2	0,5
	Above 10000 km	3,9	0,0	21,0	0,4	3,9	0,0	25,2	0,5
Wood chips from SRC (Poplar - not fertilised)	1 to 500 km	2,2	0,0	3,5	0,4	2,2	0,0	4,2	0,5
	500 to 2500	2,2	0,0	5,6	0,4	2,2	0,0	6,8	0,5
	2500 to 10000 km	2,2	0,0	11,0	0,4	2,2	0,0	13,2	0,5
	Above 10000 km	2,2	0,0	21,0	0,4	2,2	0,0	25,2	0,5
Wood chips from stemwood	1 to 500 km	1,1	0,3	3,0	0,4	1,1	0,4	3,6	0,5
	500 to 2500	1,1	0,3	5,2	0,4	1,1	0,4	6,2	0,5
	2500 to 10000 km	1,1	0,3	10,5	0,4	1,1	0,4	12,6	0,5
	Above 10000 km	1,1	0,3	20,5	0,4	1,1	0,4	24,6	0,5
Wood chips from wood industry residues	1 to 500 km	0,0	0,3	3,0	0,4	0,0	0,4	3,6	0,5
	500 to 2500	0,0	0,3	5,2	0,4	0,0	0,4	6,2	0,5
	2500 to 10000 km	0,0	0,3	10,5	0,4	0,0	0,4	12,6	0,5
	Above 10000 km	0,0	0,3	20,5	0,4	0,0	0,4	24,6	0,5

Wood briquettes or pellets

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)				Greenhouse gas emissions – default value (g CO_2eq/MJ)			
		Cultivation	Processing	Transport & distribution	N-n-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Wood briquettes or pellets from forest residue (case 1)	1 to 500 km	0,0	25,8	2,9	0,3	0,0	30,9	3,5	0,3
	500 to 2500	0,0	25,8	2,8	0,3	0,0	30,9	3,3	0,3
	2500 to 10000 km	0,0	25,8	4,3	0,3	0,0	30,9	5,2	0,3
	Above 10000 km	0,0	25,8	7,9	0,3	0,0	30,9	9,5	0,3
Wood briquettes or pellets from forest residue (case 2a)	1 to 500 km	0,0	12,5	3,0	0,3	0,0	15,0	3,6	0,3
	500 to 2500	0,0	12,5	2,9	0,3	0,0	15,0	3,5	0,3
	2500 to 10000 km	0,0	12,5	4,4	0,3	0,0	15,0	5,3	0,3
	Above 10000 km	0,0	12,5	8,1	0,3	0,0	15,0	9,8	0,3
Wood briquettes or pellets from forest residue (case 3a)	1 to 500 km	0,0	2,4	3,0	0,3	0,0	2,8	3,6	0,3
	500 to 2500	0,0	2,4	2,9	0,3	0,0	2,8	3,5	0,3
	2500 to 10000 km	0,0	2,4	4,4	0,3	0,0	2,8	5,3	0,3
	Above 10000 km	0,0	2,4	8,2	0,3	0,0	2,8	9,8	0,3
Wood briquettes from rotation coppice (Eucalyptus – case 2a)	2500 to 10000 km	3,9	24,5	4,3	0,3	3,9	29,4	5,2	0,3
Wood briquettes from rotation coppice (Eucalyptus – case 3a)	2500 to 10000 km	5,0	10,6	4,4	0,3	5,0	12,7	5,3	0,3
Wood briquettes from rotation coppice	2500 to 10000 km	5,3	0,3	4,4	0,3	5,3	0,4	5,3	0,3

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)				Greenhouse gas emissions – default value (g CO_2eq/MJ)			
		Cultivation	Processing	Transport & distribution	N-n-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
(Eucalyptus – case 1)									
Wood briquettes from short rotation coppice (Poplar – Fertilised – case1)	1 to 500 km	3,4	24,5	2,9	0,3	3,4	29,4	3,5	0,3
	500 to 10000	3,4	24,5	4,3	0,3	3,4	29,4	5,2	0,3
	Above 10000 km	3,4	24,5	7,9	0,3	3,4	29,4	9,5	0,3
Wood briquettes from short rotation coppice (Poplar – Fertilised – case 2a)	1 to 500 km	4,4	10,6	3,0	0,3	4,4	12,7	3,6	0,3
	500 to 10000	4,4	10,6	4,4	0,3	4,4	12,7	5,3	0,3
	Above 10000 km	4,4	10,6	8,1	0,3	4,4	12,7	9,8	0,3
Wood briquettes from short rotation coppice (Poplar – Fertilised – case3a)	1 to 500 km	4,6	0,3	3,0	0,3	4,6	0,4	3,6	0,3
	500 to 10000	4,6	0,3	4,4	0,3	4,6	0,4	5,3	0,3
	Above 10000 km	4,6	0,3	8,2	0,3	4,6	0,4	9,8	0,3
Wood briquettes from short rotation coppice (Poplar – no fertilisation– case 1)	1 to 500 km	2,0	24,5	2,9	0,3	2,0	29,4	3,5	0,3
	500 to 10000	2,0	24,5	4,3	0,3	2,0	29,4	5,2	0,3
	Above 10000 km	2,0	24,5	7,9	0,3	2,0	29,4	9,5	0,3
Wood briquettes from short rotation coppice (Poplar – no fertilisation– case 2a)	1 to 500 km	2,5	10,6	3,0	0,3	2,5	12,7	3,6	0,3
	500 to 10000	2,5	10,6	4,4	0,3	2,5	12,7	5,3	0,3
	Above 10000 km	2,5	10,6	8,1	0,3	2,5	12,7	9,8	0,3

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)				Greenhouse gas emissions – default value (g CO_2eq/MJ)			
		Cultivation	Processing	Transport & distribution	N-n-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Wood bri-quettes from short rotation coppice (Poplar – no fertilisa-tion– case 3a)	1 to 500 km	2,6	0,3	3,0	0,3	2,6	0,4	3,6	0,3
	500 to 10000	2,6	0,3	4,4	0,3	2,6	0,4	5,3	0,3
	Above 10000 km	2,6	0,3	8,2	0,3	2,6	0,4	9,8	0,3
Wood bri-quettes or pel-lets from stemwood (case 1)	1 to 500 km	1,1	24,8	2,9	0,3	1,1	29,8	3,5	0,3
	500 to 2500	1,1	24,8	2,8	0,3	1,1	29,8	3,3	0,3
	2500 to 10000 km	1,1	24,8	4,3	0,3	1,1	29,8	5,2	0,3
	Above 10000 km	1,1	24,8	7,9	0,3	1,1	29,8	9,5	0,3
Wood bri-quettes or pel-lets from stemwood (case 2a)	1 to 500 km	1,4	11,0	3,0	0,3	1,4	13,2	3,6	0,3
	500 to 2500	1,4	11,0	2,9	0,3	1,4	13,2	3,5	0,3
	2500 to 10000 km	1,4	11,0	4,4	0,3	1,4	13,2	5,3	0,3
	Above 10000 km	1,4	11,0	8,1	0,3	1,4	13,2	9,8	0,3
Wood bri-quettes or pel-lets from stemwood (case 3a)	1 to 500 km	1,4	0,8	3,0	0,3	1,4	0,9	3,6	0,3
	500 to 2500	1,4	0,8	2,9	0,3	1,4	0,9	3,5	0,3
	2500 to 10000 km	1,4	0,8	4,4	0,3	1,4	0,9	5,3	0,3
	Above 10000 km	1,4	0,8	8,2	0,3	1,4	0,9	9,8	0,3
Wood bri-quettes or pel-lets from wood industry resi-dues (case 1)	1 to 500 km	0,0	14,3	2,8	0,3	0,0	17,2	3,3	0,3
	500 to 2500	0,0	14,3	2,7	0,3	0,0	17,2	3,2	0,3
	2500 to 10000 km	0,0	14,3	4,2	0,3	0,0	17,2	5,0	0,3
	Above 10000 km	0,0	14,3	7,7	0,3	0,0	17,2	9,2	0,3
Wood bri-quettes or pel-lets from wood industry resi-dues	1 to 500 km	0,0	6,0	2,8	0,3	0,0	7,2	3,4	0,3
	500 to 2500	0,0	6,0	2,7	0,3	0,0	7,2	3,3	0,3
	2500 to 10000 km	0,0	6,0	4,2	0,3	0,0	7,2	5,1	0,3
	Above 10000 km	0,0	6,0	7,8	0,3	0,0	7,2	9,3	0,3

Biomass fuel production system (case 2a)	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)				Greenhouse gas emissions – default value (g CO_2eq/MJ)			
		Cultivation	Processing	Transport & distribution	N-n-CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Wood bri-quettes or pel-lets from wood industry resi-dues (case 3a)	1 to 500 km	0,0	0,2	2,8	0,3	0,0	0,3	3,4	0,3
	500 to 2500	0,0	0,2	2,7	0,3	0,0	0,3	3,3	0,3
	2500 to 10000 km	0,0	0,2	4,2	0,3	0,0	0,3	5,1	0,3
	Above 10000 km	0,0	0,2	7,8	0,3	0,0	0,3	9,3	0,3

Agriculture pathways

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (g CO_2eq/MJ)				Greenhouse gas emissions – default value (g CO_2eq/MJ)			
		Cultivation	Processing	Transport & distribution	Non -CO_2 emissions from the fuel in use	Cultivation	Processing	Transport & distribution	Non-CO_2 emissions from the fuel in use
Agricultural Residues with density < 0,2 t/m^3	1 to 500 km	0,0	0,9	2,6	0,2	0,0	1,1	3,1	0,3
	500 to 2500	0,0	0,9	6,5	0,2	0,0	1,1	7,8	0,3
	2500 to 10000 km	0,0	0,9	14,2	0,2	0,0	1,1	17,0	0,3
	Above 10000 km	0,0	0,9	28,3	0,2	0,0	1,1	34,0	0,3
Agricultural Residues with density > 0,2 t/m^3	1 to 500 km	0,0	0,9	2,6	0,2	0,0	1,1	3,1	0,3
	500 to 2500	0,0	0,9	3,6	0,2	0,0	1,1	4,4	0,3
	2500 to 10000 km	0,0	0,9	7,1	0,2	0,0	1,1	8,5	0,3
	Above 10000 km	0,0	0,9	13,6	0,2	0,0	1,1	16,3	0,3
Straw pellets	1 to 500 km	0,0	5,0	3,0	0,2	0,0	6,0	3,6	0,3
	500 to 10000	0,0	5,0	4,6	0,2	0,0	6,0	5,5	0,3
	Above 10000 km	0,0	5,0	8,3	0,2	0,0	6,0	10,0	0,3
Bagasse bri-uettes	500 to 10000	0,0	0,3	4,3	0,4	0,0	0,4	5,2	0,5
	Above 10000 km	0,0	0,3	8,0	0,4	0,0	0,4	9,5	0,5
Palm Kernel Meal	Above 10000 km	21,6	21,1	11,2	0,2	21,6	25,4	13,5	0,3
Palm Kernel Meal (no CH_4 emissions from oil mill)	Above 10000 km	21,6	3,5	11,2	0,2	21,6	4,2	13,5	0,3

Disaggregated default values for biogas for the production of electricity

Biomass fuel production system		Technology	Greenhouse gas emissions – typical value (g CO_2eq/MJ)					Greenhouse gas emissions – default value (g CO_2eq/MJ)				
			Cultivation	Processing	Non -CO_2 emissions from the fuel in use	Transport & distribution	Manure credits	Cultivation	Processing	Non-CO_2 emissions from the fuel in use	Transport & distribution	Manure credits
Wet manure (c)	Case 1	Open digestate	0,0	69,6	8,9	0,8	-107,3	0,0	97,4	12,5	0,8	-107,3
		Close digestate	0,0	0,0	8,9	0,8	-97,6	0,0	0,0	12,5	0,8	-97,6
	Case 2	Open digestate	0,0	74,1	8,9	0,8	-107,3	0,0	103,7	12,5	0,8	-107,3
		Close digestate	0,0	4,2	8,9	0,8	-97,6	0,0	5,9	12,5	0,8	-97,6
	Case 3	Open digestate	0,0	83,2	8,9	0,9	-120,7	0,0	116,4	12,5	0,9	-120,7
		Close digestate	0,0	4,6	8,9	0,8	-108,5	0,0	6,4	12,5	0,8	-108,5
Maize whole plant (d)	Case 1	Open digestate	15,6	13,5	8,9	0,0(e)	-	15,6	18,9	12,5	0,0	-
		Close digestate	15,2	0,0	8,9	0,0	-	15,2	0,0	12,5	0,0	-
	Case 2	Open digestate	15,6	18,8	8,9	0,0	-	15,6	26,3	12,5	0,0	-
		Close digestate	15,2	5,2	8,9	0,0	-	15,2	7,2	12,5	0,0	-
	Case 3	Open digestate	17,5	21,0	8,9	0,0	-	17,5	29,3	12,5	0,0	-
		Close digestate	17,1	5,7	8,9	0,0	-	17,1	7,9	12,5	0,0	-
Biowaste	Case 1	Open digestate	0,0	21,8	8,9	0,5	-	0,0	30,6	12,5	0,5	-
		Close digestate	0,0	0,0	8,9	0,5	-	0,0	0,0	12,5	0,5	-
	Case 2	Open digestate	0,0	27,9	8,9	0,5	-	0,0	39,0	12,5	0,5	-
		Close digestate	0,0	5,9	8,9	0,5	-	0,0	8,3	12,5	0,5	-
	Case 3	Open digestate	0,0	31,2	8,9	0,5	-	0,0	43,7	12,5	0,5	-
		Close digestate	0,0	6,5	8,9	0,5	-	0,0	9,1	12,5	0,5	-

[c] The values for biogas production from manure include negative emissions for emissions saved from raw manure management. The value of e_{sca} considered is equal to – 45 g CO_2eq/MJ manure used in anaerobic digestion.

[d] Maize whole plant means maize harvested as fodder and ensiled for preservation

[e] Transport of agricultural raw materials to the transformation plant is, according to the methodology provided in the Commission's report of 25 February 2010 on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling, included in the 'cultivation' value. The value for transport of maize silage accounts for 0,4 g CO_2eq/MJ biogas.

Disaggregated default values for biomethane:

Biomethane fuel production system	Technology		Greenhouse gas emissions – typical value (g CO_2eq/MJ)						Greenhouse gas emissions – default value (g CO_2eq/MJ)					
			Cultivation	Processing	Upgrading	Transport	Compression at filling station	Manure credits	Cultivation	Processing	Upgrading	Transport	Compression at filling station	Manure credits
Wet manure	Open digestate	No off-gas combustion	0,0	84,2	19,5	1,0	3,3	-124,4	0,0	117,9	27,3	1,0	4,6	-124,4
		Off-gas combustion	0,0	84,2	4,5	1,0	3,3	-124,4	0,0	117,9	6,3	1,0	4,6	-124,4
	Close digestate	No off-gas combustion	0,0	3,2	19,5	0,9	3,3	-111,9	0,0	4,4	27,3	0,9	4,6	-111,9
		Off-gas combustion	0,0	3,2	4,5	0,9	3,3	-111,9	0,0	4,4	6,3	0,9	4,6	-111,9
Maize whole plant	Open digestate	No off-gas combustion	18,1	20,1	19,5	0,0	3,3	-	18,1	28,1	27,3	0,0	4,6	-
		Off-gas combustion	18,1	20,1	4,5	0,0	3,3	-	18,1	28,1	6,3	0,0	4,6	-
	Close digestate	No off-gas combustion	17,6	4,3	19,5	0,0	3,3	-	17,6	6,0	27,3	0,0	4,6	-
		Off-gas combustion	17,6	4,3	4,5	0,0	3,3	-	17,6	6,0	6,3	0,0	4,6	-
Biowaste	Open digestate	No off-gas combustion	0,0	30,6	19,5	0,6	3,3	-	0,0	42,8	27,3	0,6	4,6	-
		Off-gas combustion	0,0	30,6	4,5	0,6	3,3	-	0,0	42,8	6,3	0,6	4,6	-
	Close digestate	No off-gas combustion	0,0	5,1	19,5	0,5	3,3	-	0,0	7,2	27,3	0,5	4,6	-
		Off-gas combustion	0,0	5,1	4,5	0,5	3,3	-	0,0	7,2	6,3	0,5	4,6	-

Total typical and default values for biomass fuels pathways:

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (gCO_2eq/MJ)	Greenhouse gas emissions -default value (gCO_2eq/MJ)
Woodchips from forest residues	1 to 500 km	5	6
	500 to 2500 km	7	9
	2500 to 10000 km	12	15
	above 10000 km	22	27
Woodchips from short rotation coppice (Eucaliptus)	2500 to 10000 km	16	18
Woodchips from short rotation coppice (Poplar - Fertilised)	1 to 500 km	8	9
	500 to 2500 km	10	11
	2500 to 10000 km	15	18
	above 10000 km	25	30
Woodchips from short rotation coppice (Poplar – No fertlisation)	1 to 500 km	6	7
	500 to 2500 km	8	10
	2500 to 10000 km	14	16
	above 10000 km	24	28
Woodchips from stemwood	1 to 500 km	5	6
	500 to 2500 km	7	8
	2500 to 10000 km	12	15
	above 10000 km	22	27
Woodchips from industry residues	1 to 500 km	4	5
	500 to 2500 km	6	7
	2500 to 10000 km	11	13
	above 10000 km	21	25
Wood briquettes or pellets from forestry residues (case 1)	1 to 500 km	29	35
	500 to 2500 km	29	35
	2500 to 10000 km	30	36
	above 10000 km	34	41
Wood briquettes or pellets from forestry residues (case 2a)	1 to 500 km	16	19
	500 to 2500 km	16	19
	2500 to 10000 km	17	21
	above 10000 km	21	25
Wood briquettes or pellets from forestry residues (case 3a)	1 to 500 km	6	7
	500 to 2500 km	6	7
	2500 to 10000 km	7	8
	above 10000 km	11	13
Wood briquettes or pellets from short rotation coppice (Eucalyptus – case 1)	2500-10000 km	33	39
Wood briquettes or pellets from short rotation coppice (Eucalyptus – case 2a)	2500-10000 km	20	23
Wood briquettes or pellets from short rotation coppice (Eucalyptus – case 3a)	2500-10000 km	10	11
Wood briquettes or pellets from short rotation	1 to 500 km	31	37
	500 to 10000 km	32	38

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (gCO_2eq/MJ)	Greenhouse gas emissions -default value (gCO_2eq/MJ)
coppice (Poplar – Fertilised – case 1)	above 10000 km	36	43
Wood briquettes or pellets from short rotation coppice (Poplar – Fertilised – case 2a)	1 to 500 km	18	21
	500 to 10000 km	20	23
	above 10000 km	23	27
Wood briquettes or pellets from short rotation coppice (Poplar – Fertilised – case 3a)	1 to 500 km	8	9
	500 to 10000 km	10	11
	above 10000 km	13	15
Wood briquettes or pellets from short rotation coppice (Poplar – no fertilisation – case 1)	1 to 500 km	30	35
	500 to 10000 km	31	37
	above 10000 km	35	41
Wood briquettes or pellets from short rotation coppice (Poplar – no fertilisation – case 2a)	1 to 500 km	16	19
	500 to 10000 km	18	21
	above 10000 km	21	25
Wood briquettes or pellets from short rotation coppice (Poplar – no fertilisation – case 3a)	1 to 500 km	6	7
	500 to 10000 km	8	9
	above 10000 km	11	13
Wood briquettes or pellets from stemwood (case 1)	1 to 500 km	29	35
	500 to 2500 km	29	34
	2500 to 10000 km	30	36
	above 10000 km	34	41
Wood briquettes or pellets from stemwood (case 2a)	1 to 500 km	16	18
	500 to 2500 km	15	18
	2500 to 10000 km	17	20
	above 10000 km	21	25
Wood briquettes or pellets from stemwood (case 3a)	1 to 500 km	5	6
	500 to 2500 km	5	6
	2500 to 10000 km	7	8
	above 10000 km	11	12
Wood briquettes or pellets from wood industry residues (case 1)	1 to 500 km	17	21
	500 to 2500 km	17	21
	2500 to 10000 km	19	23
	above 10000 km	22	27
Wood briquettes or pellets from wood industry residues (case 2a)	1 to 500 km	9	11
	500 to 2500 km	9	11
	2500 to 10000 km	10	13
	above 10000 km	14	17
Wood briquettes or pellets from wood industry residues (case 3a)	1 to 500 km	3	4
	500 to 2500 km	3	4
	2500 to 10000 km	5	6
	above 10000 km	8	10

Case 1 refers to processes in which a Natural Gas boiler is used to provide the process heat to the pellet mill. Process electricity is purchased from the grid.

Case 2a refers to processes in which a boiler fuelled with wood chips is used to provide the process heat to the pellet mill. Process electricity is purchased from the grid.

Case 3a refers to processes in which a CHP, fuelled with wood chips, is used to provide heat and electricity to the pellet mill.

Biomass fuel production system	Transport distance	Greenhouse gas emissions – typical value (gCO_2eq/MJ)	Greenhouse gas emissions -default value (gCO_2eq/MJ)
Agricultural Residues with density < 0,2 t/m^3 ([1])	1 to 500 km	4	4
	500 to 2500 km	8	9
	2500 to 10000 km	15	18
	above 10000 km	29	35
Agricultural Residues with density > 0,2 t/m^3 ([2])	1 to 500 km	4	4
	500 to 2500 km	5	6
	2500 to 10000 km	8	10
	above 10000 km	15	18
Straw pellets	1 to 500 km	8	10
	500 to 10000 km	10	12
	above 10000 km	14	16
Bagasse briquettes	500 to 10000 km	5	6
	above 10000 km	9	10
Palm Kernel Meal	above 10000 km	54	61
Palm Kernel Meal (no CH_4 emissions from oil mill)	above 10000 km	37	40

Typical and default values – biogas for electricity

Biogas production system	Technological option		Typical value Greenhouse gas emissions (g CO2eq/MJ)	Default value Greenhouse gas emissions (g CO2eq/MJ)
Biogas for electricity from wet manure	Case 1	Open digestate ([3])	-28	3
		Close digestate ([4])	-88	-84
	Case 2	Open digestate	-23	10
		Close digestate	-84	-78
	Case 3	Open digestate	-28	9
		Close digestate	-94	-89
	Case 1	Open digestate	38	47

[1] This group of materials includes agricultural residues with a low bulk density, and it comprises materials such as straw bales, oat hulls, rice husks and sugar cane bagasse bales (not exhaustive list).

[2] The group of agricultural residues with higher bulk density includes materials such as corn cobs, nut shells, soybean hulls, palm kernel shells (not exhaustive list).

[3] Open storage of digestate accounts for additional emissions of methane which change with the weather, the substrate, and the digestion efficiency. In these calculations the amounts are taken to be equal to 0,05 MJ CH4/MJ biogas for manure, 0,035 MJ CH4/MJ biogas for maize and 0,01 MJ CH4/MJ biogas for biowaste.

[4] Close storage means that the digestate resulting from the digestion process is stored in a gas tight tank and the additional biogas released during storage is considered to be recovered for production of additional electricity or biomethane.

Biogas production system	Technological option		Typical value Greenhouse gas emissions (g CO2eq/MJ)	Default value Greenhouse gas emissions (g CO2eq/MJ)
Biogas for electricity from maize whole plant		Close digestate	24	28
	Case 2	Open digestate	43	54
		Close digestate	29	35
	Case 3	Open digestate	47	59
		Close digestate	32	38
Biogas for electricity from biowaste	Case 1	Open digestate	31	44
		Close digestate	9	13
	Case 2	Open digestate	37	52
		Close digestate	15	21
	Case 3	Open digestate	41	57
		Close digestate	16	22

Typical and default values for biomethane

Biomethane production system	Technological option	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Biomethane from wet manure	Open digestate, no off-gas combustion ([1])	-20	22
	Open digestate, off-gas combustion ([2])	-35	1
	Open digestate, no off-gas combustion	-88	-79
	Open digestate, off-gas combustion	-103	-100
Biomethane from maize whole plant	Open digestate, no off-gas combustion	58	73
	Open digestate, off-gas combustion	43	52
	Open digestate, no off-gas combustion	41	51
	Open digestate, off-gas combustion	26	30
Biomethane from biowaste	Open digestate, no off-gas combustion	51	71
	Open digestate, off-gas combustion	36	50
	Open digestate, no off-gas combustion	25	35
	Open digestate, off-gas combustion	10	14

[1] This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Swing Adsorption (PSA), Pressure Water Scrubbing (PWS), Membranes, Cryogenic, and Organic Physical Scrubbing (OPS). It includes an emission of 0,03 MJ CH4/MJ biomethane for the emission of methane in the off-gases.

[2] This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Water Scrubbing (PWS) when water is recycled, Pressure Swing Adsorption (PSA), Chemical Scrubbing, Organic Physical Scrubbing (OPS), Membranes and Cryogenic upgrading. No methane emissions are considered for this category (the methane in the off-gas is combusted, if any).

Typical and default values – biogas for electricity – mixtures of manure and maize: greenhouse gas emissions with shares given on a fresh mass basis

Biogas production system		Technological options	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Manure – Maize 80 % - 20 %	Case 1	Open digestate	17	33
		Close digestate	-12	-9
	Case 2	Open digestate	22	40
		Close digestate	-7	-2
	Case 3	Open digestate	23	43
		Close digestate	-9	-4
Manure – Maize 70 % - 30 %	Case 1	Open digestate	24	37
		Close digestate	0	3
	Case 2	Open digestate	29	45
		Close digestate	4	10
	Case 3	Open digestate	31	48
		Close digestate	4	10
Manure – Maize 60 % - 40 %	Case 1	Open digestate	28	40
		Close digestate	7	11
	Case 2	Open digestate	33	47
		Close digestate	12	18
	Case 3	Open digestate	36	52
		Close digestate	12	18

Comments

Case 1 refers to pathways in which electricity and heat required in the process are supplied by the CHP engine itself.

Case 2 refers to pathways in which the electricity required in the process is taken from the grid and the process heat is supplied by the CHP engine itself. In some Member States, operators are not allowed to claim the gross production for subsidies and case 1 is the more likely configuration.

Case 3 refers to pathways in which the electricity required in the process is taken from the grid and the process heat is supplied by a biogas boiler. This case applies to some installations in which the CHP engine is not on-site and biogas is sold (but not upgraded to biomethane).

Typical and default values – biomethane - mixtures of manure and maize: greenhouse gas emissions with shares given on a fresh mass basis

Biomethane production system	Technological options	Typical value	Default value
		(g CO_2eq/MJ)	(g CO_2eq/MJ)
Manure – Maize 80 % - 20 %	Open digestate, no off-gas combustion	32	57
	Open digestate, off-gas combustion	17	36
	Close digestate, no off-gas combustion	-1	9
	Close digestate, off-gas combustion	-16	-12
Manure – Maize 70 % - 30 %	Open digestate, no off-gas combustion	41	62

	Open digestate, off-gas combustion	26	41
	Close digestate, no off-gas combustion	13	22
	Close digestate, off-gas combustion	-2	1
Manure – Maize 60 % - 40 %	Open digestate, no off-gas combustion	46	66
	Open digestate, off-gas combustion	31	45
	Close digestate, no off-gas combustion	22	31
	Close digestate, off-gas combustion	7	10

Where biomethane is used as Compressed Biomethane as a transport fuel, a value of 3,3 g CO_2eq/MJ biomethane needs to be added to the typical values and a value of 4,6 g CO2eq/MJ biomethane to the default values.

3. Changes compared to the previous edition

Date	Section	Previous requirement	Current requirement
05.05.2025	Whole document	RED II	RED III
05.05.2025	Whole document	Directive 2018/2001	Directive 2018/2001 as amended by Directive 2023/2413