



European
Commission

JRC TECHNICAL REPORTS

WELL-TO-WHEELS Appendix 1 - Version 4.a

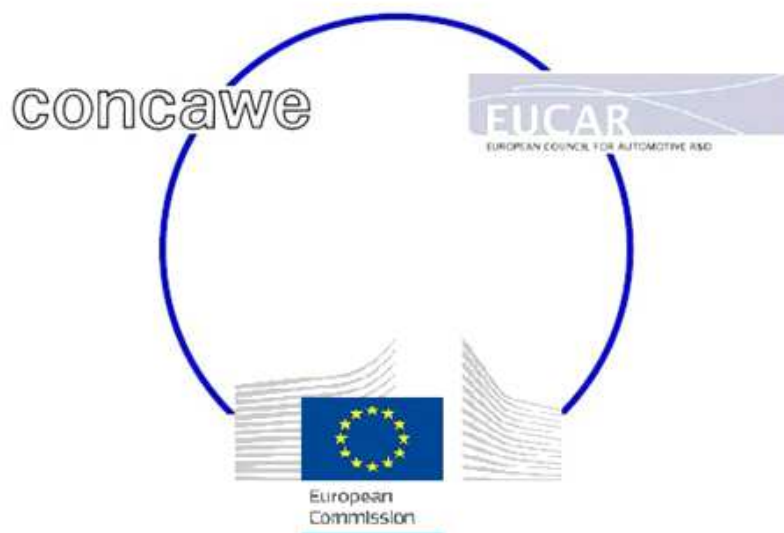
Summary of WTW Energy and GHG balances

WELL-TO-WHEELS ANALYSIS OF FUTURE AUTOMOTIVE
FUELS AND POWERTRAINS IN THE EUROPEAN CONTEXT

Authors: Robert EDWARDS (JRC), Heinz HASS (EUCAR), Jean-François LARIVÉ (CONCAWE), Laura LONZA (JRC), Heiko MAAS (EUCAR), David Rickeard (CONCAWE)

Editors: Simon Godwin (EUCAR), Heather Hamje (CONCAWE), Alois Krasenbrink (JRC), Robin Nelson (CONCAWE), Kenneth D. Rose (CONCAWE)

2014



Report EUR 26236 EN

Joint
Research
Centre

European Commission
Joint Research Centre
Institute for Energy and Transport

Contact information

Laura Lonza

Address: Joint Research Centre, Via Enrico Fermi 2749, TP 230, 21027 Ispra (VA), Italy

E-mail: laura.lonza@ec.europa.eu

Tel.: +39 0332 78 3902

Fax: +39 0332 78 6671

<http://iet.jrc.ec.europa.eu/>

<http://www.jrc.ec.europa.eu/>

This publication is a Technical Report by the Joint Research Centre of the European Commission.

Legal Notice

This publication is a Technical Report by the Joint Research Centre, the European Commission's in-house science service.

It aims to provide evidence-based scientific support to the European policy-making process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of this publication.

JRC85329

EUR 26236 EN

ISBN 978-92-79-33887-8 (PDF)

ISSN 1831-9424 (online)

doi:10.2790/95533

Luxembourg: Publications Office of the European Union, 2014

© European Union, 2014

Reproduction is authorised provided the source is acknowledged.

Printed in Italy

Summary of WTW Energy and GHG balances

This appendix gives, for selected WTW pathways, i.e. combinations of a fuel production route and a powertrain, the energy and GHG figures including uncertainty ranges for WTT, TTW and WTW.

Table of contents

1	Conventional fuels pathways	5
2	CNG	6
3	CBG & SNG	7
4	Ethanol	8
4.1	Neat fuel equivalent when used in low level blends (10% v/v or less) with conventional gasoline	8
4.2	E10 (90.1% v/v conventional gasoline, 9.9% v/v ethanol)	10
4.3	Neat fuel equivalent when used in high RON E20 blend with conventional gasoline	12
4.4	E20 (80.1% v/v conventional gasoline, 19.9% v/v ethanol)	14
4.5	Neat fuel equivalent when used in E85 blend with conventional gasoline	16
4.6	E85 (80.1% v/v conventional gasoline, 19.9% v/v ethanol)	18
5	Ethers	20
6	Biodiesel	21
6.1	Neat fuel equivalent when used in blends with conventional diesel	21
6.2	B7 (93.1% v/v diesel, 6.9% v/v biodiesel)	22
7	HVO	23
8	Synthetic diesel fuel and DME	24
9	Electricity and conventional gasoline in electrified vehicles	25
10	Electricity and conventional diesel in electrified vehicles	29
11	Hydrogen in fuel cell vehicles	32
11.1	Compressed hydrogen (C-H ₂), thermal pathways	32
11.2	Compressed hydrogen (C-H ₂), electrolysis pathways	33
11.3	Cryo-compressed liquid hydrogen (Cc-H ₂), all pathways	34
12	Electricity in battery electric vehicles (BEV)	35

1 Conventional fuels pathways

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			MJ _f /100 km			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
COG1 Conventional gasoline	2010	PISI	211	-6	6	39	-5	5	0	0	0	0	0	0	250	8	8	249	-8	8	156	-5	5	29	-3	3	0	0	0	185	-6	6			
		DISI	204	-6	6	38	-5	5	0	0	0	0	0	0	241	8	8	240	-8	8	150	-5	5	28	-3	3	0	0	0	178	-6	6			
		DISIHyb	142	-7	7	26	-4	3	0	0	0	0	0	0	168	8	8	167	-8	8	105	-5	5	20	-2	2	0	0	0	125	-6	6			
	2020+	PISI	150	-9	9	28	-4	4	0	0	0	0	0	0	178	10	9	177	-9	9	111	-6	6	21	-3	3	0	0	0	132	-7	7			
		DISI	142	-8	8	26	-4	4	0	0	0	0	0	0	169	9	9	168	-9	9	105	-6	6	20	-3	2	0	0	0	125	-7	7			
		DISIHyb	93	-9	9	17	-3	3	0	0	0	0	0	0	111	9	9	110	-9	9	70	-6	6	13	-2	2	0	0	0	83	-7	7			
COD1 Conventional diesel	2010	DICI	163	-5	5	33	-4	4	0	0	0	0	0	0	196	6	6	195	-6	6	120	-4	4	25	-3	3	0	0	0	145	-4	5			
		DICIHyb	128	-7	7	26	-3	3	0	0	0	0	0	0	154	7	7	153	-7	7	96	-5	5	20	-2	2	0	0	0	115	-5	5			
	2020+	DICI	119	-7	7	24	-3	3	0	0	0	0	0	0	143	7	8	142	-7	7	88	-5	5	18	-2	2	0	0	0	106	-6	6			
		DICIHyb	88	-8	8	18	-3	3	0	0	0	0	0	0	105	8	8	105	-8	8	66	-6	6	13	-2	2	0	0	0	79	-6	6			
LRLP1 LPG imported from remote gas field	2010	PISI	216	-10	10	26	-1	2	0	0	0	0	0	0	241	-10	10	240	-10	10	142	-6	6	17	-1	1	0	0	0	160	-6	7			
		DISI	208	-9	9	25	-1	2	0	0	0	0	0	0	232	-9	10	231	-9	10	137	-6	6	17	-1	1	0	0	0	154	-6	6			
	2020+	PISI	149	-13	13	18	-2	2	0	0	0	0	0	0	166	-13	13	165	-13	13	98	-9	9	12	-1	1	0	0	0	110	-9	9			
		DISI	143	-13	13	17	-2	2	0	0	0	0	0	0	160	-13	13	159	-13	13	95	-8	8	12	-1	1	0	0	0	106	-8	8			

2 CNG

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ _e /100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
GMCG1 CNG from EU-mix NG supply	2010	PISI	232	-10	10	38	-6	6	0	0	0	0	0	0	271	-12	12	263	-11	12	132	-6	6	30	-3	3	0	0	0	163	-7	7			
		DISI	212	-10	10	35	-5	6	0	0	0	0	0	0	247	-11	11	240	-10	11	121	-5	5	28	-3	3	0	0	0	148	-6	6			
	2020+	PISI	152	-13	13	25	-4	5	0	0	0	0	0	0	178	-14	14	173	-14	14	87	-8	8	20	-3	3	0	0	0	107	-8	8			
		DISI	145	-13	13	24	-4	4	0	0	0	0	0	0	169	-13	13	164	-13	13	83	-7	7	19	-2	3	0	0	0	102	-8	8			
GPCG1a CNG from imported NG 7000 km	2010	PISI	232	-10	10	68	-27	15	0	0	0	0	0	0	300	-29	18	292	-26	17	132	-6	6	52	-16	9	0	0	0	185	-17	11			
		DISI	212	-10	10	62	-25	13	0	0	0	0	0	0	273	-27	16	266	-24	15	121	-5	5	48	-14	8	0	0	0	169	-15	10			
	2020+	PISI	152	-13	13	44	-18	10	0	0	0	0	0	0	197	-23	17	192	-21	16	87	-8	8	34	-11	6	0	0	0	122	-13	10			
		DISI	145	-13	13	42	-17	10	0	0	0	0	0	0	187	-22	16	182	-20	15	83	-7	7	33	-10	6	0	0	0	116	-13	10			
GPCG1b CNG from imported NG 4000 km	2010	PISI	232	-10	10	49	-16	8	0	0	0	0	0	0	281	-19	13	273	-17	12	132	-6	6	37	-9	5	0	0	0	170	-11	8			
		DISI	212	-10	10	44	-15	7	0	0	0	0	0	0	256	-18	12	249	-16	11	121	-5	5	34	-8	4	0	0	0	155	-10	7			
	2020+	PISI	152	-13	13	32	-11	6	0	0	0	0	0	0	184	-17	15	179	-16	14	87	-8	8	24	-6	4	0	0	0	112	-10	8			
		DISI	145	-13	13	30	-10	5	0	0	0	0	0	0	175	-16	14	171	-15	14	83	-7	7	23	-6	3	0	0	0	106	-9	8			
GRCG1 Remote LNG, vap at import terminal	2010	PISI	232	-10	10	72	-6	7	0	0	0	0	0	0	304	-12	13	296	-12	12	132	-6	6	49	-3	4	0	0	0	181	-7	7			
		DISI	212	-10	10	66	-6	7	0	0	0	0	0	0	278	-11	12	270	-11	11	121	-5	5	45	-3	4	0	0	0	165	-6	7			
	2020+	PISI	152	-13	13	47	-5	6	0	0	0	0	0	0	200	-15	15	195	-14	14	87	-8	8	32	-3	4	0	0	0	119	-8	8			
		DISI	145	-13	13	45	-5	6	0	0	0	0	0	0	190	-14	14	185	-14	14	83	-7	7	31	-3	3	0	0	0	114	-8	8			
GRCG1C Remote LNG + CCS, vap at import terminal	2010	PISI	232	-10	10	76	-7	7	0	0	0	0	0	0	308	-13	13	300	-12	12	132	-6	6	41	-3	4	0	0	0	174	-7	7			
		DISI	212	-10	10	69	-6	7	0	0	0	0	0	0	281	-11	12	274	-11	11	121	-5	5	38	-3	3	0	0	0	158	-6	6			
	2020+	PISI	152	-13	13	50	-6	6	0	0	0	0	0	0	202	-15	15	197	-14	14	87	-8	8	27	-3	3	0	0	0	114	-8	8			
		DISI	145	-13	13	47	-6	6	0	0	0	0	0	0	193	-14	14	188	-14	14	83	-7	7	26	-3	3	0	0	0	109	-8	8			
GRCG2 Remote LNG, vap at retail point	2010	PISI	232	-10	10	60	-4	6	0	0	0	0	0	0	293	-11	12	291	-11	12	132	-6	6	50	-3	4	0	0	0	182	-6	7			
		DISI	212	-10	10	55	-3	5	0	0	0	0	0	0	267	-10	11	265	-10	11	121	-5	5	45	-2	3	0	0	0	166	-6	6			
	2020+	PISI	152	-13	13	40	-4	5	0	0	0	0	0	0	192	-14	14	191	-14	14	87	-8	8	33	-3	3	0	0	0	120	-8	8			
		DISI	145	-13	13	38	-4	5	0	0	0	0	0	0	183	-13	14	182	-13	14	83	-7	7	31	-3	3	0	0	0	114	-8	8			
GRLG1 Remote LNG, use as LNG	2010	PISI	232	-10	10	52	-4	5	0	0	0	0	0	0	285	-11	12	284	-11	12	132	-6	6	45	-3	3	0	0	0	177	-6	7			
		DISI	212	-10	10	48	-3	5	0	0	0	0	0	0	259	-10	11	259	-10	11	121	-5	5	41	-2	3	0	0	0	162	-6	6			
	2020+	PISI	152	-13	13	34	-4	4	0	0	0	0	0	0	187	-14	14	187	-14	14	87	-8	8	30	-3	3	0	0	0	117	-8	8			
		DISI	145	-13	13	33	-3	4	0	0	0	0	0	0	178	-13	13	178	-13	13	83	-7	7	28	-3	3	0	0	0	111	-8	8			
SGCG1 Shale gas (EU)	2010	PISI	232	-10	10	24	-4	6	0	0	0	0	0	0	256	-11	12	248	-11	11	132	-6	6	18	-2	9	0	0	0	150	-6	11			
		DISI	212	-10	10	21	-4	5	0	0	0	0	0	0	233	-10	11	226	-10	10	121	-5	5	16	-2	8	0	0	0	137	-6	10			
	2020+	PISI	152	-13	13	15	-3	4	0	0	0	0	0	0	168	-14	14	163	-14	14	87	-8	8	12	-1	6	0	0	0	99	-8	10			
		DISI	145	-13	13	15	-3	4	0	0	0	0	0	0	160	-13	13	155	-13	13	83	-7	7	11	-1	6	0	0	0	94	-7	9			

3 CBG & SNG

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
OWCG1 Municipal waste (closed digestate storage)	2010	PISI	232	-10	10	231	-37	34	0	0	0	0	0	0	463	-39	35	42	-7	6	132	-6	6	-93	-8	8	0	0	0	0	0	0	39	-10	10
		DISI	212	-10	10	210	-34	31	0	0	0	0	0	0	422	-35	32	38	-6	6	121	-5	5	-85	-8	7	0	0	0	0	0	0	36	-9	9
	2020+	PISI	152	-13	13	151	-27	25	0	0	0	0	0	0	304	-30	28	27	-5	4	87	-8	8	-61	-6	5	0	0	0	0	0	0	26	-10	9
		DISI	145	-13	13	144	-26	24	0	0	0	0	0	0	289	-29	27	26	-5	4	83	-7	7	-58	-5	5	0	0	0	0	0	0	25	-9	9
OWCG21 Manure (closed digestate storage)	2010	PISI	232	-10	10	466	-22	22	0	0	0	0	0	0	699	-25	24	34	-2	2	132	-6	6	-290	8	-8	0	0	0	0	0	0	-158	-10	10
		DISI	212	-10	10	425	-20	20	0	0	0	0	0	0	637	-22	22	31	-1	1	121	-5	5	-265	7	-7	0	0	0	0	0	0	-144	-9	9
	2020+	PISI	152	-13	13	306	-27	27	0	0	0	0	0	0	459	-30	30	22	-2	2	87	-8	8	-191	10	-10	0	0	0	0	0	0	-103	-12	12
		DISI	145	-13	13	291	-26	26	0	0	0	0	0	0	436	-29	29	21	-2	2	83	-7	7	-181	9	-9	0	0	0	0	0	0	-98	-12	12
OWCG22 Manure (open digestate storage)	2010	PISI	232	-10	10	503	-24	23	0	0	0	0	0	0	736	-26	26	35	-2	2	132	-6	6	-233	6	-5	0	0	0	0	0	0	-101	-8	8
		DISI	212	-10	10	459	-22	21	0	0	0	0	0	0	671	-24	23	32	-1	1	121	-5	5	-212	5	-5	0	0	0	0	0	0	-92	-8	7
	2020+	PISI	152	-13	13	330	-29	29	0	0	0	0	0	0	483	-32	32	23	-2	2	87	-8	8	-153	6	-6	0	0	0	0	0	0	-66	-10	10
		DISI	145	-13	13	314	-28	28	0	0	0	0	0	0	459	-31	31	22	-2	2	83	-7	7	-146	6	-6	0	0	0	0	0	0	-62	-10	9
OWCG4 Maize (whole plant) (closed digestate storage)	2010	PISI	232	-10	10	297	-15	14	0	0	0	0	0	0	530	-18	18	68	-3	3	132	-6	6	-33	-4	105	0	0	0	0	0	0	99	-7	105
		DISI	212	-10	10	271	-13	13	0	0	0	0	0	0	483	-16	16	62	-3	3	121	-5	5	-30	-4	95	0	0	0	0	0	0	91	-7	96
	2020+	PISI	152	-13	13	195	-18	18	0	0	0	0	0	0	348	-22	22	44	-4	4	87	-8	8	-22	-5	69	0	0	0	0	0	0	65	-9	69
		DISI	145	-13	13	186	-17	17	0	0	0	0	0	0	331	-21	21	42	-4	4	83	-7	7	-21	-5	65	0	0	0	0	0	0	62	-9	66
OWCG5 Double cropping (closed digestate storage)	2010	PISI	232	-10	10	283	-15	14	0	0	0	0	0	0	515	-18	17	54	-3	3	132	-6	6	-66	-6	27	0	0	0	0	0	0	67	-9	28
		DISI	212	-10	10	258	-13	13	0	0	0	0	0	0	470	-16	16	50	-3	2	121	-5	5	-60	-6	25	0	0	0	0	0	0	61	-8	25
	2020+	PISI	152	-13	13	186	-17	17	0	0	0	0	0	0	338	-22	21	36	-3	3	87	-8	8	-43	-5	18	0	0	0	0	0	0	44	-9	20
		DISI	145	-13	13	177	-16	16	0	0	0	0	0	0	322	-21	20	34	-3	3	83	-7	7	-41	-5	17	0	0	0	0	0	0	42	-9	19
REGG1 Synthetic methane from renewable electricity	2010	PISI	232	-10	10	247	-22	22	0	0	0	0	0	0	480	-24	24	9	-1	1	132	-6	6	-120	-3	2	0	0	0	0	0	0	12	-6	6
		DISI	212	-10	10	225	-20	20	0	0	0	0	0	0	437	-22	22	8	-1	1	121	-5	5	-109	-2	2	0	0	0	0	0	0	11	-6	6
	2020+	PISI	152	-13	13	162	-19	19	0	0	0	0	0	0	315	-23	23	6	-1	1	87	-8	8	-79	-2	1	0	0	0	0	0	0	8	-8	8
		DISI	145	-13	13	154	-18	18	0	0	0	0	0	0	300	-22	22	6	-1	1	83	-7	7	-75	-2	1	0	0	0	0	0	0	8	-7	7

4 Ethanol

4.1 Neat fuel equivalent when used in low level blends (10% v/v or less) with conventional gasoline

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
SBET1a Sugar beet, pulp to AF, slops not used	2010 DISI		204	-7	7	296	-23	25	0	0	0	0	0	0	500	-24	26	112	-9	10	146	-5	5	-63	-7	5	0	0	0	83	-8	7			
	2020+ DISI		142	-10	10	207	-20	22	0	0	0	0	0	0	349	-22	24	78	-8	8	102	-7	7	-44	-6	5	0	0	0	58	-9	9			
	2010 PISI		211	-7	7	307	-24	26	0	0	0	0	0	0	518	-25	27	116	-9	10	151	-5	5	-66	-7	5	0	0	0	86	-9	7			
	2020+ PISI		150	-10	10	218	-21	23	0	0	0	0	0	0	368	-24	25	82	-8	9	108	-8	8	-47	-6	5	0	0	0	61	-10	9			
SBET1b Sugar beet, pulp to AF, slops to biogas	2010 DISI		204	-7	7	252	-23	24	0	0	0	0	0	0	456	-24	25	67	-6	6	146	-5	5	-90	-6	4	0	0	0	56	-8	7			
	2020+ DISI		142	-10	10	176	-19	20	0	0	0	0	0	0	318	-21	22	47	-5	5	102	-7	7	-63	-5	4	0	0	0	39	-9	8			
	2010 PISI		211	-7	7	261	-24	25	0	0	0	0	0	0	472	-25	26	69	-6	7	151	-5	5	-93	-6	4	0	0	0	58	-8	7			
	2020+ PISI		150	-10	10	186	-20	21	0	0	0	0	0	0	336	-23	23	49	-5	5	108	-8	8	-66	-5	4	0	0	0	42	-9	8			
SBET1c Sugar beet, pulp to fuel, slops to biogas	2010 DISI		204	-7	7	187	-19	23	0	0	0	0	0	0	391	-20	25	25	-3	3	146	-5	5	-109	-4	5	0	0	0	37	-7	7			
	2020+ DISI		142	-10	10	131	-15	18	0	0	0	0	0	0	273	-18	21	17	-2	2	102	-7	7	-76	-3	4	0	0	0	26	-8	8			
	2010 PISI		211	-7	7	194	-20	24	0	0	0	0	0	0	405	-21	25	26	-3	3	151	-5	5	-113	-4	5	0	0	0	38	-7	7			
	2020+ PISI		150	-10	10	138	-16	19	0	0	0	0	0	0	288	-19	22	18	-2	3	108	-8	8	-80	-4	4	0	0	0	27	-8	8			
WTET1a Wheat, conv boiler, DDGS to AF	2010 DISI		204	-7	7	353	-13	13	0	0	0	0	0	0	557	-15	15	158	-6	6	146	-5	5	-4	-10	7	0	0	0	142	-11	9			
	2020+ DISI		142	-10	10	247	-17	17	0	0	0	0	0	0	389	-20	20	111	-8	8	102	-7	7	-3	-9	8	0	0	0	99	-11	10			
	2010 PISI		211	-7	7	366	-14	14	0	0	0	0	0	0	578	-16	16	164	-6	6	151	-5	5	-4	-10	7	0	0	0	147	-11	9			
	2020+ PISI		150	-10	10	260	-18	18	0	0	0	0	0	0	410	-21	21	117	-8	8	108	-8	8	-3	-9	8	0	0	0	105	-12	11			
WTET1b Wheat, conv boiler, DDGS to elec	2010 DISI		204	-7	7	239	-10	10	0	0	0	0	0	0	443	-12	12	109	-4	4	146	-5	5	-26	-7	6	0	0	0	120	-9	8			
	2020+ DISI		142	-10	10	167	-12	12	0	0	0	0	0	0	310	-15	15	76	-5	5	102	-7	7	-18	-7	7	0	0	0	84	-10	10			
	2010 PISI		211	-7	7	248	-10	10	0	0	0	0	0	0	459	-13	12	113	-5	5	151	-5	5	-27	-7	7	0	0	0	124	-9	9			
	2020+ PISI		150	-10	10	176	-13	12	0	0	0	0	0	0	327	-16	16	80	-6	6	108	-8	8	-19	-7	7	0	0	0	89	-10	10			
WTET2a Wheat, NG CHP, DDGS to AF	2010 DISI		204	-7	7	330	-12	12	0	0	0	0	0	0	534	-14	14	153	-5	5	146	-5	5	-13	-8	6	0	0	0	133	-10	8			
	2020+ DISI		142	-10	10	230	-16	16	0	0	0	0	0	0	373	-18	18	107	-7	7	102	-7	7	-9	-8	7	0	0	0	93	-11	10			
	2010 PISI		211	-7	7	342	-12	12	0	0	0	0	0	0	553	-14	14	158	-6	6	151	-5	5	-14	-9	6	0	0	0	137	-10	8			
	2020+ PISI		150	-10	10	243	-17	17	0	0	0	0	0	0	393	-19	19	112	-8	8	108	-8	8	-10	-8	7	0	0	0	98	-11	10			
WTET2b Wheat, NG CHP, DDGS to elec	2010 DISI		204	-7	7	216	-8	8	0	0	0	0	0	0	419	-11	11	103	-4	4	146	-5	5	-35	-6	6	0	0	0	111	-8	8			
	2020+ DISI		142	-10	10	151	-10	10	0	0	0	0	0	0	293	-14	14	72	-5	5	102	-7	7	-25	-6	6	0	0	0	78	-9	9			
	2010 PISI		211	-7	7	223	-8	8	0	0	0	0	0	0	435	-11	11	107	-4	4	151	-5	5	-36	-6	6	0	0	0	115	-8	8			
	2020+ PISI		150	-10	10	159	-11	11	0	0	0	0	0	0	309	-15	15	76	-5	5	108	-8	8	-26	-7	6	0	0	0	82	-10	10			
WTET3a Wheat, lignite CHP, DDGS to AF	2010 DISI		204	-7	7	314	-11	11	0	0	0	0	0	0	518	-13	13	137	-5	5	146	-5	5	30	-9	7	0	0	0	176	-10	9			
	2020+ DISI		142	-10	10	220	-15	15	0	0	0	0	0	0	362	-18	18	96	-7	7	102	-7	7	21	-9	8	0	0	0	123	-12	11			
	2010 PISI		211	-7	7	326	-11	11	0	0	0	0	0	0	537	-14	14	142	-5	5	151	-5	5	31	-9	7	0	0	0	182	-11	9			
	2020+ PISI		150	-10	10	231	-16	16	0	0	0	0	0	0	382	-19	19	101	-7	7	108	-8	8	22	-10	9	0	0	0	130	-12	12			
WTET3b Wheat, lignite CHP, DDGS to elec	2010 DISI		204	-7	7	200	-7	7	0	0	0	0	0	0	404	-10	10	88	-3	3	146	-5	5	8	-7	7	0	0	0	154	-9	9			
	2020+ DISI		142	-10	10	140	-10	10	0	0	0	0	0	0	282	-14	14	61	-4	4	102	-7	7	6	-8	8	0	0	0	108	-11	11			
	2010 PISI		211	-7	7	208	-7	7	0	0	0	0	0	0	419	-10	10	91	-3	3	151	-5	5	8	-7	7	0	0	0	160	-9	9			
	2020+ PISI		150	-10	10	148	-10	10	0	0	0	0	0	0	298	-14	14	65	-4	4	108	-8	8	6	-8	8	0	0	0	114	-11	11			

4.2 E10 (90.1% v/v conventional gasoline, 9.9% v/v ethanol)

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
SBET1a Sugar beet, pulp to AF, slops not used	2010 DISI		204	-7	7	55	-7	8	0	0	0	0	0	0	259	-10	11	231	-9	9	150	-5	5	22	-4	3	0	0	0	172	-6	6			
	2020+ DISI		142	-10	10	39	-6	6	0	0	0	0	0	0	181	-11	11	161	-10	10	105	-7	7	15	-3	3	0	0	0	120	-8	8			
SBET1b Sugar beet, pulp to AF, slops to biogas	2010 DISI		204	-7	7	52	-7	7	0	0	0	0	0	0	256	-10	10	228	-9	9	150	-5	5	20	-4	3	0	0	0	170	-6	6			
	2020+ DISI		142	-10	10	36	-6	6	0	0	0	0	0	0	179	-11	11	159	-10	10	105	-7	7	14	-3	3	0	0	0	119	-8	8			
SBET1c Sugar beet, pulp to fuel, slops to biogas	2010 DISI		204	-7	7	48	-7	8	0	0	0	0	0	0	252	-10	10	225	-8	9	150	-5	5	19	-3	3	0	0	0	168	-6	6			
	2020+ DISI		142	-10	10	33	-5	6	0	0	0	0	0	0	176	-11	11	157	-10	10	105	-7	7	13	-3	3	0	0	0	118	-8	8			
WTET1a Wheat, conv boiler, DDGS to AF	2010 DISI		204	-7	7	59	-5	5	0	0	0	0	0	0	263	-9	9	234	-8	8	150	-5	5	26	-4	3	0	0	0	176	-7	6			
	2020+ DISI		142	-10	10	41	-4	4	0	0	0	0	0	0	184	-11	11	164	-10	10	105	-7	7	18	-3	3	0	0	0	123	-8	8			
WTET1b Wheat, conv boiler, DDGS to elec	2010 DISI		204	-7	7	51	-5	5	0	0	0	0	0	0	255	-9	9	231	-8	8	150	-5	5	24	-4	3	0	0	0	174	-6	6			
	2020+ DISI		142	-10	10	36	-4	4	0	0	0	0	0	0	178	-11	10	161	-10	10	105	-7	7	17	-3	3	0	0	0	122	-8	8			
WTET2a Wheat, NG CHP, DDGS to AF	2010 DISI		204	-7	7	58	-5	5	0	0	0	0	0	0	261	-9	9	234	-8	8	150	-5	5	25	-4	3	0	0	0	175	-6	6			
	2020+ DISI		142	-10	10	40	-4	4	0	0	0	0	0	0	183	-11	11	163	-10	10	105	-7	7	18	-3	3	0	0	0	123	-8	8			
WTET2b Wheat, NG CHP, DDGS to elec	2010 DISI		204	-7	7	50	-5	5	0	0	0	0	0	0	254	-9	9	231	-8	8	150	-5	5	24	-4	3	0	0	0	174	-6	6			
	2020+ DISI		142	-10	10	35	-4	4	0	0	0	0	0	0	177	-10	10	161	-10	10	105	-7	7	17	-3	3	0	0	0	122	-8	8			
WTET3a Wheat, lignite CHP, DDGS to AF	2010 DISI		204	-7	7	56	-5	5	0	0	0	0	0	0	260	-9	9	233	-8	8	150	-5	5	28	-4	3	0	0	0	178	-6	6			
	2020+ DISI		142	-10	10	39	-4	4	0	0	0	0	0	0	182	-11	10	163	-10	10	105	-7	7	20	-3	3	0	0	0	125	-8	8			
WTET3b Wheat, lignite CHP, DDGS to elec	2010 DISI		204	-7	7	49	-5	5	0	0	0	0	0	0	252	-9	9	230	-8	8	150	-5	5	27	-4	3	0	0	0	176	-6	6			
	2020+ DISI		142	-10	10	34	-4	4	0	0	0	0	0	0	176	-10	10	160	-10	10	105	-7	7	19	-3	3	0	0	0	124	-8	8			

E10 (90.1% v/v conventional gasoline, 9.9% v/v ethanol), cont'd

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
WTET4a Wheat, straw CHP, DDGS to AF	2010 DISI		204	-7	7	58	-5	5	0	0	0	0	0	0	262	-9	9	227	-7	7	150	-5	5	21	-4	3	0	0	0	171	-6	6			
	2020+ DISI		142	-10	10	40	-4	4	0	0	0	0	0	0	183	-11	11	158	-9	9	105	-7	7	15	-3	3	0	0	0	120	-8	8			
WTET4b Wheat, straw CHP, DDGS to elec	2010 DISI		204	-7	7	50	-5	5	0	0	0	0	0	0	254	-9	9	223	-7	7	150	-5	5	19	-3	3	0	0	0	169	-6	6			
	2020+ DISI		142	-10	10	35	-4	4	0	0	0	0	0	0	177	-10	10	156	-9	9	105	-7	7	14	-3	3	0	0	0	119	-8	8			
WTET5 Wheat, conv boiler, DDGS to elec via biogas	2010 DISI		204	-7	7	49	-5	5	0	0	0	0	0	0	253	-9	9	225	-8	7	150	-5	5	21	-4	3	0	0	0	171	-6	6			
	2020+ DISI		142	-10	10	34	-4	4	0	0	0	0	0	0	177	-10	10	158	-9	9	105	-7	7	15	-3	3	0	0	0	120	-8	8			
BRET2a Barley/Rye, NG CHP, DDGS to AF	2010 DISI		204	-7	7	60	-5	5	0	0	0	0	0	0	264	-9	9	235	-8	8	150	-5	5	27	-5	4	0	0	0	177	-7	7			
	2020+ DISI		142	-10	10	42	-4	4	0	0	0	0	0	0	184	-11	11	164	-10	10	105	-7	7	19	-4	3	0	0	0	124	-8	8			
CRET2a Maize (EU), NG CHP, DDGS to AF	2010 DISI		204	-7	7	59	-5	5	0	0	0	0	0	0	263	-9	9	236	-8	8	150	-5	5	27	-4	4	0	0	0	177	-7	6			
	2020+ DISI		142	-10	10	41	-4	4	0	0	0	0	0	0	184	-11	11	165	-10	10	105	-7	7	19	-3	3	0	0	0	124	-8	8			
CRETus Corn (US)	2010 DISI		204	-7	7	58	-5	5	0	0	0	0	0	0	262	-9	9	234	-8	8	150	-5	5	26	-4	3	0	0	0	176	-6	6			
	2020+ DISI		142	-10	10	40	-4	4	0	0	0	0	0	0	183	-11	11	164	-10	10	105	-7	7	18	-3	3	0	0	0	123	-8	8			
SCET1 Sugar cane (Brazil), surplus bagasse to elec	2010 DISI		204	-7	7	64	-5	5	0	0	0	0	0	0	268	-9	9	226	-7	7	150	-5	5	20	-3	3	0	0	0	169	-6	6			
	2020+ DISI		142	-10	10	45	-4	4	0	0	0	0	0	0	187	-11	11	158	-9	9	105	-7	7	14	-3	3	0	0	0	119	-8	8			
WFET1 Wood (farmed)	2010 DISI		204	-7	7	62	-8	7	0	0	0	0	0	0	266	-11	10	227	-8	8	150	-5	5	19	-3	9	0	0	0	169	-6	11			
	2020+ DISI		142	-10	10	44	-6	6	0	0	0	0	0	0	186	-11	11	159	-10	10	105	-7	7	14	-3	7	0	0	0	119	-8	10			
WWET1 Wood (waste)	2010 DISI		204	-7	7	62	-7	7	0	0	0	0	0	0	266	-10	10	227	-8	8	150	-5	5	19	-3	3	0	0	0	169	-6	6			
	2020+ DISI		142	-10	10	43	-6	6	0	0	0	0	0	0	186	-11	11	159	-10	10	105	-7	7	13	-3	2	0	0	0	118	-8	8			
STET1 Straw (wheat)	2010 DISI		204	-7	7	53	-5	5	0	0	0	0	0	0	257	-9	9	225	-7	7	150	-5	5	17	-3	3	0	0	0	167	-6	6			
	2020+ DISI		142	-10	10	37	-4	4	0	0	0	0	0	0	180	-11	10	157	-9	9	105	-7	7	12	-3	2	0	0	0	117	-8	8			

4.3 Neat fuel equivalent when used in high RON E20 blend with conventional gasoline

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
SBET1a Sugar beet, pulp to AF, slops not used	2010 DISI		186	-8	8	271	-22	24	0	0	0	0	0	0	457	-24	25	102	-8	9	133	-6	6	-58	-6	5	0	0	0	75	-9	8			
	2020+ DISI		131	-11	11	190	-21	22	0	0	0	0	0	0	321	-23	24	71	-8	8	94	-8	8	-41	-6	5	0	0	0	53	-10	10			
	2010 PISI		193	-8	8	280	-23	25	0	0	0	0	0	0	473	-25	26	105	-9	9	138	-6	6	-60	-7	5	0	0	0	78	-9	8			
	2020+ PISI		125	-11	11	182	-21	22	0	0	0	0	0	0	308	-24	25	69	-8	8	90	-8	8	-39	-6	5	0	0	0	51	-10	10			
SBET1b Sugar beet, pulp to AF, slops to biogas	2010 DISI		186	-8	8	230	-22	22	0	0	0	0	0	0	416	-23	24	61	-6	6	133	-6	6	-82	-6	4	0	0	0	51	-8	7			
	2020+ DISI		131	-11	11	162	-19	20	0	0	0	0	0	0	292	-22	22	43	-5	5	94	-8	8	-58	-5	4	0	0	0	36	-9	9			
	2010 PISI		193	-8	8	239	-23	23	0	0	0	0	0	0	431	-24	25	63	-6	6	138	-6	6	-85	-6	4	0	0	0	53	-9	7			
	2020+ PISI		125	-11	11	155	-19	20	0	0	0	0	0	0	280	-22	23	41	-5	5	90	-8	8	-55	-5	4	0	0	0	34	-10	9			
SBET1c Sugar beet, pulp to fuel, slops to biogas	2010 DISI		186	-8	8	171	-18	22	0	0	0	0	0	0	357	-20	23	23	-2	3	133	-6	6	-100	-4	4	0	0	0	34	-7	7			
	2020+ DISI		131	-11	11	120	-15	18	0	0	0	0	0	0	250	-19	21	16	-2	2	94	-8	8	-70	-3	3	0	0	0	24	-9	9			
	2010 PISI		193	-8	8	177	-18	23	0	0	0	0	0	0	370	-20	24	24	-2	3	138	-6	6	-103	-4	5	0	0	0	35	-7	8			
	2020+ PISI		125	-11	11	115	-15	17	0	0	0	0	0	0	240	-19	21	15	-2	2	90	-8	8	-67	-3	3	0	0	0	23	-9	9			
WTET1a Wheat, conv boiler, DDGS to AF	2010 DISI		186	-8	8	323	-15	14	0	0	0	0	0	0	509	-17	17	145	-7	6	133	-6	6	-4	-9	7	0	0	0	130	-11	9			
	2020+ DISI		131	-11	11	227	-19	19	0	0	0	0	0	0	357	-22	22	101	-9	9	94	-8	8	-3	-9	8	0	0	0	91	-12	12			
	2010 PISI		193	-8	8	335	-15	15	0	0	0	0	0	0	527	-17	17	150	-7	7	138	-6	6	-4	-10	7	0	0	0	134	-11	10			
	2020+ PISI		125	-11	11	217	-20	20	0	0	0	0	0	0	343	-23	23	97	-9	9	90	-8	8	-3	-9	9	0	0	0	87	-13	12			
WTET1b Wheat, conv boiler, DDGS to elec	2010 DISI		186	-8	8	218	-10	11	0	0	0	0	0	0	404	-13	13	100	-5	5	133	-6	6	-24	-7	6	0	0	0	110	-9	9			
	2020+ DISI		131	-11	11	153	-13	13	0	0	0	0	0	0	284	-17	17	70	-6	6	94	-8	8	-17	-7	7	0	0	0	77	-11	11			
	2010 PISI		193	-8	8	226	-11	11	0	0	0	0	0	0	419	-14	14	103	-5	5	138	-6	6	-25	-7	7	0	0	0	113	-9	9			
	2020+ PISI		125	-11	11	147	-14	14	0	0	0	0	0	0	272	-18	18	67	-6	6	90	-8	8	-16	-8	7	0	0	0	74	-11	11			
WTET2a Wheat, NG CHP, DDGS to AF	2010 DISI		186	-8	8	301	-13	13	0	0	0	0	0	0	487	-15	15	139	-6	6	133	-6	6	-12	-8	6	0	0	0	121	-10	9			
	2020+ DISI		131	-11	11	211	-18	18	0	0	0	0	0	0	342	-21	21	98	-8	8	94	-8	8	-9	-8	8	0	0	0	85	-12	11			
	2010 PISI		193	-8	8	312	-14	14	0	0	0	0	0	0	505	-16	16	144	-6	6	138	-6	6	-13	-8	7	0	0	0	125	-10	9			
	2020+ PISI		125	-11	11	203	-19	19	0	0	0	0	0	0	328	-22	22	94	-9	9	90	-8	8	-8	-9	8	0	0	0	82	-12	12			
WTET2b Wheat, NG CHP, DDGS to elec	2010 DISI		186	-8	8	196	-9	9	0	0	0	0	0	0	382	-12	12	94	-4	4	133	-6	6	-32	-6	6	0	0	0	101	-9	8			
	2020+ DISI		131	-11	11	138	-12	12	0	0	0	0	0	0	268	-16	16	66	-6	6	94	-8	8	-23	-7	7	0	0	0	71	-10	10			
	2010 PISI		193	-8	8	203	-9	9	0	0	0	0	0	0	396	-12	12	98	-4	4	138	-6	6	-33	-6	6	0	0	0	105	-9	9			
	2020+ PISI		125	-11	11	132	-12	12	0	0	0	0	0	0	257	-17	17	63	-6	6	90	-8	8	-22	-7	7	0	0	0	68	-11	11			
WTET3a Wheat, lignite CHP, DDGS to AF	2010 DISI		186	-8	8	287	-12	12	0	0	0	0	0	0	473	-15	15	125	-5	5	133	-6	6	27	-9	8	0	0	0	161	-11	10			
	2020+ DISI		131	-11	11	201	-17	17	0	0	0	0	0	0	332	-20	20	88	-7	7	94	-8	8	19	-10	10	0	0	0	113	-13	13			
	2010 PISI		193	-8	8	297	-13	13	0	0	0	0	0	0	490	-15	15	130	-6	6	138	-6	6	28	-9	8	0	0	0	166	-11	10			
	2020+ PISI		125	-11	11	193	-18	18	0	0	0	0	0	0	319	-21	21	84	-8	8	90	-8	8	18	-11	10	0	0	0	108	-14	13			
WTET3b Wheat, lignite CHP, DDGS to elec	2010 DISI		186	-8	8	182	-8	8	0	0	0	0	0	0	368	-11	11	80	-3	3	133	-6	6	7	-7	7	0	0	0	141	-9	9			
	2020+ DISI		131	-11	11	128	-11	11	0	0	0	0	0	0	258	-15	15	56	-5	5	94	-8	8	5	-9	9	0	0	0	99	-12	12			
	2010 PISI		193	-8	8	189	-8	8	0	0	0	0	0	0	382	-12	12	83	-4	4	138	-6	6	8	-8	7	0	0	0	146	-10	10			
	2020+ PISI		125	-11	11	123	-11	11	0	0	0	0	0	0	248	-16	16	54	-5	5	90	-8	8	5	-9	9	0	0	0	95	-12	12			

Neat fuel equivalent when used in high RON E20 blend with conventional gasoline (cont'd)

4.4 E20 (80.1% v/v conventional gasoline, 19.9% v/v ethanol)

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
SBET1a Sugar beet, pulp to AF, slops not used	2010 DISI		201	-8	8	73	-9	10	0	0	0	0	0	0	274	-12	13	219	-9	9	148	-6	6	15	-4	3	0	0	0	163	-7	7			
	2020+ DISI		141	-11	11	51	-7	8	0	0	0	0	0	0	192	-13	13	153	-11	11	104	-8	8	10	-3	3	0	0	0	114	-9	9			
SBET1b Sugar beet, pulp to AF, slops to biogas	2010 DISI		201	-8	8	67	-9	10	0	0	0	0	0	0	268	-12	12	213	-9	9	148	-6	6	11	-4	3	0	0	0	159	-7	7			
	2020+ DISI		141	-11	11	47	-7	7	0	0	0	0	0	0	188	-13	13	149	-10	10	104	-8	8	8	-3	3	0	0	0	112	-9	9			
SBET1c Sugar beet, pulp to fuel, slops to biogas	2010 DISI		201	-8	8	58	-8	10	0	0	0	0	0	0	259	-12	13	207	-8	9	148	-6	6	9	-4	3	0	0	0	156	-7	7			
	2020+ DISI		141	-11	11	40	-6	7	0	0	0	0	0	0	181	-13	13	145	-10	10	104	-8	8	6	-3	3	0	0	0	110	-9	9			
WTET1a Wheat, conv boiler, DDGS to AF	2010 DISI		201	-8	8	81	-6	5	0	0	0	0	0	0	282	-10	10	226	-8	8	148	-6	6	23	-5	4	0	0	0	171	-7	7			
	2020+ DISI		141	-11	11	57	-6	5	0	0	0	0	0	0	197	-12	12	158	-10	10	104	-8	8	16	-4	3	0	0	0	120	-9	9			
WTET1b Wheat, conv boiler, DDGS to elec	2010 DISI		201	-8	8	65	-5	5	0	0	0	0	0	0	266	-10	10	219	-8	8	148	-6	6	20	-4	4	0	0	0	168	-7	7			
	2020+ DISI		141	-11	11	46	-5	5	0	0	0	0	0	0	186	-12	12	153	-10	10	104	-8	8	14	-3	3	0	0	0	118	-9	9			
WTET2a Wheat, NG CHP, DDGS to AF	2010 DISI		201	-8	8	78	-5	5	0	0	0	0	0	0	279	-10	10	225	-8	8	148	-6	6	22	-4	4	0	0	0	170	-7	7			
	2020+ DISI		141	-11	11	54	-5	5	0	0	0	0	0	0	195	-12	12	157	-10	10	104	-8	8	15	-4	3	0	0	0	119	-9	9			
WTET2b Wheat, NG CHP, DDGS to elec	2010 DISI		201	-8	8	62	-5	5	0	0	0	0	0	0	263	-9	9	218	-8	8	148	-6	6	19	-4	4	0	0	0	167	-7	7			
	2020+ DISI		141	-11	11	43	-5	4	0	0	0	0	0	0	184	-12	12	152	-10	10	104	-8	8	13	-3	3	0	0	0	117	-9	9			
WTET3a Wheat, lignite CHP, DDGS to AF	2010 DISI		201	-8	8	76	-5	5	0	0	0	0	0	0	277	-10	10	223	-8	8	148	-6	6	28	-4	4	0	0	0	176	-7	7			
	2020+ DISI		141	-11	11	53	-5	5	0	0	0	0	0	0	194	-12	12	156	-10	10	104	-8	8	20	-4	3	0	0	0	123	-9	9			
WTET3b Wheat, lignite CHP, DDGS to elec	2010 DISI		201	-8	8	60	-5	5	0	0	0	0	0	0	261	-9	9	216	-8	8	148	-6	6	25	-4	4	0	0	0	173	-7	7			
	2020+ DISI		141	-11	11	42	-4	4	0	0	0	0	0	0	182	-12	12	151	-10	10	104	-8	8	17	-3	3	0	0	0	121	-9	9			

E20 (80.1% v/v conventional gasoline, 19.9% v/v ethanol), cont'd

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
WTET4a Wheat, straw CHP, DDGS to AF	2010 DISI		201	-8	8	78	-5	5	0	0	0	0	0	0	280	-10	10	210	-7	7	148	-6	6	13	-4	3	0	0	0	161	-7	7			
	2020+ DISI		141	-11	11	55	-5	5	0	0	0	0	0	0	196	-12	12	147	-10	10	104	-8	8	9	-3	3	0	0	0	113	-9	9			
WTET4b Wheat, straw CHP, DDGS to elec	2010 DISI		201	-8	8	62	-5	5	0	0	0	0	0	0	264	-10	9	203	-7	7	148	-6	6	10	-4	3	0	0	0	158	-7	7			
	2020+ DISI		141	-11	11	44	-5	5	0	0	0	0	0	0	184	-12	12	142	-10	10	104	-8	8	7	-3	3	0	0	0	111	-9	9			
WTET5 Wheat, conv boiler, DDGS to elec via biogas	2010 DISI		201	-8	8	61	-5	5	0	0	0	0	0	0	262	-9	9	207	-7	7	148	-6	6	14	-4	3	0	0	0	161	-7	7			
	2020+ DISI		141	-11	11	42	-5	4	0	0	0	0	0	0	183	-12	12	145	-10	10	104	-8	8	9	-3	3	0	0	0	113	-9	9			
BRET2a Barley/Rye, NG CHP, DDGS to AF	2010 DISI		201	-8	8	83	-6	5	0	0	0	0	0	0	284	-10	10	226	-8	8	148	-6	6	25	-6	5	0	0	0	173	-8	8			
	2020+ DISI		141	-11	11	58	-5	5	0	0	0	0	0	0	199	-12	12	158	-10	10	104	-8	8	18	-4	4	0	0	0	121	-9	9			
CRET2a Maize (EU), NG CHP, DDGS to AF	2010 DISI		201	-8	8	81	-5	5	0	0	0	0	0	0	282	-10	10	230	-8	8	148	-6	6	26	-4	4	0	0	0	174	-7	7			
	2020+ DISI		141	-11	11	57	-5	5	0	0	0	0	0	0	197	-12	12	161	-10	10	104	-8	8	18	-4	4	0	0	0	122	-9	9			
CRETus Corn (US)	2010 DISI		201	-8	8	79	-5	5	0	0	0	0	0	0	280	-10	10	226	-8	8	148	-6	6	23	-4	4	0	0	0	171	-7	7			
	2020+ DISI		141	-11	11	55	-5	5	0	0	0	0	0	0	196	-12	12	158	-10	10	104	-8	8	16	-3	3	0	0	0	120	-9	9			
SCET1 Sugar cane (Brazil), surplus bagasse to elec	2010 DISI		201	-8	8	91	-6	6	0	0	0	0	0	0	293	-10	10	208	-7	7	148	-6	6	11	-4	3	0	0	0	158	-7	7			
	2020+ DISI		141	-11	11	64	-6	6	0	0	0	0	0	0	205	-12	12	146	-10	10	104	-8	8	7	-3	3	0	0	0	111	-9	9			
WFET1 Wood (farmed)	2010 DISI		201	-8	8	88	-10	10	0	0	0	0	0	0	289	-13	12	211	-8	8	148	-6	6	10	-3	13	0	0	0	158	-7	14			
	2020+ DISI		141	-11	11	61	-8	8	0	0	0	0	0	0	202	-14	13	148	-10	10	104	-8	8	7	-3	9	0	0	0	111	-9	12			
WWET1 Wood (waste)	2010 DISI		201	-8	8	87	-9	9	0	0	0	0	0	0	289	-12	12	211	-8	8	148	-6	6	9	-3	3	0	0	0	157	-7	7			
	2020+ DISI		141	-11	11	61	-8	8	0	0	0	0	0	0	202	-13	13	148	-10	10	104	-8	8	6	-3	3	0	0	0	110	-8	8			
STET1 Straw (wheat)	2010 DISI		201	-8	8	69	-5	5	0	0	0	0	0	0	271	-10	9	206	-7	7	148	-6	6	6	-3	3	0	0	0	154	-7	7			
	2020+ DISI		141	-11	11	49	-5	5	0	0	0	0	0	0	189	-12	12	144	-10	10	104	-8	8	4	-3	2	0	0	0	108	-8	8			

4.5 Neat fuel equivalent when used in E85 blend with conventional gasoline

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
SBET1a Sugar beet, pulp to AF, slops not used	2010 DISI		197	-8	8	286	-23	25	0	0	0	0	0	0	483	-24	26	108	-9	9	140	-6	6	-61	-7	5	0	0	0	79	-9	8			
	2020+ DISI		137	-11	11	199	-21	22	0	0	0	0	0	0	337	-24	25	75	-8	8	98	-8	8	-43	-6	5	0	0	0	55	-10	9			
	2010 PISI		206	-8	8	299	-24	26	0	0	0	0	0	0	505	-26	27	112	-9	10	146	-6	6	-64	-7	5	0	0	0	82	-9	8			
	2020+ PISI		144	-11	11	209	-22	23	0	0	0	0	0	0	353	-25	26	79	-8	9	103	-8	8	-45	-6	5	0	0	0	58	-10	10			
SBET1b Sugar beet, pulp to AF, slops to biogas	2010 DISI		197	-8	8	243	-23	23	0	0	0	0	0	0	440	-24	25	64	-6	6	140	-6	6	-87	-6	4	0	0	0	53	-8	7			
	2020+ DISI		137	-11	11	170	-20	20	0	0	0	0	0	0	307	-22	23	45	-5	5	98	-8	8	-61	-5	4	0	0	0	37	-9	9			
	2010 PISI		206	-8	8	254	-24	24	0	0	0	0	0	0	460	-25	26	67	-6	6	146	-6	6	-91	-6	4	0	0	0	55	-9	7			
	2020+ PISI		144	-11	11	178	-21	21	0	0	0	0	0	0	322	-24	24	47	-5	6	103	-8	8	-64	-5	4	0	0	0	39	-10	9			
SBET1c Sugar beet, pulp to fuel, slops to biogas	2010 DISI		197	-8	8	181	-19	23	0	0	0	0	0	0	377	-20	24	24	-2	3	140	-6	6	-105	-4	5	0	0	0	35	-7	7			
	2020+ DISI		137	-11	11	126	-16	18	0	0	0	0	0	0	263	-19	21	17	-2	2	98	-8	8	-73	-3	4	0	0	0	25	-8	9			
	2010 PISI		206	-8	8	189	-19	24	0	0	0	0	0	0	394	-21	25	25	-3	3	146	-6	6	-110	-4	5	0	0	0	36	-7	8			
	2020+ PISI		144	-11	11	132	-16	19	0	0	0	0	0	0	276	-20	22	18	-2	3	103	-8	8	-77	-4	4	0	0	0	26	-9	9			
WTET1a Wheat, conv boiler, DDGS to AF	2010 DISI		197	-8	8	341	-15	14	0	0	0	0	0	0	538	-17	16	153	-7	6	140	-6	6	-4	-10	7	0	0	0	136	-11	9			
	2020+ DISI		137	-11	11	238	-19	19	0	0	0	0	0	0	375	-22	22	106	-9	8	98	-8	8	-3	-9	8	0	0	0	95	-12	11			
	2010 PISI		206	-8	8	357	-15	15	0	0	0	0	0	0	562	-17	17	160	-7	7	146	-6	6	-4	-10	8	0	0	0	142	-12	10			
	2020+ PISI		144	-11	11	249	-20	20	0	0	0	0	0	0	393	-23	23	112	-9	9	103	-8	8	-3	-10	9	0	0	0	100	-13	12			
WTET1b Wheat, conv boiler, DDGS to elec	2010 DISI		197	-8	8	230	-10	11	0	0	0	0	0	0	427	-13	13	105	-5	5	140	-6	6	-25	-7	7	0	0	0	115	-9	9			
	2020+ DISI		137	-11	11	161	-13	13	0	0	0	0	0	0	298	-17	17	73	-6	6	98	-8	8	-17	-7	7	0	0	0	80	-11	11			
	2010 PISI		206	-8	8	241	-11	11	0	0	0	0	0	0	446	-14	14	110	-5	5	146	-6	6	-26	-7	7	0	0	0	120	-10	9			
	2020+ PISI		144	-11	11	168	-14	14	0	0	0	0	0	0	312	-18	18	77	-6	6	103	-8	8	-18	-8	7	0	0	0	84	-11	11			
WTET2a Wheat, NG CHP, DDGS to AF	2010 DISI		197	-8	8	318	-13	13	0	0	0	0	0	0	515	-15	15	147	-6	6	140	-6	6	-13	-8	7	0	0	0	127	-10	9			
	2020+ DISI		137	-11	11	222	-18	18	0	0	0	0	0	0	359	-21	21	103	-8	8	98	-8	8	-9	-8	8	0	0	0	89	-11	11			
	2010 PISI		206	-8	8	333	-13	14	0	0	0	0	0	0	538	-16	16	154	-6	6	146	-6	6	-13	-9	7	0	0	0	133	-11	9			
	2020+ PISI		144	-11	11	233	-18	18	0	0	0	0	0	0	376	-22	22	108	-9	9	103	-8	8	-9	-9	8	0	0	0	93	-12	11			
WTET2b Wheat, NG CHP, DDGS to elec	2010 DISI		197	-8	8	207	-8	9	0	0	0	0	0	0	404	-12	12	99	-4	4	140	-6	6	-34	-6	6	0	0	0	106	-8	8			
	2020+ DISI		137	-11	11	145	-11	12	0	0	0	0	0	0	282	-16	16	69	-5	6	98	-8	8	-24	-7	6	0	0	0	74	-10	10			
	2010 PISI		206	-8	8	217	-9	9	0	0	0	0	0	0	422	-12	12	104	-4	4	146	-6	6	-35	-7	6	0	0	0	111	-9	9			
	2020+ PISI		144	-11	11	151	-12	12	0	0	0	0	0	0	295	-17	17	73	-6	6	103	-8	8	-25	-7	7	0	0	0	78	-11	11			
WTET3a Wheat, lignite CHP, DDGS to AF	2010 DISI		197	-8	8	303	-12	12	0	0	0	0	0	0	500	-15	15	132	-5	5	140	-6	6	29	-9	8	0	0	0	169	-11	10			
	2020+ DISI		137	-11	11	211	-17	17	0	0	0	0	0	0	349	-20	20	92	-7	7	98	-8	8	20	-10	10	0	0	0	118	-13	12			
	2010 PISI		206	-8	8	317	-13	13	0	0	0	0	0	0	522	-15	15	138	-6	6	146	-6	6	30	-10	8	0	0	0	176	-11	10			
	2020+ PISI		144	-11	11	222	-17	17	0	0	0	0	0	0	365	-21	21	97	-8	8	103	-8	8	21	-11	10	0	0	0	124	-13	13			
WTET3b Wheat, lignite CHP, DDGS to elec	2010 DISI		197	-8	8	193	-8	8	0	0	0	0	0	0	389	-11	11	85	-3	3	140	-6	6	8	-7	7	0	0	0	148	-9	9			
	2020+ DISI		137	-11	11	134	-11	11	0	0	0	0	0	0	271	-15	15	59	-5	5	98	-8	8	5	-9	9	0	0	0	103	-12	12			
	2010 PISI		206	-8	8	201	-8	8	0	0	0	0	0	0	407	-12	12	89	-4	4	146	-6	6	8	-8	7	0	0	0	154	-10	10			
	2020+ PISI		144	-11	11	141	-11	11	0	0	0	0	0	0	284	-16	16	62	-5	5	103	-8	8	6	-9	9	0	0	0	108	-12	12			

4.6 E85 (80.1% v/v conventional gasoline, 19.9% v/v ethanol)

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
SBET1a Sugar beet, pulp to AF, slops not used	2010 DISI		199	-8	8	220	-19	21	0	0	0	0	0	0	418	-21	23	143	-8	9	143	-6	6	-37	-6	5	0	0	0	106	-8	7			
	2020+ DISI		139	-11	11	153	-17	18	0	0	0	0	0	0	292	-20	21	100	-7	8	100	-8	8	-26	-5	4	0	0	0	74	-9	9			
SBET1b Sugar beet, pulp to AF, slops to biogas	2010 DISI		199	-8	8	188	-19	20	0	0	0	0	0	0	387	-21	21	111	-6	6	143	-6	6	-56	-5	4	0	0	0	87	-8	7			
	2020+ DISI		139	-11	11	131	-16	16	0	0	0	0	0	0	270	-19	20	78	-6	6	100	-8	8	-39	-4	3	0	0	0	61	-9	8			
SBET1c Sugar beet, pulp to fuel, slops to biogas	2010 DISI		199	-8	8	142	-16	20	0	0	0	0	0	0	341	-18	21	82	-4	4	143	-6	6	-70	-4	4	0	0	0	73	-7	7			
	2020+ DISI		139	-11	11	99	-13	15	0	0	0	0	0	0	238	-17	19	57	-4	4	100	-8	8	-49	-3	3	0	0	0	51	-8	8			
WTET1a Wheat, conv boiler, DDGS to AF	2010 DISI		199	-8	8	260	-12	11	0	0	0	0	0	0	459	-14	14	176	-6	6	143	-6	6	5	-8	6	0	0	0	147	-10	8			
	2020+ DISI		139	-11	11	181	-15	14	0	0	0	0	0	0	320	-18	18	123	-7	7	100	-8	8	3	-8	7	0	0	0	103	-11	10			
WTET1b Wheat, conv boiler, DDGS to elec	2010 DISI		199	-8	8	179	-8	9	0	0	0	0	0	0	378	-12	12	141	-5	5	143	-6	6	-11	-6	6	0	0	0	132	-8	8			
	2020+ DISI		139	-11	11	125	-10	10	0	0	0	0	0	0	263	-15	15	99	-6	6	100	-8	8	-8	-6	6	0	0	0	92	-10	10			
WTET2a Wheat, NG CHP, DDGS to AF	2010 DISI		199	-8	8	243	-10	10	0	0	0	0	0	0	442	-13	13	172	-5	5	143	-6	6	-2	-7	6	0	0	0	141	-9	8			
	2020+ DISI		139	-11	11	170	-13	13	0	0	0	0	0	0	308	-17	17	120	-7	7	100	-8	8	-1	-7	6	0	0	0	99	-10	10			
WTET2b Wheat, NG CHP, DDGS to elec	2010 DISI		199	-8	8	162	-7	7	0	0	0	0	0	0	361	-11	11	137	-4	4	143	-6	6	-17	-5	5	0	0	0	125	-8	8			
	2020+ DISI		139	-11	11	113	-9	9	0	0	0	0	0	0	252	-14	14	96	-5	5	100	-8	8	-12	-6	5	0	0	0	88	-10	9			
WTET3a Wheat, lignite CHP, DDGS to AF	2010 DISI		199	-8	8	232	-10	10	0	0	0	0	0	0	431	-12	12	161	-5	5	143	-6	6	29	-8	6	0	0	0	171	-10	8			
	2020+ DISI		139	-11	11	162	-13	13	0	0	0	0	0	0	301	-17	17	112	-7	7	100	-8	8	20	-8	8	0	0	0	120	-11	11			
WTET3b Wheat, lignite CHP, DDGS to elec	2010 DISI		199	-8	8	151	-7	7	0	0	0	0	0	0	350	-10	10	126	-4	4	143	-6	6	13	-6	6	0	0	0	156	-8	8			
	2020+ DISI		139	-11	11	105	-8	8	0	0	0	0	0	0	244	-14	14	88	-5	5	100	-8	8	9	-7	7	0	0	0	109	-10	10			

E85 (80.1% v/v conventional gasoline, 19.9% v/v ethanol), cont'd

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
WTET4a Wheat, straw CHP, DDGS to AF	2010 DISI		199	-8	8	246	-10	10	0	0	0	0	0	0	445	-13	13	96	-3	3	143	-6	6	-47	-6	4	0	0	0	96	-8	7			
	2020+ DISI		139	-11	11	172	-14	14	0	0	0	0	0	0	310	-17	17	67	-4	4	100	-8	8	-33	-5	4	0	0	0	67	-9	9			
WTET4b Wheat, straw CHP, DDGS to elec	2010 DISI		199	-8	8	165	-7	8	0	0	0	0	0	0	364	-11	11	61	-2	2	143	-6	6	-62	-4	4	0	0	0	81	-7	7			
	2020+ DISI		139	-11	11	115	-9	9	0	0	0	0	0	0	254	-14	14	43	-3	3	100	-8	8	-43	-3	3	0	0	0	57	-8	8			
WTET5 Wheat, conv boiler, DDGS to elec via biogas	2010 DISI		199	-8	8	157	-7	7	0	0	0	0	0	0	355	-10	10	84	-3	3	143	-6	6	-45	-5	4	0	0	0	98	-7	7			
	2020+ DISI		139	-11	11	109	-9	9	0	0	0	0	0	0	248	-14	14	59	-3	3	100	-8	8	-31	-4	4	0	0	0	69	-9	9			
BRET2a Barley/Rye, NG CHP, DDGS to AF	2010 DISI		199	-8	8	270	-11	11	0	0	0	0	0	0	469	-14	14	180	-6	6	143	-6	6	14	-11	9	0	0	0	157	-12	11			
	2020+ DISI		139	-11	11	188	-15	15	0	0	0	0	0	0	327	-18	18	126	-8	8	100	-8	8	10	-9	8	0	0	0	110	-12	11			
CRET2a Maize (EU), NG CHP, DDGS to AF	2010 DISI		199	-8	8	260	-11	11	0	0	0	0	0	0	459	-13	13	197	-6	6	143	-6	6	20	-8	7	0	0	0	163	-10	9			
	2020+ DISI		139	-11	11	181	-14	14	0	0	0	0	0	0	320	-18	18	137	-8	8	100	-8	8	14	-8	8	0	0	0	114	-11	11			
CRETus Corn (US)	2010 DISI		199	-8	8	248	-10	10	0	0	0	0	0	0	446	-13	13	176	-5	5	143	-6	6	4	-6	5	0	0	0	147	-8	8			
	2020+ DISI		139	-11	11	173	-14	14	0	0	0	0	0	0	311	-17	17	123	-7	7	100	-8	8	3	-7	6	0	0	0	103	-10	10			
SCET1 Sugar cane (Brazil), surplus bagasse to elec	2010 DISI		199	-8	8	312	-13	13	0	0	0	0	0	0	510	-15	15	89	-3	3	143	-6	6	-60	-4	4	0	0	0	83	-7	7			
	2020+ DISI		139	-11	11	217	-17	17	0	0	0	0	0	0	356	-20	20	62	-4	4	100	-8	8	-42	-4	4	0	0	0	58	-9	9			
WFET1 Wood (farmed)	2010 DISI		199	-8	8	293	-22	21	0	0	0	0	0	0	492	-24	23	104	-4	4	143	-6	6	-63	-4	28	0	0	0	80	-7	29			
	2020+ DISI		139	-11	11	205	-21	20	0	0	0	0	0	0	343	-23	23	73	-5	5	100	-8	8	-44	-3	20	0	0	0	56	-8	21			
WWET1 Wood (waste)	2010 DISI		199	-8	8	292	-20	21	0	0	0	0	0	0	490	-21	22	103	-4	4	143	-6	6	-67	-2	2	0	0	0	75	-6	6			
	2020+ DISI		139	-11	11	204	-19	20	0	0	0	0	0	0	342	-22	23	72	-4	4	100	-8	8	-47	-2	2	0	0	0	53	-8	8			
STET1 Straw (wheat)	2010 DISI		199	-8	8	201	-8	8	0	0	0	0	0	0	399	-12	12	78	-2	2	143	-6	6	-82	-2	2	0	0	0	61	-6	6			
	2020+ DISI		139	-11	11	140	-11	11	0	0	0	0	0	0	279	-15	15	55	-3	3	100	-8	8	-57	-2	2	0	0	0	43	-8	8			

5 Ethers

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			MJ _{fossil} /100 km			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
GRMB1 MTBE in remote plant near gas field	2010	PISI	211	-6	6	75	-2	4	0	0	0	0	0	0	287	-7	7	285	-7	7	156	-5	5	33	-1	2	0	0	0	0	0	0	189	-5	5
		DISI	204	-6	6	73	-2	3	0	0	0	0	0	0	277	-7	7	275	-7	7	150	-5	5	32	-1	2	0	0	0	0	0	0	182	-5	5
		Hybrid	142	-7	7	51	-3	3	0	0	0	0	0	0	192	-8	8	191	-8	8	105	-5	5	22	-1	2	0	0	0	0	0	0	128	-6	6
	2020+	PISI	150	-9	9	54	-3	4	0	0	0	0	0	0	204	-9	9	202	-9	9	111	-6	6	23	-1	2	0	0	0	0	0	0	134	-7	7
		DISI	142	-8	8	51	-3	3	0	0	0	0	0	0	193	-9	9	192	-9	9	105	-6	6	22	-1	2	0	0	0	0	0	0	127	-6	6
		Hybrid	93	-9	9	33	-3	3	0	0	0	0	0	0	127	-9	9	126	-9	9	70	-6	6	15	-1	1	0	0	0	0	0	0	84	-7	7
LREB1 ETBE from isobutene and bioethanol	2010	PISI	211	-6	6	152	-5	5	0	0	0	0	0	0	364	-8	8	89	-3	3	156	-5	5	13	-2	3	0	0	0	0	0	0	169	-5	5
		DISI	204	-6	6	147	-5	5	0	0	0	0	0	0	351	-8	8	86	-3	3	150	-5	5	12	-2	3	0	0	0	0	0	0	163	-5	5
		Hybrid	142	-7	7	102	-5	5	0	0	0	0	0	0	244	-9	9	60	-3	3	106	-5	5	9	-2	3	0	0	0	0	0	0	114	-6	6
	2020+	PISI	150	-9	9	108	-6	6	0	0	0	0	0	0	258	-11	11	163	-4	4	111	-6	6	9	-3	3	0	0	0	0	0	0	120	-7	7
		DISI	142	-8	8	103	-6	6	0	0	0	0	0	0	245	-10	10	155	-4	4	105	-6	6	9	-3	3	0	0	0	0	0	0	114	-7	7
		Hybrid	93	-9	9	67	-6	6	0	0	0	0	0	0	161	-11	11	101	-4	4	70	-6	6	6	-3	3	0	0	0	0	0	0	75	-7	7

6 Biodiesel

6.1 Neat fuel equivalent when used in blends with conventional diesel

WTT Code / Description	Time Horizon	Powertrain	WTT energy from fuel			WTT expended energy from fuel production			WTT energy from electricity			WTT expended energy from elec production			WTTW						GHG emissions g CO _{2eq} / km															
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			all energy sources						TTW				WTT from fuel				WTT from elec				WTW			
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Total			Fossil			TTW				WTT from fuel				WTT from elec				WTW			
															Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
ROFA1 Rape (RME), meal to AF, glyc as chem.	2010 DIC1		163	-6	6	183	-6	6	0	0	0	0	0	0	345	-9	9	74	-3	3	125	-4	4	-36	-13	10	0	0	0	0	0	0	89	-14	11	
	2020+ DIC1		119	-8	8	133	-9	9	0	0	0	0	0	0	252	-12	12	54	-4	4	92	-6	6	-26	-10	8	0	0	0	0	0	0	65	-12	10	
ROFA2 Rape (RME), meal to AF, glyc to AF	2010 DIC1		163	-6	6	191	-7	7	0	0	0	0	0	0	354	-9	9	79	-3	3	125	-4	4	-28	-13	10	0	0	0	0	0	0	96	-14	11	
	2020+ DIC1		119	-8	8	139	-9	9	0	0	0	0	0	0	258	-12	12	58	-4	4	92	-6	6	-21	-10	8	0	0	0	0	0	0	71	-12	10	
ROFA3 Rape (RME), meal to AF, glyc to fuel	2010 DIC1		163	-6	6	184	-6	6	0	0	0	0	0	0	347	-9	9	72	-3	3	125	-4	4	-31	-11	12	0	0	0	0	0	0	94	-12	13	
	2020+ DIC1		119	-8	8	134	-9	9	0	0	0	0	0	0	253	-12	12	53	-4	4	92	-6	6	-23	-9	10	0	0	0	0	0	0	69	-11	12	
ROFA4 Rape (RME), meal to biogas, glyc to fuel	2010 DIC1		163	-6	6	111	-11	9	0	0	0	0	0	0	273	-12	11	25	-3	2	125	-4	4	-63	-13	12	0	0	0	0	0	0	62	-13	12	
	2020+ DIC1		119	-8	8	81	-9	8	0	0	0	0	0	0	199	-12	12	18	-2	2	92	-6	6	-46	-10	9	0	0	0	0	0	0	46	-11	11	
ROFA5 Rape (RME), meal to AF, glyc to hydrogen	2010 DIC1		163	-6	6	184	-6	6	0	0	0	0	0	0	346	-9	9	71	-3	3	125	-4	4	-32	-11	12	0	0	0	0	0	0	93	-12	13	
	2020+ DIC1		119	-8	8	134	-9	9	0	0	0	0	0	0	253	-12	12	52	-4	4	92	-6	6	-23	-9	10	0	0	0	0	0	0	69	-11	11	
ROFE3 Rape (REE), meal to AF, glyc to fuel	2010 DIC1		163	-7	7	203	-9	9	0	0	0	0	0	0	366	-12	12	68	-3	3	122	-6	6	-28	-16	7	0	0	0	0	0	0	93	-17	9	
	2020+ DIC1		119	-7	7	148	-9	9	0	0	0	0	0	0	267	-12	12	50	-3	3	89	-6	6	-21	-12	6	0	0	0	0	0	0	68	-13	8	
SOFA3 Sunflower (SME), meal to AF, glyc to fuel	2010 DIC1		163	-6	6	176	-15	19	0	0	0	0	0	0	339	-16	20	70	-6	7	125	-4	4	-49	-7	6	0	0	0	0	0	0	76	-8	8	
	2020+ DIC1		119	-8	8	128	-13	16	0	0	0	0	0	0	247	-16	18	51	-5	6	92	-6	6	-36	-6	6	0	0	0	0	0	0	56	-9	8	
SYFA3a Soy (SYME), no till, oil to EU, meal to AF, oil to EU, glyc to biogas	2010 DIC1		163	-6	6	411	-14	14	0	0	0	0	0	0	573	-16	16	64	-2	2	125	-4	4	-34	-83	22	0	0	0	0	0	0	91	-84	23	
	2020+ DIC1		119	-8	8	300	-20	20	0	0	0	0	0	0	418	-22	22	47	-3	3	92	-6	6	-25	-61	17	0	0	0	0	0	0	67	-61	18	
SYFA3b Soy (SYME), no till, beans to EU, meal to AF, glyc to biogas	2010 DIC1		163	-6	6	437	-15	15	0	0	0	0	0	0	600	-16	16	93	-3	3	125	-4	4	-28	-19	13	0	0	0	0	0	0	97	-20	14	
	2020+ DIC1		119	-8	8	319	-22	22	0	0	0	0	0	0	437	-23	23	68	-5	5	92	-6	6	-20	-14	11	0	0	0	0	0	0	72	-16	12	
SYFA3c Soy (SYME), conv. culture, oil to EU, meal to AF, glyc to biogas	2010 DIC1		163	-6	6	422	-15	15	0	0	0	0	0	0	584	-16	16	75	-3	3	125	-4	4	-25	-91	23	0	0	0	0	0	0	100	-91	23	
	2020+ DIC1		119	-8	8	308	-21	21	0	0	0	0	0	0	426	-22	22	55	-4	4	92	-6	6	-18	-66	17	0	0	0	0	0	0	73	-67	18	
POFA3a Palm (POME), meal to AF, no CH4 rec., heat credit, glyc to biogas	2010 DIC1		163	-6	6	191	-7	7	0	0	0	0	0	0	354	-9	9	28	-1	1	125	-4	4	-41	-3	3	0	0	0	0	0	0	84	-5	5	
	2020+ DIC1		119	-8	8	139	-9	9	0	0	0	0	0	0	258	-12	12	20	-1	1	92	-6	6	-30	-4	4	0	0	0	0	0	0	62	-7	7	
POFA3b Palm (POME), meal to AF, CH4 rec., heat credit, glyc to biogas	2010 DIC1		163	-6	6	191	-7	7	0	0	0	0	0	0	353	-9	9	28	-1	1	125	-4	4	-73	-2	2	0	0	0	0	0	0	52	-5	5	
	2020+ DIC1		119	-8	8	139	-9	9	0	0	0	0	0	0	258	-12	12	20	-1	1	92	-6	6	-53	-3	3	0	0	0	0	0	0	38	-7	7	
POFA3c Palm (POME), meal to AF, no CH4 rec., no heat credit, glyc to biogas	2010 DIC1		163	-6	6	217	-8	8	0	0	0	0	0	0	379	-9	9	54	-2	2	125	-4	4	-22	-4	4	0	0	0	0	0	0	103	-6	6	
	2020+ DIC1		119	-8	8	158	-11	11	0	0	0	0	0	0	277	-13	13	39	-3	3	92	-6	6	-16	-5	5	0	0	0	0	0	0	76	-8	8	
WOFA3a FAME from waste cooking oil	2010 DIC1		163	-6	6	45	-2	2	0	0	0	0	0	0	207	-6	6	35	-1	1	125	-4	4	-101	-1	1	0	0	0	0	0	0	23	-4	4	
	2020+ DIC1		119	-8	8	33	-2	2	0	0	0	0	0	0	151	-8	8	25	-2	2	92	-6	6	-74	-1	1	0	0	0	0	0	0	18	-6	6	
TOFA3a FAME from tallow	2010 DIC1		163	-6	6	78	-3	3	0	0	0	0	0	0	240	-6	6	65	-2	2	125	-4	4	-81	-2	2	0	0	0	0	0	0	44	-4	4	
	2020+ DIC1		119	-8	8	57	-4	4	0	0	0	0	0	0	175	-9	9	48	-3	3	92	-6	6	-59	-2	2	0	0	0	0	0	0	33	-6	6	

6.2 B7 (93.1% v/v diesel, 6.9% v/v biodiesel)

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel		WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km															
			MJ _e /100 km		MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW						
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
ROFA1 Rape (RME), meal to AF, glyc as chem.	2010 DIC1		163	-6	6	40	-4	4	0	0	0	0	0	0	202	-7	7	184	-6	6	120	-4	4	19	-4	4	0	0	0	139	-6	5			
	2020+ DIC1		119	-8	8	29	-3	3	0	0	0	0	0	0	148	-9	9	134	-8	8	88	-6	6	14	-3	3	0	0	0	102	-7	7			
ROFA2 Rape (RME), meal to AF, glyc to AF	2010 DIC1		163	-6	6	40	-4	4	0	0	0	0	0	0	203	-7	7	184	-6	6	120	-4	4	19	-4	3	0	0	0	139	-6	5			
	2020+ DIC1		119	-8	8	29	-3	3	0	0	0	0	0	0	148	-9	9	134	-8	8	88	-6	6	14	-3	3	0	0	0	102	-7	7			
ROFA3 Rape (RME), meal to AF, glyc to fuel	2010 DIC1		163	-6	6	40	-4	4	0	0	0	0	0	0	202	-7	7	184	-6	6	120	-4	4	19	-4	4	0	0	0	139	-6	6			
	2020+ DIC1		119	-8	8	29	-3	3	0	0	0	0	0	0	148	-9	9	134	-8	8	88	-6	6	14	-3	3	0	0	0	102	-7	7			
ROFA4 Rape (RME), meal to biogas, glyc to fuel	2010 DIC1		163	-6	6	35	-5	4	0	0	0	0	0	0	198	-7	7	181	-7	6	120	-4	4	17	-4	4	0	0	0	137	-6	6			
	2020+ DIC1		119	-8	8	26	-4	3	0	0	0	0	0	0	144	-9	9	132	-8	8	88	-6	6	12	-3	3	0	0	0	101	-7	7			
ROFA5 Rape (RME), meal to AF, glyc to hydrogen	2010 DIC1		163	-6	6	40	-4	4	0	0	0	0	0	0	202	-7	7	184	-6	6	120	-4	4	19	-4	4	0	0	0	139	-6	6			
	2020+ DIC1		119	-8	8	29	-3	3	0	0	0	0	0	0	148	-9	9	134	-8	8	88	-6	6	14	-3	3	0	0	0	102	-7	7			
ROFE3 Rape (REE), meal to AF, glyc to fuel	2010 DIC1		163	-6	6	41	-4	4	0	0	0	0	0	0	204	-7	7	183	-6	6	120	-4	4	19	-5	3	0	0	0	139	-6	5			
	2020+ DIC1		119	-8	8	30	-3	3	0	0	0	0	0	0	149	-9	9	134	-8	8	88	-6	6	14	-4	2	0	0	0	102	-7	6			
SOFA3 Sunflower (SME), meal to AF, glyc to fuel	2010 DIC1		163	-6	6	39	-5	6	0	0	0	0	0	0	202	-8	8	183	-7	7	120	-4	4	18	-3	3	0	0	0	138	-5	5			
	2020+ DIC1		119	-8	8	29	-4	5	0	0	0	0	0	0	147	-9	9	134	-8	8	88	-6	6	13	-3	2	0	0	0	101	-7	6			
SYFA3a Soy (SYME), no till, oil to EU, meal to AF, oil to EU, glyc to biogas	2010 DIC1		163	-6	6	55	-4	4	0	0	0	0	0	0	217	-7	7	183	-6	6	120	-4	4	19	-21	6	0	0	0	139	-22	7			
	2020+ DIC1		119	-8	8	40	-4	4	0	0	0	0	0	0	158	-9	9	134	-8	8	88	-6	6	14	-16	5	0	0	0	102	-17	8			
SYFA3b Soy (SYME), no till, beans to EU, meal to AF, glyc to biogas	2010 DIC1		163	-6	6	56	-4	4	0	0	0	0	0	0	219	-7	7	185	-6	6	120	-4	4	19	-5	4	0	0	0	139	-7	6			
	2020+ DIC1		119	-8	8	41	-4	4	0	0	0	0	0	0	160	-9	9	135	-8	8	88	-6	6	14	-4	3	0	0	0	102	-7	7			
SYFA3c Soy (SYME), conv. culture, oil to EU, meal to AF, glyc to biogas	2010 DIC1		163	-6	6	55	-4	4	0	0	0	0	0	0	218	-7	7	184	-6	6	120	-4	4	19	-23	6	0	0	0	140	-24	8			
	2020+ DIC1		119	-8	8	40	-4	4	0	0	0	0	0	0	159	-9	9	134	-8	8	88	-6	6	14	-17	5	0	0	0	102	-18	8			
POFA3a Palm (POME), meal to AF, no CH4 rec., heat credit, glyc to biogas	2010 DIC1		163	-6	6	40	-4	4	0	0	0	0	0	0	203	-7	7	181	-6	6	120	-4	4	18	-3	3	0	0	0	139	-5	5			
	2020+ DIC1		119	-8	8	29	-3	3	0	0	0	0	0	0	148	-9	9	132	-8	8	88	-6	6	13	-2	2	0	0	0	102	-6	6			
POFA3b Palm (POME), meal to AF, CH4 rec., heat credit, glyc to biogas	2010 DIC1		163	-6	6	40	-4	4	0	0	0	0	0	0	203	-7	7	181	-6	6	120	-4	4	16	-3	3	0	0	0	137	-5	5			
	2020+ DIC1		119	-8	8	29	-3	3	0	0	0	0	0	0	148	-9	9	132	-8	8	88	-6	6	12	-2	2	0	0	0	100	-6	6			
POFA3c Palm (POME), meal to AF, no CH4 rec., no heat credit, glyc to biogas	2010 DIC1		163	-6	6	42	-4	4	0	0	0	0	0	0	205	-7	7	182	-6	6	120	-4	4	19	-3	3	0	0	0	140	-5	5			
	2020+ DIC1		119	-8	8	31	-3	3	0	0	0	0	0	0	149	-9	9	133	-8	8	88	-6	6	14	-2	2	0	0	0	103	-6	6			
WOFA3a FAME from waste cooking oil	2010 DIC1		163	-6	6	31	-4	4	0	0	0	0	0	0	193	-7	7	181	-6	6	120	-4	4	14	-3	3	0	0	0	135	-5	5			
	2020+ DIC1		119	-8	8	23	-3	3	0	0	0	0	0	0	141	-9	9	132	-8	8	88	-6	6	10	-2	2	0	0	0	99	-6	6			
TOFA3a FAME from tallow	2010 DIC1		163	-6	6	33	-4	4	0	0	0	0	0	0	196	-7	7	183	-6	6	120	-4	4	16	-3	3	0	0	0	136	-5	5			
	2020+ DIC1		119	-8	8	24	-3	3	0	0	0	0	0	0	143	-9	9	134	-8	8	88	-6	6	11	-2	2	0	0	0	100	-6	6			

7 HVO

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ _f /100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
ROHY1a Rape, meal to AF, NexBTL	2010 DICI		163	-7	7	181	-8	8	0	0	0	0	0	0	344	-11	11	73	-3	3	116	-5	5	-23	-13	12	0	0	0	0	0	0	93	-14	13
	2020+ DICI		119	-10	10	132	-12	12	0	0	0	0	0	0	251	-16	16	53	-5	5	85	-8	8	-17	-11	10	0	0	0	0	0	0	68	-13	12
ROHY1b Rape, meal to AF, UOP	2010 DICI		163	-7	7	162	-7	7	0	0	0	0	0	0	324	-10	10	82	-4	4	116	-5	5	-22	-11	11	0	0	0	0	0	0	94	-12	12
	2020+ DICI		119	-10	10	118	-10	10	0	0	0	0	0	0	236	-15	15	60	-5	5	85	-8	8	-16	-10	10	0	0	0	0	0	0	69	-12	12
ROHY4 Rape, meal to biogas, NexBTL	2010 DICI		163	-7	7	108	-10	12	0	0	0	0	0	0	270	-12	14	26	-2	3	116	-5	5	-55	-11	11	0	0	0	0	0	0	61	-12	12
	2020+ DICI		119	-10	10	79	-9	10	0	0	0	0	0	0	197	-14	15	19	-2	3	85	-8	8	-40	-9	9	0	0	0	0	0	0	45	-11	11
SOHY1a Sunflower, meal to AF, NexBTL	2010 DICI		163	-7	7	169	-17	16	0	0	0	0	0	0	331	-18	18	70	-7	7	116	-5	5	-42	-7	7	0	0	0	0	0	0	74	-9	8
	2020+ DICI		119	-10	10	123	-15	15	0	0	0	0	0	0	242	-19	18	51	-6	6	85	-8	8	-31	-7	6	0	0	0	0	0	0	54	-10	10
SYHY1a Soy, no till, oil to EU, NexBTL	2010 DICI		163	-7	7	407	-18	18	0	0	0	0	0	0	570	-20	20	66	-3	3	116	-5	5	-26	-77	22	0	0	0	0	0	0	91	-77	23
	2020+ DICI		119	-10	10	297	-26	26	0	0	0	0	0	0	416	-28	28	48	-4	4	85	-8	8	-19	-56	17	0	0	0	0	0	0	67	-57	18
POY1a Palm, no CH4 rec., heat credit, NexBT	2010 DICI		163	-7	7	184	-8	8	0	0	0	0	0	0	346	-11	11	24	-1	1	116	-5	5	-36	-4	4	0	0	0	0	0	0	80	-6	6
	2020+ DICI		119	-10	10	134	-12	12	0	0	0	0	0	0	252	-16	16	18	-2	2	85	-8	8	-26	-5	5	0	0	0	0	0	0	59	-9	9
WOHY1a HVO from waste cooking oil	2010 DICI		163	-7	7	26	-2	2	0	0	0	0	0	0	188	-8	8	21	-1	1	116	-5	5	-111	-8	10	0	0	0	0	0	0	5	-10	11
	2020+ DICI		119	-10	10	19	-2	2	0	0	0	0	0	0	137	-11	11	15	-2	2	85	-8	8	-81	-6	7	0	0	0	0	0	0	5	-10	10
TOHY1a HVO from tallow	2010 DICI		163	-7	7	71	-3	3	0	0	0	0	0	0	234	-8	8	62	-3	3	116	-5	5	-84	-9	9	0	0	0	0	0	0	32	-10	10
	2020+ DICI		119	-10	10	52	-5	5	0	0	0	0	0	0	171	-11	11	45	-4	4	85	-8	8	-61	-7	7	0	0	0	0	0	0	24	-10	10

8 Synthetic diesel fuel and DME

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
GRSD1 Remote NG to syndiesel, GTL plant near gas field	2010 DICI		163	-7	7	103	-9	12	0	0	0	0	0	0	265	-12	14	264	-12	14	116	-5	5	38	-5	7	0	0	0	154	-7	8			
	2020+ DICI		119	-10	10	75	-9	10	0	0	0	0	0	0	193	-14	15	192	-14	15	85	-8	8	28	-4	5	0	0	0	113	-9	9			
GRSD1C Remote NG to syndiesel, GTL plant near gas field + CCS	2010 DICI		163	-7	7	115	-9	12	0	0	0	0	0	0	277	-11	14	276	-11	14	116	-5	5	22	-4	6	0	0	0	138	-7	8			
	2020+ DICI		119	-10	10	84	-9	11	0	0	0	0	0	0	202	-14	15	201	-14	15	85	-8	8	16	-3	5	0	0	0	101	-8	9			
KOSD1 Coal (hard, EU-mix) to syndiesel, CTL plant in EU	2010 DICI		163	-7	7	157	-15	15	0	0	0	0	0	0	319	-17	17	315	-17	17	116	-5	5	211	-17	17	0	0	0	328	-18	18			
	2020+ DICI		119	-10	10	114	-14	14	0	0	0	0	0	0	233	-18	18	230	-17	17	85	-8	8	154	-17	17	0	0	0	240	-19	19			
KOSD1C Coal (hard, EU-mix) to syndiesel, CTL plant in EU + CCS	2010 DICI		163	-7	7	171	-16	16	0	0	0	0	0	0	333	-17	17	328	-17	17	116	-5	5	65	-14	14	0	0	0	181	-15	15			
	2020+ DICI		119	-10	10	124	-15	15	0	0	0	0	0	0	243	-18	18	239	-18	18	85	-8	8	47	-11	11	0	0	0	133	-13	13			
WFSD1 Wood (farmed) to syndiesel	2010 DICI		163	-7	7	195	-21	19	0	0	0	0	0	0	357	-22	20	10	-1	1	116	-5	5	-104	-3	20	0	0	0	12	-6	21			
	2020+ DICI		119	-10	10	142	-19	18	0	0	0	0	0	0	261	-21	20	8	-1	1	85	-8	8	-76	-2	15	0	0	0	10	-8	17			
WWSD2 Wood (waste) to syndiesel via black liquor	2010 DICI		163	-7	7	148	-11	12	0	0	0	0	0	0	311	-13	14	5	0	0	116	-5	5	-111	0	0	0	0	0	5	-5	5			
	2020+ DICI		119	-10	10	108	-12	12	0	0	0	0	0	0	227	-16	16	4	0	0	85	-8	8	-81	0	0	0	0	0	4	-8	8			
RESD1 Syndiesel from renewable electricity via methanol	2010 DICI		163	-7	7	260	-19	17	0	0	0	0	0	0	423	-20	19	3	0	0	116	-5	5	-113	0	0	0	0	0	3	-5	5			
	2020+ DICI		119	-10	10	190	-20	19	0	0	0	0	0	0	308	-22	22	2	0	0	85	-8	8	-82	0	0	0	0	0	3	-8	8			
GPDE1b Piped NG (4000 km) to DME, synthesis plant in EU	2010 DICI		172	-9	9	109	-17	12	0	0	0	0	0	0	281	-19	15	280	-18	14	117	-6	6	52	-10	6	0	0	0	169	-11	9			
	2020+ DICI		122	-12	12	78	-13	11	0	0	0	0	0	0	200	-18	16	199	-18	16	84	-8	8	37	-8	6	0	0	0	121	-11	10			
GRDE1 Remote NG to DME, synthesis plant near gas field	2010 DICI		172	-9	9	92	-6	7	0	0	0	0	0	0	264	-10	11	262	-10	11	117	-6	6	38	-3	4	0	0	0	154	-6	7			
	2020+ DICI		122	-12	12	65	-7	8	0	0	0	0	0	0	188	-14	14	186	-14	14	84	-8	8	27	-3	3	0	0	0	111	-9	9			
GRDE1C Remote NG to DME, synthesis plant near gas field + CCS	2010 DICI		172	-9	9	93	-6	7	0	0	0	0	0	0	265	-10	11	263	-10	11	117	-6	6	21	-2	3	0	0	0	137	-6	7			
	2020+ DICI		122	-12	12	66	-7	8	0	0	0	0	0	0	189	-14	14	188	-14	14	84	-8	8	15	-2	3	0	0	0	98	-8	9			
KODE1 Coal (hard, EU-mix) to DME, synthesis plant in EU	2010 DICI		172	-9	9	163	-18	18	0	0	0	0	0	0	334	-20	20	322	-18	19	117	-6	6	218	-19	20	0	0	0	334	-20	20			
	2020+ DICI		122	-12	12	116	-16	16	0	0	0	0	0	0	238	-20	20	229	-19	19	84	-8	8	155	-19	19	0	0	0	239	-21	21			
WFDE1 Wood (farmed) to DME	2010 DICI		172	-9	9	184	-26	24	0	0	0	0	0	0	356	-27	25	10	-1	1	117	-6	6	-104	-2	21	0	0	0	12	-6	22			
	2020+ DICI		122	-12	12	131	-21	20	0	0	0	0	0	0	253	-25	24	7	-1	1	84	-8	8	-74	-2	15	0	0	0	9	-8	17			
WWDE2 Wood (waste) to DME via black liquor	2010 DICI		172	-9	9	95	-10	9	0	0	0	0	0	0	267	-13	13	5	0	0	117	-6	6	-112	0	0	0	0	0	5	-6	6			
	2020+ DICI		122	-12	12	68	-9	9	0	0	0	0	0	0	190	-15	15	3	0	0	84	-8	8	-80	0	0	0	0	0	4	-8	8			

9 Electricity and conventional gasoline in electrified vehicles

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			MJ _f /100 km			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
EMEL3 EU-mix LV	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	33	-2	2	168	-6	6	130	-6	6	75	-4	4	14	-2	2	22	-1	1	111	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	94	-5	5	177	-6	6	71	-3	3	26	-1	1	5	-1	1	63	-3	3	93	-4	4			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	22	-2	2	111	-8	8	86	-8	8	50	-5	5	9	-1	1	15	-2	2	74	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	74	-9	9	139	-10	10	56	-4	4	20	-2	2	4	-1	1	49	-6	6	73	-6	6			
FOEL1 Heavy fuel oil large scale power plant	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	28	-1	1	163	-6	6	104	-6	6	75	-4	4	14	-2	2	35	-2	2	124	-5	5			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	81	-4	4	164	-5	5	-1	-3	3	26	-1	1	5	-1	1	99	-6	6	130	-6	6			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	19	-2	2	108	-8	8	70	-8	8	50	-5	5	9	-1	1	23	-2	2	83	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	64	-8	8	128	-9	9	-1	-5	5	20	-2	2	4	-1	1	78	-9	9	102	-10	10			
KOEL1 Coal (hard), conventional	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	26	-5	4	161	-8	7	145	-8	7	75	-4	4	14	-2	2	43	-6	4	132	-7	6			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	75	-15	12	158	-15	12	115	-15	12	26	-1	1	5	-1	1	122	-16	13	153	-16	13			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	18	-4	3	107	-9	8	97	-8	8	50	-5	5	9	-1	1	28	-5	4	88	-7	7			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	59	-13	11	124	-14	12	90	-13	11	20	-2	2	4	-1	1	96	-16	15	120	-16	15			
KOEL2 Coal (hard), IGCC	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	23	-2	2	157	-6	6	141	-6	6	75	-4	4	14	-2	2	38	-3	3	128	-5	5			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	64	-6	6	147	-7	7	104	-6	7	26	-1	1	5	-1	1	109	-8	8	140	-8	8			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	15	-2	2	104	-8	8	94	-8	8	50	-5	5	9	-1	1	26	-3	3	85	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	51	-7	7	116	-9	9	82	-8	8	20	-2	2	4	-1	1	86	-11	11	110	-11	11			
KOEL2C Coal (hard), IGCC + CCS	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	29	-2	2	163	-6	6	148	-6	6	75	-4	4	14	-2	2	10	-2	2	100	-5	5			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	82	-7	7	165	-8	7	122	-7	7	26	-1	1	5	-1	1	30	-6	5	60	-6	5			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	19	-2	2	109	-8	8	98	-8	8	50	-5	5	9	-1	1	7	-1	1	66	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	65	-9	9	130	-10	10	96	-9	9	20	-2	2	4	-1	1	23	-5	5	47	-6	5			
GPEL1a NG, pipe 7000 km, CCGT	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	20	-4	2	154	-7	6	139	-7	6	75	-4	4	14	-2	2	21	-2	1	110	-5	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	56	-11	5	139	-11	6	97	-11	6	26	-1	1	5	-1	1	60	-7	4	91	-7	4			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	13	-3	2	103	-8	8	92	-8	8	50	-5	5	9	-1	1	14	-2	2	74	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	44	-10	6	109	-11	8	76	-10	7	20	-2	2	4	-1	1	48	-7	6	72	-8	7			
GPEL1b NG, pipe 4000 km, CCGT	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	17	-2	1	152	-6	6	137	-6	6	75	-4	4	14	-2	2	19	-2	1	109	-5	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	50	-5	4	133	-6	5	91	-5	5	26	-1	1	5	-1	1	55	-5	3	86	-5	4			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	12	-2	1	101	-8	8	91	-8	8	50	-5	5	9	-1	1	13	-2	1	72	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	39	-6	5	104	-8	7	71	-6	6	20	-2	2	4	-1	1	43	-6	5	67	-7	6			
GPEL1bc NG, pipe 4000 km, CCGT + CCS	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	25	-9	3	159	-11	6	144	-11	6	75	-4	4	14	-2	2	7	-2	1	96	-5	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	71	-25	8	154	-26	8	112	-25	8	26	-1	1	5	-1	1	19	-5	4	49	-5	4			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	17	-6	2	106	-10	8	96	-10	8	50	-5	5	9	-1	1	4	-1	1	64	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	56	-21	8	121	-22	10	88	-21	9	20	-2	2	4	-1	1	15	-4	3	39	-5	4			
GREL1 LNG, CCGT	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	20	-1	1	155	-6	6	139	-6	6	75	-4	4	14	-2	2	21	-1	1	110	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	58	-4	4	141	-5	5	99	-4	5	26	-1	1	5	-1	1	59	-3	4	90	-4	4			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	14	-2	2	103	-8	8	93	-8	8	50	-5	5	9	-1	1	14	-2	2	73	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	46	-6	6	110	-8	8	77	-7	7	20	-2	2	4	-1	1	46	-6	6	71	-6	6			

Electricity and conventional gasoline in electrified vehicles, cont'd

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			MJ _{fo} /100 km			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
OWEL1a Municipal waste (closed digestate storage), small CHP	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	50	-6	6	184	-8	8	118	-6	6	75	-4	4	14	-2	2	2	0	0	91	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	142	-17	17	225	-17	18	37	-2	2	26	-1	1	5	-1	1	6	0	0	36	-2	2			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	33	-5	5	123	-9	9	78	-8	8	50	-5	5	9	-1	1	1	0	0	61	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	112	-18	18	177	-19	19	29	-3	3	20	-2	2	4	-1	1	4	-1	1	28	-3	3			
OWEL1b Municipal waste (closed digestate storage), co-firing large CCGT	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	40	-5	5	174	-8	8	123	-6	6	75	-4	4	14	-2	2	3	-1	1	93	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	113	-14	14	196	-14	14	52	-3	3	5	-1	1	10	-3	3	41	-3	3						
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	26	-4	4	116	-9	9	82	-8	8	50	-5	5	9	-1	1	2	-1	1	62	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	89	-14	14	154	-15	15	41	-4	4	20	-2	2	4	-1	1	8	-2	2	32	-3	3			
OWEL21a Manure (closed digestate storage), small CHP	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	83	-5	5	218	-8	8	120	-6	6	75	-4	4	14	-2	2	-26	2	-2	63	-5	5			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	237	-15	16	320	-16	16	43	-2	2	26	-1	1	5	-1	1	-73	5	-5	-42	-5	5			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	55	-6	6	145	-10	10	80	-8	8	50	-5	5	9	-1	1	-17	2	-2	43	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	187	-23	24	252	-24	24	33	-3	3	20	-2	2	4	-1	1	-58	7	-7	-34	-8	8			
OWEL21b Manure (closed digestate storage), co-firing large CCGT	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	68	-4	4	203	-7	7	122	-6	6	75	-4	4	14	-2	2	-20	1	-1	69	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	194	-12	12	277	-12	12	50	-2	2	26	-1	1	5	-1	1	-58	3	-3	-27	-4	4			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	45	-5	5	135	-9	9	81	-8	8	50	-5	5	9	-1	1	-14	1	-1	46	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	153	-19	19	218	-20	20	39	-3	3	20	-2	2	4	-1	1	-46	6	-6	-22	-6	6			
OWEL22a Manure (open digestate storage), small CHP	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	89	-5	5	223	-8	8	120	-6	6	75	-4	4	14	-2	2	-17	1	-1	72	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	252	-16	16	335	-16	17	43	-2	2	26	-1	1	5	-1	1	-48	3	-3	-18	-4	3			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	59	-7	7	148	-10	10	80	-8	8	50	-5	5	9	-1	1	-11	1	-1	48	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	198	-25	25	263	-25	25	33	-3	3	20	-2	2	4	-1	1	-38	5	-5	-14	-5	5			
OWEL22b Manure (open digestate storage), co- firing large CCGT	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	73	-4	4	207	-7	7	122	-6	6	75	-4	4	14	-2	2	-9	1	-1	80	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	207	-13	13	290	-13	13	50	-2	2	26	-1	1	5	-1	1	-26	2	-2	4	-2	2			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	48	-5	5	138	-9	9	81	-8	8	50	-5	5	9	-1	1	-6	1	-1	53	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	163	-20	20	228	-21	21	39	-3	3	20	-2	2	4	-1	1	-21	3	-3	3	-4	4			

Electricity and conventional gasoline in electrified vehicles, cont'd

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ _f /100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			MJ _f /100 km			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
WFEL1 Wood (farmed), large IGCC	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	21	-2	2	155	-6	6	120	-6	6	75	-4	4	14	-2	2	1	0	2	90	-4	5			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	60	-5	6	143	-6	7	43	-2	2	26	-1	1	5	-1	1	3	-1	5	34	-2	5			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	14	-2	2	103	-8	8	80	-8	8	50	-5	5	9	-1	1	1	0	1	60	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	47	-6	7	112	-8	9	34	-3	3	20	-2	2	4	-1	1	3	-1	4	27	-3	5			
WFEL2 Wood (farmed), small IGCC	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	34	-2	2	168	-6	6	120	-6	6	75	-4	4	14	-2	2	2	0	3	91	-4	5			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	97	-7	7	180	-8	8	42	-2	2	26	-1	1	5	-1	1	4	-1	9	35	-2	9			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	23	-3	3	112	-8	8	80	-8	8	50	-5	5	9	-1	1	1	0	2	61	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	76	-10	10	141	-11	11	34	-3	3	20	-2	2	4	-1	1	4	-1	7	28	-3	8			
WFEL3 Wood (farmed), small conventional	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	39	-3	3	174	-7	7	120	-6	6	75	-4	4	14	-2	2	2	0	3	91	-4	5			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	111	-10	10	194	-10	10	44	-2	2	26	-1	1	5	-1	1	6	-1	8	37	-2	8			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	26	-3	3	115	-8	8	80	-8	8	50	-5	5	9	-1	1	1	0	2	61	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	88	-12	12	153	-13	13	34	-3	3	20	-2	2	4	-1	1	5	-1	7	29	-3	7			
WFEL4 Wood (farmed), cofiring coal plant	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	25	-5	4	159	-7	7	120	-6	6	75	-4	4	14	-2	2	2	0	2	91	-4	5			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	71	-13	12	180	-14	12	43	-2	2	26	-1	1	5	-1	1	5	-1	6	35	-2	6			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	17	-3	3	106	-8	8	80	-8	8	50	-5	5	9	-1	1	1	0	1	61	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	56	-12	11	121	-13	12	34	-3	3	20	-2	2	4	-1	1	4	-1	5	28	-3	6			
WWEL1 Wood (waste), large IGCC	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	21	-2	2	155	-6	6	120	-6	6	75	-4	4	14	-2	2	1	0	0	90	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	60	-5	6	143	-6	7	43	-2	2	26	-1	1	5	-1	1	2	0	0	33	-2	2			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	14	-2	2	103	-8	8	80	-8	8	50	-5	5	9	-1	1	1	0	0	60	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	47	-6	7	112	-8	9	33	-3	3	20	-2	2	4	-1	1	2	0	0	26	-3	3			
WWEL2 Wood (waste), small IGCC	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	33	-2	3	168	-6	6	120	-6	6	75	-4	4	14	-2	2	1	0	0	90	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	95	-7	7	178	-8	8	42	-2	2	26	-1	1	5	-1	1	2	0	0	32	-2	2			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	22	-3	3	112	-8	8	80	-8	8	50	-5	5	9	-1	1	0	0	0	60	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	75	-10	10	139	-11	11	33	-3	3	20	-2	2	4	-1	1	1	0	0	25	-3	3			
WWEL3 Wood (waste), small conventional	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	38	-3	3	173	-7	7	120	-6	6	75	-4	4	14	-2	2	1	0	0	90	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	109	-10	9	192	-10	10	42	-2	2	26	-1	1	5	-1	1	3	0	0	34	-2	2			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	25	-3	3	115	-8	8	80	-8	8	50	-5	5	9	-1	1	1	0	0	60	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	86	-12	12	151	-13	13	33	-3	3	20	-2	2	4	-1	1	2	0	0	26	-3	3			
WWEL4 Wood (waste), cofiring coal plant	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	25	-6	4	159	-8	7	120	-6	6	75	-4	4	14	-2	2	1	0	0	90	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	71	-16	12	154	-16	12	43	-2	2	26	-1	1	5	-1	1	3	0	0	34	-2	2			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	16	-4	3	106	-9	8	80	-8	8	50	-5	5	9	-1	1	1	0	0	60	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	56	-14	11	120	-15	12	34	-3	3	20	-2	2	4	-1	1	3	0	0	27	-3	3			
WWEL5 Black liquor	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	4	-1	1	139	-6	6	119	-6	6	75	-4	4	14	-2	2	0	0	0	89	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	12	-2	2	95	-4	4	41	-2	2	26	-1	1	5	-1	1	0	0	0	31	-2	2			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	3	0	0	92	-8	8	79	-8	8	50	-5	5	9	-1	1	0	0	0	60	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	9	-2	2	74	-5	5	32	-3	3	20	-2	2	4	-1	1	0	0	0	24	-3	3			

Electricity and conventional gasoline in electrified vehicles, cont'd

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ _f /100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			MJ _f /100 km			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
NUEL Nuclear	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	45	-3	3	179	-6	6	120	-6	6	75	-4	4	14	-2	2	1	0	0	90	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	128	-8	8	211	-9	8	44	-2	2	26	-1	1	5	-1	1	2	0	0	33	-2	2			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	30	-3	3	119	-8	8	80	-8	8	50	-5	5	9	-1	1	0	0	0	60	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	101	-13	12	166	-14	13	34	-3	3	20	-2	2	4	-1	1	2	0	0	26	-3	3			
WDEL Wind	2010	DISI PHEV	101	-5	5	19	-3	2	15	-1	1	2	0	0	136	-6	6	119	-6	6	75	-4	4	14	-2	2	0	0	0	89	-4	4			
		SI REEV	35	-2	2	6	-1	1	42	-2	2	5	0	0	88	-3	3	41	-2	2	26	-1	1	5	-1	1	0	0	0	31	-2	2			
		2020+ DISI PHEV	67	-7	7	12	-2	2	10	-1	1	1	0	0	91	-8	8	79	-6	6	50	-5	5	9	-1	1	0	0	0	60	-6	6			
		SI REEV	27	-3	3	5	-1	1	33	-4	4	4	0	0	69	-5	5	32	-3	3	20	-2	2	4	-1	1	0	0	0	24	-3	3			

10 Electricity and conventional diesel in electrified vehicles

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ _f /100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
EMEL3 EU-mix LV	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	34	-2	2	159	-6	6	121	-5	5	68	-4	4	14	-2	2	22	-1	1	105	-4	4			
		2020+ DICI PHEV	63	-7	7	13	-2	2	10	-1	1	23	-2	2	109	-8	8	83	-7	7	47	-5	5	10	-1	1	15	-2	2	72	-6	6			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	75	0	0	139	-5	5	55	-3	3	20	-2	2	4	-1	1	50	0	0	73	-2	2			
FOEL1 Heavy fuel oil large scale power plant	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	29	-1	1	154	-5	5	95	-5	5	68	-4	4	14	-2	2	35	-2	2	118	-4	4			
		2020+ DICI PHEV	63	-7	7	13	-2	2	10	-1	1	19	-2	2	106	-7	7	66	-7	7	47	-5	5	10	-1	1	24	-3	3	81	-6	6			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	64	0	0	129	-5	5	-2	-3	3	20	-2	2	4	-1	1	79	0	0	102	-2	2			
KOEL1 Coal (hard), conventional	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	27	-6	3	152	-8	6	136	-8	6	68	-4	4	14	-2	2	44	-6	4	126	-7	6			
		2020+ DICI PHEV	63	-7	7	13	-2	2	10	-1	1	18	-4	3	104	-8	8	93	-8	8	47	-5	5	10	-1	1	29	-5	4	86	-7	7			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	60	0	0	124	-5	5	90	-3	3	20	-2	2	4	-1	1	97	0	0	120	-2	2			
KOEL2 Coal (hard), IGCC	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	23	-2	2	148	-6	6	132	-6	6	68	-4	4	14	-2	2	39	-3	3	121	-5	5			
		2020+ DICI PHEV	63	-7	7	13	-2	2	10	-1	1	15	-2	2	102	-7	7	91	-7	7	47	-5	5	10	-1	1	26	-3	3	83	-6	6			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	51	0	0	116	-5	5	81	-3	3	20	-2	2	4	-1	1	87	0	0	110	-2	2			
KOEL2C Coal (hard), IGCC + CCS	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	29	-2	2	155	-6	6	139	-6	6	68	-4	4	14	-2	2	11	-2	2	93	-4	4			
		2020+ DICI PHEV	63	-7	7	13	-2	2	10	-1	1	20	-2	2	106	-8	8	95	-7	7	47	-5	5	10	-1	1	7	-1	2	64	-5	5			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	65	0	0	130	-5	5	96	-3	3	20	-2	2	4	-1	1	23	0	0	47	-2	2			
GPEL1a NG, pipe 7000 km, CCGT	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	20	-4	2	145	-6	6	130	-6	6	68	-4	4	14	-2	2	22	-2	2	104	-4	4			
		2020+ DICI PHEV	63	-7	7	13	-2	2	10	-1	1	14	-3	2	100	-8	7	89	-8	7	47	-5	5	10	-1	1	15	-2	2	71	-6	6			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	45	0	0	109	-5	5	76	-3	3	20	-2	2	4	-1	1	48	0	0	72	-2	2			
GPEL1b NG, pipe 4000 km, CCGT	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	18	-1	2	143	-5	6	127	-5	5	68	-4	4	14	-2	2	20	-2	1	102	-4	4			
		2020+ DICI PHEV	63	-7	7	13	-2	2	10	-1	1	12	-1	2	98	-7	7	88	-7	7	47	-5	5	10	-1	1	13	-2	2	70	-6	6			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	39	0	0	104	-5	5	71	-3	3	20	-2	2	4	-1	1	44	0	0	68	-2	2			
GPEL1bC NG, pipe 4000 km, CCGT + CCS	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	25	-9	3	151	-10	6	135	-10	6	68	-4	4	14	-2	2	7	-2	1	89	-4	4			
		2020+ DICI PHEV	63	-7	7	13	-2	2	10	-1	1	17	-6	2	103	-9	8	93	-9	7	47	-5	5	10	-1	1	4	-1	1	61	-5	5			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	56	0	0	121	-5	5	88	-3	3	20	-2	2	4	-1	1	15	0	0	39	-2	2			
GREL1 LNG, CCGT	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	21	-1	2	146	-5	6	130	-5	5	68	-4	4	14	-2	2	21	-1	1	103	-4	4			
		2020+ DICI PHEV	63	-7	7	13	-2	2	10	-1	1	14	-2	2	100	-7	7	90	-7	7	47	-5	5	10	-1	1	14	-2	2	71	-6	6			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	46	0	0	111	-5	5	77	-3	3	20	-2	2	4	-1	1	47	0	0	71	-2	2			

Electricity and conventional diesel in electrified vehicles, cont'd

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
OWEL1a Municipal waste (closed digestate storage), small CHP	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	51	-6	6	176	-8	8	108	-5	5	68	-4	4	14	-2	2	2	0	0	84	-4	4			
	2020+	DICI PHEV	63	-7	7	13	-2	2	10	-1	1	34	-5	5	120	-9	9	75	-7	7	47	-5	5	10	-1	1	1	0	0	58	-5	5			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	112	0	0	177	-5	5	28	-3	3	20	-2	2	4	-1	1	4	0	0	28	-2	2			
OWEL1b Municipal waste (closed digestate storage), co-firing large CCGT	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	40	-4	5	166	-7	7	114	-5	5	68	-4	4	14	-2	2	4	-1	1	86	-4	4			
	2020+	DICI PHEV	63	-7	7	13	-2	2	10	-1	1	27	-4	4	113	-8	8	78	-7	7	47	-5	5	10	-1	1	2	-1	1	59	-5	5			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	89	0	0	154	-5	5	40	-3	3	20	-2	2	4	-1	1	8	0	0	32	-2	2			
OWEL21a Manure (closed digestate storage), small CHP	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	85	-5	5	210	-7	8	110	-5	5	68	-4	4	14	-2	2	-26	2	-2	56	-4	4			
	2020+	DICI PHEV	63	-7	7	13	-2	2	10	-1	1	57	-6	6	143	-10	10	76	-7	7	47	-5	5	10	-1	1	-18	2	-2	39	-6	6			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	188	0	0	253	-5	5	33	-3	3	20	-2	2	4	-1	1	-58	0	0	-34	-2	2			
OWEL21b Manure (closed digestate storage), co-firing large CCGT	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	69	-4	4	195	-7	7	113	-5	5	68	-4	4	14	-2	2	-21	1	-1	61	-4	4			
	2020+	DICI PHEV	63	-7	7	13	-2	2	10	-1	1	47	-5	5	133	-9	9	78	-7	7	47	-5	5	10	-1	1	-14	2	-2	43	-5	6			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	154	0	0	219	-5	5	38	-3	3	20	-2	2	4	-1	1	-46	0	0	-22	-2	2			
OWEL22a Manure (open digestate storage), small CHP	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	90	-6	6	215	-8	8	110	-5	5	68	-4	4	14	-2	2	-17	1	-1	65	-4	4			
	2020+	DICI PHEV	63	-7	7	13	-2	2	10	-1	1	61	-7	7	147	-10	10	76	-7	7	47	-5	5	10	-1	1	-12	1	-1	45	-5	5			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	200	0	0	264	-5	5	33	-3	3	20	-2	2	4	-1	1	-38	0	0	-14	-2	2			
OWEL22b Manure (open digestate storage), co- firing large CCGT	2010	DICI PHEV	92	-5	5	19	-2	2	15	-1	1	74	-4	4	199	-7	7	113	-5	5	68	-4	4	14	-2	2	-9	1	-1	73	-4	4			
	2020+	DICI PHEV	63	-7	7	13	-2	2	10	-1	1	50	-5	6	136	-9	9	78	-7	7	47	-5	5	10	-1	1	-6	1	-1	51	-5	5			
		CI REEV	26	-3	3	5	-1	1	33	-4	4	164	0	0	229	-5	5	39	-3	3	20	-2	2	4	-1	1	-21	0	0	3	-2	2			

Electricity and conventional diesel in electrified vehicles, cont'd

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			MJ _f /100 km			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
WFEL1 Wood (farmed), large IGCC	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	21	-2	2	147	-6	6	110	-5	5	68	-4	4	14	-2	2	1	0	2	83	-4	5			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	14	-2	2	101	-7	7	76	-7	7	47	-5	5	10	-1	1	1	0	2	58	-5	6			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	47	0	0	112	-5	5	33	-3	3	20	-2	2	4	-1	1	3	0	0	26	-2	2			
WFEL2 Wood (farmed), small IGCC	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	35	-2	2	160	-6	6	111	-5	5	68	-4	4	14	-2	2	2	0	3	84	-4	5			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	23	-3	3	109	-8	8	76	-7	7	47	-5	5	10	-1	1	1	0	2	58	-5	6			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	77	0	0	141	-5	5	34	-3	3	20	-2	2	4	-1	1	4	0	0	27	-2	2			
WFEL3 Wood (farmed), small conventional	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	40	-3	3	165	-6	6	111	-5	5	68	-4	4	14	-2	2	2	0	3	84	-4	5			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	27	-3	3	113	-8	8	76	-7	7	47	-5	5	10	-1	1	1	0	2	58	-5	6			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	88	0	0	153	-5	5	34	-3	3	20	-2	2	4	-1	1	5	0	2	28	-2	2			
WFEL4 Wood (farmed), cofiring coal plant	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	25	-5	4	151	-7	7	111	-5	5	68	-4	4	14	-2	2	2	0	3	84	-4	5			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	17	-4	3	103	-8	8	76	-7	7	47	-5	5	10	-1	1	1	0	2	58	-5	6			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	56	0	0	121	-5	5	33	-3	3	20	-2	2	4	-1	1	4	0	0	27	-2	2			
WWEL1 Wood (waste), large IGCC	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	21	-2	2	147	-6	6	110	-5	5	68	-4	4	14	-2	2	1	0	0	83	-4	4			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	14	-2	2	100	-7	7	76	-7	7	47	-5	5	10	-1	1	1	0	0	57	-5	5			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	47	0	0	112	-5	5	33	-3	3	20	-2	2	4	-1	1	2	0	0	26	-2	2			
WWEL2 Wood (waste), small IGCC	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	34	-3	2	159	-6	6	110	-5	5	68	-4	4	14	-2	2	1	0	0	83	-4	4			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	23	-3	3	109	-8	8	76	-7	7	47	-5	5	10	-1	1	0	0	0	57	-5	5			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	75	0	0	140	-5	5	32	-3	3	20	-2	2	4	-1	1	1	0	0	25	-2	2			
WWEL3 Wood (waste), small conventional	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	39	-4	3	164	-6	6	110	-5	5	68	-4	4	14	-2	2	1	0	0	83	-4	4			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	26	-3	3	112	-8	8	76	-7	7	47	-5	5	10	-1	1	1	0	0	58	-5	5			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	87	0	0	151	-5	5	33	-3	3	20	-2	2	4	-1	1	2	0	0	26	-2	2			
WWEL4 Wood (waste), cofiring coal plant	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	25	-5	4	150	-7	7	110	-5	5	68	-4	4	14	-2	2	1	0	0	83	-4	4			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	17	-4	3	103	-8	8	76	-7	7	47	-5	5	10	-1	1	1	0	0	58	-5	5			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	56	0	0	121	-5	5	33	-3	3	20	-2	2	4	-1	1	3	0	0	27	-2	2			
WWEL5 Black liquor	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	4	-1	1	129	-5	5	110	-5	5	68	-4	4	14	-2	2	0	0	0	82	-4	4			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	3	-1	0	89	-7	7	76	-7	7	47	-5	5	10	-1	1	0	0	0	57	-5	5			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	9	0	0	74	-5	5	32	-3	3	20	-2	2	4	-1	1	0	0	0	24	-2	2			
NUEL Nuclear	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	46	-3	3	171	-6	6	111	-5	5	68	-4	4	14	-2	2	1	0	0	83	-4	4			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	31	-3	3	117	-8	8	76	-7	7	47	-5	5	10	-1	1	1	0	0	57	-5	5			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	102	0	0	166	-5	5	33	-3	3	20	-2	2	4	-1	1	2	0	0	25	-2	2			
WDEL Wind	2010 DICI PHEV		92	-5	5	19	-2	2	15	-1	1	2	0	0	127	-5	5	110	-5	5	68	-4	4	14	-2	2	0	0	0	82	-4	4			
	2020+ DICI PHEV		63	-7	7	13	-2	2	10	-1	1	1	0	0	87	-7	7	76	-7	7	47	-5	5	10	-1	1	0	0	0	57	-5	5			
	CI REEV		26	-3	3	5	-1	1	33	-4	4	4	0	0	69	-5	5	31	-3	3	20	-2	2	4	-1	1	0	0	0	24	-2	2			

11 Hydrogen in fuel cell vehicles

11.1 Compressed hydrogen (C-H2), thermal pathways

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ _e /100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
<i>NG reforming</i>																																			
GMCH1	2020+	FCEV	54	-5	5	53	-6	6	0	0	0	0	0	0	107	-8	8	97	-7	7	0	0	0	62	-6	6	0	0	0	62	-6	6			
EU-mix, O/S Ref		REEV-FC	13	-5	5	13	-6	6	30	0	0	67	0	0	124	-8	8	33	-7	7	0	0	0	15	0	0	45	0	0	60	-6	6			
GPCH1a	2020+	FCEV	54	-5	5.4	63	-12	8	0	0	0	0	0	0	117	-13	10	107	-12	9	0	0	0	69	-9	7	0	0	0	69	-9	7			
NG 7000 km, O/S Ref		REEV-FC	13	-5	5	16	-12	8	30	0	0	67	0	0	126	-13	10	35	-12	9	0	0	0	17	1	1	45	0	0	62	-9	7			
GPCH1b	2020+	FCEV	54	-5	5.4	57	-8	7	0	0	0	0	0	0	111	-10	9	101	-9	8	0	0	0	63	-7	7	0	0	0	63	-7	7			
NG 4000 km, O/S Ref		REEV-FC	13	-5	5	14	-8	7	30	0	0	67	0	0	125	-10	9	33	-9	8	0	0	0	16	1	0	45	0	0	61	-7	7			
GPCH2a	2020+	FCEV	54	-5	5.4	49	-10	7	0	0	0	0	0	0	103	-12	9	96	-10	8	0	0	0	61	-8	7	0	0	0	61	-8	7			
NG 7000 km, Cen ref, Pipe		REEV-FC	13	-5	5	12	-10	7	30	0	0	67	0	0	123	-12	9	32	-10	8	0	0	0	15	1	1	45	0	0	60	-8	7			
GPCH2b	2020+	FCEV	54	-5	5.4	43	-7	5	0	0	0	0	0	0	97	-9	7	90	-8	7	0	0	0	56	-6	6	0	0	0	56	-6	6			
NG 4000 km, Cen Ref, Pipe		REEV-FC	13	-5	5	11	-7	5	30	0	0	67	0	0	121	-9	7	31	-8	7	0	0	0	14	1	0	45	0	0	59	-6	6			
GPCH2bc	2020+	FCEV	54	-5	5.4	47	-7	6	0	0	0	0	0	0	100	-9	8	93	-8	7	0	0	0	23	-4	3	0	0	0	23	-4	3			
NG 4000 km, Cen Ref, Pipe, CCS		REEV-FC	13	-5	5	12	-7	6	30	0	0	67	0	0	122	-9	8	32	-8	7	0	0	0	6	1	0	45	0	0	51	-4	3			
GPCH3b	2020+	FCEV	54	-5	5.4	47	-7	6	0	0	0	0	0	0	101	-9	8	93	-8	7	0	0	0	58	-7	6	0	0	0	58	-7	6			
NG 4000 km, Cen Ref, Road		REEV-FC	13	-5	5	12	-7	6	30	0	0	67	0	0	122	-9	8	31	-8	7	0	0	0	15	1	0	45	0	0	59	-7	6			
GPLCHb	2020+	FCEV	54	-5	5.4	69	-11	9	0	0	0	0	0	0	123	-12	10	119	-11	10	0	0	0	73	-9	8	0	0	0	73	-9	8			
NG 4000 km, Cen Ref, Liq, Road, Vap/comp.		REEV-FC	13	-5	5	17	-11	9	30	0	0	67	0	0	128	-12	10	38	-11	10	0	0	0	18	1	1	45	0	0	63	-9	8			
GRCH1	2020+	FCEV	54	-5	5.4	65	-7	7	0	0	0	0	0	0	119	-9	9	109	-8	8	0	0	0	67	-7	7	0	0	0	67	-7	7			
LNG, O/S Ref		REEV-FC	13	-5	5	16	-7	7	30	0	0	67	0	0	127	-9	9	35	-8	8	0	0	0	17	0	0	45	0	0	62	-7	7			
GRCH2	2020+	FCEV	54	-5	5.4	51	-5	6	0	0	0	0	0	0	105	-8	8	97	-7	7	0	0	0	60	-6	6	0	0	0	60	-6	6			
LNG, Cen Ref, Pipe		REEV-FC	13	-5	5	13	-5	6	30	0	0	67	0	0	123	-8	8	33	-7	7	0	0	0	15	0	0	45	0	0	60	-6	6			
GRCH3	2020+	FCEV	54	-5	5.4	65	-7	7	0	0	0	0	0	0	118	-9	9	110	-8	8	0	0	0	67	-7	7	0	0	0	67	-7	7			
Rem NG, methanol, O/S Ref		REEV-FC	13	-5	5	16	-7	7	30	0	0	67	0	0	127	-9	9	36	-8	8	0	0	0	17	0	0	45	0	0	61	-7	7			
<i>Coal gasification</i>																																			
KOCH1	2020+	FCEV	54	-5	5.4	78	-8	8	0	0	0	0	0	0	132	-10	10	124	-9	9	0	0	0	128	-13	13	0	0	0	128	-13	13			
Coal EU-mix, cen Ref, Pipe		REEV-FC	13	-5	5	20	-8	8	30	0	0	67	0	0	130	-10	10	39	-9	9	0	0	0	32	0	0	45	0	0	77	-13	13			
KOCH1C	2020+	FCEV	54	-5	5.4	98	-10	10	0	0	0	0	0	0	152	-11	11	144	-11	11	0	0	0	30	-3	3	0	0	0	30	-3	3			
Coal EU-mix, cen Ref, Pipe, CCS		REEV-FC	13	-5	5	25	-10	10	30	0	0	67	0	0	135	-11	11	44	-11	11	0	0	0	7	0	0	45	0	0	52	-3	3			
<i>Wood gasification</i>																																			
WFCH1	2020+	FCEV	54	-5	5	52	-16	13	0	0	0	0	0	0	106	-17	14	64	-6	6	0	0	0	9	-1	5	0	0	0	9	-1	5			
W Wood, O/S gasif		REEV-FC	13	-5	5	13	-16	13	30	0	0	67	0	0	124	-17	14	24	-6	6	0	0	0	2	0	1	45	0	0	47	-1	5			
WFCH2	2020+	FCEV	54	-5	5	57	-7	7	0	0	0	0	0	0	110	-9	9	64	-6	6	0	0	0	9	-1	5	0	0	0	9	-1	5			
F Wood, Cen gasif, pipe		REEV-FC	13	-5	5	14	-7	7	30	0	0	67	0	0	125	-9	9	24	-6	6	0	0	0	2	0	1	45	0	0	47	-1	5			
WWCH1	2020+	FCEV	54	-5	5	51	-18	13	0	0	0	0	0	0	105	-18	14	63	-6	6	0	0	0	8	-1	1	0	0	0	8	-1	1			
W Wood, O/S gasif		REEV-FC	13	-5	5	13	-18	13	30	0	0	67	0	0	123	-18	14	24	-6	6	0	0	0	2	0	0	45	0	0	47	-1	1			
WWCH2	2020+	FCEV	54	-5	5	56	-7	7	0	0	0	0	0	0	110	-9	9	64	-6	6	0	0	0	8	-1	1	0	0	0	8	-1	1			
W Wood, Cen gasif, Pipe		REEV-FC	13	-5	5	14	-7	7	30	0	0	67	0	0	125	-9	9	24	-6	6	0	0	0	2	0	0	45	0	0	47	-1	1			
WWCH3	2020+	FCEV	54	-5	5	32	-4	4	0	0	0	0	0	0	86	-7	7	63	-6	6	0	0	0	7	-1	1	0	0	0	7	-1	1			
W Wood, Black liquor		REEV-FC	13	-5	5	8	-4	4	30	0	0	67	0	0	119	-7	7	24	-6	6	0	0	0	2	0	0	45	0	0	47	-1	1			

11.2 Compressed hydrogen (C-H2), electrolysis pathways

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
GPFL1a/CH1	2020+	FCEV	54	-5	5	142	-25	18	0	0	0	0	0	0	196	-26	19	250	-35	26	0	0	0	121	-17	14	0	0	0	121	-17	14	0	0	0
NG 7000 km, CCGT, O/S Ely		REEV-FC	13	-5	5	35	-25	18	30	0	0	67	0	0	146	-26	19	71	-35	26	0	0	0	30	3	2	45	0	0	75	-17	14	0	0	0
GPFL1b/CH1	2020+	FCEV	54	-5	5	129	-18	16	0	0	0	0	0	0	183	-19	17	237	-27	23	0	0	0	110	-14	12	0	0	0	110	-14	12	0	0	0
NG 4000 km, CCGT, O/S Ely		REEV-FC	13	-5	5	32	-18	16	30	0	0	67	0	0	143	-19	17	67	-27	23	0	0	0	28	2	1	45	0	0	72	-14	12	0	0	0
GPFL1b/CH2	2020+	FCEV	54	-5	5	129	-18	16	0	0	0	0	0	0	183	-19	17	230	-26	23	0	0	0	108	-13	12	0	0	0	108	-13	12	0	0	0
NG 4000 km, CCGT, Cen Ely, Pipe		REEV-FC	13	-5	5	32	-18	16	30	0	0	67	0	0	143	-19	17	66	-26	23	0	0	0	27	2	1	45	0	0	72	-13	12	0	0	0
GREL1/CH1	2020+	FCEV	54	-5	5	145	-17	17	0	0	0	0	0	0	199	-18	18	253	-24	24	0	0	0	118	-13	13	0	0	0	118	-13	13	0	0	0
LNG, O/S Ely		REEV-FC	13	-5	5	36	-17	17	30	0	0	67	0	0	147	-18	18	71	-24	24	0	0	0	29	1	1	45	0	0	74	-13	13	0	0	0
WFEL1/CH2	2020+	FCEV	54	-5	5	155	-19	20	0	0	0	0	0	0	209	-20	20	66	-6	6	0	0	0	13	-2	10	0	0	0	13	-2	10	0	0	0
F Wood, 200 MW gasif, CCGT, Cen eLy, Pipe		REEV-FC	13	-5	5	39	-19	20	30	0	0	67	0	0	149	-20	20	25	-6	6	0	0	0	3	0	3	45	0	0	48	-2	10	0	0	0
WFEL3/CH1	2020+	FCEV	54	-5	5	252	-30	34	0	0	0	0	0	0	306	-31	34	61	-5	6	0	0	0	12	-2	16	0	0	0	12	-2	16	0	0	0
F Wood, Conv power, O/S Ely		REEV-FC	13	-5	5	63	-30	34	30	0	0	67	0	0	174	-31	34	23	-5	6	0	0	0	3	0	4	45	0	0	48	-2	16	0	0	0
EMEL2/CH1	2020+	FCEV	54	-5	5	211	-23	24	0	0	0	0	0	0	265	-24	24	194	-16	17	0	0	0	122	-13	13	0	0	0	122	-13	13	0	0	0
Elec EU-mix, O/S Ely		REEV-FC	13	-5	5	53	-23	24	30	0	0	67	0	0	163	-24	24	57	-16	17	0	0	0	30	1	1	45	0	0	75	-13	13	0	0	0
EMEL1/CH2	2020+	FCEV	54	-5	5	218	-24	25	0	0	0	0	0	0	272	-25	25	198	-17	17	0	0	0	125	-13	14	0	0	0	125	-13	14	0	0	0
Elec EU-mix, Cen eLy, Pipe		REEV-FC	13	-5	5	54	-24	25	30	0	0	67	0	0	165	-25	25	58	-17	17	0	0	0	31	1	1	45	0	0	76	-13	14	0	0	0
KOEL1/CH1	2020+	FCEV	54	-5	5	180	-33	27	0	0	0	0	0	0	234	-33	27	285	-42	35	0	0	0	244	-37	32	0	0	0	244	-37	32	0	0	0
Elec coal EU-mix conv., O/S Ely		REEV-FC	13	-5	5	45	-33	27	30	0	0	67	0	0	156	-33	27	79	-42	35	0	0	0	61	8	5	45	0	0	106	-37	32	0	0	0
KOEL2/CH1	2020+	FCEV	54	-5	5	159	-17	44	0	0	0	0	0	0	213	-18	44	265	-23	58	0	0	0	220	-26	25	0	0	0	220	-26	25	0	0	0
Elec coal EU-mix IGCC, O/S Ely		REEV-FC	13	-5	5	40	-17	44	30	0	0	67	0	0	150	-18	44	74	-23	58	0	0	0	55	3	3	45	0	0	100	-26	25	0	0	0
KOEL2C/CH1	2020+	FCEV	54	-5	5	194	-24	23	0	0	0	0	0	0	248	-25	24	299	-31	30	0	0	0	68	-13	12	0	0	0	68	-13	12	0	0	0
Elec coal EU-mix IGCC + CCS, O/S Ely		REEV-FC	13	-5	5	48	-24	23	30	0	0	67	0	0	159	-25	24	83	-31	30	0	0	0	17	2	3	45	0	0	62	-13	12	0	0	0
KOEL1/CH2	2020+	FCEV	54	-5	5	176	-34	27	0	0	0	0	0	0	230	-34	28	274	-43	34	0	0	0	231	-38	31	0	0	0	231	-38	31	0	0	0
Elec coal EU-mix, Cen eLy, Pipe		REEV-FC	13	-5	5	44	-34	27	30	0	0	67	0	0	155	-34	28	77	-43	34	0	0	0	58	7	6	45	0	0	102	-38	31	0	0	0
NUEL1/CH1	2020+	FCEV	54	-5	5	286	-33	32	0	0	0	0	0	0	340	-33	33	54	-5	5	0	0	0	4	-1	0	0	0	0	4	-1	0	0	0	0
Elec nuclear, O/S Ely		REEV-FC	13	-5	5	71	-33	32	30	0	0	67	0	0	182	-33	33	22	-5	5	0	0	0	1	0	0	45	0	0	46	-1	0	0	0	0
WDEL1/CH2	2020+	FCEV	54	-5	5	47	-6	6	0	0	0	0	0	0	101	-8	8	62	-6	6	0	0	0	7	-1	1	0	0	0	7	-1	1	0	0	0
Wind, Cen Ely, Pipe		REEV-FC	13	-5	5	12	-6	6	30	0	0	67	0	0	122	-8	8	24	-6	6	0	0	0	2	0	0	45	0	0	46	-1	1	0	0	0

11.3 Cryo-compressed liquid hydrogen (Cc-H2), all pathways

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
<i>NG reforming</i>																																			
GPLH1a	2020+	FCEV	54	-5	5	70	-13	9	0	0	0	0	0	0	124	-14	11	123	-14	11	0	0	0	76	-10	8	0	0	0	76	-10	8	0	0	0
NG 7000 km, Cen Ref, Liq, Road		REEV-FC	13	-5	5	17	-13	9	30	0	0	67	0	0	128	-14	11	39	-14	11	0	0	0	19	0	0	0	0	0	45	0	0	64	-10	8
GPLH1b	2020+	FCEV	54	-5	5	62	-10	9	0	0	0	0	0	0	116	-11	10	115	-11	10	0	0	0	69	-8	8	0	0	0	69	-8	8	0	0	0
NG 4000 km, Cen Ref, Liq, Road		REEV-FC	13	-5	5	15	-10	9	30	0	0	67	0	0	126	-11	10	37	-11	10	0	0	0	17	-8	8	0	0	0	45	0	0	62	-8	8
GRLH1	2020+	FCEV	54	-5	5	76	-10	10	0	0	0	0	0	0	130	-11	12	129	-11	11	0	0	0	75	-8	9	0	0	0	75	-8	9	0	0	0
Rem Ref, Liq, Sea, Road		REEV-FC	13	-5	5	19	-10	10	30	0	0	67	0	0	130	-11	12	40	-11	11	0	0	0	19	-8	9	0	0	0	45	0	0	64	-8	9
GRLH2	2020+	FCEV	54	-5	5	71	-9	10	0	0	0	0	0	0	125	-10	11	124	-10	11	0	0	0	74	-8	9	0	0	0	74	-8	9	0	0	0
LNG, Cen Ref, Liq, Road		REEV-FC	13	-5	5	18	-9	10	30	0	0	67	0	0	128	-10	11	39	-10	11	0	0	0	18	-8	9	0	0	0	45	0	0	63	-8	9
<i>Wood gasification</i>																																			
WFLH1	2020+	FCEV	54	-5	5	82	-12	12	0	0	0	0	0	0	136	-13	13	58	-5	5	0	0	0	5	-1	7	0	0	0	5	-1	7	0	0	0
F Wood, Cen gasif, Liq, Road		REEV-FC	13	-5	5	21	-12	12	30	0	0	67	0	0	131	-13	13	23	-5	5	0	0	0	1	-1	7	0	0	0	45	0	0	46	-1	7
WWLH1	2020+	FCEV	54	-5	5	82	-12	11	0	0	0	0	0	0	136	-13	12	58	-5	5	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0
W Wood, Cen gasif, Liq, Road		REEV-FC	13	-5	5	20	-12	11	30	0	0	67	0	0	131	-13	12	23	-5	5	0	0	0	1	0	0	0	0	0	45	0	0	46	0	0
<i>Electrolysis</i>																																			
GPFL1b/LH1	2020+	FCEV	54	-5	5	148	-20	17	0	0	0	0	0	0	201	-21	18	254	-28	24	0	0	0	122	-32	45	0	0	0	122	-32	45	0	0	0
NG 4000 km, CCGT, Cen Ely, Liq, Road		REEV-FC	13	-5	5	37	-20	17	30	0	0	67	0	0	147	-21	18	72	-28	24	0	0	0	30	-32	45	0	0	0	45	0	0	75	-32	45
GREL1/LH1	2020+	FCEV	54	-5	5	163	-19	19	0	0	0	0	0	0	217	-20	20	270	-26	26	0	0	0	129	-35	46	0	0	0	129	-35	46	0	0	0
LNG, Ely		REEV-FC	13	-5	5	41	-19	19	30	0	0	67	0	0	151	-20	20	76	-26	26	0	0	0	32	-35	46	0	0	0	45	0	0	77	-35	46
WFEL1/LH1	2020+	FCEV	54	-5	5	168	-20	21	0	0	0	0	0	0	222	-21	22	60	-5	6	0	0	0	9	-37	51	0	0	0	9	-37	51	0	0	0
F Wood, 200 MW gasif, CCGT, Cen Ely, Liq, Road		REEV-FC	13	-5	5	42	-20	21	30	0	0	67	0	0	153	-21	22	23	-5	6	0	0	0	2	-37	51	0	0	0	45	0	0	47	-37	51
EMEL1/LH1	2020+	FCEV	54	-5	5	243	-28	27	0	0	0	0	0	0	297	-28	28	212	-19	19	0	0	0	137	-15	15	0	0	0	137	-15	15	0	0	0
Elec EU-mix, Cen Ely, Liq, Road		REEV-FC	13	-5	5	61	-28	27	30	0	0	67	0	0	171	-28	28	61	-19	19	0	0	0	34	-15	15	0	0	0	45	0	0	79	-15	15
KOEL1/LH1	2020+	FCEV	54	-5	5	203	-37	30	0	0	0	0	0	0	257	-37	31	307	-46	38	0	0	0	266	-28	67	0	0	0	266	-28	67	0	0	0
Elec coal EU-mix, Cen Ely, Liq, Road		REEV-FC	13	-5	5	51	-37	30	30	0	0	67	0	0	161	-37	31	85	-46	38	0	0	0	66	-28	67	0	0	0	45	0	0	111	-28	67
WDEL1/LH1	2020+	FCEV	54	-5	5	51	-7	7	0	0	0	0	0	0	105	-9	9	57	-5	5	0	0	0	2	-38	38	0	0	0	2	-38	38	0	0	0
Wind, Cen Ely, Liq, Road		REEV-FC	13	-5	5	13	-7	7	30	0	0	67	0	0	123	-9	9	22	-5	5	0	0	0	1	-38	38	0	0	0	45	0	0	45	-38	38

12 Electricity in battery electric vehicles (BEV)

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km																	
			MJ/100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			Total			Fossil			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
EMEL3 EU-mix LV	2010		0	0	0	0	0	0	52	-2	2	118	-4	4	170	-4	4	38	1	1	0	0	0	0	0	0	78	-2	2	78	-2	2						
	2020+		0	0	0	0	0	0	38	-3	3	86	-6	6	124	-7	7	28	2	2	0	0	0	0	0	0	57	-4	4	57	-4	4						
FOEL1 Heavy fuel oil large scale power plant	2010		0	0	0	0	0	0	52	-2	2	101	-3	3	153	-3	3	-52	-2	-2	0	0	0	0	0	0	124	-4	4	124	-4	4						
	2020+		0	0	0	0	0	0	38	-3	3	74	-5	5	112	-6	6	-38	-3	-3	0	0	0	0	0	0	91	-7	7	91	-7	7						
KOEL1 Coal (hard), conventional	2010		0	0	0	0	0	0	52	-2	2	94	-18	14	146	-18	14	93	18	14	0	0	0	0	0	0	153	-19	15	153	-19	15						
	2020+		0	0	0	0	0	0	38	-3	3	69	-14	11	107	-14	11	68	14	11	0	0	0	0	0	0	111	-16	13	111	-16	13						
KOEL2 Coal (hard), IGCC	2010		0	0	0	0	0	0	52	-2	2	80	-7	7	133	-7	7	79	6	7	0	0	0	0	0	0	137	-8	8	137	-8	8						
	2020+		0	0	0	0	0	0	38	-3	3	59	-6	6	97	-7	7	58	6	6	0	0	0	0	0	0	100	-9	9	100	-9	9						
KOEL2C Coal (hard), IGCC + CCS	2010		0	0	0	0	0	0	52	-2	2	103	-7	7	155	-7	7	101	7	7	0	0	0	0	0	0	37	-7	6	37	-7	6						
	2020+		0	0	0	0	0	0	38	-3	3	75	-7	7	114	-8	8	74	7	7	0	0	0	0	0	0	27	-5	5	27	-5	5						
GPEL1a NG, pipe 7000 km, CCGT	2010		0	0	0	0	0	0	52	-2	2	71	-13	6	123	-13	6	71	13	6	0	0	0	0	0	0	76	-8	4	76	-8	4						
	2020+		0	0	0	0	0	0	38	-3	3	52	-10	5	90	-10	6	52	10	5	0	0	0	0	0	0	55	-7	5	55	-7	5						
GPEL1b NG, pipe 4000 km, CCGT	2010		0	0	0	0	0	0	52	-2	2	62	-5	4	114	-5	4	62	5	4	0	0	0	0	0	0	69	-5	3	69	-5	3						
	2020+		0	0	0	0	0	0	38	-3	3	46	-5	4	84	-5	5	46	5	4	0	0	0	0	0	0	50	-5	4	50	-5	4						
GPEL1bC NG, pipe 4000 km, CCGT + CCS	2010		0	0	0	0	0	0	52	-2	2	89	-31	9	141	-32	9	89	31	9	0	0	0	0	0	0	23	-6	5	23	-6	5						
	2020+		0	0	0	0	0	0	38	-3	3	65	-23	8	103	-24	8	65	23	8	0	0	0	0	0	0	17	-4	4	17	-4	4						
GREL1 LNG, CCGT	2010		0	0	0	0	0	0	52	-2	2	72	-3	4	125	-3	5	72	3	4	0	0	0	0	0	0	74	-3	3	74	-3	3						
	2020+		0	0	0	0	0	0	38	-3	3	53	-4	5	91	-5	5	53	4	5	0	0	0	0	0	0	54	-4	4	54	-4	4						
OWEL1a Municipal waste (closed digestate storage), small CHP	2010		0	0	0	0	0	0	52	-2	2	177	-19	20	230	-19	20	-5	-1	-1	0	0	0	0	0	0	7	0	0	7	0	0						
	2020+		0	0	0	0	0	0	38	-3	3	130	-17	17	168	-17	17	-4	0	0	0	0	0	0	0	0	5	0	0	5	0	0						
OWEL1b Municipal waste (closed digestate storage), co-firing large CCGT	2010		0	0	0	0	0	0	52	-2	2	141	-16	16	193	-16	16	14	2	2	0	0	0	0	0	0	12	-3	3	12	-3	3						
	2020+		0	0	0	0	0	0	38	-3	3	103	-13	13	141	-14	14	10	1	1	0	0	0	0	0	0	9	-2	2	9	-2	2						
OWEL21a Manure (closed digestate storage), small CHP	2010		0	0	0	0	0	0	52	-2	2	297	-13	14	349	-13	14	2	0	0	0	0	0	0	0	0	-92	4	-4	-92	-4	4						
	2020+		0	0	0	0	0	0	38	-3	3	217	-17	18	255	-17	18	2	0	0	0	0	0	0	0	0	-67	5	-5	-67	-5	5						
OWEL21b Manure (closed digestate storage), co-firing large CCGT	2010		0	0	0	0	0	0	52	-2	2	243	-10	9	295	-10	9	11	0	0	0	0	0	0	0	0	-73	3	-3	-73	-3	3						
	2020+		0	0	0	0	0	0	38	-3	3	178	-14	13	216	-14	14	8	1	1	0	0	0	0	0	0	-53	4	-4	-53	-4	4						
OWEL22a Manure (open digestate storage), small CHP	2010		0	0	0	0	0	0	52	-2	2	315	-13	14	367	-14	14	2	0	0	0	0	0	0	0	0	-60	3	-3	-60	-3	3						
	2020+		0	0	0	0	0	0	38	-3	3	230	-18	18	269	-18	19	2	0	0	0	0	0	0	0	0	-44	4	-3	-44	-4	3						
OWEL22b Manure (open digestate storage), co-firing large CCGT	2010		0	0	0	0	0	0	52	-2	2	259	-10	11	311	-10	11	11	0	0	0	0	0	0	0	0	-33	1	-1	-33	-1	1						
	2020+		0	0	0	0	0	0	38	-3	3	189	-14	15	228	-15	15	8	1	1	0	0	0	0	0	0	-24	2	-2	-24	-2	2						

Electricity in battery electric vehicles (BEV), cont'd

WTT Code / Description	Time Horizon	Powertrain	TTW energy from fuel			WTT expended energy from fuel production			TTW energy from electricity			WTT expended energy from elec production			WTW all energy sources						GHG emissions g CO _{2eq} / km														
			MJ _e /100 km			MJ/100 km			MJ _e /100 km			MJ/100 km			MJ/100 km			MJ _{ec} /100 km			TTW			WTT from fuel			WTT from elec			WTW					
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
WFEL1 Wood (waste), large IGCC	2010		0	0	0	0	0	0	52	-2	2	75	-5	7	127	-5	7	3	0	0	0	0	0	0	0	0	4	-1	6	4	-1	6			
	2020+		0	0	0	0	0	0	38	-3	3	55	-5	6	93	-6	7	2	0	0	0	0	0	0	0	0	3	-1	5	3	-1	5			
WFEL2 Wood (farmed), small IGCC	2010		0	0	0	0	0	0	52	-2	2	121	-7	7	173	-7	7	4	0	0	0	0	0	0	0	0	6	-1	11	6	-1	11			
	2020+		0	0	0	0	0	0	38	-3	3	88	-8	8	126	-8	8	3	0	0	0	0	0	0	0	0	4	-1	8	4	-1	8			
WFEL3 Wood (farmed), small conventional	2010		0	0	0	0	0	0	52	-2	2	139	-11	10	191	-11	10	4	0	0	0	0	0	0	0	0	7	-1	10	7	-1	10			
	2020+		0	0	0	0	0	0	38	-3	3	102	-10	10	140	-11	10	3	0	0	0	0	0	0	0	0	5	-1	8	5	-1	8			
WFEL4 Wood (farmed), cofiring coal plant	2010		0	0	0	0	0	0	52	-2	2	89	-16	14	141	-16	14	3	1	1	0	0	0	0	0	0	6	-1	8	6	-1	8			
	2020+		0	0	0	0	0	0	38	-3	3	65	-13	11	103	-13	12	2	0	0	0	0	0	0	0	0	4	-1	6	4	-1	6			
WWEL1 Wood (waste), large IGCC	2010		0	0	0	0	0	0	52	-2	2	75	-5	6	127	-5	6	3	0	0	0	0	0	0	0	0	3	0	0	3	0	0			
	2020+		0	0	0	0	0	0	38	-3	3	55	-5	6	93	-6	6	2	0	0	0	0	0	0	0	0	2	0	0	2	0	0			
WWEL2 Wood (waste), small IGCC	2010		0	0	0	0	0	0	52	-2	2	119	-7	7	171	-8	8	2	0	0	0	0	0	0	0	0	2	0	0	2	0	0			
	2020+		0	0	0	0	0	0	38	-3	3	87	-8	8	125	-8	8	1	0	0	0	0	0	0	0	0	2	0	0	2	0	0			
WWEL3 Wood (waste), small conventional	2010		0	0	0	0	0	0	52	-2	2	137	-11	10	189	-11	10	2	0	0	0	0	0	0	0	0	4	0	0	4	0	0			
	2020+		0	0	0	0	0	0	38	-3	3	100	-10	10	138	-11	10	1	0	0	0	0	0	0	0	0	3	0	0	3	0	0			
WWEL4 Wood (waste), cofiring coal plant	2010		0	0	0	0	0	0	52	-2	2	88	-19	14	141	-19	14	3	1	0	0	0	0	0	0	0	4	0	0	4	0	0			
	2020+		0	0	0	0	0	0	38	-3	3	65	-15	11	103	-15	12	2	0	0	0	0	0	0	0	0	3	0	0	3	0	0			
WWEL5 Black liquor	2010		0	0	0	0	0	0	52	-2	2	15	-2	2	67	-2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	2020+		0	0	0	0	0	0	38	-3	3	11	-2	2	49	-3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
NUEL Nuclear	2010		0	0	0	0	0	0	52	-2	2	160	-7	6	213	-7	6	3	0	0	0	0	0	0	0	0	3	0	0	3	0	0			
	2020+		0	0	0	0	0	0	38	-3	3	117	-9	9	155	-10	9	2	0	0	0	0	0	0	0	0	2	0	0	2	0	0			
WDEL Wind	2010		0	0	0	0	0	0	52	-2	2	6	0	0	58	-2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	2020+		0	0	0	0	0	0	38	-3	3	5	0	0	43	-3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

Europe Direct is a service to help you find answers to your questions about the European Union
Freephone number (*): 00 800 6 7 8 9 10 11

(*) Certain mobile telephone operators do not allow access to 00 800 numbers or these calls may be billed.

A great deal of additional information on the European Union is available on the Internet.
It can be accessed through the Europa server <http://europa.eu/>.

How to obtain EU publications

Our priced publications are available from EU Bookshop (<http://bookshop.europa.eu/>),
where you can place an order with the sales agent of your choice.

The Publications Office has a worldwide network of sales agents.
You can obtain their contact details by sending a fax to (352) 29 29-42758.

European Commission
EUR 26236 EN – Joint Research Centre – Institute for Energy and Transport

Title: WELL-TO-WHEELS Appendix 1 - Version 4.a. Summary of WTW Energy and GHG balances

Author(s): Robert EDWARDS (JRC), Heinz HASS (EUCAR), Jean-François LARIVÉ (CONCAWE), Laura LONZA (JRC), Heiko MAAS (EUCAR), David Rickeard (CONCAWE)

Luxembourg: Publications Office of the European Union

2014 – 36 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series –ISSN 1831-9424 (online)

ISBN 978-92-79-33887-8 (PDF)

doi: 10.2790/95533

Abstract

The JEC research partners [Joint Research Centre of the European Commission, EUCAR and CONCAWE] have updated their joint evaluation of the well-to-wheels energy use and greenhouse gas emissions for a wide range of potential future fuel and powertrain options.

This document reports on the fourth release of this study replacing Version 3c published in July 2011.

The original version was published in December 2003.

JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

*Serving society
Stimulating innovation
Supporting legislation*

