

# Summary of WTW Energy and GHG balances

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

New pathways in this version are highlighted in **yellow**.

Note that fossil energy is only indicated where lower than total energy (i.e. for partly renewable pathways).

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# 1 Crude oil based fuels

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km								
		Total									Fossil			TTW			WTT			WTW		
		TTW (MJ/100 km)			WTT (MJ/100 km)			WTW (MJ/100km)			WTW (MJ/100km)			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
<b>Conventional fuels pathways</b>																						
COG1	Conventional gasoline																					
	PISI 2002	224	0	0	3	4	6	255	4	6												
	DISI 2002	209	8	8	29	4	6	238	10	11												
	PISI 2010	190	6	6	26	4	5	216	7	8												
	DISI 2010	188	9	9	26	4	5	214	11	12												
	PISI hybrid	162	17	12	22	3	5	184	18	14												
	DISI hybrid	163	17	13	23	3	5	186	18	14												
	Reformer + FC	162	21	37	23	3	5	185	22	38												
COD1	Conventional diesel																					
	DICI 2002	183	5	5	29	4	4	212	7	7												
	DICI 2010 no DPF	172	7	7	27	4	4	200	9	9												
	DICI 2010 DPF	177	7	7	26	4	4	205	9	9												
	DICI hybrid n DPF	141	15	11	23	3	3	164	16	12												
	DICI hybrid DPF	146	15	11	23	3	3	169	16	12												
	Reformer + FC	162	28	41	26	4	4	188	29	43												
CON1	Conventional naphtha																					
	Reformer + FC	162	7	4	18	2	3	180	8	5												
LRLP1	LPG: imports from remote gas field																					
	PISI 2002	224	4	4	26	0	2	250	4	5												
	PISI 2010	190	7	7	22	0	2	212	7	7												

## 2 CNG / CBG

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km											
		Total						Fossil						TTW			WTT			WTW					
		TTW (MJ/100 km)		WTT (MJ/100 km)		WTW (MJ/100km)		WTW (MJ/100km)		WTW (MJ/100km)		WTW (MJ/100km)		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
<b>CNG pathways</b>																									
GMCG1	CNG: EU-mix																								
	PISI bi-fuel 2002	227	12	6	27	5	6	254	14	9				132	7	4	19	2	3	151	8	5			
	PISI dedicated 2002	223	14	6	27	5	6	249	15	9				130	8	4	19	2	3	149	9	5			
	PISI bi-fuel 2010	188	12	8	22	4	5	211	13	10				108	7	4	16	2	3	124	7	5			
	PISI dedicated 2010	187	13	8	22	4	5	209	14	10				108	7	4	16	2	3	123	8	5			
	PISI hybrid	139	17	13	17	3	4	156	17	14				81	10	8	12	1	2	92	10	8			
GPCG1a	CNG: Pipeline 7000 km																								
	PISI bi-fuel 2002	227	12	6	67	24	1	294	30	7				132	7	4	49	13	1	181	18	4			
	PISI dedicated 2002	223	14	6	66	23	1	289	31	7				130	8	4	48	13	1	178	18	4			
	PISI bi-fuel 2010	188	12	8	56	20	1	244	26	9				108	7	4	41	11	1	149	15	5			
	PISI dedicated 2010	187	13	8	56	20	1	243	27	8				108	7	4	41	11	1	148	16	5			
	PISI hybrid	139	17	13	41	15	1	181	26	14				81	10	8	30	6	1	111	15	8			
GPCG1b	CNG: Pipeline 4000 km																								
	PISI bi-fuel 2002	227	12	6	43	12	4	270	19	8				132	7	4	32	7	2	164	11	5			
	PISI dedicated 2002	223	14	6	43	12	4	265	20	8				130	8	4	31	6	2	161	12	5			
	PISI bi-fuel 2010	188	12	8	36	10	3	224	17	9				108	7	4	26	5	2	135	10	5			
	PISI dedicated 2010	187	13	8	36	10	3	223	18	9				108	7	4	26	5	2	134	10	5			
	PISI hybrid	139	17	13	27	7	2	166	20	14				81	10	8	20	4	1	100	12	8			
GRCG1	CNG: LNG, Vap, Pipe																								
	PISI bi-fuel 2002	227	12	6	69	5	6	296	15	10				132	7	4	45	3	3	177	9	6			
	PISI dedicated 2002	223	14	6	68	5	6	291	17	10				130	8	4	44	3	3	174	10	6			
	PISI bi-fuel 2010	188	12	8	58	4	5	246	14	11				108	7	4	38	2	3	146	8	6			
	PISI dedicated 2010	187	13	8	57	4	5	244	15	11				108	7	4	37	2	3	145	9	6			
	PISI hybrid	139	17	13	43	3	4	182	19	15				81	10	8	28	2	2	109	11	9			
GRCG1C	CNG: LNG, Vap, Pipe, CCS																								
	PISI bi-fuel 2002	227	12	6	77	5	6	299	15	10				132	7	4	37	3	3	169	8	6			
	PISI dedicated 2002	223	14	6	77	5	6	294	17	10				130	8	4	36	3	3	166	9	5			
	PISI bi-fuel 2010	188	12	8	60	5	5	248	14	11				108	7	4	31	2	2	139	8	6			
	PISI dedicated 2010	187	13	8	60	5	5	247	15	11				108	7	4	31	2	2	138	9	6			
	PISI hybrid	139	17	13	44	3	3	184	19	15				81	10	8	23	2	2	104	11	9			
GRCG2	CNG: LNG, Road, Vap																								
	PISI bi-fuel 2002	227	12	6	59	3	6	286	13	10				132	7	4	46	1	3	178	8	6			
	PISI dedicated 2002	223	14	6	58	2	5	281	15	9				130	8	4	45	1	3	175	9	6			
	PISI bi-fuel 2010	188	12	8	49	2	5	238	13	10				108	7	4	38	1	2	147	8	6			
	PISI dedicated 2010	187	13	8	49	2	5	236	14	10				108	7	4	38	1	2	146	8	6			
	PISI hybrid	139	17	13	36	2	3	176	18	15				81	10	8	28	1	2	109	11	9			
<b>CBG pathways</b>																									
<b>OWCG1</b>																									
	CBG: municipal waste																								
	PISI bi-fuel 2002	227	12	6	198	29	33	425	42	39	39	15	10	132	7	4	-92	7	7	41	7	6			
	PISI dedicated 2002	223	14	6	195	29	33	417	43	39	38	16	10	130	8	4	-90	7	7	40	8	5			
	PISI bi-fuel 2010	188	12	8	164	24	28	353	36	35	32	13	10	108	7	4	-76	6	6	32	7	5			
	PISI dedicated 2010	187	13	8	163	24	27	351	38	35	32	15	10	108	7	4	-76	6	5	32	7	5			
	PISI hybrid	139	17	13	122	18	20	261	37	34	24	18	14	81	10	8	-56	4	4	24	10	8			
<b>OWCG2</b>																									
	CBG: liquid manure																								
	PISI bi-fuel 2002	227	12	6	219	40	34	446	53	41	7	12	7	132	7	4	-304	5	61	-171	36	52			
	PISI dedicated 2002	223	14	6	215	39	33	438	55	40	7	14	6	130	8	4	-298	5	60	-168	33	51			
	PISI bi-fuel 2010	188	12	8	182	33	28	370	46	37	6	12	8	108	7	4	-252	4	50	-144	28	40			
	PISI dedicated 2010	187	13	8	181	33	28	368	47	36	6	13	8	108	7	4	-250	4	50	-143	26	40			
	PISI hybrid	139	17	13	135	25	21	274	44	36	4	17	13	81	10	8	-186	3	37	-106	13	21			
<b>OWCG3</b>																									
	CBG: dry manure																								
	PISI bi-fuel 2002	227	12	6	215	38	36	442	51	43	2	12	6	132	7	4	-125	7	6	7	7	5			
	PISI dedicated 2002	223	14	6	211	38	35	434	52	42	2	14	6	130	8	4	-123	7	6	7	8	4			
	PISI bi-fuel 2010	188	12	8	179	32	30	367	44	38	2	12	8	108	7	4	-104	6	5	5	7	5			
	PISI dedicated 2010	187	13	8	177	32	30	365	46	38	2	13	8	108	7	4	-103	6	5	5	8	5			
	PISI hybrid	139	17	13	132	24	22	272	43	37	1	17	13	81	10	8	-77	4	4	4	11	8			

### 3 Ethanol

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km											
		Total						Fossil						TTW				WTT							
		TTW (MJ/100 km)		WTT (MJ/100 km)		WTW (MJ/100km)		WTW (MJ/100km)		WTW (MJ/100km)		WTW (MJ/100km)		Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Ethanol pathways, as blended fuels	SBET1 EtOH: Sugar beet, pulp to fodder	PISI 2002 95/5	224	2	2	50	31	31	274	31	32	252				168	2	2	25	3	5	193	4	5	
		DISI 2002 95/5	209	9	9	47	29	29	256	32	32	235				157	6	6	23	3	4	180	8	8	
		PISI 2010 95/5	190	6	6	43	26	26	233	28	28	214				140	4	4	21	3	4	162	6	7	
		DISI 2010 95/5	188	10	10	42	26	26	230	30	30	212				139	7	7	21	3	4	160	8	9	
		DISI hybrid 95/5	163	17	13	37	22	23	200	31	28	183				120	13	9	18	2	4	139	13	11	
		SBET3 EtOH: Sugar beet, pulp to heat	PISI 2002 95/5	224	2	2	44	8	8	268	8	9	245				168	2	2	22	3	5	190	4	5
DISI 2002 95/5	209		9	9	41	7	7	250	12	12	229				157	6	6	21	3	4	177	8	8		
PISI 2010 95/5	190		6	6	37	6	7	227	10	10	209				140	4	4	19	3	4	159	6	6		
DISI 2010 95/5	188		10	10	37	6	7	225	13	13	206				139	7	7	18	3	4	157	8	9		
DISI hybrid 95/5	163		17	13	34	6	6	199	19	15	179				120	13	9	16	2	3	136	13	10		
WTET1a EtOH: Wheat, conv NG boiler, DDGS as AF	PISI 2002 95/5		224	2	2	49	14	9	273	15	9	252				168	2	2	25	4	5	193	4	6	
	DISI 2002 95/5	209	9	9	46	13	8	255	17	13	235				157	6	6	24	4	5	180	8	9		
	PISI 2010 95/5	190	6	6	42	12	7	232	15	11	214				140	4	4	21	3	4	162	6	7		
	DISI 2010 95/5	188	10	10	42	12	7	229	17	13	212				139	7	7	21	3	4	160	8	9		
	DISI hybrid 95/5	163	17	13	36	10	6	199	22	16	184				120	13	9	18	3	4	139	13	11		
	WTET1b EtOH: Wheat, conv NG boiler, DDGS as fuel	PISI 2002 95/5	224	2	2	44	9	9	268	10	9	247				168	2	2	24	4	5	192	4	6	
DISI 2002 95/5		209	9	9	41	8	8	250	13	13	231				157	6	6	23	4	5	180	8	9		
PISI 2010 95/5		190	6	6	37	8	7	227	11	10	210				140	4	4	21	3	4	161	6	7		
DISI 2010 95/5		188	10	10	37	8	7	225	13	13	207				139	7	7	20	3	4	159	8	9		
DISI hybrid 95/5		163	17	13	32	7	6	199	20	15	180				120	13	9	18	3	4	138	13	11		
WTET2a EtOH: Wheat, NG GT+CHP, DDGS as AF		PISI 2002 95/5	224	2	2	41	11	9	270	12	9	249				168	2	2	24	4	5	192	4	6	
	DISI 2002 95/5	209	9	9	44	11	8	252	15	13	235				157	6	6	22	4	5	179	8	9		
	PISI 2010 95/5	190	6	6	40	10	7	230	12	11	212				140	4	4	20	3	4	160	6	7		
	DISI 2010 95/5	188	10	10	39	10	7	227	15	13	209				139	7	7	20	3	4	159	8	9		
	DISI hybrid 95/5	163	17	13	34	8	6	197	21	15	182				120	13	9	17	3	4	138	13	11		
	WTET2b EtOH: Wheat, NG GT+CHP, DDGS as fuel	PISI 2002 95/5	224	2	2	41	6	9	265	7	9	244				168	2	2	23	4	5	191	4	6	
DISI 2002 95/5		209	9	9	39	6	8	247	11	13	228				157	6	6	21	3	4	178	8	9		
PISI 2010 95/5		190	6	6	35	5	7	225	9	10	207				140	4	4	19	3	4	160	6	7		
DISI 2010 95/5		188	10	10	35	5	7	223	12	13	205				139	7	7	19	3	4	158	8	9		
DISI hybrid 95/5		163	17	13	30	5	6	193	19	15	178				120	13	9	17	3	4	137	13	11		
WTET3a EtOH: Wheat, Lignite CHP, DDGS as AF		PISI 2002 95/5	224	2	2	49	14	9	273	14	9	251				168	2	2	29	4	5	197	5	6	
	DISI 2002 95/5	209	9	9	46	13	8	255	17	13	235				157	6	6	27	4	5	184	8	9		
	PISI 2010 95/5	190	6	6	42	12	7	232	14	11	214				140	4	4	25	3	4	165	6	7		
	DISI 2010 95/5	188	10	10	41	12	7	229	17	13	211				139	7	7	24	3	4	163	8	9		
	DISI hybrid 95/5	163	17	13	36	10	6	199	22	16	183				120	13	9	21	3	4	142	13	11		
	WTET3b EtOH: Wheat, Lignite CHP, DDGS as fuel	PISI 2002 95/5	224	2	2	44	9	9	267	9	9	246				168	2	2	28	4	5	196	4	6	
DISI 2002 95/5		209	9	9	41	8	8	250	13	13	230				157	6	6	26	3	5	183	8	9		
PISI 2010 95/5		190	6	6	37	7	7	227	11	10	209				140	4	4	24	3	4	164	6	7		
DISI 2010 95/5		188	10	10	37	7	7	225	13	13	207				139	7	7	24	3	4	162	8	9		
DISI hybrid 95/5		163	17	13	32	6	6	195	20	15	180				120	13	9	20	3	4	141	13	11		
WTET4a EtOH: Wheat, Straw CHP, DDGS as AF		PISI 2002 95/5	224	2	2	48	7	9	272	8	9	245				168	2	2	21	4	5	189	4	6	
	DISI 2002 95/5	209	9	9	45	7	8	254	12	13	229				157	6	6	20	4	5	177	8	9		
	PISI 2010 95/5	190	6	6	41	6	7	231	10	11	208				140	4	4	18	3	4	158	6	7		
	DISI 2010 95/5	188	10	10	41	6	7	229	13	13	206				139	7	7	18	3	4	157	8	9		
	DISI hybrid 95/5	163	17	13	35	5	6	198	19	16	179				120	13	9	16	3	4	136	13	11		
	WTET4b EtOH: Wheat, Straw CHP, DDGS as fuel	PISI 2002 95/5	224	2	2	49	2	9	267	3	9	240				168	2	2	20	4	5	188	4	6	
DISI 2002 95/5		209	9	9	46	2	8	249	9	13	224				157	6	6	19	4	5	176	8	9		
PISI 2010 95/5		190	6	6	43	2	7	227	7	10	204				140	4	4	17	3	4	158	6	7		
DISI 2010 95/5		188	10	10	43	2	7	224	10	13	202				139	7	7	17	3	4	156	8	9		
DISI hybrid 95/5		163	17	13	31	2	6	194	18	15	175				120	13	9	15	3	4	135	13	11		
WWET1 EtOH: W Wood		PISI 2002 95/5	224	2	2	51	7	7	275	8	8	245				168	2	2	21	3	4	188	4	5	
	DISI 2002 95/5	209	9	9	48	7	6	257	12	12	229				157	6	6	19	3	4	176	7	8		
	PISI 2010 95/5	190	6	6	44	6	6	234	10	9	208				140	4	4	18	3	4	158	5	6		
	DISI 2010 95/5	188	10	10	43	6	6	231	13	12	206				139	7	7	17	3	4	156	8	8		
	DISI hybrid 95/5	163	17	13	37	5	5	200	19	15	179				120	13	9	15	2	3	136	13	10		
	WFET1 EtOH: F wood	PISI 2002 95/5	224	2	2	51	7	7	275	8	8	245				168	2	2	21	3	5	189	4	6	
DISI 2002 95/5		209	9	9	48	7	7	257	12	12	229				157	6	6	20	3	5	177	8	9		
PISI 2010 95/5		190	6	6	44	6	6	234	10	10	208				140	4	4	18	3	4	158	6	7		
DISI 2010 95/5		188	10	10	43	6	6	231	13	13	206				139	7	7	18	3	4	156	8	9		
DISI hybrid 95/5		163	17	13	37	5	5	200	19	15	179				120	13	9	15	2	4	136	13	11		
STET1 EtOH: Wheat straw		PISI 2002 95/5	224	2	2	44	5	7	268	6	7	243				168	2	2	20	3	4	187	4	5	
	DISI 2002 95/5	209	9	9	41	5	6	250	11	12															

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km								
		Total						Fossil						TTW			WTT			WTW		
		TTW (MJ/100 km)		WTT (MJ/100 km)		WTW (MJ/100km)		TTW (MJ/100km)		WTT (MJ/100km)		WTW (MJ/100km)		Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
<b>EtOH pathways contribution based on neat fuel (netback calculation)</b>																						
SBET1	EtOH: Sugar beet, pulp to fodder																					
	PISI 2002	224	2	2	415	26	30	639	30	34	194	14	16	161	2	2	-31	7	8	130	7	8
	DISI 2002	209	9	9	388	24	28	597	41	45	181	21	22	151	6	6	-29	7	7	122	8	9
	PISI 2010	190	6	6	353	22	25	543	34	37	165	17	18	137	4	4	-26	6	7	111	7	7
	DISI 2010	188	10	10	349	22	25	537	41	44	163	21	22	136	7	7	-26	6	7	110	8	9
SBET3	EtOH: Sugar beet, pulp to heat																					
	PISI 2002	224	2	2	290	26	27	513	29	30	69	7	8	161	2	2	-93	6	4	68	5	4
	DISI 2002	209	9	9	271	24	26	480	36	38	65	12	12	151	6	6	-87	6	4	64	7	6
	PISI 2010	190	6	6	246	22	23	436	30	32	59	9	10	137	4	4	-79	5	4	58	5	5
	DISI 2010	188	10	10	244	22	23	432	36	37	58	13	13	136	7	7	-78	5	4	58	7	7
WTET1a	EtOH: Wheat, conv NG boiler, DDGS as AF																					
	PISI 2002	224	2	2	397	4	5	621	8	9	198	5	5	161	2	2	-27	16	18	134	16	18
	DISI 2002	209	9	9	371	4	5	580	21	22	185	13	13	151	6	6	-26	15	17	125	16	17
	PISI 2010	190	6	6	338	4	4	528	15	16	168	9	10	137	4	4	-23	14	15	114	14	15
	DISI 2010	188	10	10	334	4	4	522	23	23	167	14	14	136	7	7	-23	14	15	113	15	16
WTET1b	EtOH: Wheat, conv NG boiler, DDGS as fuel																					
	PISI 2002	224	2	2	292	5	5	515	9	8	98	4	3	161	2	2	-47	15	15	115	15	15
	DISI 2002	209	9	9	272	5	4	481	18	18	92	10	10	151	6	6	-44	14	14	107	14	14
	PISI 2010	190	6	6	246	5	4	438	14	13	84	7	7	137	4	4	-40	13	13	98	13	12
	DISI 2010	188	10	10	245	5	4	433	20	19	83	11	11	136	7	7	-39	13	13	97	13	13
WTET2a	EtOH: Wheat, NG GT+CHP, DDGS as AF																					
	PISI 2002	224	2	2	342	4	5	566	8	8	145	4	4	161	2	2	-55	16	15	106	16	14
	DISI 2002	209	9	9	320	4	4	529	19	20	135	11	11	151	6	6	-52	15	14	99	15	13
	PISI 2010	190	6	6	291	4	4	481	14	15	123	8	8	137	4	4	-47	14	13	90	13	12
	DISI 2010	188	10	10	288	4	4	476	21	21	122	12	12	136	7	7	-47	14	13	89	13	12
WTET2b	EtOH: Wheat, NG GT+CHP, DDGS as fuel																					
	PISI 2002	224	2	2	236	5	5	460	7	7	45	3	3	161	2	2	-75	14	15	87	13	15
	DISI 2002	209	9	9	221	4	4	430	16	16	42	9	9	151	6	6	-70	13	14	81	12	13
	PISI 2010	190	6	6	201	4	4	391	12	12	38	6	6	137	4	4	-64	12	13	74	11	12
	DISI 2010	188	10	10	199	4	4	387	17	17	38	10	10	136	7	7	-63	12	13	73	11	12
WTET3a	EtOH: Wheat, Lignite CHP, DDGS as AF																					
	PISI 2002	224	2	2	390	1	1	613	5	5	193	3	3	161	2	2	47	17	17	209	18	17
	DISI 2002	209	9	9	364	1	1	573	18	18	180	12	12	151	6	6	44	16	15	195	19	18
	PISI 2010	190	6	6	331	1	1	521	13	13	164	8	8	137	4	4	40	15	14	178	17	16
	DISI 2010	188	10	10	328	1	1	516	20	20	162	13	13	136	7	7	40	15	14	176	18	17
WTET3b	EtOH: Wheat, Lignite CHP, DDGS as fuel																					
	PISI 2002	224	2	2	284	1	1	508	4	4	93	3	3	161	2	2	28	14	17	189	14	17
	DISI 2002	209	9	9	265	1	1	474	15	15	87	9	9	151	6	6	26	13	16	177	16	18
	PISI 2010	190	6	6	241	1	1	431	10	10	79	7	7	137	4	4	24	12	14	161	13	16
	DISI 2010	188	10	10	239	1	1	427	16	16	78	10	10	136	7	7	24	12	14	160	15	17
WTET4a	EtOH: Wheat, Straw CHP, DDGS as AF																					
	PISI 2002	224	2	2	378	1	1	602	5	5	62	2	2	161	2	2	-104	16	15	57	15	14
	DISI 2002	209	9	9	353	1	1	562	18	18	58	9	9	151	6	6	-97	15	14	54	13	12
	PISI 2010	190	6	6	321	1	1	511	12	12	53	6	6	137	4	4	-88	14	13	49	12	11
	DISI 2010	188	10	10	316	1	1	506	19	19	52	10	10	136	7	7	-88	14	13	48	11	11
WTET4b	EtOH: Wheat, Straw CHP, DDGS as fuel																					
	PISI 2002	224	2	2	272	1	1	496	4	4	-38	2	2	161	2	2	-123	17	15	38	16	14
	DISI 2002	209	9	9	254	1	1	463	14	14	-35	9	9	151	6	6	-115	16	14	36	13	11
	PISI 2010	190	6	6	231	1	1	421	10	10	-32	6	6	137	4	4	-105	15	13	33	12	10
	DISI 2010	188	10	10	229	1	1	417	16	16	-32	10	10	136	7	7	-104	14	13	32	12	10
WWET1	EtOH: W Wood																					
	PISI 2002	224	2	2	434	23	23	657	28	28	60	4	4	161	2	2	-119	0	0	42	2	2
	DISI 2002	209	9	9	405	22	22	614	40	39	56	10	10	151	6	6	-112	0	0	39	8	8
	PISI 2010	190	6	6	369	20	20	559	32	32	51	7	7	137	4	4	-101	0	0	36	5	5
	DISI 2010	188	10	10	365	20	20	553	39	39	50	11	11	136	7	7	-100	0	0	36	9	9
WFET1	EtOH: F wood																					
	PISI 2002	224	2	2	430	24	23	659	28	27	61	5	4	161	2	2	-111	6	15	50	5	14
	DISI 2002	209	9	9	407	22	21	615	40	39	57	10	10	151	6	6	-104	6	14	47	7	11
	PISI 2010	190	6	6	370	20	19	560	32	32	52	7	7	137	4	4	-94	5	12	43	5	10
	DISI 2010	188	10	10	366	20	19	554	40	39	51	11	11	136	7	7	-93	5	12	43	7	10
STET1	EtOH: Wheat straw																					
	PISI 2002	224	2	2	295	0	0	519	4	4	24	2	2	161	2	2	-140	0	0	22	2	2
	DISI 2002	209	9	9	276	0	0	485	14	14	22	9	9	151	6	6	-130	0	0	20	8	8
	PISI 2010	190	6	6	251	0	0	441	10	10	20	6	6	137	4	4	-119	0	0	19	6	6
	DISI 2010	188	10	10	248	0	0	436	16	16	20	10	10	136	7	7	-117	0	0	19	9	9
SCET1	EtOH: Sugar cane (Brazil)																					
	PISI 2002	224	2	2	401	1	1	625	5	5	5	2	2	161	2	2	-136	1	1	25	2	2
	DISI 2002	209	9	9	375	1	1	583	18	18	5	9	9	151	6	6	-127	0	1	24	8	8
	PISI 2010	190	6	6	341	1	1	531	13	13	4	6	6	137	4	4	-116	0	1	22	5	5
	DISI 2010	188	10	10	337	1	1	525	20	20	4	10	10	136	7	7	-115	0	0	21	9	9
DISI hybrid	163	17	13	292	0	0	455	35	26	4	17	13	118	13	9	-99	0	0	19	16	12	

## 4 Ethers

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km									
		Total									Fossil			TTW			WTT			WTW			
		TTW (MJ/100 km)			WTT (MJ/100 km)			WTW (MJ/100km)			WTW (MJ/100km)			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
<b>Ethers (as neat fuels)</b>																							
<b>GRMB1</b>	<b>MTBE: remote plant</b>																						
	PISI 2002	224	2	2	67	1	3	<b>290</b>	3	4					159	2	2	30	0	2	<b>189</b>	2	3
	DISI 2002	209	9	9	63	1	3	<b>271</b>	9	10					149	6	6	28	0	2	<b>177</b>	7	7
	PISI 2010	190	6	6	57	1	3	<b>247</b>	6	7					135	4	4	26	0	2	<b>161</b>	5	5
	DISI 2010	188	10	10	56	1	3	<b>244</b>	10	11					134	7	7	25	0	2	<b>159</b>	7	8
	DISI hybrid	163	17	13	49	0	2	<b>212</b>	18	14					116	12	9	22	0	1	<b>138</b>	13	10
<b>LREB1</b>	<b>ETBE: imported C4 and wheat ethanol</b>																						
	PISI 2002	224	2	2	169	1	3	<b>392</b>	4	5	<b>240</b>	5	7	160	2	2	-8	6	6	<b>152</b>	6	6	
	DISI 2002	209	9	9	157	1	3	<b>366</b>	12	13	<b>224</b>	14	16	149	6	6	-7	5	6	<b>142</b>	8	8	
	PISI 2010	190	6	6	143	1	2	<b>333</b>	8	9	<b>204</b>	10	12	136	4	4	-6	5	5	<b>129</b>	6	7	
	DISI 2010	188	10	10	142	1	2	<b>330</b>	13	14	<b>202</b>	15	17	134	7	7	-6	5	5	<b>128</b>	8	9	
	DISI hybrid	163	17	13	123	1	2	<b>286</b>	22	17	<b>175</b>	26	21	116	12	9	-6	4	5	<b>111</b>	13	10	

# 5 Bio-diesel

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km											
		Total						Fossil						TTW						WTT					
		TTW (MJ/100 km)			WTT (MJ/100 km)			WTT (MJ/100km)			WTT (MJ/100km)			TTW			WTT			WTT					
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	
<b>Bio-diesel pathways, as blended fuels</b>																									
ROFA1	RME: Gly as chemical																								
	DICI 2002 95/5	183	6	6	36	8	7	221	11	10	205					138	4	4	21	5	5	160	7	7	
	DICI 2010 no DPF 95/5	172	8	8	36	7	6	208	12	11	193					128	6	6	20	4	5	148	8	8	
	DICI 2010 DPF 95/5	177	8	8	37	7	7	214	12	11	198					132	6	6	21	4	5	152	8	8	
	DICI hybrid n DPF 95/5	141	15	11	29	6	5	171	17	13	158					106	11	8	16	4	4	121	12	10	
	DICI hybrid DPF 95/5	146	15	11	30	6	5	176	18	14	163					109	11	8	16	4	4	125	13	10	
ROFA2	RME: Gly as animal feed																								
	DICI 2002 95/5	183	6	6	36	8	7	222	11	10	206					138	4	4	22	5	5	160	7	7	
	DICI 2010 no DPF 95/5	172	8	8	36	8	6	209	12	11	193					128	6	6	20	5	5	149	8	8	
	DICI 2010 DPF 95/5	177	8	8	37	8	7	214	12	11	199					132	6	6	21	5	5	153	8	8	
	DICI hybrid n DPF 95/5	141	15	11	30	6	5	171	17	13	159					106	11	8	16	4	4	122	12	10	
	DICI hybrid DPF 95/5	146	15	11	31	7	5	176	18	14	164					109	11	8	17	4	4	126	13	10	
ROFE1	REE: Gly as chemical																								
	DICI 2002 95/5	183	6	6	36	7	7	222	10	10	205					138	4	4	21	5	5	159	7	7	
	DICI 2010 no DPF 95/5	172	8	8	36	7	6	209	11	11	193					128	6	6	19	4	5	148	8	8	
	DICI 2010 DPF 95/5	177	8	8	37	6	6	214	12	11	198					132	6	6	20	5	5	152	8	8	
	DICI hybrid n DPF 95/5	141	15	11	30	6	5	171	17	13	158					106	11	8	15	4	4	121	12	10	
	DICI hybrid DPF 95/5	146	15	11	31	6	5	176	18	14	163					109	11	8	16	4	4	125	13	10	
ROFE2	REE: Gly as animal feed																								
	DICI 2002 95/5	183	6	6	36	8	7	222	11	10	205					138	4	4	21	4	5	159	7	7	
	DICI 2010 no DPF 95/5	172	8	8	37	7	6	209	12	11	193					128	6	6	20	4	5	148	8	8	
	DICI 2010 DPF 95/5	177	8	8	36	7	6	215	12	11	198					132	6	6	20	4	5	152	8	8	
	DICI hybrid n DPF 95/5	141	15	11	30	6	5	171	17	13	158					106	11	8	16	4	4	121	12	10	
	DICI hybrid DPF 95/5	146	15	11	31	6	5	177	18	14	163					109	11	8	16	4	5	125	13	10	
SOFA1	SME: Gly as chemical																								
	DICI 2002 95/5	183	6	6	36	7	6	219	10	9	204					138	4	4	19	4	4	158	6	7	
	DICI 2010 no DPF 95/5	172	8	8	34	6	5	206	11	10	192					128	6	6	18	4	4	146	7	7	
	DICI 2010 DPF 95/5	177	8	8	35	7	5	212	11	10	197					132	6	6	19	4	4	150	7	8	
	DICI hybrid n DPF 95/5	141	15	11	28	5	4	169	17	13	157					106	11	8	14	3	4	119	12	9	
	DICI hybrid DPF 95/5	146	15	11	29	5	5	174	17	13	162					109	11	8	14	3	4	123	12	10	
SOFA2	SME: Gly as animal feed																								
	DICI 2002 95/5	183	6	6	37	7	6	220	10	9	205					138	4	4	20	4	4	158	6	6	
	DICI 2010 no DPF 95/5	172	8	8	34	7	5	207	11	10	192					128	6	6	18	4	4	147	7	7	
	DICI 2010 DPF 95/5	177	8	8	35	7	5	212	11	10	198					132	6	6	19	4	4	151	7	8	
	DICI hybrid n DPF 95/5	141	15	11	28	6	4	169	17	13	158					106	11	8	14	3	3	120	12	9	
	DICI hybrid DPF 95/5	146	15	11	29	6	5	175	17	13	163					109	11	8	15	3	3	124	12	10	
<b>Bio-diesel pathways contribution based on neat fuel (netback calculation)</b>																									
ROFA1	RME: Gly as chemical																								
	DICI 2002	183	5	5	210	18	16	393	25	23	76	10	10	143	4	4	-65	35	34			78	34	33	
	DICI 2010 no DPF	172	7	7	197	17	15	369	26	24	71	12	11	133	6	6	-61	33	32			72	31	30	
	DICI 2010 DPF	177	7	7	202	17	15	379	27	25	73	12	11	136	6	6	-63	34	33			73	32	31	
	DICI hybrid n DPF	141	15	11	161	14	12	303	34	27	58	18	14	109	11	8	-50	27	27			59	25	24	
	DICI hybrid DPF	146	15	11	161	14	13	312	35	28	60	19	14	113	12	9	-52	26	27			61	26	25	
ROFA2	RME: Gly as animal feed																								
	DICI 2002	183	5	5	219	20	20	402	27	28	85	12	12	143	4	4	-56	39	37			87	37	36	
	DICI 2010 no DPF	172	7	7	206	18	19	378	28	29	80	13	13	133	6	6	-52	36	35			81	35	33	
	DICI 2010 DPF	177	7	7	211	19	20	388	29	30	82	13	13	136	6	6	-54	37	36			83	35	34	
	DICI hybrid n DPF	141	15	11	169	15	16	310	36	31	66	19	16	109	11	8	-43	30	29			66	28	27	
	DICI hybrid DPF	146	15	11	174	16	16	320	37	32	68	20	16	113	12	9	-44	31	30			68	29	28	
ROFE1	REE: Gly as chemical																								
	DICI 2002	183	5	5	221	17	18	404	24	25	67	9	9	143	4	4	-78	37	37			65	35	35	
	DICI 2010 no DPF	172	7	7	207	16	17	380	26	27	63	10	11	133	6	6	-73	35	35			59	32	32	
	DICI 2010 DPF	177	7	7	213	16	17	390	26	27	64	11	11	136	6	6	-75	36	36			61	33	33	
	DICI hybrid n DPF	141	15	11	170	13	14	311	34	29	51	17	14	109	11	8	-60	29	29			49	25	26	
	DICI hybrid DPF	146	15	11	175	13	14	321	35	30	53	18	14	113	12	9	-62	29	30			51	26	26	
ROFE2	REE: Gly as animal feed																								
	DICI 2002	183	5	5	229	15	20	412	22	27	75	9	10	143	4	4	-69	33	41			73	31	39	
	DICI 2010 no DPF	172	7	7	216	14	18	388	24	29	70	10	12	133	6	6	-65	31	38			68	29	36	
	DICI 2010 DPF	177	7	7	221	14	19	398	25	29	72	11	12	136	6	6	-67	32	39			69	30	37	
	DICI hybrid n DPF	141	15	11	177	11	15	318	33	31	58	17	14	109	11	8	-54	25	31			56	23	29	
	DICI hybrid DPF	146	15	11	182	12	16	328	34	32	60	18	15	113	12	9	-55	26	32			57	24	29	
SOFA1	SME: Gly as chemical																								
	DICI 2002	183	5	5	168	15	17	351	21	23	56	9	9	143	4	4	-106	22	23			37	19	20	
	DICI 2010 no DPF	172	7	7	157	14	16	330	22	24	52	10	11	133	6	6	-100	20	22			33	17	18	
	DICI 2010 DPF	177	7	7	162	15	17	338	23	25	54	10	11	136	6	6	-102	21	22			34	17	19	
	DICI hybrid n DPF	141	15	11	129	12	13	270	29	26	43	17	13	109	11	8	-82	17	18			27	14	14	
	DICI hybrid DPF	146	15	11	133	12	14	279	30	26	44	17	14	113	12	9	-84	17	18			28	14	15	
SOFA2	SME: Gly as animal feed																								
	DICI 2002	183	5	5	177	15	17	360	22	23	65	9	10	143	4	4	-97	21	19			46	19	17	
	DICI 2010 no DPF	172	7	7	166	15	16	339	23	24	61	11	11	133	6	6	-91	20	18			42	17	15	
	DICI 2010 DPF	177	7	7	171	15	1																		

# 6 Synthetic diesel fuel

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km										
		Total						Fossil						TTW			WTT			WTW				
		TTW (MJ/100 km)		WTT (MJ/100 km)		WTW (MJ/100km)		TTW (MJ/100km)		WTT (MJ/100km)		WTW (MJ/100km)		Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min
<b>SD pathways, as blended fuels</b>																								
GPSD1a	Syn-diesel: NG 7000 km, GTL, Diesel mix																							
	DICI 2002	183	5	5	37	6	4	220	9	8				130	4	4	29	4	3	167	6	6		
	DICI 2010 no DPF	172	7	7	34	12	4	207	15	9				120	6	6	27	3	3	154	7	7		
	DICI 2010 DPF	177	7	7	35	12	4	212	16	9				131	6	6	28	4	3	159	7	7		
	DICI hybrid n DPF	141	15	11	28	10	3	169	19	12				105	11	8	22	3	3	127	12	9		
	DICI hybrid DPF	146	15	11	29	10	4	175	20	13				100	11	8	23	3	3	131	13	10		
GPSD1b	Syn-diesel: NG 4000 km, GTL, Diesel mix																							
	DICI 2002	183	5	5	35	5	4	218	8	8				130	4	4	28	3	3	166	6	6		
	DICI 2010 no DPF	172	7	7	33	5	4	205	9	9				120	6	6	26	3	3	154	7	7		
	DICI 2010 DPF	177	7	7	34	5	4	211	10	9				131	6	6	27	3	3	158	7	7		
	DICI hybrid n DPF	141	15	11	27	4	3	168	16	12				104	11	8	22	3	3	126	12	9		
	DICI hybrid DPF	146	15	11	28	4	4	174	17	13				100	11	8	22	3	3	130	12	10		
GRSD1	Syn-diesel: Rem GTL, Sea, Diesel mix																							
	DICI 2002	183	5	5	34	4	5	217	8	8				130	4	4	27	3	4	165	6	6		
	DICI 2010 no DPF	172	7	7	32	4	4	204	9	9				120	6	6	25	3	3	153	7	7		
	DICI 2010 DPF	177	7	7	33	4	4	209	9	10				131	6	6	26	3	3	157	7	7		
	DICI hybrid n DPF	141	15	11	26	3	4	167	16	12				105	11	8	21	2	3	126	12	9		
	DICI hybrid DPF	146	15	11	27	3	4	173	16	13				100	11	8	21	2	3	130	12	10		
WWSD1	Syn-diesel: W Wood, diesel mix																							
	DICI 2002	183	5	5	39	5	5	222	8	8	202			130	4	4	19	3	3	156	6	6		
	DICI 2010 no DPF	172	7	7	36	5	5	208	10	10	190			120	6	6	18	3	3	145	7	7		
	DICI 2010 DPF	177	7	7	37	5	5	214	10	10	195			131	6	6	18	3	3	149	7	7		
	DICI hybrid n DPF	141	15	11	30	4	4	171	16	12	156			105	11	8	14	2	2	119	12	9		
	DICI hybrid DPF	146	15	11	31	4	4	176	17	13	161			100	11	8	15	2	3	123	12	9		
WFSD1	Syn-diesel: F wood, diesel mix																							
	DICI 2002	183	5	5	39	5	5	222	8	8	202			130	4	4	19	3	4	157	6	6		
	DICI 2010 no DPF	172	7	7	36	5	5	208	10	10	190			120	6	6	18	3	4	145	7	7		
	DICI 2010 DPF	177	7	7	37	5	5	214	10	10	195			131	6	6	18	3	4	149	7	7		
	DICI hybrid n DPF	141	15	11	30	4	4	171	16	12	156			105	11	8	15	2	3	119	12	9		
	DICI hybrid DPF	146	15	11	31	4	4	176	17	13	161			100	11	8	15	2	3	123	12	9		
<b>BLSD1 Syn-diesel: W Wood, Black liquor</b>																								
BLSD1	DICI 2002	183	5	5	36	4	5	219	8	8	202			130	4	4	18	3	3	156	6	6		
	DICI 2010 no DPF	172	7	7	34	4	4	206	9	9	190			120	6	6	17	3	3	145	7	7		
	DICI 2010 DPF	177	7	7	35	4	4	212	9	10	195			131	6	6	18	3	3	149	7	7		
	DICI hybrid n DPF	141	15	11	28	3	3	169	16	12	156			105	11	8	14	2	2	119	12	9		
	DICI hybrid DPF	146	15	11	29	4	4	174	16	13	160			100	11	8	15	2	3	123	12	9		
	<b>SD pathways as neat fuel</b>																							
GRSD1	Syn-diesel: Rem GTL, Sea, Diesel mix																							
	DICI 2002	183	5	5	124	8	13	307	13	17				133	4	4	46	5	7	179	7	9		
	DICI 2010 no DPF	172	7	7	117	8	12	289	15	18				124	5	5	43	4	7	167	8	10		
	DICI 2010 DPF	177	7	7	120	8	12	297	15	19				127	5	5	44	5	7	171	8	10		
	DICI hybrid n DPF	141	15	15	96	6	10	237	22	25				102	11	11	35	4	6	137	13	14		
	DICI hybrid DPF	146	15	15	99	7	10	244	23	26				105	11	11	36	4	6	141	13	14		
GRSD2	Syn-diesel: Rem GTL, Sea, Rail/Road																							
	DICI 2002	183	5	5	125	9	11	308	14	16				133	4	4	46	5	6	179	7	9		
	DICI 2010 no DPF	172	7	7	117	8	11	289	15	17				124	5	5	43	5	6	167	8	9		
	DICI 2010 DPF	177	7	7	120	8	11	297	15	18				127	5	5	44	5	6	171	8	10		
	DICI hybrid n DPF	141	15	11	96	7	9	237	22	19				102	11	8	35	4	5	137	13	11		
	DICI hybrid DPF	146	15	11	99	7	9	245	23	20				105	11	8	36	4	5	141	13	11		
<b>GRSD2C Syn-diesel: Rem GTL, Sea, Rail/Road, CCS</b>																								
GRSD2C	DICI 2002	183	5	5	139	9	11	323	15	16				133	4	4	24	5	6	157	7	8		
	DICI 2010 no DPF	172	7	7	131	9	10	303	16	17				124	5	5	22	5	6	146	8	9		
	DICI 2010 DPF	177	7	7	135	9	10	311	17	18				127	5	5	23	5	6	150	8	9		
	DICI hybrid n DPF	141	15	11	107	7	8	249	23	20				102	11	8	18	4	5	120	12	10		
	DICI hybrid DPF	146	15	11	111	7	9	257	24	20				105	11	8	19	4	5	124	12	10		
	<b>KOSD1 Syn-diesel: CTL, Diesel mix</b>																							
KOSD1	DICI 2002	183	5	5	176	15	15	361	21	21				133	4	4	236	15	15	369	23	23		
	DICI 2010 no DPF	172	7	7	167	14	14	339	23	22				124	5	5	222	14	14	346	24	24		
	DICI 2010 DPF	177	7	7	172	15	14	348	23	23				127	5	5	228	15	15	355	25	25		
	DICI hybrid n DPF	141	15	11	137	12	11	278	30	25				102	11	8	182	12	12	284	32	27		
	DICI hybrid DPF	146	15	11	142	12	12	287	31	25				105	11	8	188	12	12	293	33	28		
	<b>KOSD1C Syn-diesel: CTL, CCS, Diesel mix</b>																							
KOSD1C	DICI 2002	183	5	5	194	14	15	377	21	22				133	4	4	71	14	15	204	17	18		
	DICI 2010 no DPF	172	7	7	182	13	14	354	22	23				124	5	5	67	14	14	191	17	18		
	DICI 2010 DPF	177	7	7	187	14	14	363	23	24				127	5	5	69	14	15	196	18	18		
	DICI hybrid n DPF	141	15	11	149	11	12	290	30	25				102	11	8	55	11	12	157	20	18		
	DICI hybrid DPF	146	15	11	154	11	12	299	31	26				105	11	8	57	12	12	162	20	18		
	WWSD1	Syn-diesel: W Wood, diesel mix																						
DICI 2002		183	5	5	219	21	19	402	28	26	12	6	6	133	4	4	-121	0	0	12	5	5		
DICI 2010 no DPF		172	7	7	205	20	18	378	30	28	11	7	7	124	5	5	-114	0	0	10	7	7		
DICI 2010 DPF		177	7	7	211	20	19	388	30	29	12	8	8	127	5	5	-117	0	0	10	7	7		
DICI hybrid n DPF		141	15	11	160	16	15	310	37	30	9	15	11	102	11	8	-93	0	0	8	14	10		
DICI hybrid DPF		146	15	11	174	17	15	319	38	31	9	15	11	105	11	8	-96	0	0	9	14	11		
WFSD1	Syn-diesel: F wood, diesel mix																							
	DICI 2002	183	5	5	219	21	17	402	28	24	12	6	6	133	4	4	-116	5	12	17	4	9		
	DICI 2010 no DPF	172	7	7	205	20	16	378	29	26	11	7	7	124	5	5	-109	5	11	14	5	8		
	DICI 2010 DPF	177	7	7	211	20	17	388	30	27	11	8	8	127	5	5	-112	5	11	15	5	9		
	DICI hybrid n DPF	141	15	11	168	16	13	309	36	28	9	15	11	102	11	8	-90	4	9	12	12	8		
	DICI hybrid DPF	146	15	11	174	17	14	319	38	29	9	15	11	105	11	8	-92	4	9	12	12	8		
<b>BLSD1 Syn-diesel: W Wood, Black liquor</b>																								
BLSD1	DICI 2002	183	5	5	167	10	10	350	16	16	7	6	6	133	4	4	-125	0	0	8	5	5		

# 7 Methanol and DME

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km									
		Total									Fossil			TTW									
		TTW (MJ/100 km)			WTT (MJ <sub>ref</sub> /100 km)			WTW (MJ/100km)			WTW (MJ <sub>ref</sub> /100km)			TTW			WTT			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
<b>Methanol pathways</b>																							
GPME1a	MeOH: NG 7000 km, Syn, Rail/Road Reformer + FC	148	18	34	125	2	1	273	25	45					109	13	25	61	12	2	170	23	30
GPME1b	MeOH: NG 4000 km, Syn, Rail/Road Reformer + FC	148	18	34	102	9	2	250	28	43					109	13	25	44	5	1	154	17	28
GRME1	MeOH: Rem Syn, Sea, Rail/Road Reformer + FC	148	18	34	90	3	4	238	23	42					109	13	25	35	2	3	145	15	27
KOME1	MeOH: Coal EU-mix, Cen, Rail/Road Reformer + FC	148	18	34	138	13	15	286	35	58					109	13	25	188	13	15	297	39	64
WWME1	MeOH: W Wood, Road Reformer + FC	148	18	34	158	19	20	306	42	65	9	18	34		109	13	25	-95	0	0	14	18	33
WFME1	MeOH: F Wood, Road Reformer + FC	148	18	34	150	20	18	306	43	64	9	18	34		109	13	25	-92	3	6	18	16	29
BLME1	MeOH: W Wood, Black liquor Reformer + FC	148	18	34	87	7	7	235	25	43	5	18	34		109	13	25	-99	0	0	11	18	34
<b>DME pathways</b>																							
GPDE1a	DME: NG 7000 km, Syn, Rail/Road DICI 2002	183	5	5	141	26	3	324	31	9					127	4	4	71	15	2	198	17	6
	DICI 2010 no DPF	172	7	7	130	25	3	305	31	11					118	5	5	67	14	2	185	17	7
	DICI hybrid n DPF	141	15	11	109	20	3	250	35	15					97	10	7	55	11	1	152	20	9
GPDE1b	DME: NG 4000 km, Syn, Rail/Road DICI 2002	183	5	5	114	12	4	297	16	9					127	4	4	51	7	2	178	9	5
	DICI 2010 no DPF	172	7	7	107	11	3	279	17	11					118	5	5	48	6	2	166	10	6
	DICI hybrid n DPF	141	15	11	88	9	3	229	23	14					97	10	7	40	5	2	136	14	9
GRDE1	DME: Rem Syn, Sea, Rail/Road DICI 2002	183	5	5	97	3	6	280	8	10					127	4	4	38	0	0	165	4	4
	DICI 2010 no DPF	172	7	7	91	3	6	264	10	12					118	5	5	36	0	0	154	5	5
	DICI hybrid n DPF	141	15	11	75	3	5	216	18	15					97	10	7	29	0	0	126	11	8
KODE1	DME: Coal EU-mix, Cen, Rail/Road DICI 2002	183	5	5	170	18	15	353	24	21					127	4	4	235	18	0	361	8	8
	DICI 2010 no DPF	172	7	7	160	17	14	332	25	22					118	5	5	221	1	1	338	11	11
	DICI hybrid n DPF	141	15	11	131	14	12	272	31	24					97	10	7	181	1	1	278	23	17
GRDE1C	DME: Rem Syn, Sea, Rail/Road, CCS DICI 2002	183	5	5	99	0	13	282	6	17					127	4	4	20	0	0	146	4	4
	DICI 2010 no DPF	172	7	7	93	0	12	265	8	18					118	5	5	19	0	0	136	5	5
	DICI hybrid n DPF	141	15	11	76	0	10	217	17	19					97	10	7	15	0	0	112	10	8
WWDE1	DME: W Wood, Road DICI 2002	183	5	5	196	22	27	379	29	34	11	6	6		127	4	4	-115	0	0	12	5	5
	DICI 2010 no DPF	172	7	7	184	21	26	356	30	34	10	7	8		118	5	5	-108	0	0	10	7	7
	DICI hybrid n DPF	141	15	11	151	17	21	292	36	34	9	15	11		97	10	7	-89	0	0	8	13	10
WFDE1	DME: F Wood, Road DICI 2002	183	5	5	198	24	24	379	31	30	11	6	6		127	4	4	-110	3	9	16	4	7
	DICI 2010 no DPF	172	7	7	184	23	22	356	31	31	10	8	7		118	5	5	-104	3	8	14	5	6
	DICI hybrid n DPF	141	15	11	151	19	18	292	37	32	8	15	11		97	10	7	-85	3	7	12	12	7
BLDE1	DME: W Wood, Black liquor DICI 2002	183	5	5	101	8	10	284	12	14	6	6	6		127	4	4	-119	0	0	7	5	5
	DICI 2010 no DPF	172	7	7	95	7	9	267	14	15	5	7	7		118	5	5	-112	0	0	6	7	7
	DICI hybrid n DPF	141	15	11	78	6	7	219	20	17	4	15	11		97	10	7	-92	0	0	5	14	10

## 8 Compressed hydrogen (C-H<sub>2</sub>)

### 8.1 C-H<sub>2</sub> from natural gas reforming and coal gasification

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km								
		Total						Fossil						TTW			WTT			WTW		
		TTW (MJ/100 km)		WTT (MJ/100 km)		WTW (MJ/100km)		TTW (MJ <sub>f</sub> /100km)		WTT		WTW		Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
<b>C-H<sub>2</sub> pathways</b>																						
GMCH1	C-H <sub>2</sub> , EU-mix, O/S Ref	180	0	0	152	6	10	332	6	10				0	0	0	189	3	5	189	3	5
	PISI 2002	168	5	5	141	6	9	309	11	14				0	0	0	175	3	5	176	8	10
	PISI 2010	149	13	11	125	5	8	274	20	21				0	0	0	155	3	4	156	16	16
	PISI hybrid	94	12	12	79	3	5	173	17	19				0	0	0	98	2	3	98	14	15
	FC	84	10	10	71	3	4	154	15	17				0	0	0	88	2	2	88	12	13
	FC hybrid	84	10	10	71	3	4	154	15	17				0	0	0	88	2	2	88	12	13
GPCH1a	C-H <sub>2</sub> , NG 7000 km, O/S Ref	180	0	0	199	28	4	379	28	4				0	0	0	220	15	3	220	15	3
	PISI 2002	168	5	5	185	26	4	353	32	10				0	0	0	205	14	2	205	20	8
	PISI 2010	149	13	11	164	23	3	313	39	19				0	0	0	181	13	2	182	28	16
	PISI hybrid	94	12	12	104	14	2	198	29	19				0	0	0	115	8	1	115	22	15
	FC	84	10	10	93	13	2	176	26	17				0	0	0	102	7	1	102	20	14
	FC hybrid	84	10	10	93	13	2	176	26	17				0	0	0	102	7	1	102	20	14
GPCH1b	C-H <sub>2</sub> , NG 4000 km, O/S Ref	180	0	0	171	14	6	351	14	6				0	0	0	200	8	3	200	8	3
	PISI 2002	168	5	5	159	13	5	327	19	11				0	0	0	186	8	3	186	13	8
	PISI 2010	149	13	11	141	12	5	290	27	19				0	0	0	165	7	2	165	21	15
	PISI hybrid	94	12	12	89	7	3	183	22	18				0	0	0	104	4	2	104	17	14
	FC	84	10	10	80	7	3	163	19	16				0	0	0	93	4	1	93	15	13
	FC hybrid	84	10	10	80	7	3	163	19	16				0	0	0	93	4	1	93	15	13
GPCH2a	C-H <sub>2</sub> , NG 7000 km, Cen ref, Pipe	180	0	0	154	26	5	334	26	5				0	0	0	195	15	3	195	15	3
	PISI 2002	168	5	5	144	24	4	311	29	10				0	0	0	182	14	2	182	19	8
	PISI 2010	149	13	11	127	22	4	276	35	18				0	0	0	161	12	2	161	26	14
	PISI hybrid	94	12	12	81	14	2	179	26	17				0	0	0	102	6	1	102	20	14
	FC	84	10	10	72	12	2	155	23	15				0	0	0	91	7	1	91	18	12
	FC hybrid	84	10	10	72	12	2	155	23	15				0	0	0	91	7	1	91	18	12
GPCH2b	C-H <sub>2</sub> , NG 4000 km, Cen Ref, Pipe	180	0	0	129	13	5	309	13	5				0	0	0	177	7	3	177	7	3
	PISI 2002	168	5	5	120	12	5	287	16	10				0	0	0	164	7	3	165	12	8
	PISI 2010	149	13	11	106	11	4	255	24	17				0	0	0	146	6	2	146	19	13
	PISI hybrid	94	12	12	67	7	3	161	19	16				0	0	0	92	4	1	92	15	13
	FC	84	10	10	60	6	2	144	17	14				0	0	0	82	3	1	82	13	11
	FC hybrid	84	10	10	60	6	2	144	17	14				0	0	0	82	3	1	82	13	11
GPCH2bC	C-H <sub>2</sub> : NG 4000 km, Cen Ref, Pipe, CCS	180	0	0	139	14	6	319	14	6				0	0	0	67	8	3	67	8	3
	PISI 2002	168	5	5	129	13	5	297	17	11				0	0	0	62	7	3	63	9	5
	PISI 2010	149	13	11	115	11	5	263	25	18				0	0	0	55	6	2	56	11	7
	PISI hybrid	94	12	12	73	7	3	167	20	17				0	0	0	35	4	2	35	8	6
	FC	84	10	10	65	6	3	148	18	15				0	0	0	31	4	1	31	7	5
	FC hybrid	84	10	10	65	6	3	148	18	15				0	0	0	31	4	1	31	7	5
GPCH3b	C-H <sub>2</sub> : NG 4000 km, Cen Ref, Road	180	0	0	122	12	4	309	12	4				0	0	0	178	7	2	178	7	2
	PISI 2002	168	5	5	120	11	4	288	15	9				0	0	0	166	6	2	166	11	7
	PISI 2010	149	13	11	107	10	3	255	23	16				0	0	0	147	6	2	148	18	13
	PISI hybrid	94	12	12	67	6	2	161	18	16				0	0	0	93	4	1	93	15	13
	FC	84	10	10	60	5	2	144	16	14				0	0	0	83	3	1	83	13	11
	FC hybrid	84	10	10	60	5	2	144	16	14				0	0	0	83	3	1	83	13	11
GPLCHb	C-H <sub>2</sub> : NG 4000 km, Cen Ref, Liq, Road, Vap/comp.	180	0	0	230	25	14	410	25	14				0	0	0	239	15	8	239	15	8
	PISI 2002	168	5	5	214	24	13	382	30	20				0	0	0	222	14	8	223	21	14
	PISI 2010	149	13	11	190	21	11	338	39	28				0	0	0	197	12	7	198	29	22
	PISI hybrid	94	12	12	120	13	7	214	30	25				0	0	0	125	8	4	125	23	20
	FC	84	10	10	107	12	6	191	27	22				0	0	0	111	7	4	111	21	17
	FC hybrid	84	10	10	107	12	6	191	27	22				0	0	0	111	7	4	111	21	17
GRCH1	C-H <sub>2</sub> : LNG, O/S Ref	180	0	0	202	6	11	382	6	11				0	0	0	215	4	6	215	4	6
	PISI 2002	168	5	5	186	6	10	355	12	16				0	0	0	200	3	5	201	9	11
	PISI 2010	149	13	11	166	5	9	315	23	24				0	0	0	177	3	5	178	18	18
	PISI hybrid	94	12	12	105	3	6	199	20	22				0	0	0	112	2	3	112	16	17
	FC	84	10	10	94	3	5	177	18	19				0	0	0	100	2	3	100	14	15
	FC hybrid	84	10	10	94	3	5	177	18	19				0	0	0	100	2	3	100	14	15
GRCH2	C-H <sub>2</sub> : LNG, Cen Ref, Pipe	180	0	0	157	7	9	337	7	9				0	0	0	191	3	5	191	3	5
	PISI 2002	168	5	5	146	6	8	313	12	14				0	0	0	178	3	5	178	9	10
	PISI 2010	149	13	11	129	5	7	278	21	21				0	0	0	157	3	4	158	16	16
	PISI hybrid	94	12	12	82	3	5	176	18	19				0	0	0	100	2	3	100	14	15
	FC	84	10	10	73	3	4	156	16	17				0	0	0	89	2	2	89	12	13
	FC hybrid	84	10	10	73	3	4	156	16	17				0	0	0	89	2	2	89	12	13
GRCH3	C-H <sub>2</sub> : Rem NG, methanol, O/S Ref	180	0	0	204	4	8	384	4	8				0	0	0	214	2	4	214	2	4
	PISI 2002	168	5	5	190	4	7	357	11	14				0	0	0	199	2	4	199	8	10
	PISI 2010	149	13	11	168	4	6	316	22	22				0	0	0	176	2	3	177	17	17
	PISI hybrid	94	12	12	106	2	4	200	19	21				0	0	0	111	1	2	111	15	16
	FC	84	10	10	95	2	4	178	17	18				0	0	0	99	1	2	99	13	14
	FC hybrid	84	10	10	95	2	4	178	17	18				0	0	0	99	1	2	99	13	14
KOCH1	C-H <sub>2</sub> : Coal EU-mix, cen Ref, Pipe	180	0	0	252	3	3	432	3	3				0	0	0	419	2	1	419	2	1
	PISI 2002	168	5	5	234	3	3	402	11	11				0	0	0	390	1	1	391	13	13
	PISI 2010	149	13	11	207	3	3	356	24	22				0	0	0	346	1	1	346	31	27
	PISI hybrid	94	12	12	131	2	2	225	21	21				0	0	0	219	1	1	219	28	28
	FC	84	10	10	117	2	1	201	19	19				0	0	0	195	1	1	195	25	25
	FC hybrid	84	10																			

## 8.2 C-H<sub>2</sub> from biomass processing

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km									
		Total						Fossil						TTW			WTT			WTW			
		TTW (MJ/100 km)			WTT (MJ/100 km)			WTW (MJ/100km)			WTW (MJ/100km)			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
WWCH1	C-H2: Wood W, O/S gasif	180	0	0	220	18	18	400	18	18	34	3	3	0	0	0	19	1	1	19	1	1	
	PISI 2002	168	5	5	204	17	17	372	24	24	32	6	6	0	0	0	18	1	1	18	2	2	
	PISI 2010	149	13	11	181	15	15	330	33	31	28	14	12	0	0	0	16	1	1	16	3	2	
	PISI hybrid	94	12	12	115	10	10	209	26	26	18	12	12	0	0	0	10	1	1	10	2	2	
	FC	84	10	10	102	9	9	186	23	23	16	11	11	0	0	0	9	1	1	9	2	2	
	FC hybrid	84	10	10	102	9	9	186	23	23	16	11	11	0	0	0	9	1	1	9	2	2	
WWCH2	C-H2: Wood W, Cen gasif, Pipe	180	0	0	175	15	14	355	15	14	4	3	3	0	0	0	22	1	1	22	1	1	
	PISI 2002	168	5	5	162	14	13	330	19	18	38	7	7	0	0	0	20	1	1	21	2	2	
	PISI 2010	149	13	11	144	12	11	293	28	25	34	14	12	0	0	0	18	1	1	18	3	3	
	PISI hybrid	94	12	12	91	8	7	185	22	22	22	12	12	0	0	0	11	1	1	11	2	2	
	FC	84	10	10	81	7	6	165	20	19	19	11	11	0	0	0	10	1	1	10	2	2	
	FC hybrid	84	10	10	81	7	6	165	20	19	19	11	11	0	0	0	10	1	1	10	2	2	
WFCH1	C-H2: Wood F, O/S gasif	180	0	0	224	19	18	404	19	18	39	3	3	0	0	0	27	4	8	27	4	8	
	PISI 2002	168	5	5	208	17	17	376	24	24	36	6	6	0	0	0	25	4	7	26	4	8	
	PISI 2010	149	13	11	185	15	15	333	34	31	32	14	12	0	0	0	23	3	7	23	5	8	
	PISI hybrid	94	12	12	117	10	10	211	27	27	20	12	12	0	0	0	14	2	4	14	4	6	
	FC	84	10	10	104	9	9	188	24	24	18	11	11	0	0	0	13	2	4	13	3	5	
	FC hybrid	84	10	10	104	9	9	188	24	24	18	11	11	0	0	0	13	2	4	13	3	5	
WFCH2	C-H2: Wood F, Cen gasif, pipe	180	0	0	175	15	15	355	15	15	4	4	4	0	0	0	26	2	7	26	2	7	
	PISI 2002	168	5	5	162	14	14	330	20	20	36	7	7	0	0	0	24	2	7	24	3	7	
	PISI 2010	149	13	11	144	12	13	292	28	26	34	14	13	0	0	0	21	2	6	22	4	8	
	PISI hybrid	94	12	12	91	8	8	185	22	22	22	12	12	0	0	0	13	1	4	13	3	5	
	FC	84	10	10	81	7	7	165	20	20	19	11	11	0	0	0	12	1	3	12	3	5	
	FC hybrid	84	10	10	81	7	7	165	20	20	19	11	11	0	0	0	12	1	3	12	3	5	
BLCH1	C-H2: Wood W, Black liquor	180	0	0	92	5	7	272	5	7	37	2	3	0	0	0	18	1	1	18	1	1	
	PISI 2002	168	5	5	86	5	7	253	9	11	34	6	6	0	0	0	17	1	1	17	2	2	
	PISI 2010	149	13	11	76	4	6	224	17	16	30	13	12	0	0	0	15	1	1	15	2	2	
	PISI hybrid	94	12	12	48	3	4	142	14	15	19	12	12	0	0	0	9	1	1	9	2	2	
	FC	84	10	10	43	2	3	126	13	13	17	11	11	0	0	0	8	1	1	8	2	2	

### 8.3 C-H<sub>2</sub> from electrolysis (all electricity sources)

WTT Code	Powertrain	Energy MJ / 100 km									GHG g CO <sub>2eq</sub> / km										
		Total			Fossil			TTW			WTT			WTT							
		Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max					
GPEL1a/CH1	C-H2: NG 7000 km, CCGT, O/S Ely	180	0	0	490	75	21	670	75	21	0	0	0	406	45	13	406	45	13		
	PISI 2002	168	5	5	456	70	19	623	84	33	0	0	0	377	41	12	378	53	23		
	PISI 2010	149	13	11	406	62	17	552	98	49	0	0	0	335	37	11	335	68	36		
	PISI hybrid	94	12	12	256	39	11	350	72	44	0	0	0	212	23	7	212	49	33		
	FC	84	10	10	226	35	10	311	64	39	0	0	0	189	21	6	189	44	29		
GPEL1b/CH1	C-H2: NG 4000 km, CCGT, O/S Ely	180	0	0	433	43	29	613	43	29	0	0	0	364	25	17	364	25	17		
	PISI 2002	168	5	5	402	40	27	570	52	40	0	0	0	339	24	16	339	34	26		
	PISI 2010	149	13	11	357	35	24	505	67	52	0	0	0	300	21	14	301	47	37		
	PISI hybrid	94	12	12	226	22	15	320	51	44	0	0	0	190	13	9	190	37	32		
	FC	84	10	10	201	20	14	285	46	40	0	0	0	169	12	8	169	33	29		
GPEL1b/CH2	C-H2: NG 4000 km, CCGT, Cen Ely, Pipe	180	0	0	442	47	34	622	47	34	0	0	0	364	28	20	364	28	20		
	PISI 2002	168	5	5	411	44	32	578	56	44	0	0	0	339	26	19	339	36	29		
	PISI 2010	149	13	11	364	39	28	513	71	57	0	0	0	300	23	17	300	49	39		
	PISI hybrid	94	12	12	231	24	18	325	54	47	0	0	0	190	15	10	190	38	34		
	FC	84	10	10	206	22	16	289	48	42	0	0	0	169	13	9	169	34	30		
GREL1/CH1	C-H2: LNG, O/S Ely	180	0	0	490	43	45	675	43	45	0	0	0	396	25	26	396	25	26		
	PISI 2002	168	5	5	460	40	42	628	54	56	0	0	0	368	23	24	369	34	36		
	PISI 2010	149	13	11	408	36	37	557	72	69	0	0	0	327	21	22	327	49	47		
	PISI hybrid	94	12	12	258	23	24	352	55	56	0	0	0	207	13	14	207	38	39		
	FC	84	10	10	230	20	21	314	49	50	0	0	0	184	12	12	184	34	35		
WFEL2/CH1	C-H2: F Wood, 200 MW gasif, CCGT, O/S Ely	180	0	0	469	38	39	649	38	39	14	1	1	23	6	16	23	6	16		
	PISI 2002	168	5	5	436	35	37	603	48	50	13	5	5	0	0	21	5	15	22	6	16
	PISI 2010	149	13	11	386	31	32	535	66	63	11	13	11	0	0	19	5	13	19	6	15
	PISI hybrid	94	12	12	245	20	21	339	51	52	7	12	12	0	0	12	3	9	12	4	10
	FC	84	10	10	218	18	18	301	45	46	6	10	10	0	0	11	3	8	11	4	9
WFEL3/CH1	C-H2: F Wood, Conv power, O/S Ely	180	0	0	797	68	52	977	68	52	20	2	1	0	0	56	9	24	56	9	24
	PISI 2002	168	5	5	741	64	49	909	86	71	19	5	5	0	0	52	8	22	52	10	24
	PISI 2010	149	13	11	657	56	43	806	114	94	17	13	12	0	0	46	7	20	46	11	23
	PISI hybrid	94	12	12	416	36	27	510	87	79	11	12	12	0	0	29	5	12	29	8	16
	FC	84	10	10	370	32	24	454	78	70	9	10	10	0	0	26	4	11	26	7	14
EMEL1/CH1	C-H2: Elec EU-mix, O/S Ely	180	0	0	652	31	31	833	31	31	0	0	0	375	14	14	375	14	14		
	PISI 2002	168	5	5	607	29	29	774	47	47	0	0	0	349	13	13	349	23	23		
	PISI 2010	149	13	11	538	26	25	686	73	67	0	0	0	309	11	11	310	38	35		
	PISI hybrid	94	12	12	340	16	16	434	59	59	0	0	0	196	7	7	196	31	31		
	FC	84	10	10	303	14	14	387	53	52	0	0	0	174	6	6	174	28	28		
KOEL1/CH1	C-H2: Elec coal EU-mix, O/S Ely	180	0	0	571	96	76	751	96	76	0	0	0	763	85	90	763	85	90		
	PISI 2002	168	5	5	531	89	71	699	105	87	0	0	0	709	79	84	710	101	105		
	PISI 2010	149	13	11	471	79	63	619	120	99	0	0	0	629	70	74	629	124	122		
	PISI hybrid	94	12	12	298	50	40	392	87	77	0	0	0	398	44	47	398	93	96		
	FC	84	10	10	265	45	36	349	78	69	0	0	0	354	40	42	354	83	85		
KOEL1/CH2	C-H2: Elec coal EU-mix, Cen ely, Pipe	180	0	0	571	96	76	751	96	76	0	0	0	763	85	90	763	85	90		
	PISI 2002	168	5	5	531	89	71	699	105	87	0	0	0	709	79	84	710	101	105		
	PISI 2010	149	13	11	471	79	63	619	120	99	0	0	0	629	70	74	629	124	122		
	PISI hybrid	94	12	12	298	50	40	392	87	77	0	0	0	398	44	47	398	93	96		
	FC	84	10	10	265	45	36	349	78	69	0	0	0	354	40	42	354	83	85		
NUEL1/CH1	C-H2: Elec nuclear, O/S Ely	180	0	0	906	48	48	1085	48	48	0	0	0	13	1	1	13	1	1		
	PISI 2002	168	5	5	842	45	45	1010	70	70	0	0	0	12	1	1	12	1	1		
	PISI 2010	149	13	11	746	40	40	895	105	97	0	0	0	10	1	1	11	1	1		
	PISI hybrid	94	12	12	472	25	25	566	84	84	0	0	0	7	0	0	7	1	1		
	FC	84	10	10	421	22	22	504	75	75	0	0	0	6	0	0	6	1	1		
WDEL1/CH2	C-H2: Wind, Cen Ely, Pipe	180	0	0	142	11	10	322	11	10	35	3	2	0	0	0	16	1	1		
	PISI 2002	168	5	5	132	10	9	299	15	14	32	6	6	0	0	0	15	1	1		
	PISI 2010	149	13	11	117	9	8	265	23	21	29	14	12	0	0	0	14	1	1		
	PISI hybrid	94	12	12	74	6	5	168	19	18	18	12	12	0	0	0	9	1	9		
	FC	84	10	10	66	5	5	150	17	16	16	11	11	0	0	0	8	1	8		

# 9 Liquid hydrogen (L-H<sub>2</sub>)

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km											
		Total						Fossil						TTW			WTT			WTW					
		TTW (MJ/100 km)			WTT (MJ/100 km)			WTW (MJ/100km)			WTW (MJ/100km)			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
<b>L-H<sub>2</sub> pathways</b>																									
GPLH1a	L-H <sub>2</sub> :NG 7000 km, Cen Ref, Liq, Road	180	0	0	240	40	6	420	40	6	0	0	0	253	23	4	253	23	4	253	23	4	253	23	4
	PISI 2002	168	5	5	220	37	6	391	44	14	0	0	0	236	21	4	236	21	4	236	21	4	236	21	4
	PISI 2010	141	11	12	188	31	5	330	47	24	0	0	0	199	18	3	199	18	3	199	18	3	199	18	3
	FC	94	12	12	125	21	3	219	38	22	0	0	0	132	12	2	132	12	2	132	12	2	132	12	2
	FC hybrid	84	10	10	111	18	3	195	34	20	0	0	0	118	11	2	118	11	2	118	11	2	118	11	2
GPLH1b	L-H <sub>2</sub> : NG 4000 km, Cen Ref, Liq, Road	180	0	0	204	25	15	384	25	15	0	0	0	227	15	9	227	15	9	227	15	9	227	15	9
	PISI 2002	168	5	5	190	23	14	357	29	20	0	0	0	212	14	8	212	14	8	212	14	8	212	14	8
	PISI 2010	141	11	12	160	19	12	302	33	28	0	0	0	179	11	7	179	11	7	179	11	7	179	11	7
	FC	94	12	12	107	13	8	201	28	24	0	0	0	119	8	5	119	8	5	119	8	5	119	8	5
	FC hybrid	84	10	10	95	11	7	179	25	21	0	0	0	106	7	4	106	7	4	106	7	4	106	7	4
GRLH1	L-H <sub>2</sub> : Rem Ref, Liq, Sea, Road	180	0	0	256	22	27	437	22	27	0	0	0	250	13	15	250	13	15	250	13	15	250	13	15
	PISI 2002	168	5	5	236	21	25	406	28	32	0	0	0	232	12	14	232	12	14	232	12	14	232	12	14
	PISI 2010	141	11	12	201	18	21	343	35	40	0	0	0	196	10	12	196	10	12	196	10	12	196	10	12
	FC	94	12	12	134	12	14	228	30	32	0	0	0	130	7	8	130	7	8	130	7	8	130	7	8
	FC hybrid	84	10	10	119	10	12	203	27	29	0	0	0	116	6	7	116	6	7	116	6	7	116	6	7
GRLH2	L-H <sub>2</sub> : LNG, Cen Ref, Liq, Road	180	0	0	241	21	23	421	21	23	0	0	0	247	12	13	247	12	13	247	12	13	247	12	13
	PISI 2002	168	5	5	224	19	21	392	26	28	0	0	0	229	11	12	230	18	19	230	18	19	230	18	19
	PISI 2010	141	11	12	189	16	18	331	32	36	0	0	0	194	9	10	194	9	10	194	9	10	194	9	10
	FC	94	12	12	126	11	12	220	29	30	0	0	0	129	6	7	129	6	7	129	6	7	129	6	7
	FC hybrid	84	10	10	112	10	11	196	25	26	0	0	0	115	6	6	115	6	6	115	6	6	115	6	6
WFLH1	L-H <sub>2</sub> : Wood F, Cen gasif, Liq, Road	180	0	0	270	30	24	450	30	24	12	1	1	0	0	0	15	3	9	15	3	9	15	3	9
	PISI 2002	168	5	5	251	28	22	418	36	30	11	5	5	0	0	0	14	2	8	14	2	8	14	2	8
	PISI 2010	141	11	12	212	24	19	353	41	39	9	11	12	0	0	0	11	2	7	12	3	8	12	3	8
	FC	94	12	12	141	16	13	235	35	32	6	12	12	0	0	0	8	1	5	8	1	5	8	1	5
	FC hybrid	84	10	10	125	14	11	209	31	28	5	10	10	0	0	0	7	1	4	7	1	4	7	1	4
GPEL1b/LH1	L-H <sub>2</sub> : NG 4000 km, CCGT, Cen Ely, Liq, Road	180	0	0	516	53	30	696	53	30	0	0	0	415	33	18	415	33	18	415	33	18	415	33	18
	PISI 2002	168	5	5	480	49	28	647	64	43	0	0	0	386	29	17	386	29	17	386	29	17	386	29	17
	PISI 2010	141	11	12	405	41	24	546	73	60	0	0	0	325	24	14	326	49	42	326	49	42	326	49	42
	FC	94	12	12	269	28	16	363	62	50	0	0	0	216	16	9	216	16	9	216	16	9	216	16	9
	FC hybrid	84	10	10	240	25	14	323	55	45	0	0	0	193	14	8	193	14	8	193	14	8	193	14	8
EMEL1/LH1	L-H <sub>2</sub> : Elec EU-mix, Cen Ely, Liq, Road	180	0	0	761	38	36	941	38	36	0	0	0	425	17	16	425	17	16	425	17	16	425	17	16
	PISI 2002	168	5	5	708	35	33	875	56	55	0	0	0	395	16	15	396	28	27	396	28	27	396	28	27
	PISI 2010	141	11	12	597	30	28	739	76	80	0	0	0	334	13	13	334	39	41	334	39	41	334	39	41
	FC	94	12	12	397	20	19	491	69	68	0	0	0	222	9	8	222	36	36	222	36	36	222	36	36
	FC hybrid	84	10	10	354	17	17	437	62	61	0	0	0	197	6	7	197	32	32	197	32	32	197	32	32
KOEL1/LH1	L-H <sub>2</sub> : Elec coal EU-mix, Cen Ely, Liq, Road	180	0	0	672	99	77	852	99	77	0	0	0	854	79	101	854	79	101	854	79	101	854	79	101
	PISI 2002	168	5	5	625	93	72	793	111	91	0	0	0	795	73	94	795	97	118	795	97	118	795	97	118
	PISI 2010	141	11	12	528	78	61	669	119	107	0	0	0	671	62	80	671	113	137	671	113	137	671	113	137
	FC	94	12	12	351	52	40	445	96	84	0	0	0	446	41	53	446	96	108	446	96	108	446	96	108
	FC hybrid	84	10	10	312	46	36	396	85	75	0	0	0	397	37	47	397	85	96	397	85	96	397	85	96

# 10 Summary of pathways with CC&S

WTT Code	Powertrain	Energy MJ / 100 km												GHG g CO <sub>2eq</sub> / km											
		Total						Fossil						TTW			WTT			WTW					
		TTW (MJ/100 km)			WTT (MJ/100 km)			WTW (MJ/100km)			WTW (MJ/100km)			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
<b>CCS pathways</b>																									
GRCG1C	CNG: LNG, Vap, Pipe, CCS																								
	PISI bi-fuel 2002	227	12	6	72	5	6	299	15	10															
	PISI dedicated 2002	223	14	6	71	5	6	294	17	10															
	PISI bi-fuel 2010	188	12	8	60	5	5	248	14	11															
	PISI dedicated 2010	187	13	8	60	5	5	247	15	11															
	PISI hybrid	139	17	13	44	3	3	184	19	15															
GPCH2bC	C-H2: NG 4000 km, Cen Ref, Pipe, CCS																								
	PISI 2002	180	0	0	139	14	6	319	14	6															
	PISI 2010	168	5	5	129	13	5	297	17	11															
	PISI hybrid	149	13	11	115	11	5	263	25	18															
	FC	94	12	12	73	7	3	167	20	17															
	FC hybrid	84	10	10	65	6	3	148	18	15															
KOCH1C	C-H2: Coal EU-mix, cen Ref, Pipe, CCS																								
	PISI 2002	180	0	0	319	3	3	499	3	3															
	PISI 2010	168	5	5	297	3	3	464	13	13															
	PISI hybrid	149	13	11	263	2	2	412	28	25															
	FC	94	12	12	167	2	2	261	25	25															
	FC hybrid	84	10	10	148	1	1	232	22	22															
GRSD2C	Syn-diesel: Rem GTL, Sea, Rail/Road, CCS																								
	DICI 2002	183	5	5	139	9	11	323	15	16															
	DICI 2010 no DPF	172	7	7	131	9	10	303	16	17															
	DICI 2010 DPF	177	7	7	135	9	10	311	17	18															
	DICI hybrid n DPF	141	15	11	107	7	8	249	23	20															
	DICI hybrid DPF	146	15	11	111	7	9	257	24	20															
KOSD1C	Syn-diesel: CTL, CCS, Diesel mix																								
	DICI 2002	180	0	0	190	14	15	371	14	15															
	DICI 2010 no DPF	168	5	5	177	13	14	345	19	20															
	DICI 2010 DPF	149	13	11	157	12	12	305	28	27															
	DICI hybrid n DPF	94	12	12	99	7	8	193	23	23															
	DICI hybrid DPF	84	10	10	88	7	7	172	20	20															
GRDE1C	DME: Rem Syn, Sea, Rail/Road, CCS																								
	DICI 2002	183	5	5	99	0	13	282	6	17															
	DICI 2010 no DPF	172	7	7	93	0	12	265	8	18															
	DICI hybrid n DPF	141	15	11	76	0	10	217	17	19															