

Supplementary material

Table S3: Countries and origin of national emission estimates for the historic emissions 2000-2014 excluding international shipping

Country group	Country	ISO3	Source CO ₂ _ff	Source CO ₂ _bf except AWB ¹⁾
EU15+CHE+NOR	Austria	AUT	UNFCCC	UNFCCC
EU15+CHE+NOR	Belgium	BEL	UNFCCC	UNFCCC
EU15+CHE+NOR	Switzerland	CHE	UNFCCC	UNFCCC
EU15+CHE+NOR	Germany	DEU	UNFCCC	UNFCCC
EU15+CHE+NOR	Denmark	DNK	UNFCCC	UNFCCC
EU15+CHE+NOR	Spain	ESP	UNFCCC	UNFCCC
EU15+CHE+NOR	Finland	FIN	UNFCCC	UNFCCC
EU15+CHE+NOR	France	FRA	UNFCCC	UNFCCC
EU15+CHE+NOR	United Kingdom	GBR	UNFCCC	UNFCCC
EU15+CHE+NOR	Greece	GRC	UNFCCC	UNFCCC
EU15+CHE+NOR	Ireland	IRL	UNFCCC	UNFCCC
EU15+CHE+NOR	Italy	ITA	UNFCCC	UNFCCC
EU15+CHE+NOR	Luxembourg	LUX	UNFCCC	UNFCCC
EU15+CHE+NOR	Netherlands	NLD	UNFCCC	UNFCCC
EU15+CHE+NOR	Norway	NOR	UNFCCC	UNFCCC
EU15+CHE+NOR	Portugal	PRT	UNFCCC	UNFCCC
EU15+CHE+NOR	Sweden	SWE	UNFCCC	UNFCCC
EU-NMS	Bulgaria	BGR	UNFCCC	UNFCCC
EU-NMS	Cyprus	CYP	UNFCCC	UNFCCC
EU-NMS	Czech Republic	CZE	UNFCCC	UNFCCC
EU-NMS	Estonia	EST	GAINS ³⁾	TNO ²⁾
EU-NMS	Croatia	HRV	UNFCCC	UNFCCC
EU-NMS	Hungary	HUN	UNFCCC	UNFCCC
EU-NMS	Lithuania	LTU	UNFCCC	UNFCCC
EU-NMS	Latvia	LVA	UNFCCC	UNFCCC
EU-NMS	Malta	MLT	UNFCCC	UNFCCC
EU-NMS	Poland	POL	UNFCCC	UNFCCC
EU-NMS	Romania	ROU	UNFCCC	UNFCCC

EU-NMS	Slovakia	SVK	UNFCCC	UNFCCC
EU-NMS	Slovenia	SVN	UNFCCC	UNFCCC
Non-EU	Albania	ALB	GAINS	TNO ²⁾
Non-EU	Armenia	ARM	EDGAR	EDGAR
Non-EU	Azerbaijan	AZE	EDGAR	EDGAR
Non-EU	Bosnia-Herzegovina	BIH	GAINS	TNO ²⁾
Non-EU	Belarus	BLR	UNFCCC	UNFCCC
Non-EU	Georgia	GEO	EDGAR	EDGAR
Non-EU	Iceland	ISL	UNFCCC	UNFCCC
Non-EU	Republic of Moldova	MDA	GAINS	TNO ²⁾
Non-EU	Former Yugoslav Republic of Macedonia	MKD	GAINS	TNO ²⁾
Non-EU	Russian Federation	RUS	UNFCCC	UNFCCC
Non-EU	Turkey	TUR	GAINS	TNO ²⁾
Non-EU	Ukraine	UKR	UNFCCC	UNFCCC
Non-EU	Serbia and Montenegro	YUG	GAINS	TNO ²⁾

¹⁾ CO₂ from Agricultural Waste burning (AWB) is estimated by TNO using activity data from GAINS and corresponding emission factor from Akagi et al. (2011) for all countries

²⁾ Calculated by TNO using corresponding activity data from GAINS and emissions factors from IPCC (2006).

³⁾ At the time of data collection no data were available for Estonia at UNFCCC.

Table S4: Cross-walk table from the CRF_codes to the aggregated SNAP_level1 used in this study

SNAP_level1	SNAP_Name	CRF_Code	CRF_Name
1	Energy industries	1.A.1.a	Public electricity and heat production
		1.A.1.b	Petroleum refining
		1.A.1.c	Manufacture of solid fuels and other energy industries
2	Small combustion	1.A.4.a	Commercial/institutional
		1.A.4.b	Residential
		1.A.4.c	Agriculture/forestry/fishing
34	Industry (combustion + processes)	1.A.2.a	Iron and steel
		1.A.2.b	Non-ferrous metals
		1.A.2.c	Chemicals
		1.A.2.d	Pulp, paper and print
		1.A.2.e	Food processing, beverages and tobacco
		1.A.2.f	Non-metallic minerals
		1.A.2.g	ther (please specify)
		1.B.1.b	Solid fuel transformation
		1.C.1	Transport of CO2
		1.C.2	Injection and storage
		1.C.3	Other
		2.A.1	Cement production
		2.A.2	Lime production
		2.A.3	Glass production
		2.A.4	Other process uses of carbonates
		2.B.1	Ammonia production
		2.B.10	Nitric acid production
		2.B.2	Adipic acid production
		2.B.3	Caprolactam, glyoxal and glyoxylic acid production
		2.B.4	Carbide production
2.B.5	Titanium dioxide production		
2.B.6	Soda ash production		
2.B.7	Petrochemical and carbon black production		
2.B.8	Fluorochemical production		
2.B.9	Other (as specified in table 2(I).A-H)		

		2.C.1	Iron and steel production
		2.C.2	Ferroalloys production
		2.C.3	Aluminium production
		2.C.4	Magnesium production
		2.C.5	Lead production
		2.C.6	Zinc production
		2.C.7	Other (as specified in table 2(I).A-H)
		2.E.1	Integrated circuit or semiconductor
		2.E.2	TFT flat panel display
		2.E.3	Photovoltaics
		2.E.4	Heat transfer fluid
		2.E.5	Other (as specified in table 2(II))
		2.G.1	Electrical equipment
		2.G.4	Other
		2.H	Other (as specified in tables 2(I).A-H and 2(II))(3)
		1.A.5.a	Stationary
5	Exploration and production of fossil fuels	1.B.1.a	Coal mining and handling
		1.B.1.c	Other (as specified in table 1.B.1)
		1.B.2.a	Oil
		1.B.2.b	Natural gas
		1.B.2.c	Venting and flaring
		1.B.2.d	Other (as specified in table 1.B.2)
6	Product use	2.D.1	Lubricant use
		2.D.2	Paraffin wax use
		2.D.3	Other
		2.F.1	Refrigeration and air conditioning
		2.F.2	Foam blowing agents
		2.F.3	Fire protection
		2.F.4	Aerosols
		2.F.5	Solvents
		2.F.6	Other applications
		2.G.2	SF6 and PFCs from other product use
		2.G.3	N2O from product uses
7	Road transport	1.A.3.b	Road transportation

8	Non-road transport	1.A.3.a	Domestic aviation
		1.A.3.c	Railways
		1.A.3.d	Domestic navigation
		1.A.3.e	Other transportation
		1.A.5.b	Mobile
9	Waste	5.A.1	Managed waste disposal sites
		5.A.2	Unmanaged waste disposal sites
		5.A.3	Uncategorized waste disposal sites
		5.B.1	Composting
		5.B.2	Anaerobic digestion at biogas facilities
		5.C.1	Waste incineration
		5.C.2	Open burning of waste
		5.D.1	Domestic wastewater
		5.D.2	Industrial wastewater
		5.D.3	Other (as specified in table 6.B)
		5.E	Other (please specify)
10	Agriculture	3.A.1	Cattle
		3.A.2	Sheep
		3.A.3	Swine
		3.A.4	Other livestock
		3.B.1	Cattle
		3.B.2	Sheep
		3.B.3	Swine
		3.B.4	Other livestock
		3.B.5	Indirect N ₂ O emissions
		3.C	Rice cultivation
		3.D	Agricultural soils
		3.E	Prescribed burning of savannas
		3.F	Field burning of agricultural residues
		3.G	Liming
3.H	Urea application		
3.I	Other carbon-containing fertilizers		
3.J	Other (please specify)		

Table S5: Emission from point sources on the North Sea by country

Country	Lon	Lat	ISO3	Year	SNAP ¹⁾	CO ₂ emission (ton/yr)
Denmark	4.700	56.300	DNK	2010	5	19
	4.750	55.567	DNK	2010	5	110795
	4.750	55.717	DNK	2010	5	60348
	4.900	55.517	DNK	2010	5	86730
	5.100	55.600	DNK	2010	5	19
	5.133	55.467	DNK	2010	5	94816
Germany	6.688	53.594	DEU	2010	5	275
	6.813	53.531	DEU	2010	5	19
	6.813	53.594	DEU	2010	5	38
Netherlands	4.450	53.500	NLD	2010	1	577109
	4.450	53.500	NLD	2010	5	24
Norway	2.847	57.113	NOR	2010	1	81823
	2.847	57.113	NOR	2010	5	37025
	3.085	56.906	NOR	2010	1	39545
	3.085	56.906	NOR	2010	5	17894
	3.223	56.522	NOR	2010	1	263636
	3.223	56.522	NOR	2010	5	119294
	3.266	56.378	NOR	2010	1	132622
	3.266	56.378	NOR	2010	5	60011
	3.327	56.643	NOR	2010	1	33919
	3.327	56.643	NOR	2010	5	15348
	3.395	56.279	NOR	2010	1	197727
3.395	56.279	NOR	2010	5	89471	
United Kingdom	1.167	53.717	GBR	2010	1	934680
	1.167	53.717	GBR	2010	5	8419
	1.383	57.450	GBR	2010	1	37069
	1.383	57.450	GBR	2010	5	16733
	2.050	56.400	GBR	2010	1	37050
	2.050	56.400	GBR	2010	5	16725
	2.150	56.483	GBR	2010	1	767440
	2.150	56.483	GBR	2010	5	346428
	2.767	56.167	GBR	2010	1	55891

¹ Flaring emissions reported under SNAP5, all emissions from energy combustion for energy supply of equipment, machinery, and production allocated to SNAP1.

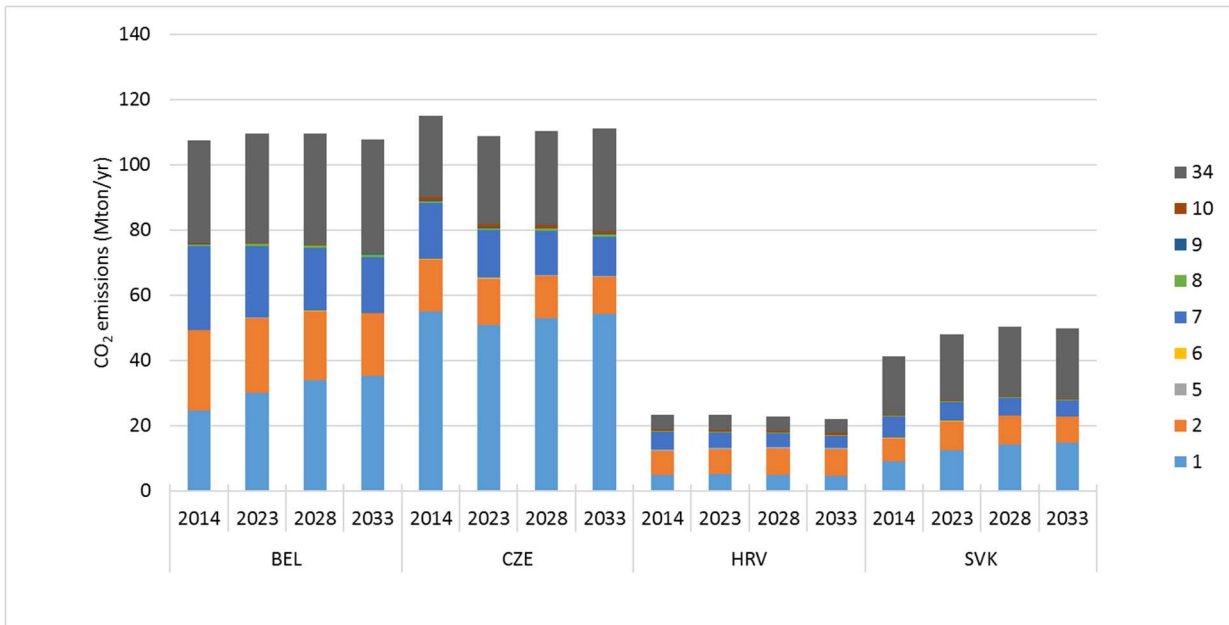


Figure S10: Emissions under the CC scenario for selected small European countries by source sector in 2014, 2023, 2028, 2033. (BEL = Belgium; CZE = Czech Republic; HRV = Croatia; SVK = Slovakia)