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# Environmentally Extended Input-Output Table for Switzerland 2008 - Greenhouse Gas Emissions (Carbon Footprint)

factsheet

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## Imprint

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## Environmentally Extended Input-Output Table

An input-output table (IOT) depicts the economic transactions between the different sectors and the final demand of a country and serves as an important instrument in empirical analyses. The monetary IOT can be extended with data on the pollutant emissions and resource uses of the individual economic sectors and the final demand to yield an environmentally extended input-output table (EE-IOT). The EE-IOT allows, among other things:

- the identification of key sectors and activities responsible for environmental impacts,
- the assessment of the economic and environmental impacts of a certain consumption pattern and
- the development of policies to proceed towards a more sustainable economy.

In the present project, an EE-IOT was estimated for the Swiss economy in the year 2008 with a special focus on the energy, transportation, agricultural and food sectors. The resulting EE-IOT is made available to the public and can be used for further analyses. In this factsheet, the greenhouse gas emissions caused by the Swiss economy are evaluated.

## Greenhouse Gas Emissions

The global increase in temperature of 0.85 °C observed between 1880 and 2012 is mainly caused by anthropogenic greenhouse gas (GHG) emissions (IPCC 2013). GHGs include carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF<sub>6</sub>). In addition to their direct warming effect, GHGs have a number of indirect effects such as changes in precipitation patterns, an increase in the frequency of extreme weather events and a rise in sea level (IPCC 2013). That is why climate change was identified by Rockström et al. (2009) as one of the planetary boundaries that has already been exceeded.

Switzerland has committed itself to reduce its domestic GHG emissions by 20 % until 2020 in comparison to the emission level of 1990 (Schweizerischer Bundesrat 2011) and states the need for a reduction by between 50 % and 85 % until 2050 (Schweizerischer Bundesrat 2012). The potency of different GHGs in terms of their warming effect is characterized by the global warming potential (GWP, calculated for a period of 100 years), and CO<sub>2</sub> is used as the reference substance.

## Domestic and Foreign GHG Emissions

An overview of the total domestic and foreign GHG emissions caused by Switzerland is given in Tab. 1. The Swiss domestic GHG emissions amount to 60.5 Mt CO<sub>2</sub>-eq. A fraction of 27 % (16.1 Mt CO<sub>2</sub>-eq) thereof is related to the production of exported goods and services. The Swiss domestic final demand, i.e. consumption of private households, the government, non-profit institutions and capital formation, results in GHG emissions of 103 Mt CO<sub>2</sub>-eq in Switzerland and abroad. This means that a fraction of 57 % (58.7 Mt CO<sub>2</sub>-eq) of the total GHG emissions ultimately caused by Swiss consumption occurs abroad. The net traded emissions, defined as the difference between emissions abroad caused by domestic final demand and domestic emissions caused by exports, are 42.6 Mt CO<sub>2</sub>-eq.

Tab. 1 Domestic and foreign GHG emissions caused by Swiss domestic final demand and by exports.

	Greenhouse gas emissions		
	Domestic emissions	Emissions abroad	Total emissions
	t CO <sub>2</sub> -eq.	t CO <sub>2</sub> -eq.	t CO <sub>2</sub> -eq.
Emissions caused by domestic final demand	44'401'697	58'749'043	103'150'740
Emissions caused by exports	16'127'362		
<b>Total</b>	<b>60'529'059</b>		
Net traded emissions			42'621'681

## Important Contributors to Domestic GHG Emissions

The ten most important contributors to total domestic GHG emissions are listed in Tab. 2. Only direct emissions by households and industry sectors are considered for the identification of the ten most important contributors to GHG emissions. It becomes evident that the ten most important contributors cause more than two thirds of Switzerland's total GHG emissions. The two dominant contributors, namely the household consumption categories housing and energy (c04) and transportation (c07), are responsible for more than one third (21.7 Mt CO<sub>2</sub>-eq) of the total domestic GHG emissions.

The remaining eight economic sectors of the ten most important contributors cause together about one third of the total domestic GHG emissions. Air transport (g62) and freight transport by road (g60f) are responsible for approximately 10 % of domestic GHG emissions. Cattle farming (dairy (g01o) and non-dairy (g01k)) causes roughly 9 % of Switzerland's GHG emissions. Further important contributors to GHG emissions are the cement industry (g26), the chemical and pharmaceutical industry (g24) and heat generation in waste incineration plants (g90b). With the exception of wholesale, retail, vehicles and fuels trade, which has a high economic relevance, service sectors are not among the ten most important contributors to total domestic GHG emissions.

Tab. 2 The ten most important contributors to total domestic GHG emissions. Only direct emissions by households and sectors are taken into account.

			Greenhouse gas emissions t CO <sub>2</sub> -eq.	Share in total
1.	c04	Housing and energy	11'762'002	19%
2.	c07	Transport	9'942'569	16%
3.	g62	Air transport	4'996'949	8%
4.	g01o	Dairy cattle and raw milk	3'786'380	6%
5.	g26	Manufacture of other non-metallic mineral products	3'480'168	6%
6.	g24	Chemicals, chemical and pharmaceutical products	1'998'393	3%
7.	g50b52	Wholesale, retail, vehicles and fuels trade, repair	1'932'689	3%
8.	g01k	Non-dairy cattle	1'770'735	3%
9.	g90b	Heat from waste incineration	1'358'710	2%
10.	g60f	Freight transport by road	1'211'514	2%
	Remaining contributors		18'288'951	30%
	<b>Total</b>		<b>60'529'059</b>	<b>100%</b>

## Carbon Footprint: GHG Emissions due to Final Consumption

Domestic and foreign GHG emissions attributable to Switzerland from the consumption perspective (carbon footprint) can be shown by final consumption category and by product group.

The carbon footprint by final consumption category is shown in Tab. 3. The consumption of private households causes 74 % of the total GHG emissions related to Swiss consumption. The most important categories of household consumption with respect to GHG emissions are housing and energy (c04, 21 %), transport (c07, 17 %) and food and non-alcoholic beverage (c01, 12 %). Capital formation is responsible for 21 % of the consumption related GHG emissions and the consumption of the government and of non-profit institutions causes 5 %.

The major share of consumption related GHG emissions (57 %) are caused by imports outside Switzerland, the remaining 43 % of emissions occur domestically. Consumption categories with particularly high shares of GHG emissions caused abroad are clothing and footwear (c03) with 95% of total emissions, household equipment and maintenance (c05) with 89% as well as alcoholic beverages, tobacco and narcotics (c02) with 81%.

Tab. 3 Disaggregation of the carbon footprint by consumption category: GHG emissions in Switzerland and abroad caused by consumption of private households, the government and non-profit institutions as well as by capital formation. The consumption of private households is further divided into twelve categories (c01 to c12).

			Greenhouse gas emissions			
			Domestic emissions	Emissions abroad	Total emissions	Share in total
			t CO <sub>2</sub> -eq.	t CO <sub>2</sub> -eq.	t CO <sub>2</sub> -eq.	
Consumption of private households			37'422'092	38'965'482	76'387'574	74%
c01	Food and non-alcoholic beverage		4'987'236	7'078'558	12'065'793	12%
c02	Alcoholic beverages, tobacco and narcotics		233'995	926'319	1'160'315	1%
c03	Clothing and footwear		121'565	2'222'571	2'344'136	2%
c04	Housing and energy		14'294'963	7'451'076	21'746'039	21%
c05	Household equipment and maintenance		315'982	2'550'979	2'866'961	3%
c06	Health		1'716'838	2'302'799	4'019'637	4%
c07	Transport		11'880'413	5'406'940	17'287'353	17%
c08	Communications		169'787	527'239	697'025	1%
c09	Recreation and culture		1'436'135	4'118'561	5'554'696	5%
c10	Education		74'806	78'894	153'700	0%
c11	Restaurants and hotels		1'449'068	3'558'316	5'007'384	5%
c12	Misc. goods and services		741'305	2'743'231	3'484'536	3%
Consumption of the government and non-profit institutions			2'611'656	2'959'310	5'570'966	5%
Capital formation			4'367'949	16'824'251	21'192'200	21%
<b>Total domestic final consumption (excl. exports)</b>			<b>44'401'697</b>	<b>58'749'043</b>	<b>103'150'740</b>	<b>100%</b>

In a second analysis the contribution of the most important product groups to the consumption related GHG emissions is shown. Tab. 4 shows the ten product groups, that cause the highest total GHG emissions with a disaggregation into domestic emissions and emissions abroad. They cover a share of 60 % of the total GHG emissions caused by Swiss consumption.

The direct GHG emissions by private households (HH) account for 21 % of the total consumption related GHG emissions. Construction services (g45) have the second-highest share in GHG emissions with 8%. Hotel and restaurant services (g55) and health services (g85) follow next with 5% and 4% of total emissions, respectively. These services have a large share in household consumption expenditure. Product groups with a particularly high share of emissions abroad are machinery (g29), electricity (g40e), petroleum products (g23a) as well as hotel and restaurant services (g55). One explanation for the large share in the last case is that these services are partly used by Swiss residents travelling abroad.

Tab. 4 Disaggregation of the carbon footprint by product group: GHG emissions in Switzerland and abroad caused by Swiss consumption.

			Greenhouse gas emissions			
			Domestic emissions	Emissions abroad	Total emissions	Share in total
			t CO <sub>2</sub> -eq.	t CO <sub>2</sub> -eq.	t CO <sub>2</sub> -eq.	
1.	HH	Direct emissions by households	21'827'794	0	21'827'794	21%
2.	g45	Construction services	3'135'404	5'294'806	8'430'209	8%
3.	g55	Serv. of hotels and restaurants	1'582'417	3'875'397	5'457'814	5%
4.	g85	Health and social work services	2'109'748	2'490'702	4'600'451	4%
5.	g23a	Refined petroleum products	318'750	3'823'762	4'142'512	4%
6.	g50b52	Automobile, wholesale and retail trade	1'500'573	2'403'331	3'903'903	4%
7.	g29	Machinery	236'743	3'598'343	3'835'086	4%
8.	g15a	Processed meat	2'057'008	1'739'986	3'796'994	4%
9.	g40e	Distributed electricity	222'931	3'200'336	3'423'268	3%
10.	g62	Air transport	1'625'246	1'341'767	2'967'013	3%
Remaining product groups			9'785'084	30'980'612	40'765'697	40%
<b>Total</b>			<b>44'401'697</b>	<b>58'749'043</b>	<b>103'150'740</b>	<b>100%</b>

## Conclusions and Outlook

The comparison of the domestic emissions occurring in Switzerland (60.5 Mt CO<sub>2</sub>-eq) with the GHG emissions ultimately caused by Swiss consumption (103 Mt CO<sub>2</sub>-eq) makes clear that the GHG emissions associated with imported goods and services cannot be disregarded when Switzerland's responsibility for global climate change is assessed. However, the high share of GHG emissions related to Swiss consumption occurring abroad makes it difficult to effectively develop and implement policies to reduce the total emissions. A life cycle approach can be employed to identify the key product groups and consumption categories responsible for the domestic and foreign GHG emissions caused by Swiss consumption.

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