Annex A - Non-energy uses of petroleum and gas products

Petrochemical activities are often part of Oil and Gas companies and lead to direct emissions, while at the same time petrochemical products have potential for carbon storage, whose permanence is increased with the implementation of circular economy principles (e.g. re-using or recycling).

While petrochemical companies per se are out of scope, Oil and Gas companies with petrochemical activities can account for their direct and indirect (electricity, heat, steam and cooling) emissions. However, in estimating their Indirect S3, Use of Sold Products emissions, they can opt for excluding the emissions associated with non-energy use.

This Annex explains: 1) to which products this approach should apply; 2) under what conditions this approach should apply, considering the different stages of the Oil and Gas value chains.

There are many different uses of petroleum and gas products other than for fuel. However, many of these uses entail significant energy consumption and hence significant combustion-related CO_2 emissions. There may be GHG emissions associated with other non-energy uses of petroleum products. Emissions may occur during the use or end-of-life phases. Accounting for non-energy uses is complex e.g. (Eva Krtková et al., 2019). For the purposes of setting an SBT for the Oil and Gas sector, it is an unnecessary complexity.

To simplify what is an already complex exercise, for upstream and downstream activities, the flows of petroleum products destined for non-energy uses can be deducted from total production volumes based on the approaches in Tables I.1 to I.3.

Table A.1 – Quantification methodology of non-energy uses of petrochemicals that can be deducted from Indirect/S3 Use of Sold Products emission estimations

Upstream Oil and Gas	Tier 1 (default): Use default percentages of oil and gas destined for non-energy purposes (Table A.4) and exclude these volumes from the Indirect S3, Use of Sold Products category. Tier 2: If the volumes of product that are expected to be used for non-energy purposes are known, it should consider using the guidance in tables A.2 and A.3
Midstream Oil and Gas	Tier 1: Refineries can use default percentages for volumes of product intended for non-energy use and deduct this from the volume of product from their refineries. Tier 2 (default): Refineries can attribute non-energy usages to their products or feedstocks as per Tables A.2 and A.3.

Table I.2 – Some non-energy uses of petroleum products and potential emissions associated with their use

Non-energy uses & end-of-life treatment of petroleum products	When do emissions arise and when are they "energy use" emissions?
Asphalt/ bitumen *Non-energy uses:* Road paving and other bituminous products for construction, e.g. roof shingles. End-of-life treatment: recycling, landfill.	Asphalt/bitumen are composed of heavy hydrocarbons which are known to persist in the environment (Brown et al., 2017) and undergo a slow biodegradation and release of CO_2; (McCoy et al., 2015) estimated a half-life of 108 years for their biodegradation and ultimate release as CO_2; and (IPCC, 2006, Chapter 5.4) states that "the production and use of asphalt results mainly in emissions of NMVOC, CO, SO_2 and particulate matter, while the fate of the remaining hydrocarbons are stored in the product (much less than one per cent of the carbon is emitted)." The end-of-life destination for road pavement asphalt is usually re-used in substructure (road base) and no significant energy uses are currently known (Butt, 2014). Overall, emissions from asphalt/bitumen use are negligible. As such, these flows can be discounted from Indirect/S3 Use of Sold Product emission estimations. NB: NMVOC stands for non-methane volatile organic compounds.
Lubricants *Non-energy uses:* Lubricants used in transportation and industry engines. *End-of-life treatment:* recycling, landfill, incineration or disposal.	(IPCC, 2006, Chapter 5.3) says "The use of lubricants in engines is primarily for their lubricating properties and associated emissions are therefore considered as non-combustion emissions to be reported in the IPPU Sector. However, in the case of 2-stroke engines, where the lubricant is mixed with another fuel and thus on purpose co-combusted in the engine, the emissions should be estimated and reported as part of the combustion emissions in the Energy Sector (see Volume 2)." Lubricants can also emit NMVOCs which will later be oxidized, but this is difficult to estimate. "Therefore, for calculating CO_2 emissions, the total amount of lubricants lost during their use is assumed to be fully combusted and these emissions are directly reported as CO_2 emissions" (IPCC, 2006). For the portion of lubricants remaining after use, end-of-life treatments are usually: recycling, disposal (landfill or incineration) or combusted for energy-use (e.g. co-incineration). Almost all these uses entail release of the embedded carbon in the lubricant itself with different release rates, although only the co-incineration and 2-stroke engine route would qualify as an "energy use". For simplification purposes, these flows can be deducted from Indirect/S3 Use of Sold Products emission estimations. NB: IPPU stands for Industrial Processes and Product Uses.
Waxes *Non-energy uses:* Candles, corrugated boxes, paper	According to (IPCC, 2006, Chapter 5.4) "…emissions from the use of waxes derive primarily when the waxes or derivatives of paraffins are combusted during use (e.g., candles), and when they are incinerated with or without heat recovery or in

coating, board sizing, adhesives, food production, packaging. *End- of-life treatment:* recycling, landfill, incineration or disposal.	wastewater treatment (for surfactants). In the cases of incineration and wastewater treatment the emissions should be reported in the Energy or Waste Sectors, respectively". Nevertheless, for simplification, these uses should be deducted from Indirect/ S3 Use of Sold Products emission estimations.
Naphtha, white spirit, turpentine, kerosene and others Non-energy uses: As solvent e.g. for surface coating (paint), dry cleaning; benzene and other aromatic compounds can also be used for production of resins (e.g. polystyrene), foams, fibres (nylon) and plastics (e.g. polycarbonate). End-of-life treatment: solvents are usually volatized, but unquantified amounts can also enter the waste incineration stream.	The (IPCC, 2006, Chapter 5.5) says "The use of solvents manufactured using fossil fuels as feedstocks can lead to evaporative emissions of various non-methane volatile organic compounds (NMVOC), which are subsequently further oxidised in the atmosphere. … This source category 'solvent use' is treated as a separate category because the nature of this source requires a somewhat different approach to emissions estimation than that used for calculating other emission categories." NMVOC are indirect GHGs that are not reported under current GHG corporate standards. As such, these emissions also do not need to be reported under Indirect/ S3Use of Sold Products emissions, unless they are accounted for by taking into consideration the embedded carbon in these products.[1] For the use of aromatics in other petrochemical products, see the entry on olefins.
Petroleum coke (petcoke) Non-energy uses: Low-sulphur petcoke is widely used in metals manufacturing as an anode or in iron manufacturing as a substitute for metallurgical coke. It is also used as in other industrial processes e.g. manufacturing brick, glass, paper, paint and colourings and fertilizer[2]. End-of-life treatment: not specified beyond above pathways.	Petroleum coke is a common fuel for power production and cement kilns. Fuel-grade petcoke represents approximately 80% of production worldwide[3]. Lower-sulphur petcoke is also used as a non-energy product most commonly in metal (e.g. aluminium and steel) manufacturing as an anode. This largely represents the rest of petcoke production (20%) with other uses being residual (<2%)[4]. Note that the anode gets consumed in the process and releases both CH4 and CO2, which are listed by IPCC (2006) as process emissions in the Industrial Processes and Product Use emissions category. Petcoke shall therefore be treated as 100% oxidized, irrespective of its grade. These uses cannot be deducted from Indirect/S3, Use of Sold Products emissions estimations.

[1] Similarly, during combusting NMVOCs, CH_4 and CO are released, and these are considered to be oxidized at some stage in the atmosphere and so are already accounted for as CO_2 emissions in the CO_2 emission factor by considering the carbon content of the fuel.

[2] https://www.api.org/~/media/files/news/2014/14-november/petcoke-one-pager.pdf

[3] https://www.oxbow.com/Products_Energy_Products_Petroleum_Coke.html

[4] Based on data from 2006 by R. Dickie "Calcining growth and expansion. 8° Carbon Conference – Greats Lakes Carbon, Houston, 2006", quoted in (Santos et al., 2015).

Table I.3 – Some non-energy uses of gas products and potential emissions associated with their use

Non-energy uses & end-of-life treatment of gas products	When do emissions arise and when are they "energy use"?
Olefins (ethylene, propylene) *Non-energy uses:* Feedstock/precursors for wide range of petrochemical products, notably plastics, fibres, foams, rubbers, etc. *End-of-life treatment:* recycling, landfill, incineration (olefin pollution also found in oceans).	Plastics account for about 6% of the fossil carbon extracted by the Oil and Gas industry. In recent years, the issue of plastic pollution has been rising in the public sustainability agenda. Of the 385 million tonnes of plastic produced worldwide in 2015, only 20% of the plastic waste has been recycled, 25% incinerated and 55% discarded in landfills or in the wild[5]. Most plastics do not degrade biologically in the environment. However, GHGs are emitted when plastics are incinerated. These emissions fall within the category of indirect/S3 End-of-Life Treatment of Sold Products. As such, they should be deducted from estimations of Indirect/ S3 Use of Sold Products emissions.
Ammonia *Non-energy uses:* Production of hydrogen by steam reforming for ammonia production.	Ammonia production uses natural gas or liquefied petroleum gas to produce hydrogen by steam reforming. These emissions would normally be classified as "process emissions" (non-combustion, non-energy related), but for corporate GHG accounting purposes they shall be classified as Indirect/ S3 Use of Sold Product emissions.

Default percentages of oil and gas destined for non-energy purposes

The United Nations (UN) International Recommendations for Energy Statistics (IRES) (UN, 2018) publication defines "final consumption of energy products" as

> *5.5. The final consumption of energy products consists of (a) final energy consumption, i.e. deliveries of energy products to the users located in the territory of reference for their energy needs, such as for heat raising, transportation and electricity, and (b) non-energy use, i.e. deliveries of energy products for use as chemical feedstocks or as raw materials (see para. 5.21 for details).*

further defining

> *5.21. Non-energy use consists of the use of energy products as raw materials for the manufacture of products outside the scope of SIEC, as well as for direct uses that do not involve using the products as a source of energy, nor as a transformation input. Examples are lubrication, sealing, preservation, road surfacing and use as a solvent.*

[5] https://ourworldindata.org/faq-on-plastics

These definitions are aligned with the definitions used by the SBTi guidance for the Oil and Gas sector and the exclusions of non-energy uses of Oil&Gas sector products. For the purposes of applying those exclusion, default factors can be applied to the amounts of Oil&Gas produced by the companies, on a country-by-country basis. Those factors are shown below for a selection of countries. They can be derived from the UN Energy Balance statistics (available at https://unstats.un.org/unsd/energystats/dataPortal/) for each country using the most recent year of data available.

Table A.4 - Non-energy use factors derived for a selection of countries based on UN Energy Statistics data (year 2017, source: https://unstats.un.org/unsd/energystats/dataPortal/)

Country	Total energy supply (TJ)	Non-energy use (TJ)	Non-energy use factor (%)
Brazil	12,900,284	601,447	4.7%
Canada	12,088,437	860,110	7.1%
China	123,597,543	7,641,078	6.2%
France	10,277,980	599,082	5.8%
Germany	12,998,503	970,720	7.5%
India	38,083,240	1,127,047	3.0%
Indonesia	9,958,835	401,411	4.0%
Italy	6,436,908	333,878	5.2%
Japan	18,115,730	1,471,796	8.1%
Mexico	7,622,295	211,338	2.8%
Netherlands	3,085,417	571,301	18.5%
Norway	1,235,137	103,598	8.4%
Russia	31,181,503	3,181,299	10.2%
Saudi Arabia	8,945,953	1,136,197	12.7%
South Africa	6,652,971	149,727	2.3%
Spain	1,368,070	206,202	15.1%
UK	7,352,932	310,073	4.2%
USA	90,227,874	5,990,071	6.6%
Average			***6.4%***