Greenhouse Gas Emissions Balance 2017

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I. Context and purpose

This document is the CNIM Group's response to Article 75 of Law No 2010-788 of 12 July 2010 and its Implementing Decree No 2011-829 of 11 July 2011 concerning the greenhouse gas emissions balance:

- Article 75 of Law No 2010-788 of 12 July 2010 concerning the French national commitment to the environment (ENE) adds a new section to Book II, Title II, Chapter IX of the Environment Code, entitled 'Greenhouse gas emissions balance and regional climate-energy plan'.
- In compliance with Article 75, Implementing Decree No 2011-829 of 11 July 2011 concerning the greenhouse gas emissions balance and regional climate-energy plan introduces new regulatory provisions into Articles R229-45 to R229-56 of the Environment Code, defining the ways in which the new provision should be applied.

Since 2012, the CNIM Group has drawn up an annual greenhouse gas emissions balance each year.
These balances are available on the Group's website, http://www.cnim.com, from the Corporate Social Responsibility (CSR) page.

The main aims of the Greenhouse Gas Emissions Balance (BEGES) are to:

- estimate sources and quantities of greenhouse gas emissions associated with the Group's activities in order to assess the current situation and establish a carbon indicator;
- map the emissions associated with the Group's various activities so that effective, targeted action can be taken;
- measure activities' dependence on fossil fuels and anticipate the economic and social impact of a shortage of these fuels;
- raise awareness of good practice in the industry

II. Organizational scope

The CNIM Group's greenhouse gas balance for 2017 covers emissions produced by the following companies:

- CNIM SA
- BERTIN IT
- Bertin PHARMA
- BERTIN TECHNOLOGIES
- CNIM Azerbaijan
- CNIM Babcock Maroc
- CNIM Centre France
- CNIM Energie Biomasse
- CNIM Insertion
- CNIM Ouest Armor
- CNIM Singapore
- CNIM Terre Atlantique
- CNIM Thiverval Grignon
- CNIM Transport Equipment
- ESTREE MONS Energie Biomasse
- LAB SA
- LAB WASHINGTON
- MES Environmental Ltd
- SAPHYMO GmBH
- SUNCNIM
- VECSYS

The chosen method of consolidation is the operational control approach, whereby the organization consolidates 100% of the emissions generated by plants over which it has operational control, i.e. which it runs and manages.

III. Methodology

- The Greenhouse Gas Emissions Balance (BEGES) is based on the Bilan Carbone© method.
- All greenhouse gas emissions covered by the Kyoto Protocol are converted into CO_2 equivalents (CO_2 e).
  - The Global Warming Potential (GWP) factor makes it possible to express and quantify greenhouse gas emissions in CO_2 equivalents:

$$GWP_{100\,years} = \frac{\int_0^{100\,years} RadiativeForcing_{gas}(t)dt}{\int_0^{100\,years} RadiativeForcing_{CO_2}(t)dt}$$

Table of gases regulated by the Kyoto Protocol (5th IPCC report):

Greenhouse gas	Formula	Source	GWP 100 years CO_2e
Carbon dioxide	CO_2	Combustion	1
Methane	CH_4	Decomposition	30
Nitrous oxide	N_2O	Fertilizer, industry	265
Sulfur hexafluoride	SF_6	Industry	26,100

Emissions to be included as a minimum in a compulsory greenhouse gas emissions balance are as follows:

Category	Number	Heading
SCOPE 1 Direct greenhouse gas emissions	1	Direct stationary combustion emissions
	2	Direct mobile thermal engine emissions
	3	Direct emissions from non-energy processes
	4	Direct fugitive emissions
	5	Biomass emissions (soils and forests)
SCOPE 2 Indirect emissions associated with energy	6	Indirect emissions associated with electricity consumption
	7	Indirect emissions associated with vapor, heat or cold energy consumption

Scope 3 covers, on an optional basis, the following items which may be included to obtain a more far-reaching assessment:

Category	Number	Heading
SCOPE 3 Other indirect greenhouse gas emissions	8	Energy-related emissions not included in items 1-7
	9	Purchased goods and services
	10	Capital property
	11	Waste
	12	Upstream goods transport
	13	Business travel
	14	Upstream franchising
	15	Upstream leasing assets
	16	Investments
	17	Visitor and customer transport
	18	Downstream goods transport
	19	Use of products sold
	20	End-of-life of products sold
	21	Downstream franchising
	22	Downstream leasing
	23	Commuting
	24	Other indirect emissions

To calculate emissions for each item, the Carbon Accounting (Bilan Carbone©) tool uses a set of emissions factors (ADEME's Bilan Carbone database).

- A few examples:

	Kg of CO_2e emitted by MWh LHV consumed	
Heading	**Upstream**	**Combustion**
Natural gas, France (including overseas departments and territories)	37	204
Domestic fuel, France (including overseas departments and territories)	57	272
Pure diesel, France (including overseas departments and territories)	57	273

Heading	**Kg of CO2e emitted per passenger for every 1,000 km travelled**
0-50 seater airplane, 0-1,000 km	373
180-250 seater airplane, 9,000-10,000 km	118
Average private petrol car, 1 passenger	259
Average private petrol car, 3 passengers	87
Complete train in France, TGV	4

These factors are calculated analytically, measured or estimated, with a value of uncertainty associated with each emission factor.

Specific features of the method used:

- The greenhouse gas emissions balance covers CNIM's consolidated activity for 2017 (see, in Chapter II, the list of companies included).
- The greenhouse gas emissions balance sheet 2017 covers scopes 1 and 2 (compulsory) but also takes account of emissions associated with the final waste of waste-treatment and waste-to-energy centers (optional scope 3).
- The fuel consumption of all of the Group's vehicles has been included.
- The tool used is the V8.1 spreadsheet program of the Association Bilan Carbone®.
- Acetylene is a gas used by some CNIM Group companies. It is not referenced in the Carbon Database. It has been added to the balance with the following characteristics:
  - density 1.1 kg / m^3
  - emission factor: 3.38 kg CO_2e/ kg (based on the stoichiometric reaction ratio).

IV. Greenhouse gas emissions

a) Emissions balance

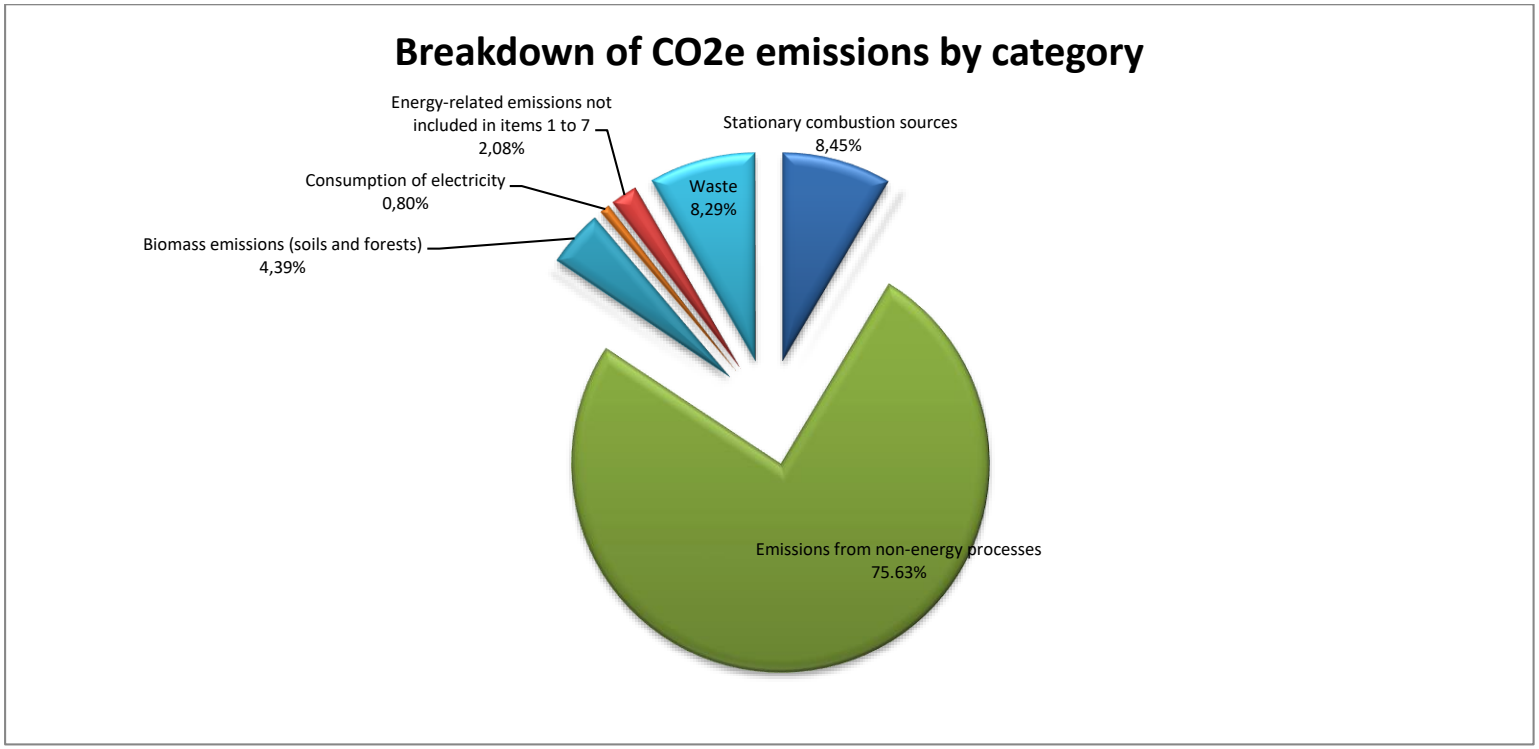
In 2017, the consolidated greenhouse gas emissions were 485,598 tCO_2e, with a 40% uncertainty.

			Values							
			Greenhouse gas emissions							Avoided
Emissions categories	**Numbers**	**Emissions headings**	CO_2 ($t\ CO_2e$)	CH_4 ($t\ CO_2e$)	N_2O ($t\ CO_2e$)	Other gases ($t\ CO_2e$)	**Total ($t\ CO_2e$)**	CO_2 b ($t\ CO_2e$)	Uncertainty ($t\ CO_2e$)	**Total ($t\ CO_2e$)**
Direct greenhouse gas emissions	1	Stationary combustion emissions	45,311	63	428	0	45,802	1,450	2,629	0
	2	Mobile emissions	997	1	9	0	1,007	195	31	0
	3	Emissions from non-energy processes	379,961	5	0	58	409,888	0	193,565	291,596
	4	Fugitive emissions	0	0	0	725	725	0	217	31,891
	5	Biomass emissions (soils and forests)	18,904	0	0	0	23,807	541,211	1,471	0
	Sub-total		**445,174**	**69**	**437**	**783**	**481,229**	**542,856**	**193,589**	**323,487**
Indirect emissions associated with energy	6	Indirect emissions associated with electricity consumption	4,334	0	0	0	4,334	0	150	0
	7	Indirect emissions associated with steam, heat or cold	35	0	0	0	35	0	8	0
	Sub-total		**4,369**	**0**	**0**	**0**	**4,369**	**0**	**150**	**0**
Other indirect greenhouse gas emissions	8	Energy-related emissions not included in items 1-7	9,150	1,801	325	0	11,276	-1,645	670	0
	9	Purchased goods and services	0	0	0	0	0	0	0	0
	10	Capital property	0	0	0	0	0	0	3	0
	11	Waste	44,596	0	339	0	44,935	18	11,213	0
	12	Upstream goods transport	0	0	0	0	0	0	0	0
	13	Business travel	157	0	0	0	157	0	0	0
	14	Upstream leasing	0	0	0	0	0	0	0	0
	15	Investments	0	0	0	0	0	0	0	0
	16	Visitor and customer transport	0	0	0	0	0	0	0	0
	17	Upstream goods transport	0	0	0	0	0	0	0	0
	18	Use of products sold	0	0	0	0	0	0	0	0
	19	End-of-life of products sold	0	0	0	0	0	0	0	0
	20	Downstream tax exemption	0	0	0	0	0	0	0	0
	21	Downstream leasing	0	0	0	0	0	0	0	0
	22	Commuting	0	0	0	0	0	0	0	0
	23	Other indirect emissions	0	0	0	0	0	0	0	0
	Sub-total		**53,903**	**1,801**	**664**	**0**	**56,368**	**-1,627**	**11,233**	**0**

Note CO2b: CO2 of organic origin (biomass and organic waste), chemically identical to fossil-origin CO2e but reported differently in the carbon account. It is classified as short-cycle carbon, unlike fossil-origin CO2.

At constant scope, the CNIM Group's greenhouse gas emissions were relatively stable in comparison to 2016. This stability may be explained by the regularity of the waste recovery activity, which alone represents 75% of the Group’s emissions.

b) Breakdown of CO2 emissions by category



Note: values of less than 0.5% are not included.

- The item 'Direct emissions from non-energy processes' represents 76% of the CNIM Group's CO_2 emissions. These emissions are related to waste-to-energy operations, which also make a very important contribution to avoided emissions.
- The item 'Waste', which accounts for 8% of the Group's CO_2 emissions, is also linked to the sorting and processing of waste.
- The other greenhouse gas emissions, amounting to approximately 15%, are due to energy consumption (gas, electricity and diesel, etc.) by vehicles and in industrial and tertiary buildings belonging to Group companies.
- "Stationary combustion emissions" rose in comparison to 2016, due to the increased consumption of non-road diesel by CNIM SA (9,932m^3 in 2017, compared with 40m^3 in 2016).

V. Emissions avoided

The Bilan Carbone® method estimates the emissions avoided by a certain activity. In the case of the CNIM Group, there are two sources of avoided emissions: the sorting and processing of waste.

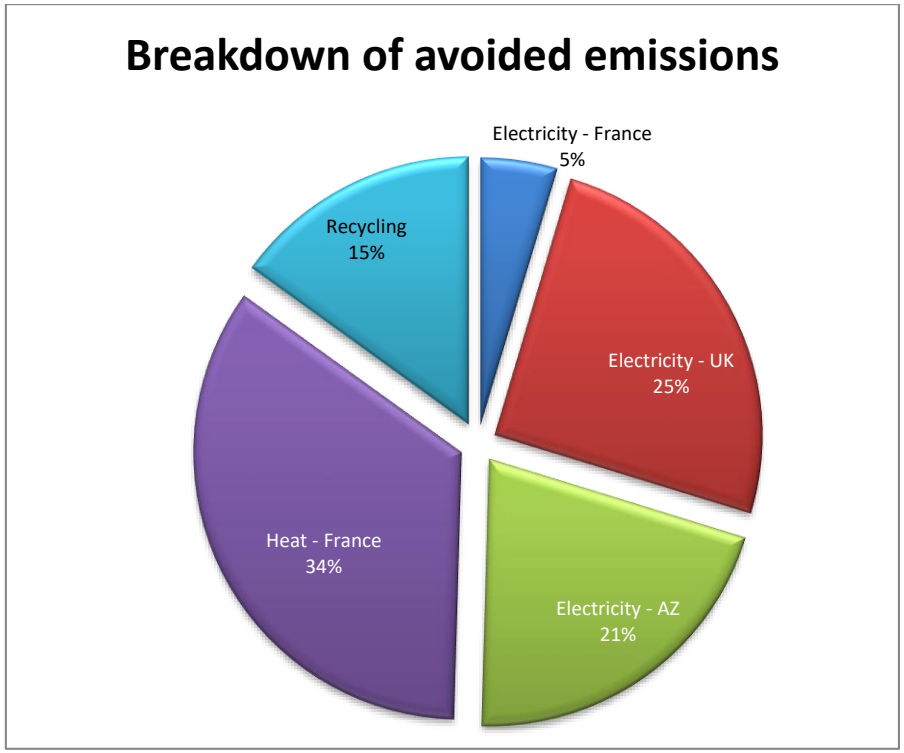
Thanks to waste-to-energy conversion and material waste processing at

- Thiverval-Grignon, Pluzunet, Launay Lantic, Saint-Pantaléon de Larche, Nesles, Estrées Mons (France),
- Wolverhampton, Stoke-on-Trent and Dudley (UK),
- and Baku (Azerbaijan),

the CNIM Group avoided emissions of 323,487 tCO_2e in 2017.

Definition of avoided emissions: emissions that would have been generated in order to produce the same quantity of energy or raw material according to conventional production methods (national energy mix).

	Item	Emission Factor	CTG CVD		CTG CDT		COA PLUZUNET		COA LANTIC		CCF		CTA		CEB NESLE		CEB ESTRE MONS		LAB Washington		MESE-Stoke-Dudley-Wolves		AZ		Total	
		kgCO_2e / MWh	MWh	t.CO_2e	MWh	t.CO_2e	MWh	t.CO_2e			MWh	t.CO_2e	MWh	t.CO_2e	MWh	t.CO2e	MWh	t.CO2e	MWh	t.CO_2e	MWh	t.CO2e	MWh	t.CO2e	MWh	t.CO_2e
Energy recovery	Electricity, France	56	22,182	1,242			10,876	609	230	13	6,249	350		0	120,697	6,759	104,352	5,844							264,586	14,817
	Electricity, UK	505		0				0				0		0		0		0			161,231	81,422			161,231	81,422
	Electricity, AZ	473		0				0				0		0		0		0					141,577	66,966	141,577	66,966
	Heat, France	279	44,103	12,305			14,094	3,932			34,744	9,694		0	225,509	62,917	81,381	22,705							399,831	111,553
	Total Energy		66,285	13,547			24,970	4,541	230	13	40,993	10,044	0	0	346,206	69,676	185,733	28,549			161,231	81,422	141,577	66,966	967,225	274,757
		kgCO_2/T																							t	t.CO_2e
Recycling of materials	Scrap iron	3,190																			2,806	8,951			2,806	8,951
	Packaging	2,380											2,542	6,050											2,542	6,050
	HDPE	1,920			421	808																			421	808
	Steel	3,190			446	1,423													4,061	12,954					446	14,377
	Aluminium	9,830			27	265																			27	265
	Glass	422			10,646	4,493			2,653	1,120			6,126	2,585											19,425	8,197
	Carboard/tetra	1,060			5,153	5,462																			5,153	5,462
	Paper	1			5,355	5																			5,355	5
	PET	3,270			1,340	4,382																			1,340	4,382
	Compost	36							6,435	232															6,435	232
	Total recycling		0	0	23,388	16,838	0	0	9,088	1,351	0	0	8,668	8,635	0	0	0	0	4,061	12,954	2,806	8,951	0	0	37,515	48,730
	Total per site			**13,547**		**16,838**		**4,541**		**1,364**		**10,044**		**8,635**		**69,676**		**28,549**		**12,954**		**90,373**		**66,966**	**323,487**	**t.CO_2e avoided**
																									Total emissions avoided	



- Emission savings have increased by +26% by comparison with 2016, thanks in particular to sales of heat by Estrées-Mons Energie Biomasse and the inclusion of new recycling activities for CNIM Ouest Armor and CNIM Terre Atlantique.

- Electricity sold in France has little effect on the Group's emissions both because of the part played by nuclear power in France's energy mix, which gives an emission factor per kWh that is ten times lower than in the UK or Azerbaijan, and because of the smaller capacity of French sites by comparison with those elsewhere.

VI. Examples of action taken to reduce greenhouse gas emissions

a) Energy consumption reduction measures

- **Energy audits**

Energy audits have been conducted in the various companies in the Group since 2015, in accordance with European Directive 2012/27/EU and the EN 16 247 standard. This measure is aimed at encouraging companies exceeding certain size or revenue thresholds to put an energy efficiency strategy in place for their businesses. Following this structured approach enables opportunities to improve energy efficiency to be identified, as well as the capital expenditure that would be required and the payback period for the investments. These audits confirmed that steps had already been under way for several years to control energy consumption at the main sites.

- **La Seyne-sur-Mer: a multi-year plan to cut consumption**

At the La Seyne-sur-Mer site, the Group's principal site, the multi-year campaign of works initiated with the objective of reducing energy consumption is continuing. The main measures undertaken in 2017 were:

- all outside outdoor sodium spotlights have now been replaced by LEDs;
- work has continued on replacing indoor lights by LEDs and replacing light switches by individual sensors: work is complete in 900m^2 of office space;
- the fitting of solar protection films to reduce use of air conditioning in summer has finished: all tertiary buildings now have the films;
- the acquisition of software enabling consumption of all fluids to be firstly monitored and then ultimately controlled for each building: one complete site now has the software, which issues alerts in the event of abnormal consumption;
- the acquisition of four electric vehicles for on-site industrial maintenance, which have replaced carbon vehicles, and the introduction of recharging terminals for these vehicles and employees' vehicles.

b) Development of services helping to reduce our customers' greenhouse gases

- **LAB wins a contract to install marine scrubbers on cruise ships**

In 2017, LAB won a contract to install marine scrubbers on three cruise ships. This contract was performed in partnership with a major company in the French ship construction industry (an engineering and installation firm). LAB is responsible for the dimensioning, technical specifications, purchasing, manufacturing control and the commissioning of the equipment. On this contract, LAB is using the DeepBlueLAB® technology, the result of 15 years of R&D. Three scrubbers have already been installed on the first ship. They will clean more than 97.1% of sulphur dioxide emissions and 90% of fine particles larger than two microns, allowing the shipping company that owns the three ships to comply with the MARPOL directive, which seeks to reduce polluting emissions by ships.

- **Helsingør Kraftvarmeværk A/S chooses a smoke treatment created by LAB for its biomass electricity plant**

In Denmark, the Helsingør thermal power plant is converting to biomass to meet the energy and environmental performance targets of Helsingør Kraftvarmeværk A/S, a major player in the utilities sector (a supplier of electricity, urban heating and water) and waste-to-energy processing in Denmark, in particular the reduction in CO2 emissions. LAB has won a contract to design, engineer, install and commission a combined smoke treatment system, namely a process of the SecoLAB® type followed by a condensation and combustion air humidification system.

- **An in-depth technical analysis with a view to converting two coal-fired urban heating boilers (operated by CPCU) to use biomass exclusively**

In 2017, CNIM Babcock Services conducted an in-depth technical analysis with a view to converting two coal-fired urban heating boilers (operated by CPCU Saint Ouen) to use biomass exclusively. In addition to this assessment, the company performed production tests. Converting to wood significantly cut NOx, sulphur and particulate emissions. As the site is located in a residential area, CNIM Babcock Services also carried out a joint study with Bertin Technologies, with the aim of abating noise and visual nuisances (including eliminating the plume) at the facility.

- **CNIM WEMS division and CNIM Ouest Armor obtain ISO 50001 certification**

In 2017, CNIM WEMS obtained ISO 50,001 certification for the factories operated through Group subsidiaries. This certification supplements the ISO 14001 and OHSAS 18001 certifications it previously obtained. In addition to demonstrating that energy aspects are prioritized in operating these plants, this certification allows CNIM's French customers to benefit from a reduction in the *Taxe Générale sur les Activités Polluantes* (General Tax on Polluting Activities). It should also be noted that, in 2017, the Pluzunet plant, operated by the subsidiary CNIM Ouest Armor (COA), obtained the ISO 50001 certification. This plant is the first CNIM plant to hold all three certifications.