Greenhouse Gas Emissions Balance 2018

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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, and inform stakeholders about the Group's sustainable development strategy.

II. Organizational scope

The CNIM Group's greenhouse gas balance for 2018 covers emissions produced by the following companies:

- CNIM SA
- BERTIN GmBH
- BERTIN IT
- BERTIN TECHNOLOGIES
- CNIM Azerbaïdjan
- CNIM Babcock Maroc
- CNIM Centre France
- CNIM MARTIN Pvt. Ltd.
- CNIM Ouest Armor
- CNIM Singapour
- CNIM Terre Atlantique
- CNIM Thiverval Grignon
- CNIM Transport Equipment
- LAB SA
- LAB WASHINGTON
- MES Environmental Ltd
- SUNCNIM

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 regularly updated set of emissions factors (ADEME's Bilan Carbone database).

- The table below shows the emission factors (EF) currently in the Bilan Carbone database that were used for the 2018 assessment:

Modified EFs	2017	2018
Electricity mix, France ($kgCO_2$ / MWh)	79	57
Electricity mix, France, excluding transport ($kgCO_2$ / MWh)	56	40
Electricity mix, UK ($kgCO_2$ / MWh)	505	457
Electricity mix, AZ ($kgCO_2$ / MWh)	473	439

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 2018 (see, in Chapter II, the list of companies included).
- The greenhouse gas emissions balance sheet 2018 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 2018, the consolidated greenhouse gas emissions were 547,489 tCO_2e, with a 39% uncertainty.

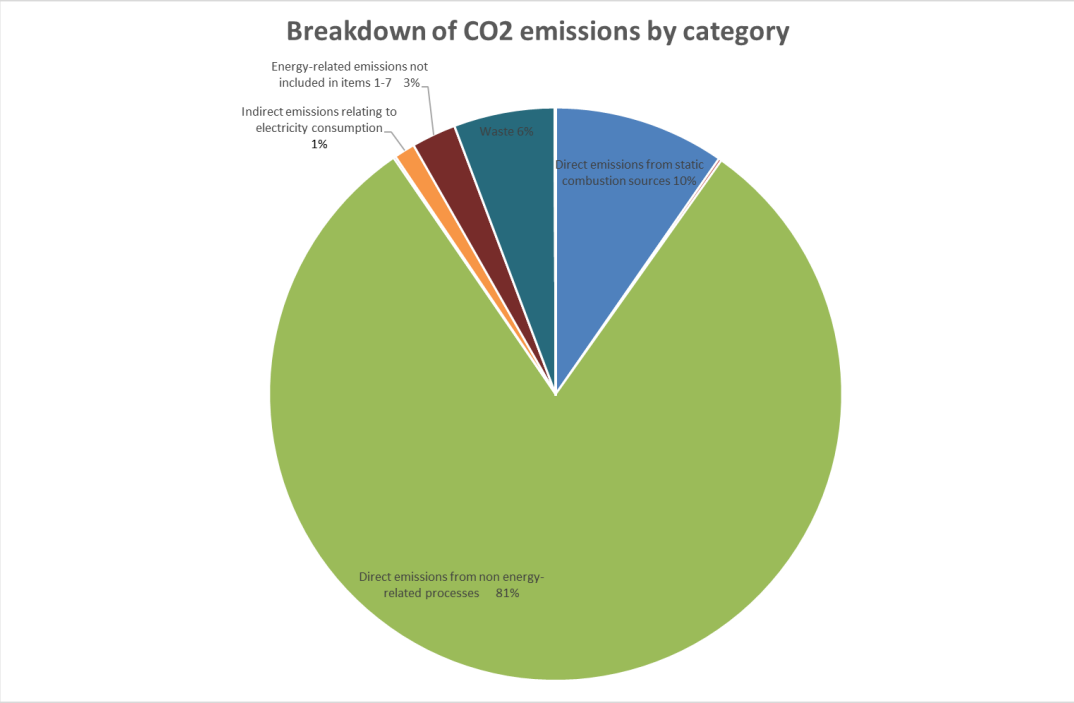
			Calculated values							
			Greenhouse gas emissions							Avoided greenhouse gas emissions
Emission categories	**Numbers**	**Emission items**	CO2 (t CO2e)	CH4 (t CO2e)	N2O (t CO2e)	Other gases (t CO2e)	**Total (t CO2e)**	CO2 b (t CO2e)	Uncertainty (t CO2e)	**Total (t CO2e)**
Direct greenhouse gas emissions	1	Direct emissions from static combustion sources	52 308	53	462	0	52 824	2 211	3 803	0
	2	Direct emissions from internal combustion-powered mobile sources	912	1	8	0	921	124	25	0
	3	Direct emissions from processes (excluding energy)	405 745	9	0	170	441 117	0	204 388	172 090
	4	Transient direct emissions	0	0	0	725	725	0	217	34 272
	5	Emissions from biomass (land and forests)	0	0	0	0	0	0	0	0
	Sub-total		**458 966**	**62**	**470**	**895**	**495 586**	**2 335**	**204 424**	**206 362**
Indirect emissions relating to energy	6	Indirect emissions relating to electricity consumption	6 450	0	0	0	6 450	0	255	0
	7	Indirect emissions relating to consumption of steam, heat or cooling	26	0	0	0	26	0	8	0
	Sub-total		**6 477**	**0**	**0**	**0**	**6 477**	**0**	**255**	**0**
Other indirect greenhouse gas emissions	8	Energy-related emissions not covered by items 1 - 7	11 589	1 666	467	0	13 722	-2 356	988	0
	9	Purchases of goods and services	0	0	0	0	0	0	0	0
	10	Fixed assets	0	0	0	0	0	0	4	0
	11	Waste	30 938	0	199	0	31 137	9	9 613	140
	12	Upstream goods transport	0	0	0	0	0	0	0	0
	13	Business travel	318	0	0	0	318	0	0	0
	14	Upstream leased assets	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	Downstream goods transport	0	0	0	0	0	0	0	0
	18	Use of sold products	0	0	0	0	0	0	0	0
	19	End-of-life management of sold products	0	0	0	0	0	0	0	0
	20	Downstream franchising	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		**42 845**	**1 666**	**665**	**0**	**45 177**	**-2 348**	**9 664**	**140**

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.

The 39% uncertainty rating is largely attributable to the significant waste incineration business, as the incineration emission factor has an uncertainty of 50%.

At constant scope, the CNIM Group's greenhouse gas emissions in 2018 were relatively stable compared to 2017 (+6%). This stability may be explained by the regularity of the waste recovery activity, which accounts for more than 74% of the Group’s emissions.

b) Breakdown of CO_2e emissions by category



- The item 'Direct emissions from non-energy processes' represents 81% 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 6% 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 14%, are due to energy consumption (gas, electricity and diesel, etc.) by vehicles and in industrial and tertiary buildings belonging to Group companies.

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

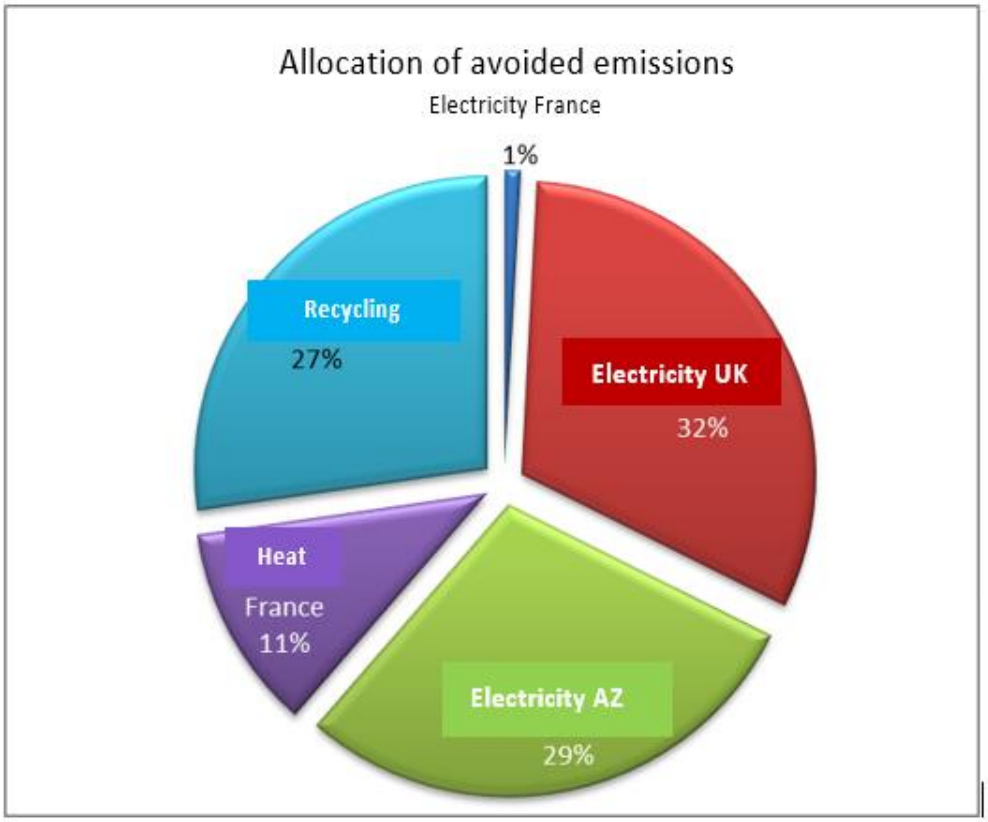
- Thiverval-Grignon, Pluzunet, Launay Lantic, Saint-Pantaléon de Larche (France),
- Wolverhampton, Stoke-on-Trent and Dudley (UK),
- and Baku (Azerbaijan),

the CNIM Group avoided emissions of 206,362 tCO_2e in 2018.

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		LAB Washington		MESE-Stoke-Dudley-Wolves		AZ		Total	
Waste-to-energy		$kgCO_2e$ / MWh	MWh	$t.CO_2e$	MWh	$t.CO_2e$	MWh	$t.CO_2e$			MWh	$t.CO_2e$	MWh	$t.CO_2e$	MWh	$t.CO_2e$	MWh	t.CO2e	MWh	t.CO2e	MWh	$t.CO_2e$
	Electricity, France	40	25,309	1,000		0	10,897	430	236	9	6,909	273		0		0		0		0	43,351	1,712
	Electricity, UK	457		0		0		0		0		0		0		0	142,512	65,128		0	142,512	65,128
	Electricity, AZ	439		0		0		0		0		0		0		0		0	136,285	59,829	136,285	59,829
	Heat, France	279	34,878	9,731		0	14,364	4,008		0	34,765	9,699		0		0		0		0	84,007	23,438
	Total energy		60,187	10,731			25,261	4,438	236	9	41,674	9,972	0	0			142,512	65,128	136,285	59,829	406,155	150,107
Material recycling		$kgCO_2/T$																			t	$t.CO_2e$
	Scrap	3,190				0		0		0		0		0		0	4,047	12,910		0	4,047	12,910
	Packaging	2,380				0		0		0		0	2,710	6,450		0		0		0	2,710	6,450
	HDPE	1,920			490	941		0		0		0		0		0		0		0	490	941
	Steel	3,190			396	1,263		0		0		0		0	5,012	15,988		0		0	5,408	17,252
	Aluminium	9,830			15	147		0		0		0		0		0		0		0	15	147
	Glass	422			10,557	4,455		0	2,796	1,180		0	6,314	2,665		0		0		0	19,667	8,299
	Card/Tetra	1,060			5,552	5,885		0		0		0		0		0		0		0	5,552	5,885
	Paper	1			4,545	5		0		0		0		0		0		0		0	4,545	5
	PET	3,270			1,237	4,045		0		0		0		0		0		0		0	1,237	4,045
	Compost	36		0		0		0	8,915	321		0		0		0		0		0	8,915	321
	Total recycling		0	0	22,792	16,741	0	0	11,711	1,501	0	0	9,024	9,114	5,012	15,988	4,047	12,910	0	0	43,671	56,255
	Total per site			**10,731**		**16,741**		**4,438**		**1,510**		**9,972**		**9,114**		**15,988**		**78,038**		**59,829**		
																					Total avoided emissions	**206,362 $t.CO_2e$ avoided**

- Nature of the 206,362 tCO_2e of emissions avoided in 2018:



- At constant scope, avoided emissions deceased slightly (-8)% year-on-year.
- Waste sorting activities accounted for 30% of avoided emissions.
- Avoided emissions represented 38% of the CO2 emissions generated by the Group.
- 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**

Where required, 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 CNIM Group sites.

- **Construction and renovation of buildings at the La Seyne sur Mer plant**

At the Group's flagship plant located in La Seyne-sur-Mer, a major investment plan entailing the construction and renovation of industrial and commercial buildings is underway. As part of this programme, energy efficiency studies are conducted for each building.

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

- **ISO 50 001 certification of waste processing and waste-to-energy sites**

The CNIM Group has set a target of obtaining ISO 50001 certification for all waste processing and waste-to-energy facilities operated by the Group by 2025.

In 2018, an additional three sites obtained this certification:

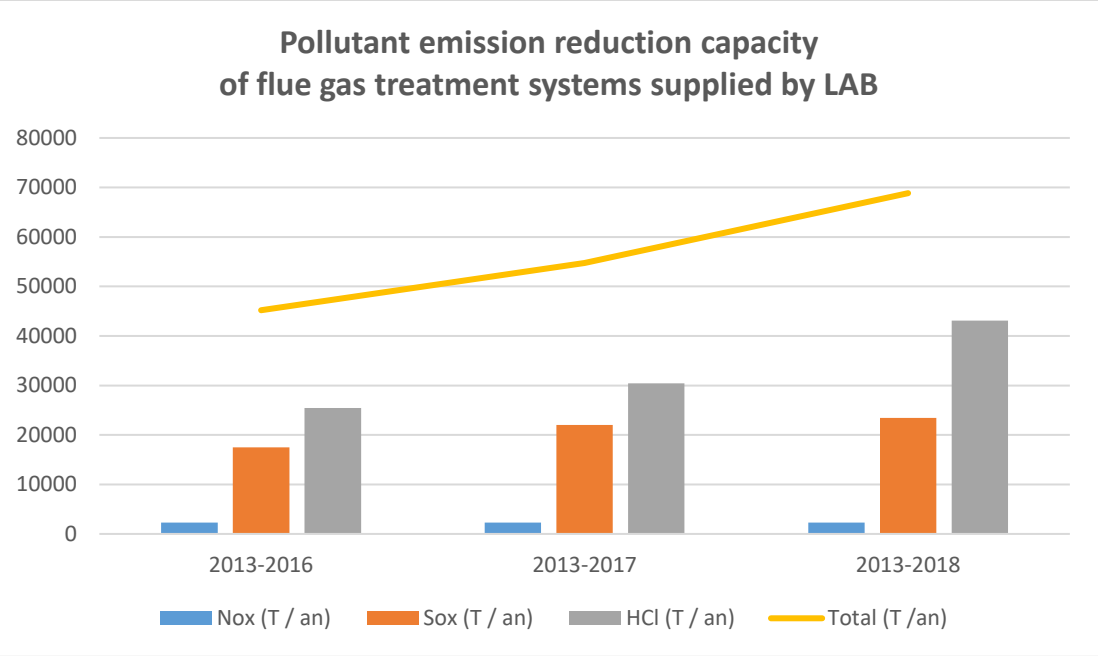
- CNIM Thiverval-Grignon,
- CNIM Centre France,
- CNIM Terre Atlantique.

Following on from CNIM Ouest Armor in 2017, all waste processing and waste-to-energy facilities operated by the Group in France are now certified.

- **Lab activities**

Lab strives to supply the most effective emissions reduction systems, featuring state-of-the-art technologies, in order to reduce the environmental impact of combustion systems. To achieve this goal, Lab designs and builds combustion gas scrubbing systems that incorporate the best available techniques (BAT), as specified by customers.

The chart below shows the combined pollutant emissions reduction capacity of the fume treatment systems delivered by Lab. Clearly, the efforts invested in terms of research and development, winning new business and in the areas of quality and environmental impacts have paid off, resulting in significantly increased reductions in our customers' atmospheric emissions. In this respect, Lab is a major contributor to improvements in our partners' environmental footprints and operating conditions.



The project carried out at the Solvay plant in Tavaux is a good illustration of Lab's achievements in 2018. For this plant, Lab built a fume treatment system featuring high-performance SecoLab technology. After commissioning the new system, pollutant emissions measurements revealed the level achieved to be lower than the contractually guaranteed target level. For example, the measured level of SOx emissions was 125 mg/Nm3, compared with a specified level of 150 mg/Nm3.

- **Modernisation of the waste-to-energy plant in Thiverval-Grignon (France)**

In late 2016, CNIM won a design-build-operate-maintain (DBOM) contract for energy efficiency works at the Thiverval-Grignon waste-to-energy plant. The project consisted in optimising the W2E plant to address the following issues:

- Increase the amount of energy recovered from the waste incineration process;
- Improve energy performance to comply with the European Union criterion R1 (Recovery One);
- Improve fume treatment on the retained existing line, by replacing the current wet-process solution with a dry-process system, eliminating the plume and decreasing Nox levels;
- Develop an educational tour of the facility.

The project was handed over on schedule, in late 2018. Compliance works for the final fume treatment line began at the end of 2018 and are scheduled for completion in late 2019.

- **SUNCNIM continues construction work at the concentrating solar power plant in Llo (France)**

In 2018, SUNCNIM continued construction work at the concentrating solar power (CSP) plant in Llo, in France's Pyrénées Orientales department. SUNCNIM will begin operating the new facility in 2019. This will be the world's first Fresnel thermodynamic solar power plant with a thermal energy storage capacity of several hours. The Llo CSP plant is designed to generate 9 MWe of electric power, equivalent to the consumption of more than 6,000 households, producing renewable energy that will be exported to France's national grid. Eco-designed using exclusively recyclable or reusable components, the facility will employ SUNCNIM's Fresnel reflector technology to recover heat energy by means of mechanically oriented mirrors that direct solar radiation onto a solar boiler known as the receiver. This thermal energy can then be stored or converted to electricity via a steam production process.