Greenhouse Gas Emissions Balance 2015

CNIM

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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 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 in 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 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 2015 covers emissions produced by the following companies:

- CNIM SA
- Babcock Wanson France
- Babcock Wanson Maroc
- Babcock Wanson UK
- Bertin Pharma
- Bertin Technologies*
- CNIM Azerbaïdjan
- CNIM Centre France
- CNIM Énergie Biomasse
- CNIM Insertion
- CNIM Ouest Armor
- CNIM Singapour
- CNIM Terre Atlantique
- CNIM Thiverval Grignon
- CNIM Transport Equipment
- LAB SA
- MES Environmental Ltd
- Vecsys

** Montigny le Bretonneux (78) site only.*

Unless otherwise indicated, all the establishments and/or sites of each of these companies have been taken into account.

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 is based on the Carbon Accounting method.
- All greenhouse gas emissions covered by the Kyoto Protocol are converted into CO_2 equivalents (CO_2e).
  - 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 and also covered by the decree of 24 August 2011:

Greenhouse gas	Formula	Source	GWP 100 years CO_2e
Carbon dioxide	CO_2	Combustion	1
Methane	CH_4	Decomposition	25
Nitrous oxide	N_2O	Fertilizer, industry	298
Sulfur hexafluoride	SF_6	Industry	22,800
Hydrofluorocarbon	HFC	Coolants, industry	124 to 14,800
Perfluorocarbon	PFC	Coolants, industry	7,390 to 12,200

**other gases may be included voluntarily.*

Emissions to be included as a minimum in a compulsory Greenhouse Gas Emissions Balance are as follows:

Category	Number	Heading
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)
Indirect emissions associated with energy	6	Indirect emissions associated with electricity consumption
	7	Indirect emissions associated with vapor, heat or cold energy consumption

The following items can be included voluntarily to obtain a more far-reaching assessment:

Category	Number	Heading
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 products
	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.

- A few examples:

Heading	Kg of CO_2e emitted by MWh LHV consumed	
	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 2015 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 the Group's vehicles has been included.
- The tool used is the V7.2 spreadsheet program of the Association Bilan Carbone® (French Carbon Accounting Association), applying emission factors from the Carbon Database, except in the case of the heating system for the town of Vélizy-Villacoublay. The emission factors applied are 326 kg CO2e/metric ton for household waste incineration, and 128 kg CO2e/metric ton for landfill.
- Acetylene is a gas used by some CNIM Group companies. It is not referenced in the Carbon Database, and has been added to the carbon account as follows:
  - density: 1.1kg/m^3 ;
  - emission factor: 3.38kgCO_2/kg (based on stoichiometric ratios).

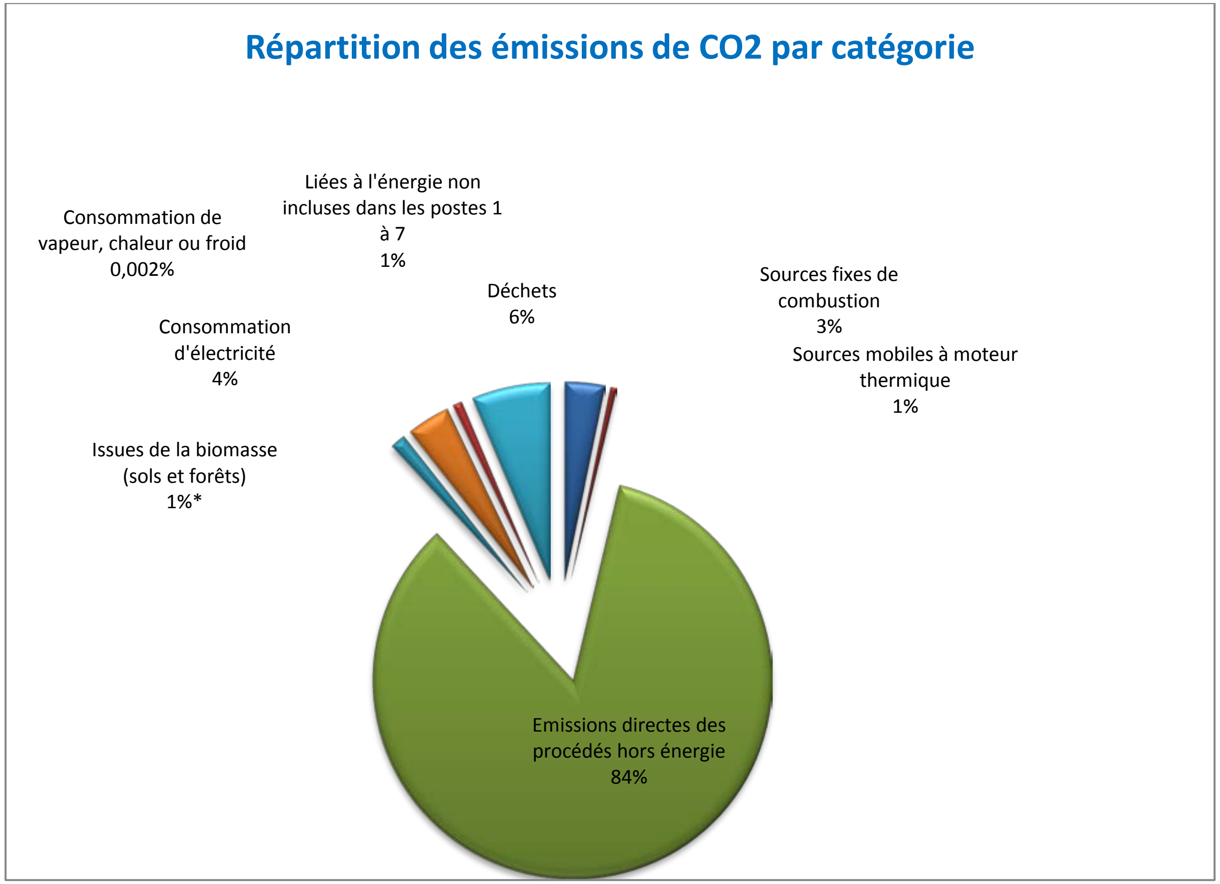
IV. Greenhouse gas emissions

a) Emissions balance

In 2015, the consolidated greenhouse gas emissions for scopes 1 and 2 were 465,594 tCO2e, with a 36% uncertainty.
On a like-for-like basis, emissions were the same as in 2014.

			Valeurs calculées							
			Emissions de GES							Emissions évitées de GES
Catégories d'émissions	**Numéros**	**Postes d'émissions**	CO2 (tonnes)	CH4 (tonnes)	N2O (tonnes)	Autres gaz (tonnes)	**Total (t CO2e)**	CO2 b (tonnes)	Incertitude (t CO2e)	**Total (t CO2e)**
Scope 1 : Emissions directes de GES	1	Emissions directes des sources fixes de combustion	15 871	1	1	0	16 089	230 296	785	0
	2	Emissions directes des sources mobiles à moteur thermique	2 498	0	0	0	2 522	110	193	0
	3	Emissions directes des procédés hors énergie	376 130	0	72	637	422 885	758 934	164 295	256 289
	4	Emissions directes fugitives	0	0	0	0	228	0	68	0
	5	Emissions issues de la biomasse (sols et forêts)	0	0	0	156	6 240	0	1 872	0
		Sous total	**394 500**	**1**	**73**	**793**	**447 964**	**989 340**	**167 214**	**256 289**
Scope 2 : Emissions indirectes associées à l'énergie	6	Emissions indirectes liées à la consommation d'électricité	0	0	0	0	17 622	0	1 637	0
	7	Emissions indirectes liées à la consommation de vapeur, chale	0	0	0	0	8	0	2	0
		Sous total	**0**	**0**	**0**	**0**	**17 630**	**0**	**1 639**	**0**
Scope 3 : Autres émissions indirectes de GES	8	Emissions liées à l'énergie non incluses dans les postes 1 à 7	2 626	31	0	0	3 798	-230 406	182	0
	9	Achats de produits ou services	0	0	0	0	0	0	0	0
	10	Immobilisations de biens	0	0	0	0	0	0	0	0
	11	Déchets	30 749	40	0	0	31 745	0	15 873	0
	12	Transport de marchandise amont	0	0	0	0	0	0	0	0
	13	Déplacements professionnels	0	0	0	0	0	0	0	0
	14	Franchise amont	0	0	0	0	0	0	0	0
	15	Actifs en leasing amont	0	0	0	0	0	0	0	0
	16	Investissements	0	0	0	0	0	0	0	0
	17	Transport des visiteurs et des clients	0	0	0	0	0	0	0	0
	18	Transport de marchandise aval	0	0	0	0	0	0	0	0
	19	Utilisation des produits vendus	0	0	0	0	0	0	0	0
	20	Fin de vie des produits vendus	0	0	0	0	0	0	0	0
	21	Franchise aval	0	0	0	0	0	0	0	0
	22	Leasing aval	0	0	0	0	0	0	0	0
	23	Déplacements domicile travail	0	0	0	0	0	0	0	0
	24	Autres émissions indirectes	0	0	0	0	0	0	0	0
		Sous total	**33 375**	**71**	**0**	**0**	**35 543**	**-230 406**	**16 054**	**0**

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



Note: the item 'Biomass emissions (soils and forests)' does not take into account the organic CO2b emitted by the CNIM Énergie Biomasse site.

- The item 'Direct emissions from non-energy processes' represents 84% 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 emission savings.
- The item 'Waste', which accounts for 6% of the Group's CO2 emissions, is also linked to the sorting and processing of waste.
- The other greenhouse gas emissions, amounting to approximately 10%, are due to energy consumption (gas, electricity and fuel) by vehicles and in buildings belonging to CNIM Group companies.

V. Emissions avoided

The Carbon Accounting method makes it possible to estimate 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:

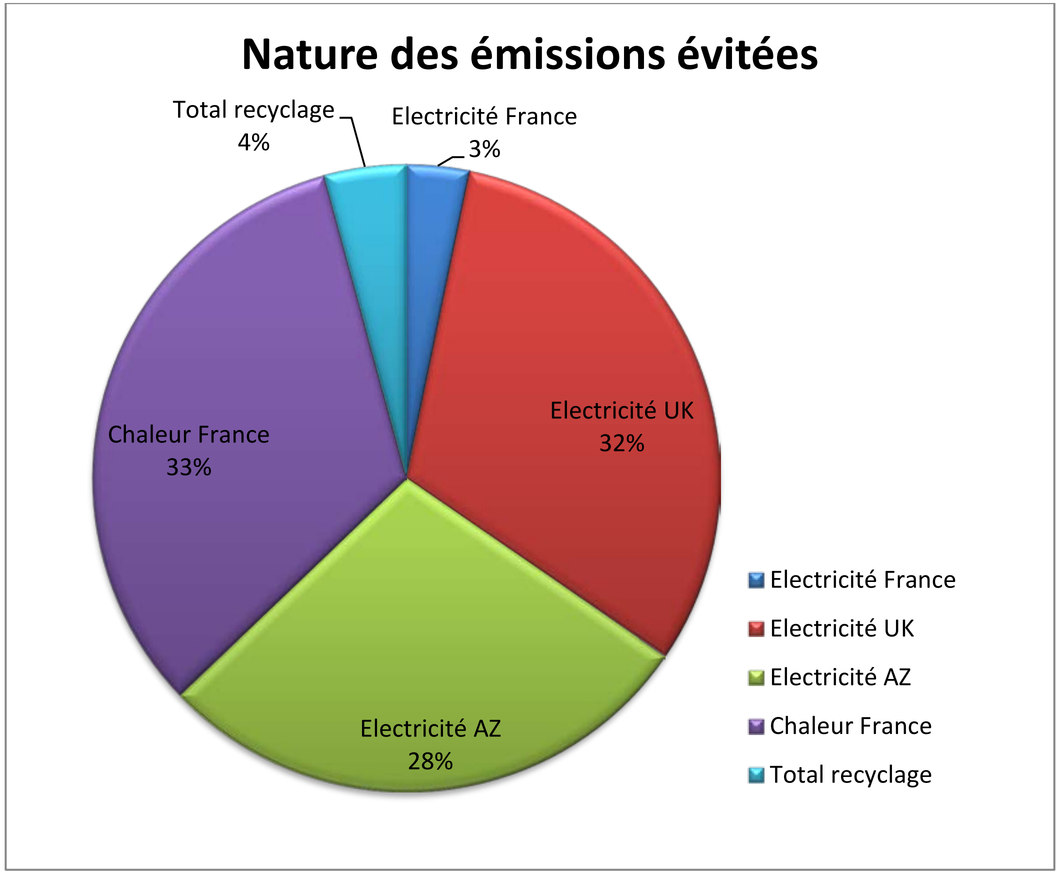
- Thiverval-Grignon, Pluzunet, Launay Lantic, Saint-Pantaléon de Larche and Nesles (France),
- Wolverhampton, Stoke-on-Trent and Dudley (UK),
- and Baku (Azerbaijan),

the CNIM Group made emission savings of 256,289 tCO_2e in 2015.

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).

	Poste	Facteur d'émission	MESE-Stoke-Dudley-Wolves		CTG		COA		CCF		CEB		BAKU		Total	
Valorisation énergétique		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.CO_2e
	Electricité France	56			22 022	1 233	8 212	460	3 729	209	113 649	6 364			147 612	8 266
	Electricité UK	505	159 209	80 401											159 209	80 401
	Electricité AZ	473											153 187	72 457	153 187	72 457
	Chaleur France	279			33 705	9 404	27 020	7 539	36 228	10 108	205 360	57 295			302 313	84 345
		Total énergie	159 209	80 401	55 727	10 637	35 232	7 998	39 957	10 316	319 009	63 660	153 187	72 457	762 321	245 470
Recyclage des matériaux		kgCO_2/T			t	t.CO_2e	t	t.CO_2e							t	t.CO_2e
	Compost	36					7 775	280								
	PET	3 061			1 317	4 031										
	PEHD	1 705			509	868										
	Acier	2 090			451	943										
	Aluminium	9 314			29	270										
	Verre	422			10 493	4 428										
		Total recyclage	-	-	12 799	10 540	7 775	280	-	-	-	-	-	-	20 574	10 820
		Total par site	**159 209**	**80 401**	**55 727**	**10 637**	**35 232**	**7 998**	**39 957**	**10 316**	**319 009**	**63 660**	**153 187**	**72 457**		

Total des émissions évitées (t.CO2e) 256 289



Emission savings have increased by 74% by comparison with 2014, mainly because of the inclusion of CNIM AZ in the consolidation area, and thanks to CNIM Énergie Biomasse, which operated throughout the year.

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. Uncertainties

Method of calculating total uncertainty: the standard method of calculating the uncertainty of a figure is to make a quadratic sum of all errors. Using this method, we obtain a total uncertainty of approximately 17%. This method takes into account the fact that uncertainties can compensate for each other. However, it only works if the values being added together are independent. In this case, as most emissions are due to the incineration of household waste (90% of the total), all these emissions depend directly on the household waste incineration factor. As these values are not independent, as in previous years the uncertainties have been added together to calculate the total uncertainty.

VII. Examples of action taken to reduce greenhouse gas emissions

a) Examples of action taken in 2015

- **Furnace conversion: contract with LyondellBasell**

In 2015, LyondellBasell, the world's third largest independent chemicals company, commissioned CNIM Babcock Services to revamp one of its furnaces at the Berre l'Étang industrial site, one of the biggest petrochemicals complexes in the south of France. The contract was for conversion from fuel oil to natural gas. The aim was not only to comply with future environmental constraints (NOx), but also to reduce the company's energy bill and greenhouse gas emissions. The objective has been achieved, with CO2 emissions reduced by 60 kt/year, SOx and NOx emissions halved and particulate emissions divided by five. The new furnace was inaugurated on 17 February 2015 in the presence of the Senator-Mayor of Berre l'Étang, and LyondellBasell took the opportunity to express its satisfaction with CNIM Babcock Services' work at the ceremony.

- **LAB marine scrubbers for three Brittany Ferries vessels**

With the European Directive to reduce sulfur emissions by vessels in ECA (Emission Control Area) zones coming into force on 1 January 2015, French boat-builder STX chose LAB's marine scrubbing technology to bring three Brittany Ferries vessels into compliance. These are the first marine scrubbers on the market to be made of composite material, which makes them lighter, easier to repair and highly competitive. The world market comprises a fleet of about 1,000 vessels that will need to be adapted to comply with the directive.

- **Energy audits for CNIM SA and Bertin Technologies**

In 2015, CNIM SA and Bertin Technologies conducted an energy audit, in compliance with European Directive 2012/27/EU and standard EN 16247. These audits confirmed that measures to control energy consumption had been in place for several years on the companies' main sites. The structured approach of an audit made it possible to identify opportunities for improvement in terms of energy efficiency, assess the investment that would be required to implement improvements, and calculate how long it would take to see a return on the investment. At the La Seyne sur mer site, potential improvements are listed in order of priority, and the list is used as a basis for the discussion of investment budgets each year.

b) Examples of action taken with a view to the future

Babcock Wanson is in the process of completing the collaborative R&D project, Demoxya (Development and Demonstration of Very Low Nitrogen Oxide Emission Burners). This 30-month research program is led by Babcock Wanson, working in partnership with Bertin Technologies and the Institut Prime (a research unit of the CNRS – French National Center for Scientific Research). Its goal is to work on various issues with the common theme of the efficiency of both gas and oil-fired domestic heating boilers. The two main objectives are:

- to improve energy efficiency by increasing boilers' modulation rate;
- to reduce nitrogen oxide (NOx) emissions from combustion systems that run on fossil fuels.

Demoxya aims to develop increasingly energy-efficient, ecofriendly solutions. The program has led to the marketing of a new boiler, Modulo +, which offers a record modulation rate (from 1 to 12) and NOx emission levels that are below the regulatory limits.