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The purpose of this report is to describe the **Abengoa Greenhouse Gas Inventory (GHG)** for the 2011 period.

The responsible persons of the present report elaboration are Fernando Martínez Salcedo, Sustainability General Secretary, and Carlos Sánchez Pérez, manager of the Corporate Control Department, in accordance with the specific requirements specified in Section 7.3 of the UNE-ISO 14064-1 Standard.

The report was verified with a reasonable level of assurance through a systematic independent process documented by Aenor.



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## General Company Information

### Identification

Abengoa is an international company that applies innovative technology solutions for sustainability in the energy and environment sectors, generating energy from the sun, producing biofuels, desalinating sea water and recycling industrial waste.

### Basic information

Our business is organized into three different activities:

#### **Engineering and construction**

Engineering and construction includes our traditional engineering activities in the energy and water sectors, with more than 70 years of experience in the market. We specialize in carrying out complex turn-key projects for solar-thermal plants, solar-gas hybrid plants, conventional generation plants, biofuels plants and water infrastructures, as well as large-scale desalination plants and transmission lines, among others.

#### **Concession-type infrastructures**

We have an extensive and young portfolio of proprietary concession assets that generate revenues that are governed by long term sales agreements with formats such as take-or-pay contracts, tariff contracts or power purchase agreements (PPAs). This activity includes the operation of electric (solar, cogeneration or wind) energy generation plants and transmission lines. These assets generate no demand risk and we focus on operating them as efficiently as possible.

#### **Industrial production**

The latter covers involving our businesses with a high technological component, such as biofuels, industrial waste recycling or the development of solar technology. The company holds an important leadership position in these activities in the geographical markets in which it operates.

### Consolidation method

Inventory consolidation is performed based on company operational control. The consolidation scope taken into account, has been included in Appendix A of this document.

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Inventory calculation methodology

Abengoa has developed an internal standard where methodologies for calculating the following sources are developed:

- **Scope 1 (Direct emissions sources):**
  - Stationary combustion sources
  - Mobile combustion sources
  - CO<sub>2</sub> emissions in metal recovery processes
  - Emissions of CO<sub>2</sub> from the bioethanol production process
  - Emissions from the composting process
  - Emissions from the decomposition of organic matter in landfills.
  - Process emissions from wastewater treatment plants
  - Fugitive emissions of natural gas
  - Fugitive emissions of HFC from refrigeration systems
  - Fugitive emissions of SF<sub>6</sub> from electrical equipment
  - Emissions of HFC/PFC from the use of solvents (not aerosols)
  - Emissions of HFC/PFC from the use of aerosols
  - Emissions of HFC/PFC from the use of foam blowing agents
  - CO<sub>2</sub> emissions derived from the use of lubricants
  - CO<sub>2</sub> emissions derived from the use of paraffinic waxes.
  - Diffuse emissions derived from the use of greenhouse gases
  
- **Scope 2 (indirect emissions)**
  - Emissions associated with generating purchased thermal energy.
  - Emissions associated with generating purchased electrical energy.
  
- **Scope 3 (other indirect emissions):**
  - Business trips.
  - Employee commuting to the workplace.
  - Indirect emissions from losses during electricity transport and distribution.
  - Indirect emissions due to the value chain of the fuels employed for the production of the electricity consumed.
  - Goods and services purchased.

Abengoa companies have excluded from their inventories those sources which imply a value less than or equal to 0,5 % of their total emissions.

Different sources have been employed as references for developing these methodologies: GHG Protocol tools, IPCC guidelines, National Inventories reports to UNFCCC, among other bibliographical information.

Most cases, the methodology used has been built on the general equation of:

**Emissions = activity data x emission factor**

Where the activity data is a representative parameter of the activity degree to which the emissions are associated with and the emission factor is made up by a statistic value or obtained by analytical data of the substances used during the activity. The most extended example is the combustion emissions calculation, where the activity data is the fuel consumption (in energy terms, for example) and the emission factor is a value obtained by stoichiometric data from the combustion reaction, expressed in emissions per energetic consumption.

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Other specific methodologies have been developed, such as:

**Emissions in metal recovery processes:** CO<sub>2</sub> emissions are calculated by a balance of matter, from the difference of carbon content in the process input flows and the carbon content in output flows. Flow rates measurements and carbon content analysis are involved in these calculations.

The emissions related to the use of biomass, which are counted separately come from the use of biomass as fuel and as a raw material in the bioethanol process.

**Biogenic CO<sub>2</sub> emissions from bioethanol production process:** Bioethanol production must be controlled, and stoichiometric relationship between ethanol and CO<sub>2</sub> production is applied for the calculations. It is supposed that per 46 kg of pure ethanol is produced; 44 kg of CO<sub>2</sub> is emitted.

**Emissions from refrigeration systems:** In this case, the amount of gas recharged due to maintenance activities is supposed to be emitted to the atmosphere.

**Business trips:** The travel expenses tools are integrated with the corporate GHG tool, allowing the automatic GHG calculation basing on the distance and transport means of each trip carried out by the staff. Emission factors employed have been taken from sources such as DEFRA, IPCC guidelines and GHG Protocol.

**Employee commuting to the workplace:** Employee surveys are launched in a yearly basis, obtaining the distances and transport means used by the staff in their displacement to/from the workplace. The emission factors used in this calculation are obtained from sources such as DEFRA, IPCC guidelines and GHG Protocol.

**Indirect emissions from losses during electricity transport and distribution:** Using the information published in statements such as the International Electricity Agency or the electric agencies of the countries where Abengoa works, ratios of the electricity grid distribution losses have been obtained. It has been assumed that the final consumption in our Companies must be increased due to these losses, so emissions are also increased.

**Indirect emissions due to the value chain of the fuels employed for the production of the electricity consumed:** Using country electricity mixes and bibliographic data related to the emissions generated during the fuels value chain, emission ratios have been estimated for the extraction, processing and transport of the fuels used for the electric energy production.

**Goods and services purchased:** Abengoa has included in all purchasing conditions the obligation for the providers to report the emission associated to the service and product there are providing, including their upstream emissions and covering at least the most important stage of the product life cycle assessment. A detailed validation of the information provided by the supplier is carried out, using life cycle analysis data bases for a wide range of products.

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## Greenhouse gases taken into consideration

The greenhouse gases taken into consideration for the inventory are those defined under the Kyoto Protocol:

- Carbon dioxide.
- Methane.
- Nitrous oxide.
- Perfluorocarbons.
- Hydrofluorocarbons.
- Sulphur hexafluoride.

## Base year

Abengoa's inventory is the result of consolidating the inventories of its companies and each one of them define their own base year depending on their characteristics and, in this way, the perimeter variations are carried out at a subsidiary company level.

## Uncertainty and base year

The uncertainty associated with the values of the emissions reported in this report is determined by the individual uncertainties of each one of the parameters employed in calculation thereof (activity data, emissions factors, and others).

Generally speaking, the activity data used in Abengoa's GHG Emissions Inventory estimation correspond to data subject to metrological control regulations, which ensures a high degree of accuracy, or are taken from the company's own meters subject to calibration and verification programs.

The emission factors used to carry out the Abengoa's GHG inventory are extracted from specific official sources for each source category. Selection of these emission factors is geared towards minimizing this uncertainty as far as possible. Unless clear evidence exists otherwise, probability density functions are assumed to follow a normal distribution.

A maximum level of relative significance has been set at 5 % with respect to the emissions total, with the exception of facilities subject to regulatory verification, in which case the level is to be set at either 2 % or 5 % in accordance with the requirements of Decision 2007/589/EC.

Abengoa has an internal system in place to estimate data reliability based on assigning quality indexes to each one of the parameters involved in emissions calculation. Based on the range of possible alternatives for determining each one of the factors involved in the methodologies for quantifying emissions, increasing quality indexes (on a decimal basis) are assigned to the most trustworthy options.

Subsequent statistical treatment of the individual quality indexes enables a single measurement of the reliability of the result to be obtained, which can in turn be compared to the value obtained for previous years, proving improvements made to the Abengoa's GHG Inventory.

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Greenhouse Gas Emissions inventory

GHG emissions

Scope 1

a) GHG emissions

GHG emissions inventory 2011			
Scope 1 emissions-Greenhouse Gases			
Non biomass emissions (t CO <sub>2</sub> -eq)		Biomass emissions (t CO <sub>2</sub> -eq)	
Mobile combustion	93,549	Mobile combustion	1,541
Stationary combustion	2,515,716	Stationary combustion	586,666
Fugitive emissions	10,704	Fugitive emissions	383
Processes	333,051	Processes	1,874,682
<b>Total</b>	<b>2,953,020</b>	<b>Total</b>	<b>2,463,272</b>

b) Emissions per GHG type

GHG emissions inventory 2011	
Scope 1 emissions -CO <sub>2</sub> *	
Total emissions (t CO <sub>2</sub> -eq)	
Mobile combustion	93,732
Stationary combustion	3,067,591
Fugitive emissions	411
Processes	2,196,720
<b>Total</b>	<b>5,358,454</b>

\*Emissions from biomass are included

GHG emissions inventory 2011	
Scope 1 emissions -CH <sub>4</sub>	
Total emissions (t CO <sub>2</sub> -eq)	
Mobile combustion	705
Stationary combustion	11,095
Fugitive emissions	5,329
Processes	10
<b>Total</b>	<b>17,139</b>

GHG emissions inventory 2011	
Scope 1 emissions -N <sub>2</sub> O	
Total emissions (t CO <sub>2</sub> -eq)	
Mobile combustion	654
Stationary combustion	23,695
Processes	11,004
<b>Total</b>	<b>35,353</b>

GHG emissions inventory 2011	
Scope 1 emissions -HFC	
Total emissions (t CO <sub>2</sub> -eq)	
Fugitive	3,099
<b>Total</b>	<b>3,099</b>

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GHG emissions inventory 2011	
Scope 1 emissions –SF <sub>6</sub>	
<b>Total emissions (t CO<sub>2</sub>-eq)</b>	
Fugitive	2,248
<b>Total</b>	<b>2,248</b>

\*Note: PFC emission sources have not been identified.

Scope 2

a) GHG emissions

GHG emissions inventory 2011	
Scope 2 emissions- Greenhouse gases	
<b>Total emissions (t CO<sub>2</sub>-eq)</b>	
Electric energy consumption	520,653
Thermal energy consumption	123,556
<b>Total</b>	<b>644,209</b>

Scope 3

a) GHG emissions

GHG emissions inventory 2011	
Scope 3 emissions- Greenhouse gases	
<b>Total emissions (t CO<sub>2</sub>-eq)</b>	
Acquired supplies	6,759,727
Business trips	14,978
Employee commuting	12,712
Electric energy distribution losses	73,962
Value chain of the fuels used to generate de energy consumed	103,329
<b>Total</b>	<b>6,964,708</b>

GHG emissions per activity segment

	Industrial production	Concession-type infrastructures	Engineering and construction	Total
Scope 1	2,499,660	408,555	44,805	<b>2,953,020</b>
Scope 2	631,075	625	12,509	<b>644,209</b>
Scope 3	5,032,684	190,415	1,741,609	<b>6,964,708</b>
<b>Total</b>	<b>8,163,419</b>	<b>599,595</b>	<b>1,798,923</b>	<b>10,561,937</b>

In addition, the emissions from biomass are:

	Industrial production	Concession-type infrastructures	Engineering and construction	Total
Biomass	2,463,104	1	167	<b>2,463,272</b>

## Verification Statement of AENOR on the Inventory of GHG 2011

**AENOR** Asociación Española de Normalización y Certificación

### Verification Statement of AENOR for ABENGOA on the Inventory of greenhouse gas emissions corresponding to the year 2011

DOSSIER: 1993J0205/VIEJ01

#### Introduction

Abengoa (hereinafter the company) commissioned the Spanish Association for Standardisation and Certification (AENOR) to make a reasonable revision of the inventory of greenhouse gases (GHG) for the year 2011 of its activities included in the GHG report of 2011, which is part of this Declaration.

Inventory of GHG emissions issued by the Organisation: Abengoa, Campus Palmas Altas c/ Energía Solar, 1- Palmas Altas 41014 Seville (Spain).

Representatives of the Organisation: Fernando Martínez Salcedo, Sustainability Secretary, and Carlos Sánchez Pérez, manager of the Corporate Control Department.

Abengoa was responsible for reporting its GHG emissions considered in accordance with the reference standard UNE-ISO 14064-1:2006.

#### Objective

The objective of the verification is to provide the interested parties with an independent and professional opinion on the information and data contained in the above mentioned GHG Report issued by Abengoa.

#### Scope of the Verification

The scope of the verification is established for the activities carried out by the companies belonging to Abengoa represented in 2011 annual report, volume II "Corporate Social Responsibility", appendix A, available in Abengoa's website (<http://www.abengoa.com>).

During the verification the information was analysed according to Operational control approach. The company reports all the GHG emissions attributable to the operations under its control.

The scope of the activities of the company is identified in accordance with the guidelines of standard UNE-ISO 14064-1:2006 in direct and indirect activities.

Direct, indirect activities and exclusions from the verification.

#### Scope 1- Direct GHG emissions

Direct emissions occur from sources that are the property of or are controlled by Abengoa. These include:

- Stationary combustion sources
- Mobile combustion sources
- CO<sub>2</sub> emissions in metal recovery processes
- Emissions of CO<sub>2</sub> from the bioethanol production process
- Emissions from the composting process
- Emissions from the decomposition of organic matter in landfills.
- Process emissions from wastewater treatment plants
- Fugitive emissions of natural gas

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### AENOR Asociación Española de Normalización y Certificación

- Fugitive emissions of HFC from refrigeration systems
- Fugitive emissions of SF6 from electrical equipment
- Emissions of HFC/PFC from the use of solvents (not aerosols)
- Emissions of HFC/PFC from the use of aerosols
- Emissions of HFC/PFC from the use of foam blowing agents
- CO<sub>2</sub> emissions derived from the use of lubricants
- CO<sub>2</sub> emissions derived from the use of paraffinic waxes.
- Diffuse emissions derived from the use of greenhouse gases

#### Scope 2 – Indirect GHG emissions

Indirect emissions are those derived from the activity but generated by other entities, including the emissions of the generation of electricity acquired and consumed by the company. These emissions are:

- Emissions associated with generating purchased thermal energy.
- Emissions associated with generating purchased electrical energy.

#### Scope 3- Other indirect emissions

The rest of the indirect emissions are a consequence of the activities of the company, but occur in sources that are not the property of the company or controlled by it. These other emissions are:

- Business trips.
- Employee commuting to the workplace.
- Indirect emissions from losses during electricity transport and distribution.
- Indirect emissions due to the value chain of the fuels employed for the production of the electricity consumed.
- Goods and services purchased.

#### Exclusions

Abengoa companies have been able to exclude from their inventories those sources which imply a value less than or equal to 0,5 % of their total emissions.

#### Greenhouse gases taken into consideration

The greenhouse gases taken into consideration for the inventory are those defined under the Kyoto Protocol:

- Carbon dioxide.
- Methane.
- Nitrous oxide.
- Perfluorocarbons.
- Hydrofluorocarbons.
- Sulphur hexafluoride.

#### Base year

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**Materiality**

For the verification it was agreed to consider as material discrepancies those omissions, distortions or errors that could be quantified and result in a difference of more than 5% with respect to the total of emissions declared.

**Criteria**

The criteria and information that have been taken into consideration to carry out the verification were the following:

- 1) Standard UNE-ISO 14064-1:2006: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.
- 2) Standard UNE-ISO 14064-3:2006: Specification with guidance for the validation and verification of greenhouse gas assertions.
- 3) Internal Standard of Abengoa NOC-05/003 "Quality and Environment Management. Sustainability Management. Greenhouse gas emissions inventory"
- 4) Technical Instructions and procedures of Abengoa companies.

Finally, the "Abengoa Greenhouse gas emissions report 2011" was subject to verification.

AENOR waives any responsibility for decisions, regarding investment or of any other type, based on this declaration.

**Conclusion**

Based on the above, in our opinion *the information on the GHG emissions reported in "Abengoa Greenhouse gas emissions report 2011" is materially correct and is a fair representation of the emissions of its activities.*

In consequence with this Declaration below is a list of the emissions data that were finally verified. The information is broken down according to two different criteria:

- I) by scope according to Standard UNE-ISO 14064-1
- II) by activity segment

  
Lead Verifier: JOSE MAGRO GONZALEZ

  
Director of New Products: D. Jaime FONTANALS RODRIGUEZ

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Greenhouse Gas Emissions inventory

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**I) Verified data broken down by scope according to Standard UNE-ISO 14064-1**

Scope 1

a) GHG emissions.

Scope 1 emissions-Greenhouse Gases			
Non biomass emissions (t CO <sub>2</sub> -eq)		Biomass emissions (t CO <sub>2</sub> -eq)	
Mobile combustion	93.549	Mobile combustion	1.541
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<b>Total</b>	<b>2.953.020</b>	<b>Total</b>	<b>2.463.272</b>

b) Emissions per GHG type.

Scope 1 emissions -CO <sub>2</sub> *	
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\* Emissions from biomass are included

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Scope 1 emissions –N <sub>2</sub> O	
Total emissions (t CO <sub>2</sub> -eq)	
Mobile combustion	654
Stationary combustion	23.695
Processes	11.004
Total	35.353

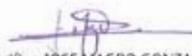
Scope 1 emissions –HFC	
Total emissions (t CO <sub>2</sub> -eq)	
Fugitive emissions	3.099
Total	3.099

Scope 1 emissions –SF <sub>6</sub>	
Total emissions (t CO <sub>2</sub> -eq)	
Fugitive emissions	2.248
Total	2.248

Note: PFC emission sources have not been identified.

Scope 2

Total emissions (t CO <sub>2</sub> -eq)	
Electric energy consumption	520.653
Thermal energy consumption	123.556
Total	644.209

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Director of New Products:  Jaime FONTANALS RODRIGUEZ

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Greenhouse Gas Emissions inventory

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Scope 3

Total emissions (t CO <sub>2</sub> -eq)	
Acquired supplies	6.759.727
Business trips	14.978
Employee commuting	12.712
Electric energy distribution losses	73.962
Value chain of the fuels used to generate de energy consumed	103.329
<b>Total</b>	<b>6.964.708</b>

**II) Verified data broken down by activity segment**

The business of Abengoa is organized into three different activities: Industrial production, Concession-type infrastructures and Engineering and construction. Below is a list of the emissions data that were verified broken down by activity segment according to the ISO 14064-1 scopes.

	Industrial production	Concession-type Infrastructures	Engineering and construction	Total
Scope 1	2.499.660	408.555	44.805	2.953.020
Scope 2	631.075	625	12.509	644.209
Scope 3	5.032.684	190.415	1.741.609	6.964.708
<b>Total</b>	<b>8.163.419</b>	<b>599.595</b>	<b>1.798.923</b>	<b>10.561.937</b>

In addition, the emissions from biomass are:

	Industrial production	Concession-type Infrastructures	Engineering and construction	Total
Biomass	2.463.104	1	167	2.463.272

Lead Verifier: JOSE MAGRO GONZALEZ

Madrid, 14 February 2012

Director of New Products: D. Jaime FONTANALS RODRIGUEZ