Tendances Carbone

The European carbon market monthly bulletin

Methodology – Version 2, January 2007

Tendances Carbone presents six groups of indicators every month:

1. Monthly summary
2. Climate
3. Economic activity
4. Energy
5. Institutional environment
6. Dashboard

This document aims at presenting the methodology for database treatment of these groups of indicators.

1. Monthly summary

- **Monthly trading volume on the European CO_2 market**

The monthly trading volume is the sum total of all the daily transaction volumes as communicated by Point Carbon on their website.

- **Price of CO_2: spot price of Powernext Carbon and ECX Future prices Dec.08**

Daily allowance trading prices and daily market transaction volumes are provided by Powernext Carbon and ECX.

2. Climate

- **European temperature index**

Powernext Weather temperature indexes are developed and distributed by Powernext and Météo France.
Powernext provides the *Powernext Weather* index[1] for the following 4 countries: France, Germany, Spain and the United Kingdom. This national business-climate index is defined as the average daily temperature of the regions making up the country, weighted by the population of these regions, which gives a good approximation of the weight of regional economic activity.

[1] The full methodology for calculating these indexes is available on the Powernext website.

This index Θ, expressed in °C, is calculated for each country as follows:

$$\theta = \frac{\sum_{i=1}^{N} p_i \times \theta_i}{\sum_{i=1}^{N} p_i}$$

With:

N : Number of regions in the country under consideration;

p_i : Population of region i;

θ_i : Average temperature of region i during the month under consideration, in °C.

The monthly index is the average of the daily Powernext Weather indices during the month.

Calculation of the **Tendances Carbone** *European temperature index*

The European temperature index is equal to the average of the national temperature indices θ, weighted by the share of each National Allocation Plan (NAP) in the total for the four countries (France, Germany, Spain and the United Kingdom).

This European temperature index is calculated as follows:

$$T = \frac{\sum_{j=1}^{4} Q_j \times \theta_j}{\sum_{j=1}^{4} Q_j}$$

With:

Q_j : Number of allowances allocated by the NAP in country j;

θ_j : National temperature index of country j.

The weighting for the period 2005-2007 is as follows:

	France	**Germany**	**United Kingdom**	**Spain**	**Total**
Number of allowances allocated by the NAP – 1st period ($MtCO_2$)	156.51	499.00	245.43	174.57	1,075.51
National share of this allocation in the total allocation of EUAs (%)	14.55%	46.40%	22.82%	16.23%	100.00%

Source: European Commission

Example:

December 2005	**France**	**Germany**	**United Kingdom**	**Spain**	**Total**
National temperature index (°C)	3.4	1.4	4.0	9.1	
Number of allowances allocated by the NAP 1st period ($MtCO_2$)	156.51	499.00	245.43	174.57	1,075.51
European temperature index (°C)	0.4947	0.6496	0.9128	1.476	**3.53**

T = (3,4 x 156,51/1 075,51) + (1.4 x 499.00/1 075.51) + (4.0 x 245.43/1 075.51) + (9.1 x 174.57)
= 3.53

- **European precipitation index**

The monthly precipitation data (national precipitation index) of the capitals of the four countries observed (Paris, London, Berlin and Madrid) are collected on the *Weatheronline* website: www.weatheronline.co.uk

For each city, two types of data are noted:
- the monthly precipitation of the given month;
- the average monthly precipitation of the given month, observed over the last ten years.

Calculation of the European precipitation index **Tendances Carbone**

The European precipitation index is defined by the average of the national precipitation indices π, weighted by the share of hydroelectricity in the total electric power production of each country.

The European precipitation index, expressed in mm, is calculated as follows:

$$P = \frac{\sum_{j=1}^{4} H_j \times \pi_j}{\sum_{j=1}^{4} H_j}$$

With:

H_j : Hydroelectricity production of country j;

π_j : National precipitation index of country j, in mm.

The weighting is as follows:

	France	Germany	United Kingdom	Spain	Total
Average annual hydroelectricity production: 1992-2003 (in GWh)	721,37	23,800	6,694	32,044	134,675
Share of national hydroelectricity in total hydroelectricity production (%)	53.56%	17.67%	4.97%	23.79%	100.00%

Source: Eurostat

Example:

December 2005	Paris	Berlin	London	Madrid	Total
National precipitation index (mm)	25.8	49.5	45.4	10.2	
Annual average hydroelectricity production: 1992-2003 (in GWh)	72,137	23,800	6,694	32,044	134,675
Share of national hydroelectricity in total hydroelectricity production (%)	53.56%	17.67%	4.97%	23.79%	100.00%
European precipitation index (mm)	13.82	8.75	2.26	2.43	**27.25**

P = (25.8 x 0.5356) + (49.5 x 0.1767) + (45.4 x 0.0497) + (10.2 x 0.2379)
= 27.25

3. Business activity

- ***European industry production index***

Each month, Eurostat publishes the production indices for all industries except construction, corrected for seasonal variations (base year: 2000). These indices are calculated for the month M-2. For example, in January 2006, Eurostat published the indices of the month of November 2005.
The "European industry production index" indicator published in Tendances Carbone corresponds to the index of production of all industries for the month M-2 for the EU of 25 and the Euro Zone.

Source:
http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136195,0_45572094&_dad=portal&_schema=PORTAL

- ***Opinion of business leaders***

The Directorate General of Economic and Financial Affairs of the European Commission publishes a report each month on the morale of industrial leaders. This index is calculated for the month M-1. For example, in the month of January 2006, the Directorate General published the indexes of the month of December 2005.
The "Opinion of business leaders" indicator, published in Tendances Carbone, corresponds to the industrial confidence index for the month M-1 for the EU of 25 and the Euro Zone.

Source: http://europa.eu.int/comm/economy_finance/indicators/businessandconsumersurveys_en.htm

4. Energy

The "Energy prices" indicators correspond to the monthly average daily closing price of each energy:

- the prices of natural gas Zeebrugge Month Ahead;
- the prices of coal CIF ARA Month Ahead;
- the prices of electricity Powernext Futures Month Ahead Base;
- the prices of electricity Powernext Futures Month Ahead Peak.

Furthermore, Climate Mission calculates two specific spread indicators based on the price of CO_2 published by Point Carbon, and the following parameters:

- Net thermal Efficiency of a conventional coal-fired plant : 40 % (Source : NEA/IEA (2005), *The Projected Costs of Generating Electricity*, p. 30) ;
- Net thermal Efficiency of a conventional gas-fired plant : 55 % (Source : NEA/IEA (2005), *The Projected Costs of Generating Electricity*, p. 29) ;
- Emissions factor (CO_2/MWh) of a conventional coal-fired plant: 0, 86 tCO_2/MWh (calculated on the base of 0.095 tCO_2 per GJ of coal (data BMU) or of 0.34 tCO2 per MWh of coal and of a net thermal efficiency of 40%);
- Emissions factor (CO_2/MWh) of a conventional gas-fired plant: 0, 36 tCO_2/MWh (calculated on the base of 0.055 tCO_2 per GJ of gas (données BMU) or of 0.198 tCO_2 per MWh of gas and a net thermal efficiency of 55%); (Source: AIE Data Services, Emissions factors UE25 2005).

Calculation of **Tendances Carbone** *spreads*

- ***Clean Dark Spread***

The Clean dark spread, expressed in €/MWh, represents the difference between the price of electricity at peak hours and the price of coal used to generate that electricity, corrected for the energy output of the coal plant.

It is calculated for each day as follows:

Clean Dark Spread = $p_{ElecBase} - \left(p_{Coal} \times \frac{1}{\rho_{Coal}} + p_{CO_2} \times FE_{Coal} \right)$

With:

$p_{ElecBasee}$: Price of electricity Powernext Futures Month Ahead Peak, in €/MWh;

p_{coal} : Price of coal CIF ARA Month Ahead, in €/MWh (€/MWh = (€/GJ)/0.27777 = ((€/t)/29.31)/0.2777);

ρ_{coal} : Net thermal Efficiency of a conventional coal-fired plant (40%);

p_{CO_2} : Price of CO_2 of Powernext carbon, in €;

$FE_{Charbon}$: CO_2 emission factor of a conventional coal-fired plant in tCO_2/MWh (0. 86).

The monthly Clean Dark Spread published in Tendances Carbone corresponds to the monthly average of daily Clean Dark Spreads.

$$CDS = \frac{1}{n} \sum_{k=1}^{n} cds_k$$

With:

cds_k : Clean Dark Spread of day k;

n: Number of days in the month.

- ***Clean Spark Spread***

The Clean Spark Spread, expressed in €/MWh, represents the difference between the price of electricity at peak hours and the price of natural gas used to generate that electricity, corrected for the energy output of the gas-fired plant.

It is calculated, for each day, as follows:

Clean Spark Spread = $p_{ElecBase} - \left(p_{Gas} \times \frac{1}{\rho_{Gas}} + p_{CO_2} \times FE_{Gas} \right)$

With:

$p_{EleElecBase}$: Price of electricity Powernext Futures Month Ahead Base, in €/MWh;

p_{Gas} : Price of natural gas Zeebrugge Month Ahead, in €/MWh (€/MWh = (€/MMBTU)/0.2931);

ρ_{Gas} : Net thermal Efficiency of a conventional gas-fired plant (55%):

p_{CO_2} : Price of CO_2 of Powernext carbon, in €;

FE_{Gas} : CO_2 emission factor of a conventional gas-fired plant, in tCO_2/MWh.

The monthly Clean Spark Spread published in Tendances Carbone corresponds to the monthly average of daily Clean spark spreads.

$$CSS = \frac{1}{n}\sum_{k=1}^{n} css_k$$

With:

css_k : Clean Dark Spread of day k

n: Number of days in the month

- ***Calculation of the CO_2 allowance price enabling the switch from coal to natural gas –* Tendances Carbone**

This indicator is the fictional daily price that establishes an equilibrium between the Clean Dark Spread and the Clean Spark Spread. It therefore represents the price of CO_2 above which it becomes advantageous in the short term for an electric power producer to switch from coal to natural gas, and below which it is advantageous to switch from natural gas to coal.

It is calculated for each day as follows:

$$\textit{Price Switch} = \frac{\cos t(gas)/MWh - \cos t(coal)/MWh}{tCO_2(coal)/MWh - tCO_2(gas)/MWh}$$

With:

Cost (gas): Production cost of one MWh of electricity on base of net CO_2 emissions of gas in €/MWh (€/MWh = (€/MMBTU)/0.2931). The value of one €/MMBTU)/0.2931 is the Zeebrugge price.

Cost (coal): Production cost of one MWh of electricity on base of net CO_2 emissions of coal in €/MWh (€/MWh = (€/GJ)/0.27777 = ((€/t)/29.31)/0.2777). The value of one €/t is the le CIF ARA Month Ahead price;

tCO_2 (coal): Emissions factor (CO_2/MWh) of a conventional coal-fired plant: 0, 86 tCO_2/MWh

tCO_2 (gas): Emissions factor (CO_2/MWh) of a conventional gas-fired plant: 0, 36 tCO_2/MWh

The price of the monthly switch price published in Tendances Carbone corresponds to the monthly average of daily switch prices.

$$P_{BasculeCO_2} = \frac{1}{n}\sum_{k=1}^{n} p_{BasculeCO_2\,k}$$

Avec:

$p_{BasculeCO_2\,k}$: Switch price of day k

n: Number of days in the month

5. Institutional environment

Indicators of the institutional environment, pertaining to national registries, CO_2 allowances, plant compliance, etc., are developed on the basis of public information communicated by the European Commission or each of the Member States. The published indicators change according to the current institutional situation of the European CO_2 market.