

# International Climate Policy & Carbon Markets

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## BI-MONTHLY REPORT

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**International Climate Policy and Carbon Markets** is a bi-monthly report aimed to provide a clear analysis of the worldwide evolution of the carbon market, and the international and domestic climate policies.

The report is drafted in four sections focused on i) international negotiations and national policies, ii) European and international energy policy, iii) flexible mechanisms and developing countries, and finally, iv) the valuation of the carbon price in the European and global market.

The information and data presented in each section are not only an update of recent events but also an extrapolation of the **quantitative implications** of recent events, based on a detailed analysis of academic papers and recently published reports (i.e. how will the carbon price be impacted by changes in the demand or supply side, etc). Every two months for each section we will briefly introduce and analyse the most important policies (proposed or

applied) and actions. Each article will include boxes, figures and graphs in order to provide in-depth examinations and data exemplifications; all papers and reports used for the analysis will be cited in the final reference section.

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## INTERNATIONAL NEGOTIATIONS AND NATIONAL POLICIES

### Carbon tax or cap-and-trade?

There are two main policy approaches aimed at mitigating the emissions of CO<sub>2</sub> and other greenhouse gases (GHGs): cap-and-trade and taxes. The key difference between the two is that cap-and-trade provides environmental certainty, since the quantity of total allowable emissions is set, whereas carbon taxes provide price certainty, since the cost of emitting a given amount of GHGs is set. Both are market-based approaches that put a price on carbon and provide an economy-wide signal to encourage emission reductions, beginning with the lowest-cost opportunities (**Box 1**).

During the last Congress in Copenhagen (10-12 March) everyone agreed on the need to cut CO<sub>2</sub> emissions, but there were different opinions on the way to reach this goal. In particular, Yale University economist William Nordhaus said that the current approach, i.e. setting a Kyoto treaty-style international goal of cutting a certain amount of emissions by a given date, would be a mistake and that it should be replaced with a global carbon tax. In particular, he stressed that "many countries are very scared of signing up to emissions reductions commitments under the Kyoto protocol because they do not know if they can achieve them and are concerned as to the consequences if they do not."<sup>1</sup>

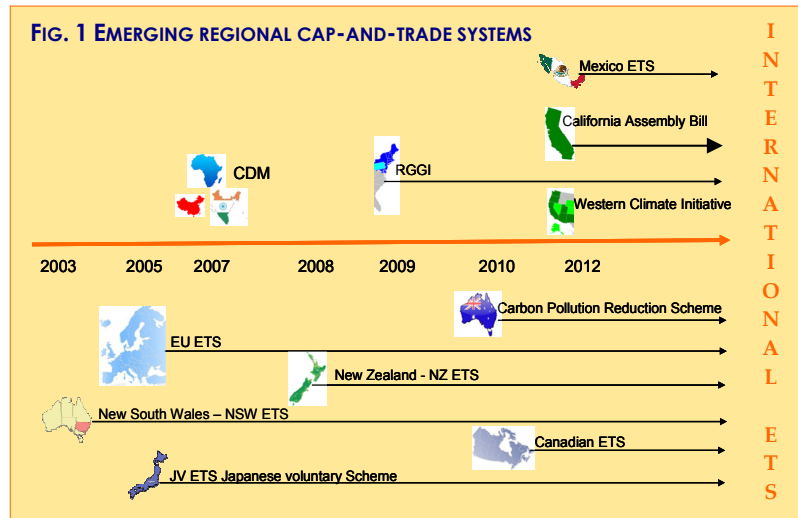
#### BOX 1 PRO AND CONS OF CARBON TAX AND CAP-AND-TRADE

	Advantage	Disadvantage
<b>Carbon tax</b>	<ul style="list-style-type: none"> <li>- provide greater certainty regarding cost</li> <li>- provide automatic temporal flexibility, which needs to be built into a cap-and-trade system through provision for banking, borrowing, and possibly a cost-containment mechanism.</li> <li>- easier to understand</li> <li>- revenue can be returned via tax cuts and/or used for public goods</li> </ul>	<ul style="list-style-type: none"> <li>- political economy forces strongly point to less severe targets if carbon taxes are used, rather than cap-and-trade</li> <li>- political pressures on carbon tax system lead to exemptions of sectors/firms, which reduces environmental effectiveness and drives up costs</li> <li>- many emitters will reduce their emissions, but others might simply accept the additional cost and continue to emit.</li> <li>- does not guarantee achievement of an emissions target</li> <li>- no uniform application across borders</li> </ul>
<b>Cap and trade</b>	<ul style="list-style-type: none"> <li>- predictable carbon emissions</li> <li>- revenue can be returned via rebates and/or used for public goods</li> <li>- revenue rises as emissions decline</li> <li>- catalyzes lowest-cost abatement</li> <li>- provides a straightforward means to harmonize with other countries' climate policies</li> <li>- markets can be linked</li> <li>- engages private sector</li> </ul>	<ul style="list-style-type: none"> <li>- price signals can be volatile and short-term depending on many market variables.</li> <li>- depending on the scope, method of allocation, and other design elements, too many permits may be issued, and other market imperfections may arise.</li> <li>- political pressures lead to different allocations of allowances, which affect only distribution, not environmental effectiveness, not cost effectiveness</li> <li>- transaction cost can be high</li> </ul>

<sup>1</sup> <http://www.guardian.co.uk/environment/2009/mar/12/carbon-tax-should-replace-kyoto-protocol>

## Architecture for future international emissions trading

One of the key messages of the three-day Congress in Copenhagen was the need for a rapid, sustained, and effective mitigation based on a coordinated global and regional action to avoid dangerous climate change. In particular,



*Global trading versus linking: Architectures for international emissions trading*, presented during the Congress, tried to figure out some plausible international emissions trading architectures after 2012. Two main approaches have been analysed: (1) **top down**, driven by the UNFCCC or a similar institution and (2) **bottom up** under which different regional systems are linked, directly or indirectly (**Box 2**). This second option could be feasible especially in view of emerging cap-and-trade systems around the world (**Fig. 1**).

**BOX 2 TOP DOWN AND BOTTOM UP APPROACHES**

	Approach	Advantage	Disadvantage
<b>Top down</b>	<b>Kyoto II</b> an international treaty establishes national emission targets for all Annex-I (and possible other) countries for specified periods. Parties receive emission allowances representing the amount they are allowed to emit which can then be traded among them	- Caps not for all countries - Enables burden-sharing across capped economies	- Impasse over burden-sharing - Market efficiency questionable - Leakage concerns
	<b>Global government cap-and-trade</b> a global trading architecture agreed upon in a Global Deal would build on the Kyoto approach	- No leakage - Enables global burden-sharing	- Impasse over global burden-sharing - Institutional requirements - Market efficiency questionable
<b>Bottom up</b>	<b>Direct link</b> emerging regional carbon markets may be formally linked to each other	- Market efficiency - No leakage among partners	- Need for regulatory coordination, no unilateral system control - Leakage
	<b>Indirect link</b> occurs if different ETS accept certificates from the same credit-generating mechanisms like CDM or JI	- No need for coordination and burden-sharing - Price convergence	- Uncertainty on price convergence - Loss of unilateral control, lack of joined market governance - Leakage - Ambitious climate policy?

## ENERGY POLICY

### US: Renewable Energy Measures signed into Law

Governments around the world have stepped up the pace of new climate change regulation over the last months, underscoring their commitment to fight global warming despite the global economic downturn. In particular, the Congress passed the American Recovery and Reinvestment Act of 2009, which President Obama has signed into law. This massive \$787 billion spending bill will drive new national strategies in renewable energy, smart grid, transmission, advanced vehicles, energy efficiency, and many other aspects of energy, environment, climate and sustainability that were at the heart of the 2008 Presidential election (**Box 3**).

#### **Box 3 MAIN FEATURES OF AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009**

Source: Acore (2009). *Overview Renewable Energy Provisions American Recovery and Reinvestment Act of 2009*

##### Tax Incentives:

- a three-year extension of the Production Tax Credit (PTC) for **electricity** derived from wind facilities placed in service by 31-12- 2012, as well as for geothermal, biomass, hydropower, landfill gas, waste-to-energy and marine facilities placed in service by 31-12- 2013.
- project developers of wind, geothermal, biomass and other technologies eligible for the PTC, the option of instead utilizing the 30% Investment Tax Credit (ITC) that previously only applied to solar and other clean technology projects.
- \$2 billion worth of **energy-related manufacturing investment** credits at a 30% rate. These credits apply to projects creating or retooling manufacturing facilities to make components used to generate renewable energy, storage systems for use in electric or hybrid-electric cars, power grid components supporting addition of renewable sources, and equipment for carbon capture and storage (CCS).

##### Direct Spending

- **\$16.8 billion** in direct spending for **renewable energy** and **energy efficiency** programs over the next ten years.
- **\$11 billion** to modernize the nation's **electricity grid** with smart grid technology.
- **\$2.5 billion** for renewable energy and energy efficiency **R&D**, demonstration and deployment activities.

##### Bond and Loan Programs

- \$1.6 billion of **new clean energy renewable bonds** to finance wind, closed-loop biomass, open-loop biomass, geothermal, small irrigation, hydropower, landfill gas, marine renewable, and trash combustion facilities.
- \$6 billion for a **temporary loan guarantee program** for renewable energy power generation and transmission projects that begin construction by September 2011. Up to \$500 million of the overall \$6 billion can be used for the development of leading edge biofuels that have been demonstrated and have commercial promise to substantially reduce greenhouse gas emissions.

The US economic stimulus package above described has recently garnered a lot of press, but it sits within a broader set of "green" economic stimulus programs around the world, some of them are described in **Box 4**.

**BOX 4 OTHER "GREEN" ECONOMIC STIMULUS PACKAGES**

Source: DB Climate Change Advisor (2009). *Global Climate Change Regulation Policy Developments: July 2008- February 2009*

Country	Green focused provision	Description
EU	European Investment Bank Funding	<p><b>€15.6 billion</b> of which:</p> <ul style="list-style-type: none"> <li>- €4 billion in low interest loans to promote the safety and environmental performance of cars</li> <li>- €1 billion to support research in green vehicles, including electric cars, and improved traffic management</li> <li>- additional €10.6 billion to other green technologies, such as energy efficiency in buildings</li> </ul>
	Trans-European Transport and Energy Networks	€5 billion for more efficient transport links across EU member states and for grid upgrades.
UK	Efficiency Measures	\$1.4 billion for better heating and energy efficiency in 76,000 low-income households, up to 20 new rail carriages, and flood defenses in 27,000 homes.
	Low-Carbon Power	\$600 million of support has been allocated to low-carbon power
France	Clean Autos	\$1.72 billion to support the transformation of the automobile sector in France, including a €1,000 tax credit for car owners who scrap their old vehicles to buy an energy efficient car.
	Infrastructure Stimulus	\$13.9 billion to infrastructure projects, including constructing four new TGV lines and accelerating energy projects
Germany	Transport Efficiency	\$11.9 billion Seeks to scale-up transportation efficiency by providing a €2,500 credit for people scrapping a car more than 9 years old and buying a new vehicle.
Italy	Energy Efficiency	\$1.2 billion to energy efficiency initiatives
Spain	Low-Carbon Power	\$800 million for low-carbon power projects
	Energy Efficiency	\$600 million to energy efficiency initiatives
China	Electricity Grid Upgrade	\$70 billion to upgrade and integrate the national electric power grid. This is in addition to a similar-sized grid upgrade program that is already underway
	Power Plant Construction	\$29 billion for power plants, including a number of nuclear plants and an east-west natural gas pipeline
	Water Conservation and Irrigation	\$2.9 billion for water conservation and irrigation projects
	Other Environmental Initiatives	\$1.78 billion will be spent on other environmental initiatives
Australia	Energy efficiency, roads, hospitals and school improvements	AUD \$3.9 billion for free ceiling insulation for 2.7 million homes and for increased climate-friendly tax credits. Under the plan, the solar hot water rebate will be increased from AUD \$1,000 to AUD \$1,600, and the low emissions plan for renters rebate will increase from \$500 to \$1,000
	Environmentally-friendly vehicles	AUD \$6.2 billion for car industry assistance to protect jobs and develop environmentally-friendly vehicles
	Transport infrastructure improvement	AUD \$4.7 billion to fund infrastructure improvements, including rail improvements to speed exports
Japan	Energy efficiency	\$11 billion to energy efficiency projects

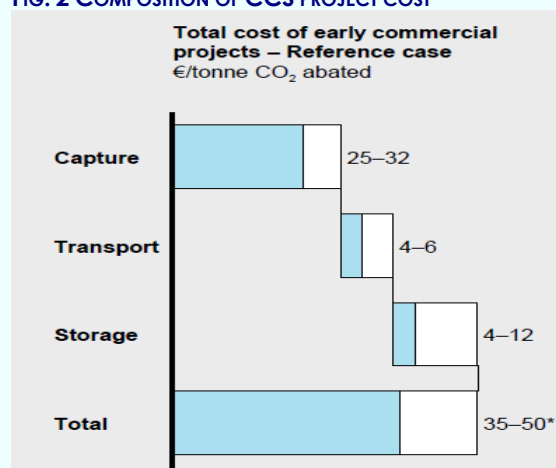
## Carbon capture and storage

Carbon capture and storage (CCS) has received increasing attention in the last few years as an important tool to efficiently fight climate change. According to the IEA "in the power and industrial sectors alone, CCS could contribute nearly one-fifth of the reductions needed to halve back greenhouse gas emissions by 2050, and this at reasonable cost."<sup>2</sup> Despite International (the G8 meeting in 2008 decided that 20 large-scale CCS demonstration projects had to be committed by 2010, with a view to broad commercial deployment in 2020) and European commitments towards implementing CCS large-scale projects (**Box 5**), the IEA finds in its *Carbon Dioxide Capture and Storage: A Key Carbon Abatement Option* that current spending in CCS is well below the potential **\$20 billions** that could be needed for near-term demonstration. In *Carbon Capture and Storage: Assessing the economics*, McKinsey calculates that CCS could contribute to about **39 billion t/CO<sub>2</sub>** reductions per year under a \$40 price of carbon, and identifies in public safety, support issues and the lack of a specific legal framework the major obstacles to the development of large-scale commercial CCS projects, whose main cost components are depicted in **Fig. 2**. Finally, the report underlines the need to provide certainty about the sources of financing of CCS.

### **BOX 5 CCS – MILESTONES IN EU POLICY**

- **January 10, 2007:** proposal on CCS introduced in Energy Package (by 2015 10-12 large demonstration plants, by 2020 all power plants should be equipped with CCS)
- **January, 2008:** Communication on CCS included in Climate and Energy package
- **April 1, 2008:** Revised environmental state aid guidelines allow EU countries to subsidize CCS
- **October, 7 2008:** EU Parliament Environment Committee backs Davis report for directive on CCS
- **December 12, 2008:** EU summit agrees to provide 300 million allowances from the Emissions Trading Scheme to subsidize the construction of CCS demonstration plants
- **December 18, 2008:** adoption of CCS Directive by the European Parliament
- **January 2009 :** in its Stimulus Package, the European Commission proposes to spend €1.25 billion on funding plants that will capture and store carbon dioxide underground
- **February 20, 2009:** funding for CCS in the Stimulus package cut by €100 millions, the original list of fund recipients Germany, Netherlands, Poland, Spain and the UK enlarged to include Italy and France

**FIG. 2 COMPOSITION OF CCS PROJECT COST**



Source: McKinsey

<sup>2</sup> [http://www.iea.org/textbase/press/pressdetail.asp?PRESS\\_REL\\_ID=272](http://www.iea.org/textbase/press/pressdetail.asp?PRESS_REL_ID=272)

### CDM, JI – state-of-the-art and call for reform as Copenhagen looms closer

This year has seen an intensifying activity at government level to shape up the positions that countries will put forward at the International climate talks taking place in Copenhagen this December. Recently, a possible phasing out of the flexible mechanisms CDM and JI has been put forward by the **European Commission**, which has proposed a sectoral approach to replace the CDM in advanced developing countries and highly competitive economic sectors under a new global climate deal. This position, which received the support of the European environmental ministers in March, has been criticized by the **International Emission Trading Association (IETA)** that has stressed the need to clarify several points before moving away from the CDM experience (**Box 6**). IETA's concerns echo the preoccupation manifested by **UN chief officer De Boer** about the reluctance of developing countries to accept sectoral mechanisms, which they regard as a back-door way of putting restrictions on their economic growth. Technical and political difficulties surround the possible CDM reform, that is nevertheless in agenda, as the recent discussions on, to name a few, the institutional reform or the expansion of project categories prove (**Box 7**.)

The CDM market has slowed down both at price and at project level in the last months; according to the **UNEP Risø Center March update**, only 75 new projects were added to the pipeline in February 2009, slightly more than 50 percent of the projects that had been added in February 2008. Accordingly, UNEP Risø has further reduced its forecast of likely carbon credit issuance from Clean Development Mechanism (CDM) projects by 2012 by 2.3%, following a 6% cut last month.

#### **Box 6 IETA'S CONCERNS ON EC PROPOSAL TO PHASE OUT CDM**

- Existing CDM projects need not to lose their financial viability that in some cases depends solely on the demand for carbon credits in the market
- transition towards the new systems needs to be clarified: sectors eligible to continuing CDM in the medium period should be listed, to provide certainty for investments
- clarifications on how the sectoral mechanisms will work and how the private sector is going to be involved are needed
- how are competitive sectors to be defined?

#### **Box 7 A REFORMED CDM**

Source: UNEP Risø Center publication *A reformed CDM*

- Need to enhance the **sustainable development component** and achieve a greater geographical **equity**
- **Institutional reform** to better achieve objectives and improve technology transfer
- **Expansion of project categories** (sustainable urban transport, energy efficiency)
- Scaling up **mitigation**

## The green investment schemes

The third Kyoto flexible mechanism is the International Emission Trading (IET) which would facilitate countries agreeing to tougher targets through the trading of Assigned Amount Units (AAUs) with each other.

However, the excessive number of AAUs allocated to former communist countries in the first round of Kyoto commitments has undermined the climate effectiveness of these units. Thus, the introduction of **Green Investment Schemes** (GIS), which aim to reinvest the revenue from the sale of surplus AAUs in projects or programs in the economies in transition (EITs) for the local, regional or global environment benefits, represented a competitive solution in order to compete with the CDM market through an environmentally credible proposal.

The development of this scheme has been extremely rapid during the past 2-3 years, progressing from initial consideration to completion of the first transactions in the Autumn of 2008 (**Box 8**).

Critics argue that increased scrutiny surrounding the environmental integrity of CDM projects, built in developing countries, makes their project-based offsets, called certified emissions reductions (CERs), a better alternative to AAUs. However, the **Box 9** below summarizes the main characteristics of GIS that distinguish them from the others and also make them a feasible option comparing to CERs.

### **Box 8 GIS PROGRESS**

**Hungary** (69-89 million AAUs surplus 2008-2012):

- pioneer national law on GIS implementation (2007)
- first to announce GIS sales (autumn 2008) □ sold 8 MtCO<sub>2e</sub> of AAUs to Belgium and Spain

**Latvia** (40 million AAUs surplus 2008-2012):

- legal framework and institutional system established
- agree to sell a total of 10 million AAUs to Austria, Japan and Netherlands

**Ukraine:**

- General legislation adopted
- First GIS deal expected soon □ Japan may purchase about 30 million AAUs

**Czech Republic:** general legislation adopted

**Romania:**

- General legislation adopted
- First GIS deal expected soon

### **Box 9 MAIN DIFFERENT FEATURES OF GIS COMPARED TO OTHER PROJECT MECHANISMS**

Source: Carbon Trust (2009). *Global Carbon Mechanisms Emerging lessons and implications*

- **FLEXIBILITY:** free from the restrictions of the project-by-project **additionality** criteria of the project mechanisms
- **TIME HORIZONS:** any unused emission allowances under the Kyoto Protocol can be **banked** forward into the Kyoto second period, post-2012.
- **UPFRONT FINANCE:** whereas CDM and JI transactions are financed against the expectation that they will generate emission credits in the future, GIS contracts involve an **immediate transfer** of AAUs that can be used by a purchasing country for compliance with its Kyoto obligations.
- **GOVERNMENT-LED:** national emission allowances **cannot be used** for compliance under the EU ETS, thus GIS deals are led by governments as part of national strategies for complying with Kyoto obligations.
- **CO-BENEFITS:** GIS projects may have a broad range of **socio-economic** and **ecological co-benefits**. For instance, improving building energy efficiency can yield many benefits beyond the value of saved energy and reduced emissions: improved health and comfort, jobs and new business opportunities, lower energy bills, and improved energy security.

### *The structure of the analysis*

This section is dedicated to the presentation of the most recent carbon price estimations both for the European carbon market, represented by the EU ETS (European Emission Trading Scheme) and for the International market. These evaluations are divided into two tables according to the time horizon. The first one (**Tab. 1**) includes the evaluations in the short term (within 2020) usually published by consultancies and focused on the EU ETS with estimations for the second phase (2008-2012) and for the third phase (2013-2020).

The second table (**Tab. 2**) presents the long-term estimations (after 2020) as calculated through economic models. For each evaluation collected we will define the source (AUTHORS) and the publication year (YEAR).

For both sub-sessions (short and long-term analysis) information will be provided on the **scenario** assumed in the models, which may be useful in order to understand the achieved results (assumptions on the policy, allowed use of flexible mechanisms, geographic area reference, etc), on the assumption on the **fossil fuel prices**, and on the **variability** observed in the group of models analysed monthly, in particular in terms of **mean** and **variance**, showed at the bottom of the tables.

For what concerns **Tab. 2**, the stabilization scenario at **450** parts per million (ppm) of CO<sub>2</sub> in the atmosphere will involve higher carbon prices compared to less ambitious stabilization scenarios such as the 550 ppm one. Taking into account that the present CO<sub>2</sub> concentration is around 380 ppm, it is easy to understand that in order to keep the concentration under a certain level such as 450 ppm (this is the level needed in order to avoid a 2°C temperature increase by the end of the century according to many authoritative sources) a strict policy with a high CO<sub>2</sub> price is required.

Finally, the **new average** and **variance** will be included in the last rows of each table below the average and the standard deviation of **previous estimations**, which are computed taking into account all estimations from previous reports, in order to reach an increasingly reliable price value.

**TAB. 1 SHORT TERM EVALUATION OF THE EU ETS ALLOWANCES PRICE**

<b>SOURCE</b>	<b>SCENARIO</b>	<b>2009-2012 II PHASE PRICE (€/TCO<sub>2</sub>)</b>	<b>2013-2020 III PHASE PRICE (€/TCO<sub>2</sub>)</b>
Daiwa (2009)	<ul style="list-style-type: none"> <li>- 6.7% contraction in 2009 EU industrial output □ lower demand of permits</li> <li>- cut cumulative phase II emission forecasts by 465 Mt to an annual average of 2,055 Mt and phase III emission forecasts by only 171 Mt</li> <li>- 2009 CER prices will trade around project development costs</li> <li>- a net short position post CER/ERU offset supply for the combined phase II and III</li> <li>- commodity price forecasts in the long term: Oil: 100 \$/bbl Coal: 96 \$/t Gas: 49 p/therm</li> </ul>	10.25 <sup>3</sup>	20.00 <sup>4</sup>
Societe Generale (2009)	<ul style="list-style-type: none"> <li>-demand for industrial products and electricity falls</li> <li>-emissions decrease</li> <li>-excess of AAU and CERS supply</li> </ul>	16.70 <sup>5</sup>	n.a.
AVERAGE OF PREVIOUS ESTIMATIONS		30.29	44.49
STANDARD DEVIATION OF PREVIOUS ESTIMATIONS		15.53	23.94
<b>NEW AVERAGE ESTIMATION</b>		<b>28.00</b>	<b>43.93</b>
<b>NEW STANDARD DEVIATION ESTIMATION</b>		<b>15.20</b>	<b>24.50</b>

<sup>3</sup> As mean value of yearly estimations: 2009: € 8.00, 2010: € 10.00, 2011: € 11.00, 2012: € 12.00.

<sup>4</sup> As mean value of yearly estimations: 2013: € 15.00, 2014: € 17.00, 2015: € 18.00, 2016: € 20.00, 2017: € 21.00, 2018: € 22.00, 2019: € 23.00, 2020: € 24.00.

<sup>5</sup> As mean value of yearly estimations: 2009: € 11.80, 2010: € 16.00, 2011: € 19.00, 2012: € 20.00.

**TAB. 2 ECONOMICS MODELS FOR THE LONG-TERM CARBON PRICE EVALUATION**

MODEL	AUTHOR	YEAR	SCENARIO	CO2 PRICE ESTIMATION (€/tCO2)			
				2020	2030	2050	2100
WITCH	Recipe	2009	<p>Global cap-and-trade stabilization target at 450 ppm CO2 by 2100, no banking under different scenarios:</p> <ul style="list-style-type: none"> <li>- <b>Immediate global action scenario:</b> all regions immediately participate in a global agreement through a contraction and converge (C&amp;C) allocation which foresees a smooth transition of emission shares from emissions in 2005 to equal per capita emissions in 2050 in order to achieve the stabilization target</li> <li>- <b>Delay in global action:</b> countries do not take on binding targets immediately but start from 2020</li> <li>- <b>EU-only:</b> EU takes a reduction target that is equal to its reduction implied by the all-2010 C&amp;C allocation rule until 2020, while the other regions continue according to BAU joining the EU in 2020</li> <li>- <b>Technology impasse:</b> there is a limit in the use of renewable energy to achieve the stabilization target</li> </ul>	16.52 0.00 0.00 14.56	58.28 7.81 5.82 66.87	376.32 603.11 579.41 652.09	1011.94 1708.02 1455.17 1323.77
FAIR	Netherlands Environmental Assessment Agency	2009	<ul style="list-style-type: none"> <li>- international trading market</li> <li>- full use of the flexible Kyoto mechanisms</li> <li>- all banked excess emission allowances during the period 2008-2012 are fully used in the period 2013- 2018</li> <li>- three scenarios for our assumptions on the aggregate <b>Annex I</b> emission reduction of <ul style="list-style-type: none"> <li>* <b>20%</b> □ long-term stabilization levels of <b>550 ppm</b> CO2eq □ non-Annex I: -10% compared to the BAU</li> <li>* <b>30%</b> □ long-term stabilization levels of <b>450 ppm</b> CO2eq □ non-Annex I: -16% compared to the BAU</li> <li>* <b>40%</b> □ long-term stabilization levels of <b>400 ppm</b> CO2eq □ non-Annex I: -22% compared to the BAU</li> </ul> </li> <li>- contraction and convergence approach, with a convergence year of 2050, under a global emission pathway for stabilization</li> </ul>	41.23 74.04 197.72	n.a.	n.a.	n.a.
AVERAGE OF MODELS ANALYSED THIS MONTH				75.71	34.70	530.24	1374.72
STANDARD DEVIATION OF MODELS ANALYSED THIS MONTH				85.89	32.39	103.98	289.69
AVERAGE OF PREVIOUS ESTIMATION Stabilization at <b>450</b> or 550 ppm				32.29 18.23	56.79 23.54	151.85 43.68	538.48 119.00
STANDARD DEVIATION OF PREVIOUS ESTIMATION Stabilization at <b>450</b> or 550 ppm				12.52 8.17	24.49 11.37	92.76 26.33	581.55 98.79
NEW AVERAGE ESTIMATION Stabilization at <b>450</b> or 550 ppm				39.84 19.19	52.37 23.54	227.52 43.98	817.23 119.00
NEW STANDARD DEVIATION Stabilization at <b>450</b> or 550 ppm				37.65 9.27	26.86 11.37	180.59 26.33	638.47 98.79

## REFERENCES

Acore (2009). *Overview Renewable Energy Provisions American Recovery and Reinvestment Act of 2009*

Carbon Trust (2009). *Global Carbon Mechanisms Emerging lessons and implications*

Christian Flachsland (2009). *Global trading versus linking: Architectures for international emissions trading*

DB Climate Change Advisor (2009). *Global Climate Change Regulation Policy Developments: July 2008- February 2009*

IEA (20 October 2008). *IEA urges a quick and global push to develop and deploy Carbon Capture and Storage (CCS) technologies*  
[http://www.iea.org/textbase/press/pressdetail.asp?PRESS\\_REL\\_ID=272](http://www.iea.org/textbase/press/pressdetail.asp?PRESS_REL_ID=272)

IETA, *Position paper on the European Commission's Communication "towards a comprehensive climate change agreement in Copenhagen" March 2009, downloadable at*  
<http://www.ieta.org/ieta/www/pages/getfile.php?docID=3255>

McKinsey, *Carbon Capture and Storage: Assessing the economic, 2008 downloadable at*  
[http://www.mckinsey.it/storage/first/uploadfile/attach/140972/file/d\\_documento\\_and\\_settings\\_cristina\\_bellini\\_desktop\\_a\\_ito\\_web\\_site\\_a\\_realizzazione\\_sito\\_area\\_idee\\_articoli\\_13\\_dicembre\\_2008\\_2\\_practice\\_news\\_ccs\\_assessing\\_the\\_economics.pdf](http://www.mckinsey.it/storage/first/uploadfile/attach/140972/file/d_documento_and_settings_cristina_bellini_desktop_a_ito_web_site_a_realizzazione_sito_area_idee_articoli_13_dicembre_2008_2_practice_news_ccs_assessing_the_economics.pdf)

Netherlands Environmental Assessment Agency(2008). *Exploring comparable post-2012 reduction efforts for Annex I countries.*

The Guardian (12 March 2009). *Replace Kyoto protocol with global carbon tax, says Yale economist*  
<http://www.guardian.co.uk/environment/2009/mar/12/carbon-tax-should-replace-kyoto-protocol>

UNEP Risoe Center, *A reformed CDM, Prospective series 2008, report presented at a side event to COP 14 in December 2008 and downloadable at*  
<http://www.cd4cdm.org/Publications/Perspectives/ReformedCDM.pdf>

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