

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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Waxman-Markey vs. EU ETS III phase

The debate on emission trading has increased in USA, where at federal level several bills have been introduced. The most significant is the **American Clean Energy and Security Act** of 2009 (ACES) which has been approved with 212 to 219 votes by the House of Representatives on Friday, June 26. This vote represent the first important step forward a comprehensive climate change legislation, the next will be the Senate vote, in which 60 votes are needed (Tab.1). The Bill, also known as **Waxman-Markey Bill**, would impose the **first federal restrictions on CO2 emissions** establishing an emission trading system and promoting investment in, and transition to, cleaner-energy technologies.

TAB. 1 THE STEPS OF THE BILL'S APPROVAL

Introduced May 15, 2009	Voted on by House June 26, 2009	Voted on by Senate Fall 2009	Considered By President	Bill becomes Law
✓	✓			

Considering that the EU and USA combined account around **60%** of total current Annex I emissions, it will be interesting to analyze the common design features of the above mentioned Bill and the European Emissions Trading Scheme III phase in the view of a future **linking** (Tab. 2).

TAB. 2 WAXMAN-MARKEY VS. EU ETS III

Design Features	American Clean Energy and Security Act Waxman-Markey Bill)	EU Emission Trading Scheme (Phase III)
Start	2012	2013-2020
Coverage	<ul style="list-style-type: none"> - 85% of total GHG emission, including electric utilities, oil companies, large industrial sources and other entities emitting more than 25,000 tCO₂e per year; - A wide range of GHGs (CO₂, N₂O, CH₄ etc.) emitted from a chemical manufacturing process at an industrial stationary source, any perfluorocarbon, nitrogen trifluoride. 	<p>Phase I and II cover only CO₂ emissions of power stations and other combustion plants, oil refineries, coke ovens, iron and steel plants and factories making cement, glass, lime, bricks, ceramics, pulp, paper and board.</p> <p>In the phase III will be included:</p> <ul style="list-style-type: none"> - CO₂ emissions from petrochemicals, ammonia and aluminium; - N₂O emissions from the production of nitric, adipic and glycolic acid production and perfluorocarbons from the aluminium sector; - the aviation sector. <p>Member States may remove installations whose reported GHG emissions were lower than 25,000 tCO₂e in each of a 3-year period under certain conditions.</p>

Design Features	American Clean Energy and Security Act Waxman-Markey Bill)	EU Emission Trading Scheme (Phase III)
Point of regulation (downstream vs. upstream)	Mixed upstream/downstream: <ul style="list-style-type: none"> – upstream coverage of fossil-based liquid fuel and GHGs producers and importers; – downstream coverage of electricity generators and large industrial sources. 	Downstream
Emissions targets	Emission reductions, below 2005 levels <ul style="list-style-type: none"> – 3 % by 2012; – 17 % by 2020 (4% below 1990 levels); – 42 % by 2030 (32% below 1990 levels); – 83 % by 2050 (80% below 1990 levels). 	Emission reduction compared to 1990 levels by 2020 <ul style="list-style-type: none"> – 20% (autonomous target); – 30% if other developed countries commit to a comprehensive agreement.
Allowance allocation	<ul style="list-style-type: none"> – 85% of allowances would be given away free at the start of the program, with the percentage decreasing over time; – 15% allowances would be auctioned at the start of the program, with the percentage increasing over time. Price collar at \$10. 	<ul style="list-style-type: none"> – Industrial installations will receive transitional free allocation; – Electricity sector auctioning rate in 2013 is to be at least 30% in relation to emissions in the first period and has to increase progressively to 100% no later than 2020; – Other sectors, allocations for free will be phased out progressively from 2013, starting at 20% auctioning in 2013, increasing to 70% auctioning in 2020 with a view to reaching 100% in 2027; – Exception are made for sectors most susceptible to carbon leakage which can demonstrate that purchasing permits significantly increases its costs (more than 5 % of its gross value added) and that it faces international competition (non-EU trade intensity above 10 %),
Banking and borrowing	<ul style="list-style-type: none"> – Unlimited banking of allowances; – Rolling two-year compliance period, effectively allowing covered entities to borrow from one year ahead without penalty; – Allowances from two to five years in the future can be borrowed under limited circumstances. 	Unlimited banking and borrowing allowed.
Penalty	Two times the auction clearly price for the earliest vintage year emission allowances in the last auction carried out per excess tCO ₂ e.	€ 100 per excess tCO ₂ (phase II) increased in accordance with the European Index of Consumer Prices from January 2013.
Use of offsets	Regulated companies would be allowed to purchase carbon offsets for up to 2 GtCO₂ of total emission reductions each year, including: <ul style="list-style-type: none"> – up to 1 GtCO₂ of international projects; – up to 1 GtCO₂ of national projects. 	Up to 3GtCO₂ of total emission reductions of the period 2008-2020.

The G8 in a crucial year

At the end of 2009 in the Copenhagen UN Conference governments of the world should be able to agree on the future of the global climate treaty making this year crucial for climate change. In this view, it seems that things are going on the right direction, even if at slow pace: for the first time the world's biggest eight industrialized economies **recognised** in the last G8 summit that the rise in average global temperature should be limited to **2°C** relative to pre-industrial levels (**Box 1**). However, a first critical point was given by the **base year** for calculating emission reductions because the declaration only stated that the reductions should be *compared to 1990 or more recent years* creating some collisions especially in the EU's internal negotiations where the EU 15 supported a 1990 while Eastern states argued for 2005.

Regardless of the base year, the 2°C seems to be a really **challenge goal**. Firstly, in order to achieve it the stabilization target has to be **450** parts per million (ppm) CO₂-e and the present concentration is around 430 ppm, secondly, developed and developing world have not already reached a **consensus** on a global action against climate change and finally current climate policies and mitigation measures defined by **developed countries** seem not enough.

BOX 1 CRUCIAL KEYS IN G8 DECLARATION (8 JULY 2009)

1. FIGHTING CLIMATE CHANGE

- the increase in global average temperature above preindustrial levels ought not to exceed **2°C**
- reducing **global** emissions reduction by **50%** and **developed** countries emissions of GHG by **80%** or more by 2050 compared to *1990 or more recent years*

2. PROMOTING THE ROLE OF MARKETS TO REDUCE EMISSIONS

- supporting efficient **carbon markets**
- considering emissions trading as one of the most cost-effective means of boosting investment in energy efficiency, renewable energy etc. complemented by other incentives such as fees and emission taxes
- eliminating or reducing tariff and non-tariff **barriers** to trade in environmental goods and services
- tackling **carbon leakage**
- exploring carbon trading schemes and their possible **linkages**
- **expanding** carbon markets to emerging and developing countries
- developing, reforming and enhancing policy-based offset **mechanisms**
- stressing the role of **sectoral approaches** in facilitating involvement of emerging economies and reinforcing mitigation policies of developed countries
- considering **international aviation** and **maritime transport** as a growing source of emissions

3. TECHNOLOGY DEVELOPMENT AND RESEARCH

- developing and deploying technologies and know-how as a crucial element both in **mitigation** and **adaptation**
- improving energy efficiency and renewable energy
- encouraging **private sector investments**
- promoting **international** participation and cooperation in R&D activities
- deploying, diffusing, transferring and demonstrating **climate friendly technologies**

4. FINANCING

- all countries, except least developed, should **participate** in the financial effort to tackle climate change
- ensuring **governance** of mechanisms disbursing funds is transparent, fair, efficient and effective
- promoting **public-private partnership** to facilitate investments in research, development, deployment and diffusion of clean technologies

5. ADAPTATION

- including effective adaptation strategies and risk assessments into **international cooperation programmes**
- assisting developing countries in integrating adaptation efforts into national development plans and policies
- addressing the need for financing adaptation through appropriate **bilateral** and **multilateral mechanisms**

Reducing emissions calls for investment in energy

In the context of the new Energy Policy, the European Commission proposed on 16 July to increase investment in energy projects focusing on three main energy sectors such as **oil** (including biofuels), **electricity** (including nuclear electricity) and **gas**, but also in related areas such as the transport and storage of carbon related to energy production.

The proposal is a complement to other EU initiatives; in particular, Europe has already earmarked **€3.98 billion** for investments in energy infrastructure within its wider economic recovery plan, in addition the Commission estimates that around **€1 trillion** will have to be spent on improving Europe's electricity network and generation capacity plus **€150 billion** on gas networks between now and 2030 to respond to climate and security of supply challenges.

The pressure on investments in energy sector has been put also by the report *Technology for a Low Carbon Future* which finds that **70%** of the global reductions needed by 2020 (**19 Gt**) can be achieved by investing in **energy efficiency** (lighting, vehicles, buildings and motors), **reducing deforestation** and using **lower-carbon energy** sources, including nuclear and renewables. In this context, seven known policies, already implemented around the world, could deliver such goal (**Box 2**).

BOX 2 POLICIES TO BE IMPLEMENTED FOR REDUCTIONS DELIVERING BY 2020:

1. **RENEWABLE ENERGY STANDARDS** → Regulation to require or feed-in tariffs to stimulate an increased production of energy from **renewable sources**, in particular wind and solar, could deliver **2.1 Gt** of savings
2. **INDUSTRY EFFICIENCY** → Improved **motors** and other efficiency gains could deliver **2.4Gt** of savings
3. **BUILDING CODES** → Improving **standards** for new buildings and modernising existing building stock could save **1.3 Gt**
4. **VEHICLE EFFICIENCY STANDARDS** → Driving up standards for **vehicle efficiency** could save **0.4 Gt**
5. **FUEL CARBON CONTENT STANDARDS** → Reducing the carbon content of **fuels** could lead to **0.3 Gt** of savings
6. **APPLIANCE STANDARDS** → Increasing the **energy efficiency** of white goods and other appliances could reduce emissions by **0.3 Gt**.
7. **POLICIES TO REDUCE EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION (REDD)** → deliver close to **9 Gt** of reductions.

Scaling technology up to the needed level would required an **annual average investment** of approximately **\$1 trillion** between now and **2050** at global level. Such amount represents, according to the report, only a re-distribution of investment displace on high-carbon alternatives in the business as usual scenario; hence, implying only a small incremental cost of additional investment. In particular, global incremental cost of **additional investment** would be of approximately **€317 billion** annually in **2015**, rising to **€811 billion** in **2030** for an oil price of \$60 per barrel.

Nuclear energy: the EU at the forefront in nuclear safety

Nuclear energy currently provides about **15%** of the **electricity** consumed in the world, about a **third** of the **electricity** and **15%** of the **energy** used in the **European Union**.

The development of this technology dates back to the **1930s**, and was initially developed during the 1940s with warlike ends. Nuclear technology focused on power generation already in the 1950s, with the first major commercial nuclear power plant opening in England in 1956 with an installed capacity of 50 MW. A lot of **progress** has been made since then, with modern plants able to generate as much as 200 MW.

Producing nuclear energy is a basically **carbon-free option** that is gaining increasing attention in the energy choices of the world players especially in light of climate change and energy security reasons. The European Union currently hosts the largest number of power plants across the world, with each Member State entitled to decide whether or not to pursue the nuclear option (**Box 3**).

BOX 3 NUCLEAR POWER AROUND THE GLOBE		
Country	Nuclear plants	Share of energy from nuclear plants
USA	100 nuclear reactors	20% of electricity consumption
France	59 reactors, total capacity over 3 GW	75% of electricity consumption, largest electricity exporter
Italy	None operating, only G8 country without nuclear power plants	10% all imported
UK	19 reactors, all but one to be retired in 2023, with new-generation ones in 2017	About 20% of electricity consumption

Source: *World nuclear association*

Despite the issue of nuclear proliferation, the choice to invest in nuclear technology faces several **safety concerns**, including safety of the power plants and management and disposal of radioactive wastes. The international body overseeing cooperation and development of safe nuclear technology is the **International Atomic Energy Association**, (IAEA), an institution independent from the United Nations created in 1957, whose work focuses on three main areas: **(i)** Safety and Security; **(ii)** Science and Technology; and **(iii)** Safeguards and Verification. Thanks to the considerable work by Governments, national nuclear safety authorities and the IAEA a Convention on Nuclear Safety was adopted in Vienna on 17 June 1994, with the aim to legally commit participating States to maintain a high level of safety of their operating land-based nuclear power plants by setting international benchmarks. The IAEA produces and updates the Fundamental Safety Principles that have been recently endorsed by a

formal position of the **European Union**. In particular, in late June the Council of the European Union adopted **Directive on nuclear safety**, which provides binding legal force to those standards and to the obligations resulting from the Convention on Nuclear Safety (**Box 4**).

BOX 4 EU NUCLEAR SAFETY DIRECTIVE

OBJECTIVES

- ✓ to establish a Community framework in order to maintain and promote the continuous improvement of nuclear safety and its regulation;
- ✓ to ensure that Member States shall provide for appropriate national arrangements for a high level of nuclear safety to protect workers and the general public against the dangers arising from ionizing radiations from nuclear installations.

SCOPE

- ✓ the Directive applies to all civilian nuclear installations in the European Union and does not forbid Member States to put in place more stringent safety measures.

OBLIGATIONS

- ✓ Member States have to establish and maintain a **national legislative, regulatory and organizational framework for nuclear safety of nuclear installations** that allocates responsibilities such as adoption of national nuclear safety requirements, provision of a system of licensing and prohibition of operation of nuclear installations without a license, provision of a system of nuclear safety supervision and enforcement actions like suspension of operation and modification or revocation of a license;
- ✓ operating experience, insights gained from safety analyses for operating nuclear installations, development of technology and results of safety research are to be used by Member States to improve the national frameworks for nuclear safety;
- ✓ Member States have to establish a **competent regulatory authority** in the field of nuclear safety of nuclear installations that is separate from any other body or organization concerned with the promotion, or utilization of nuclear energy. Such authority is to be given legal and human resources to verify compliance with nuclear safety requirement, through assessments or inspections;
- ✓ Member States ensure that the **responsibility of nuclear safety** rests with the **holder of the license**, whom the national regulatory framework must require to regularly assess and verify the safety of the installations implement management systems which give due priority to nuclear safety;
- ✓ Member States must ensure that appropriate **education and training** is provided to the staff dealing with nuclear safety, that appropriate **information** is made available to the general public and that **reports** are presented to the Commission for the implementation of the Directive every three years.

The nuclear safety directive builds on a consistent framing legislative framework in the EU, which had already established a European Atomic Energy Association in 1957 (**Box 5**).

BOX 5 NUCLEAR ENERGY IN EUROPE

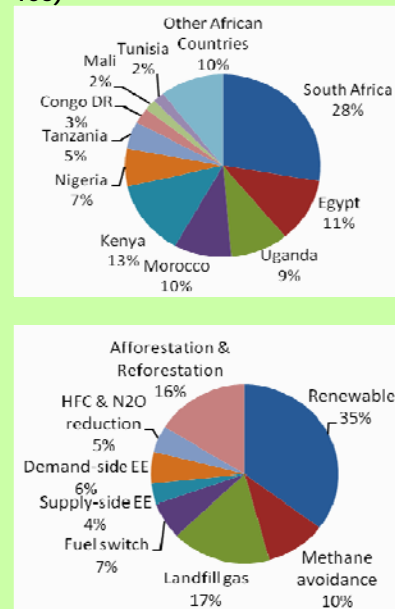
- **July 1952**, establishment of the European Coal and Steel Community
- **March 1957**, Second treaties of Rome established a European Atomic Energy Community (Euratom) entered into force on **January 1958**
- **March 2007**: review of the Euratom Treaty by the European Commission ends with positive assessment of its activities, particularly in the areas of research, health protection, monitoring of the peaceful use of nuclear material, and international relations.
- **December 2007**: minor changes in the institutional and financial fields to the Euratom Treaty via the "Protocol No 12 amending the Treaty establishing the European Atomic Energy Community", included in the Treaty amending the EU and EC Treaties.
- **June 2009**, adoption of the EU Nuclear Safety Directive

Reforming CDM for African countries

The Clean Developed Mechanism (CDM) is having a relevant role in achieving the Kyoto targets as well as in creating a dynamic carbon market. Since the Kyoto Protocol entered in force, the total amount of CDM projects increased very quickly: currently more than **4200** projects are in the pipeline, of which 1727 registered and other 66 in the registration process while the total of expected Certified Emission Reductions (CERs) is more than 2.9 billion tCO₂ until the end of 2012. However, the **geographical distribution** of these projects is very **unequal**. As underlined by some developing countries in the last Talks in Bonn, **Africa** is lagging behind in CDM projects, hosting indeed only **105** projects, less than **2.5%** of the total. In comparison almost 78% are in Asia and Pacific area.

According to the pipeline June 2009 (**Fig.1**) also projects distribution inside the continent are not well-shared from

FIG. 1 GEOGRAPHICAL AND TECHNOLOGICAL DISTRIBUTION CDM IN AFRICA PER NUMBER OF PROJECTS (N= 105)



Source: UNEPCDM Pipeline (June 2009)

BOX 6 POTENTIAL REFORMS TO STIMULATE AFRICA'S PARTICIPATION IN CDM

- to make sustainable development an indicator for CDM;
- to improve communication strategy, including local committees;
- to strengthen the institutional framework and the performance system;
- to deliver the objectives of the Nairobi Framework:
 - to build and enhance the capacity of Designated National Authorities (DNA) to become fully operational;
 - to build capacity in developing CDM project activities;
 - to promote investment opportunities for project;
 - to improve information sharing;
 - to promote inter-agency coordination.

Source: Lesolle (2008).

both a geographical and technological prospective, with **South Africa, Kenya** and **Egypt** hosting more than **50%** of the total projects while for sectors emerge **renewable energies, landfill gas** and **forestry**. These percentages are slightly different considering the amount of CERs issued.

In most cases, the lack of CDM activity in African countries is closely related to the **inadequacy** of local institutions and the **lack** of experts and financial resources to support the process. In addition, Africa contributes **less than 4%** to global GHG emissions. Based on the above assessment, UNFCCC African delegates are asking for a reformed CDM to ensure the involvement of their countries in the view of next Copenhagen Conference (**Box 6**).

Gone "green" with the wind: another Chinese supremacy?

As one of the fastest-growing economies of the world, second-biggest energy consumer and top greenhouse gas emitter, China's position over a follow-up to the Kyoto Protocol is going to be crucial for the success of an international agreement, both for what concerns actual emissions and as an example among other developing countries. If China is still rejecting to take up any formal commitments as regards emission cuts, it is far more active in what looks like one of the more prominent renewable energy market: the wind energy market (**Box 7**).

Box 7 CHINA WIND POWER TARGET UPDATES

- The National Development and Reform Commission defines the pace of wind energy in the country, setting a series of targets for installed capacity: **10 GW in 2010 and 30 GW in 2020**
- China more than doubles wind power capacity, installing 4.66GW of additional capacity reaching **over 12 GW** in installed capacity, beating the target set in 2007 two years earlier than required.
- A senior energy official announces that China will have 100GW installed wind power in 2020, a threefold increase compared to the original target set in 2007.

According to the *World Wind Energy report 2008*, wind energy continues to be the most dynamically **growing energy source** in 2009, bringing world nameplate capacity to **152 gigawatts (GW)**, an almost **20%** increase compared to the previous year despite the economic crisis. If China ranks "only" fourth in installed capacity, it has shown the **highest** increase in **installed capacity** for the fourth year in a row, reaching **12 GW** at the end of 2008 and becoming one of the two **largest markets** for wind energy capacity alongside the USA. Thanks to cash perks and tax breaks the Chinese government managed to attract in the national wind sector more than **US\$2 billion in investment** from the world's biggest wind firms, including Denmark's Vestas, Spain's Gamesa, and GE Energy, benefiting also local wind firms such as turbine makers Sinovel Wind, Goldwind Science and Technology, and Dongfang Electric, which now account for more than 50% of a market. According to the estimates of the China Academy of Meteorological Sciences the country possesses a total **235 GW** of practical onshore wind power potential that can be utilized at 10 meters above the ground, with the potential for offshore wind power is even greater, estimated at 750 GW (**Box 8**).

Box 8 REGIONAL WIND POTENTIAL IN CHINA

- **Mongolia:** hosts about 40% of total Chinese installed capacity and based on the announced projects wind capacity installed in the region in 2010 could exceed 5 GW
- **Gansu province:** as of the end of 2007 there were a total of 500 MW of wind farms operating, with another 1 GW in planning. According to the plan drawn in 2007, 4 GW capacity will be installed by 2011
- **Shandong province:** a coastal province with estimated wind potential of 67 GW of wind power resources. According to the provincial government's plan, Shandong will have 1 GW of wind power generating capacity by 2010 and 3 GW by 2020.
- **Other provinces (main projects):** in the Heilongjiang Province the Mulan Wind Power Plant, which was started up in 2004, has installed capacity of 12 MW.

THE CARBON PRICE

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. 3**) 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. 4**) 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. 4**, the stabilization scenario at **450** parts per million (ppm) of CO₂ in the atmosphere will involve higher carbon prices compared to less ambitious stabilization scenarios such as the 550 ppm CO₂. Taking into account that the present CO₂ 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 CO₂ 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. 3 SHORT TERM EVALUATION OF THE EU ETS ALLOWANCES PRICE

SOURCE	SCENARIO	2009-2012 II PHASE PRICE (€/TCO2)	2013-2020 III PHASE PRICE (€/TCO2)
KfW/ZEW (2009)	- emissions reduction efforts of covered installations are assumed to increase during the third phase - sharp increase of CERs during the third trading period - oil and gas price expected to rise in a long time horizon	19.80	28.10
AVERAGE OF PREVIOUS ESTIMATIONS		28.01	42.59
STANDARD DEVIATION OF PREVIOUS ESTIMATIONS		15.19	23.49
NEW AVERAGE ESTIMATION		27.33	41.27
NEW STANDARD DEVIATION ESTIMATION		14.68	22.70

TAB. 4 ECONOMICS MODELS FOR THE LONG-TERM CARBON PRICE EVALUATION

MODEL	AUTHOR	YEAR	SCENARIO	CO2 PRICE ESTIMATION (€/TCO2)			
				2020	2030	2050	2100
EPPA	Paltsev et al.	2009	<ul style="list-style-type: none"> - International emission trading - Banking and borrowing allowed - GDP growth, 2005-2050, 2.5% rate/yr - 2050 baseline emissions: 10.8 GtCO2e - Mitigation efforts among countries: <ul style="list-style-type: none"> • Developed countries (with exception of US) reducing to 50% below 1990 levels by 2050; • US emissions 80% below 1990 by 2050 (167 Bmt) • China, India, Russia, and Brazil starting in 2030 on a linear path to 50% below their 2030 emissions level by 2070; • the rest of the countries delaying action beyond the 2050 horizon - Different cost assumption about nuclear, CCS and renewables <ul style="list-style-type: none"> • cost advantage to nuclear • <i>cost advantage to CCS</i> 	45.54 55.58 63.30 56.35	67.16 82.59 93.40 83.37	146.66 181.40 205.33 182.17	n.d.

			<ul style="list-style-type: none"> neither nuclear or CCS available slow renewable penetration 				
MODEL	AUTHOR	YEAR	SCENARIO	CO2 PRICE ESTIMATION (€/TCO2)			
				2020	2030	2050	2100
MERGE	Blanford et al.	2009	<ul style="list-style-type: none"> - Global cap-and-trade - One decade of unconstrained emissions growth in Non-Annex B countries - Expected growth rate downward to 2.4% between 2003 and 2030 	69.47 7.72	121.96 32.42	<i>n.d.</i>	<i>n.d.</i>
WITCH	Bosetti et al.	2009	<ul style="list-style-type: none"> - Global carbon market - World energy intensity fall by 65% - Carbon intensity falls by 45% - Energy decarbonisation is achieved mainly in power sector - share of low-carbon technologies in electricity mix rising to 90% - possibility of investing in breakthrough technologies 	28.04 28.70	69.07 52.37	271.46 122.23	1515.7 6 408.59
AVERAGE OF MODELS ANALYSED THIS MONTH Stabilization at 450 or 550 ppm				50.42 7.72	81.66 32.42	184.49 -	962.18 -
STANDARD DEVIATION OF MODELS ANALYSED THIS MONTH Stabilization at 450 or 550 ppm				15.22 -	20.69 -	47.13 -	782.89 -
AVERAGE OF PREVIOUS ESTIMATION Stabilization at 450 or 550 ppm				40.36 18.60	54.20 23.08	218.17 43.35	817.23 119.00
STANDARD DEVIATION OF PREVIOUS ESTIMATION Stabilization at 450 or 550 ppm				35.44 9.19	25.75 11.13	169.90 26.36	638.47 98.79
NEW AVERAGE ESTIMATION Stabilization at 450 or 550 ppm				42.32 18.20	64.39 23.71	183.13 43.35	837.94 119.00
NEW STANDARD DEVIATION Stabilization at 450 or 550 ppm				32.33 9.25	23.86 11.24	114.90 26.36	628.36 98.79

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