

Greenhouse Gas Emissions Service

New markets linking fuels and sectors across the globe

What is a ton of CO₂ worth? The answer to that question is in a continuous process of being decided — by policymakers with widely diverging opinions, by markets already functioning to equilibrate supply and demand of emissions allowances, and by the energy industry that must respond to the challenge of a lower-carbon future.

Governments concerned about global warming are pushing forward agendas to limit greenhouse gas (GHG) emissions, the large majority of which is CO₂ resulting from the combustion of fossil fuels. Countries committed to the limits imposed by the Kyoto Protocol are taking actions to limit their own emissions while driving GHG reduction investment in the developing world through project-based reduction mechanisms. Even within countries not bound by Kyoto there are important initiatives to limit GHG emissions and ongoing debates about the appropriate course of action. Recent trends are towards ever-increasing activity to stem the growth of emissions.

Building on the success of the U.S. SO₂ Title IV Emissions Trading Program, policymakers are turning to market mechanisms to ensure that emissions reductions are achieved at the lowest possible cost. In the end, such markets differ from more traditional markets in that the product — namely, the right to emit GHG — has a value entirely linked to governments' decisions on desired reductions. Policymakers choose what types of reductions are desired (if any), how these would be incentivized (command-and-control regulation, renewable energy efforts, targeted subsidies, cap-and-trade programs, etc.) and when they would be required. Once implemented, these policy decisions provide the rules of the game and the structure needed for the relevant markets to operate and the relevant sectors to appropriately respond.

PIRA'S GREENHOUSE GAS EMISSIONS SERVICE combines a thorough assessment of policymaking drivers with an in-depth understanding of the underlying emissions fundamentals involving fuel choices, technology and economic growth. Through comprehensive reports and a customized Web “portal,” GREENHOUSE GAS EMISSIONS provides far-reaching geographic scope with special focus and capabilities regarding GHG emissions and markets. Recognizing that there are a number of different GHG regulatory frameworks and individual national and regional priorities, PIRA tracks the likelihood and potential for linkages as well as emerging competing approaches. Understanding the fundamentals of GHG also provides additional insight into markets for the primary fossil fuels (coal, gas and oil), as well as for electricity (prices, incentives for new generation and “clean energy”) and is critically important to energy-intensive industries such as refining, chemicals, cement, iron/steel and pulp/paper.

PIRA'S GREENHOUSE GAS EMISSIONS SERVICE provides critical analysis on:

- **European Emissions Trading System (ETS) CO₂ market**, with updates and outlooks on supply/demand balances and allowance prices, leveraging PIRA's regular coverage of European electricity, coal, gas, and oil markets.
- **Compliance with the Kyoto Protocol**, by following:
 - Developments with project-based GHG markets (CDM, JI).
 - Country-specific compliance issues.

- **North American GHG policy developments**, including:
 - Prospects and implications of U.S. federal legislation
 - Implementation of regional markets (RGGI, WCI, California, etc.)
- **Prospects for post-Kyoto regulation and markets.**

Components of the Greenhouse Gas Emissions Service

Clients to GREENHOUSE GAS EMISSIONS benefit from the following deliverables:

1. Monthly *European Emissions Trading System Market Outlook*

This report provides clients with an up-to-date appraisal of the ETS CO₂ markets, including:

- **Summary and Scorecard** - A summary of the monthly report and a quick-reference scorecard. →
- **Monthly Developments** - An updated supply/demand balance for ETS emissions allowances that assesses:

- **Power Sector Emissions** - Leveraging its analysis of European electricity markets, PIRA focuses on power sector emissions from coal, natural gas and oil. The section includes analysis of overall demand, weather effects, inter-fuel substitution and renewable generation.
- **Industrial Emissions** - A review of trends in emissions from other sectors covered by the European ETS — refining, cement, iron/steel, pulp/paper and others — within the context of overall macroeconomic and industrial developments.

PIRA Energy Group		PIRA
December 30, 2008		Greenhouse Gas Emissions Service
European Emissions Trading System Market Outlook		
Phase II ETS Market Summary		
Overall Demand	Price Influence	Comments
Macroeconomics		Our estimates of expected Western European GDP growth continue to slide; to 0.7% in 2008 and down to -1.6% in 2009. The German IFO Business Climate Index in December has hit its lowest level on record. The expected drop in Eastern Europe has been sharpened to -0.5%.
Weather		UK mean temperatures are likely to be below average in January. The rest of Europe is expected see an average winter, with the exception of Southeastern Europe, which may see above average temperatures and precipitation.
Power Sector Demand	Price Influence	Comments
Non-Emitting Generation		PIRA estimates that non-emitting generation in 2008 across the EU ETS grid-connected power sector is up by about 3% year on year. With power demand basically flat year on year, fossil fuel requirements have made an unprecedented downward move.
New Build / Retirements		EDF's 1650 MW Flamanville EPR, in addition to being over budget, is seeing further delays and is now not expected to start up until after Phase II of the ETS.
Coal-Gas Spread: UK		With the nearing of the completion of the final SO ₂ retrofits for a number of UK coal plants, they will become free of their temporary output limits. Coal burn losses were limited somewhat by more sustained operation of the units opting out of the LCPD directive, which have been dispatched for about 4,500 hours in 2008 (compared to a 20,000 hours allowance through 2015). PIRA estimates that the UK still accounts for about 50% of the overall Western European switching capabilities.

The Scorecard section of the *European ETS Market Outlook*.

- **CDM/JI Prospects** - A more detailed assessment of the potential supply of emissions credits from CDM/JI projects for ETS compliance.
- **Allowance Price Outlook** - While commenting on current market prices, PIRA provides forecasts of allowance prices, given the expected balances and integrated PIRA forecasts of coal, gas, and oil prices. Market opportunities and risks through the different phases of the program are highlighted.
- **Institutional and Policy Developments** - Identification of key trends in the institutional capacity and growth of this new and growing market. PIRA provides assessments of policy developments as they impact the Phase II and prospective Phase III markets.

2. North American GHG Quarterly Update

While the U.S. has not signed Kyoto and Canada's commitment is uncertain, they are seeing continued domestic and regional developments in regulating GHG. Northeastern U.S. states have taken steps to implement a cap on power sector CO₂ emissions through the RGGI program/market, while California has committed to significantly reduce GHG and is actively developing policies to achieve its goals. On a U.S. federal level, legislative and regulatory options for national programs are being discussed, and the choices made can have serious implications for market players. Canada's federal and provincial efforts have been at the center of controversy, under the cloud of political uncertainty. The *North American GHG Quarterly Update* reviews the policy processes and offers timely assessments of the latest developments. It also looks at the latest emissions trends across sectors, helping inform, prepare and shape industry responses to potential new markets and regulations.

3. Greenhouse Gas Special Reports

The GHG Special Reports, focusing on specific relevant greenhouse emissions-related issues, provide more depth on particular longer-term regional policies, trends in the relevant markets, or the development of prospective technologies for GHG reduction.

- PIRA's forecasting of worldwide fuel balances provides insight into future emissions relative to projected UN IPCC scenarios as well as national CO₂ trends that illustrate expected emissions positions relative to the Kyoto requirements.
- Post-Kyoto policy developments. While the Kyoto Protocol expires in 2012, PIRA's review and insight into ongoing discussions and proposals for GHG regulation after Kyoto can help inform longer-term strategic decision-making. Developments involving broader inclusion of the developing world into the regulatory regime and more direct regulation of additional sectors, such as aviation and transportation, are also reviewed.
- Special focus reports will address and analyze key GHG mitigation and policy issues developing in the U.S. and Canada. Additional reports include coverage of motor vehicle-related GHG analysis, emissions-reduction technologies, and corporate carbon strategies.

4. Greenhouse Gas Bulletins

These one-off reports provide clients with analytic briefs on important timely issues confronting global emissions markets. Unexpected shifts in the market fundamentals from movements in supply or demand require timely review and understanding to ensure an accurate assessment of emissions markets going forward. Such shifts can be policy-related (such as announcements of EC decisions on the EU ETS design), or they could involve factors such as extreme weather events or sudden movements in the fuel markets, which may lead PIRA to update our price views.

5. Emissions “Portal” on PIRA Online

GREENHOUSE GAS EMISSIONS SERVICE clients are able to access a special online data portal, providing updated additional data and tools such as:

- Worldwide long-term **CO₂ projections**, with by-region and by-country detail.
- **Kyoto participant emissions projections**, with estimates of reduction shortfalls.
- For the **European ETS**:
 - Updates of country- and sector-level emissions forecasts, overall emissions vs. total allowances
 - Historical emissions balances
 - Expected regional coal-gas price spreads
 - Implied CO₂ prices for fuel switching (using various generating capacity)
- **U.S. quarterly power sector CO₂ data.**
- **CO₂ “emissions calculators”** for coal, gas and oil generation technologies
- **Price histories and forecasts** — delivered through PIRA’s integrated Energy Price Portal — for
 - EUAs (Phase I)
 - EUAs (Phase II, III)
 - RGGI CO₂
 - WCI CO₂
 - U.S. Federal CO₂

Greenhouse Emissions Retainer Service					
Carbon Capture and Sequestration Power Plant Proposals					
	Who	Where	What	When	
4	EC and private companies	Denmark	430 MW existing Esbjerg coal facility	online in March	Pilot CCS project
5					
6	Vattenfall	Germany	30 MW coal	2008	Demonstration project
7	Total	France	existing gas boiler		Pilot CCS project
8	Naturkraft	Norway	450 MW gas - Karsto	2007, 2009	Capture plant to be built
9	Statoil, Shell	Norway	800 MW gas	2011, 2012	Plans to transport CO2 to transport fields
10	BP, Shell, Conoco-Phillips, Scottish & Southern	UK	350 MW gas	2009	Peterhead project
11	Renew Tees Valley, Progressive	UK	850 MW coal/petcoke-gasification		EOR at BP's North Sea
12	E.ON UK	UK	450 MW coal	2011	CO2 sequestration
13	RWE	UK	1000 MW supercritical coal	2016	CO2 sequestration
14	Scottish and Southern	UK	500 MW supercritical coal	2011/12, ?	UK's first supercritical opportunities
15	RWE	Germany	400-450 MW IGCC coal	2014	CO2 sequestration
16					
17	Occidental / BP/Edison Mission	California	500 MW Hydrogen powered plant	?	Plant to be developed
18	Xcel Energy	Colorado	300-350 MW IGCC	Construction start in 2009?	Occidental's Calif Application to CRI benefits and dem injection in depleted

A sample spreadsheet from GHG’s online Data Center

- Relevant emissions factors: global warming potential factors for the different greenhouse gases, carbon content of different fuels
- PIRA’s macroeconomic slide shows covering developments in Europe, North America and Asia
- Worldwide CDD/CDD weather (monthly)

6. Access to PIRA Staff

One-on-one interaction between our clients and our analysts is a cornerstone of PIRA’s Retainer Services. In that tradition, GREENHOUSE GAS EMISSIONS SERVICE clients benefit from direct access (phone/email) to the Group, allowing them to discuss issues that are of specific relevance to them.

Fees

The fee for becoming a client company to GREENHOUSE GAS EMISSIONS SERVICE is \$14,000 per annum for up to 10 users located at one client site. (Companies requiring access beyond 10 users or one site should contact PIRA for a license quote.) There are discounts **for existing clients to one, two or three of PIRA Retainer Services.**

For more information, please refer to the Acceptance Form or page 8.

Who Can Benefit from the Greenhouse Gas Emissions Service?

GHG markets have the potential to link all sectors and industries that are dependent on, or impacted by, energy from fossil fuels. In the short term, efforts to reduce CO₂ emissions will rely on fuel switching and improved efficiencies, but in the longer term, investments in new technologies would be needed to drive reductions without compromising economic growth. **On an ongoing basis, PIRA's GREENHOUSE GAS EMISSIONS SERVICE provides the critical market intelligence that can be relied on by professionals in the following areas of business:**

Currently covered sectors

Most immediately, GREENHOUSE GAS EMISSIONS can clearly help industries currently covered by existing CO₂ programs understand the fundamentals of the underlying market and develop appropriate compliance strategies. Within the European ETS these industries include:

- **Power generation, refineries, iron and steel, cement/lime/ceramics, and pulp/paper**
- **Other sectors utilizing industrial boilers/CHPs for their production processes**

Other GHG-intensive sectors covered by Kyoto

GREENHOUSE GAS EMISSIONS can provide insight into how developing policies to comply with Kyoto will affect their industries — including the transportation sector, where growth is driving the largest emissions increases.

GHG-intensive industries in North America

GREENHOUSE GAS EMISSIONS sheds light on the “lessons learned” from the pioneering markets, explaining how regional efforts are shaping up and the prospects for potential national efforts.

GHG-intensive industries in the developing countries

GREENHOUSE GAS EMISSIONS provides estimates of the value of emissions-mitigation efforts in order to assess sellable project-based Kyoto reductions and to develop a longer-term post-Kyoto emissions strategy.

Gas, coal, and electricity traders and marketers

Provides critical intelligence and an outlook on CO₂ and its impact on power prices and levels of inter-fuel competition.

Coal, gas, and oil producers

GREENHOUSE GAS EMISSIONS helps them monitor longer-term demand-side developments resulting from GHG policy changes across the globe.

Banks and other financial institutions

More and more, investors are demanding that companies disclose their potential financial risk from GHG regulation. Efforts such as the Carbon Disclosure Project are working to catalogue and understand the differing and common approaches for identifying and addressing these risks.

GREENHOUSE GAS EMISSIONS can help institutions better quantify such risks. The service also identifies risks and opportunities for investments in “greener” and higher efficiency projects and technologies.

Greenhouse Gas Emissions Group

Roman Kramarchuk (Managing Dir., Emissions and Clean Energy) joined PIRA in 2005, coming from the U.S. EPA's Clean Air Markets Division, where he was extensively involved in the development of the CAIR and CAMR (Mercury) Rules and the BART Guidelines. His previous experience includes work in the merchant power sector and with PA Consulting / PHB Hagler Bailly, where he evaluated strategies on power sector fuel choice, allowance purchases, and capital investments in pollution control equipment and advised on power plant development and acquisition, transmission expansion and asset valuation within various North American markets. Additionally, Roman has spent several years working on USAID- and World Bank-funded projects to develop power markets, market rules and regulatory capacity in Ukraine, Armenia and India. He has a MPP from the Kennedy School of Government at Harvard and a BA in economics and BSE in system engineering from the University of Pennsylvania.

Dr. Ronald B. Gold (Sr. Director, Emissions and Clean Energy) is an International Energy Economist with broad experience in analyzing energy, economic, and environmental trends. Dr. Gold joined PIRA in 1997 after retiring from Exxon, where he was Company Economist and Manager of the Energy Outlook Division. In that capacity, he supervised the preparation of international energy and economic outlooks and conducting special business-related studies. Earlier in his career, he worked for the U.S. Treasury Department and Office of Tax Analysis, and he was also an assistant professor of economics at Ohio State University. Dr. Gold received his undergraduate degree from Brooklyn College, City University of New York, and his M.A. and Ph.D. in economics from Princeton University.

Jennifer McIsaac (Associate Director, Emissions and Clean Energy) co-authors PIRA's N.A. EMS reports. Before joining PIRA, she worked at NUI, where she analyzed gas supply needs and recommended baseload/swing purchases and storage injections/withdrawals. Prior to that, while pursuing her degrees, she was an economics research intern in Exxon's Corporate Planning Department, where among many tasks she analyzed emissions in the transportation and power generation sectors. She holds a BA from Drew University and is a doctoral candidate in economics at Cornell University.

Glenn Schwartz (Senior Analyst, Emissions and Clean Energy) joined PIRA in 2010 from the legal sector with experience in environmental and administrative/regulatory law in both the public and private sectors, having advised clients in industry, public interest groups and local governments. At PIRA, he tracks and interprets government regulations and legislation that will impact the energy sector as well as emissions and clean energy markets. He received his undergraduate degree in economics from the University of Pennsylvania and holds a JD from Temple University School of Law.

Jeffrey Berman (Analyst, Emissions and Clean Energy) joins PIRA where he will be assisting with assessments of the EU ETS and Kyoto carbon markets and researching renewable power technologies. He holds a Master's degree in energy policy and finance from Columbia University and a Bachelor's degree from the London School of Economics. Prior to earning his Masters, he worked as a research assistant and data manager at MDRC, a New York-based public policy research organization.



Bruno Brunetti (Sr. Director, European Electricity) manages PIRA's European Electricity Service. Prior to joining PIRA in 2001, he was at Caminus, where he carried out market studies, providing advice to a significant number of new projects as well as working on acquisition and divestment of assets across Europe. He began his career in the strategic planning department of Enel in Rome. Bruno graduated magna cum laude in economics and management from Bari University (Italy) and obtained a masters degree in energy economics from the ENSPM, the School of the French Institute of Petroleum (Paris).

Dan Klein (Sr. Director, International Coal) oversees PIRA's International Coal Service, responsible for the *International Thermal Coal Market Forecast* and *International Coal Markets Scorecard*, and he contributes to the *U.S. Coal Market Forecast*. Prior, Dan was a member of PIRA's North American Electricity team. He has a BA in economics from Calvin College.

Michelle Patron (Sr. Director, Political Risk) oversees the Global Political Risk Service. She has over a decade of experience analyzing international energy issues. Prior to joining PIRA in 2004, she was a Fellow at the Council on Foreign Relations and conducted energy research at Deutsche Bank. She spent five years as an international policy advisor at the U.S. DOE. In 2001, Michelle served as Energy Attaché at the U.S. Embassy in Beijing. Prior to the DOE, she worked at the International Energy Agency, the White House, UNICEF and the Center for International Environmental Law. Ms. Patron holds a BA from Columbia University and an MA from Johns Hopkins School of Advanced International Studies.



Acceptance Form

We wish to become a client to PIRA Energy Group’s GREENHOUSE GAS EMISSIONS SERVICE and we understand and agree that the fee for the service is (circle as appropriate). NOTE: **Discounts are available to clients of the Retainer Services listed below:**

Company Status	Annual Fee Options	
	GHG	OR, combine your GHG Service with PIRA’s North American Emissions Markets Intelligence Service (N.A. EMIS) at these rates:
Non-Retainer Client	\$14,000	GHG w/N.A. EMIS \$26,000
Client of One Service*	\$12,000	\$22,500
Client of Two Services*	\$9,500	\$17,500

* Services include: Global Oil, North American Natural Gas, North American Electricity, European Natural Gas, European Electricity, and International Coal

- Prices are applicable through December 31, 2012.
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- GREENHOUSE GAS EMISSIONS SERVICE contains no confidential technical information to the best knowledge of PIRA. However, except for information that is or becomes available to the public in printed publication, or is already in the possession of, or developed independently by, the client, or is received by the client in good faith from a third party, any information in the service is for the sole and confidential use of the client. Client agrees to use reasonable efforts to protect the confidential nature of the information supplied to it.

Company: _____

First Name: _____ Last Name: _____

Position Title: _____

Address: _____

City/Code/Country: _____

Phone: _____ Fax: _____

Email: _____

Total Fee: _____ Signature: _____

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