

Waste-dump rich v, waste-dump poor: New assets define wealth in post-oil world

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Price and supply curves emerge for new post-oil commodity: CO2 waste dumps

1

The emergence of a new and valuable form of energy commodity was detailed in a paper, *A First-order Global Geological Co2-Storage Potential Supply Curve And Its Application In A Global Integrated Assessment Model* to the seventh International Conference on Greenhouse Gas

Control Technologies (GHGT-7), held Vancouver, Canada 5 - 9 September, 2004, the authors looked at supply and demand for carbon waste-dumps - CO2-storage reservoirs.

Rapidly rising price: A rapidly rising price was forecast for nine of 14 world economic regions.

Oil era winds down: Hubbert's Peak hit at year 2004.7, that is, August 2004.

The new CO2 commodity: The CO2 commodity-value models assumed CO2 safety standards and exploration regulations were set. A world meeting in Melbourne this week aimed to set those new rules and manage plans to gain positive public opinion. (see inside: *Ten new CO2 dump projects get legs at Melbourne waste-dump roadshow*)

EU market to change energy tactics: less coal, more gas; drought-cost: EU9/MWh more if price at EU10/t CO2

Shifts would take place in the configuration and structure of energy production, predicted PricewaterhouseCooper's *Global Utilities Insight 2004*.

contents

- 2 CO2 waste-dump-capacity defines economic success in 21st Century
- 3 Waste-dump rich v, waste-dump poor: New assets define wealth in post-oil world
- 4 Oil era winds down: Hubbert's Peak hit at year 2004.7: August 2004
- 6 CO2 waste-dumps a double winner: raise oil production 12 to 17pc, so value of CO2 to rise with oil price
- 6 Ten new CO2 dump projects get legs at Melbourne waste-dump roadshow
- 7 Secret programs come out of the cave: Warm fuzzy CO2 waste dump Policy Group to examine "public outreach"
- 7 17 nations agree on CO2 dumps in Ministerial Communiqué 13-16 Sept
- 7 9 different concepts for natural gas fired power plants with CO2 capture compared
- 8 Lack of data in residential and commercial sectors leads to difficulties in emissions projections, Japan tells UN

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Big gen and fuel changes: Even in scenarios where companies received allocations that protected their high emitting installations, there would be incentives to change the configuration of these installations and the new merit order would affect investment plans.

Pricing points affect fuel mix: Different pricing points would have an impact on the strategic fuel mix decision.

- A switch from coal to gas, for example, could reduce the cost of emissions by Euro dollar 5/MWh (assuming 500kg/MWh @ Euro dollar 10/t CO₂);
- At the opposite end of the spectrum, a dry season forcing the substitution of coal for hydro could create an additional Euro dollar 9/MWh cost.

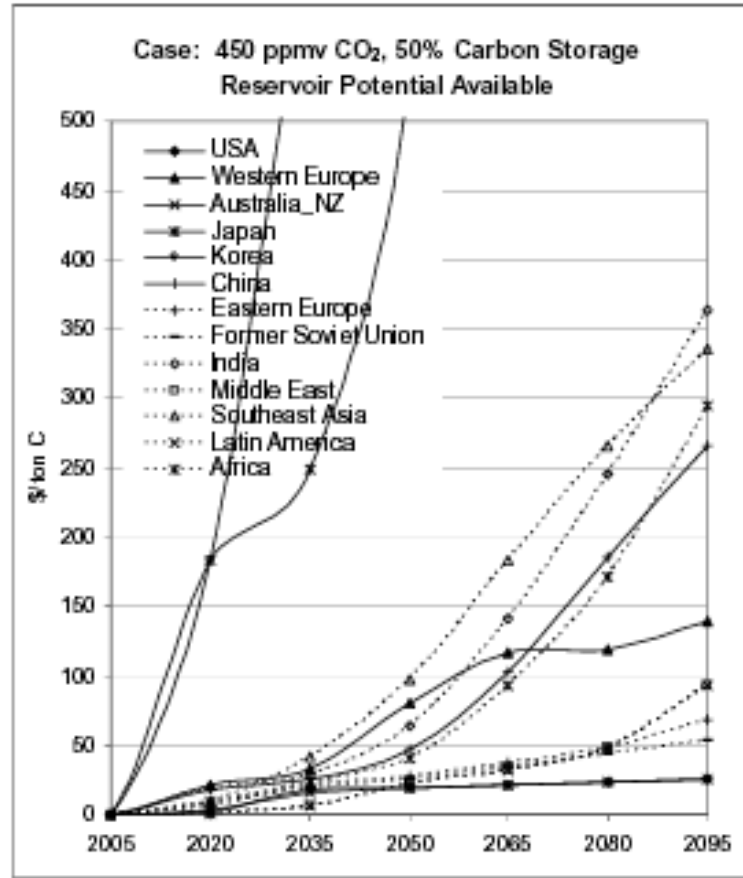
Reference: Emission critical, Connecting carbon and value strategies in utilities, Global Utilities Insight 2004, by PricewaterhouseCooper.

CO₂ waste-dump-capacity defines economic success in 21st Century

2

A paper to Greenhouse Gas Control Technologies Conference showed changed behaviour in energy markets;

- Japan would pay high prices for carbon, and thus for energy;



Japan at \$500/tonne in 2020: How Australia's carbon cost stays low relative to other nations over time at a 450 ppmv global CO₂, and 50 per cent Reservoir Potential Available Case.

Source: A First-order Global Geological Co₂-Storage Potential Supply Curve And Its Application In A Global Integrated Assessment Model

- Australia, New Zealand, Canada, and the USA had the best CO₂ dump resources and hence the lowest 21 Century energy price.

Energy constraints for some nations: Most regions experienced some constraints in some scenarios, implying that defining the true availability of geological storage CO₂ capacity within these regions was “a pressing research issue as it speaks to the possible evolution of these regions future energy systems”.

Short of CO₂ dumps, must buy credits: “For those regions with limited storage capacity, international trade in emissions allowances offers a mechanism for accessing the larger international resource”.

Japan cuts coal use: Of the regions studied, Japan had a small ability to use CO₂ waste dumps, for geological reasons. The models presented shows fossil fuel-use was cut in half in Japanese power generation under a world

policy where CO2 was stored in domestic geological reservoirs under a CO2 credit system. Japan plans to dump CO2 at sea. The analysis "recognizes that all CO2 will be captured and stored locally in large but finite reservoirs". Geological CO2 storage were modelled as a graded, depletable resource.

The findings were:

- some regions always encounter constraints on their ability to field CCS systems;
- other regions never encounter these constraints during the 21st century.

A First-order Global Geological Co2-Storage Potential Supply Curve And Its Application In A Global Integrated Assessment Model J.J. Dooley 1*, S.H. Kim 1, J.A. Edmonds 1, S.J. Friedman 2, and M.A. Wise 1 1 Battelle/Pacific Northwest National Laboratory's Joint Global Change Research Institute, 8400 Baltimore Ave., Suite 201, College Park, MD. 20740. USA 2 Energy and Environmental Directorate, Lawrence Livermore National Laboratory Livermore, CA. USA

Waste-dump rich v, waste-dump poor: New assets define wealth in post-oil world

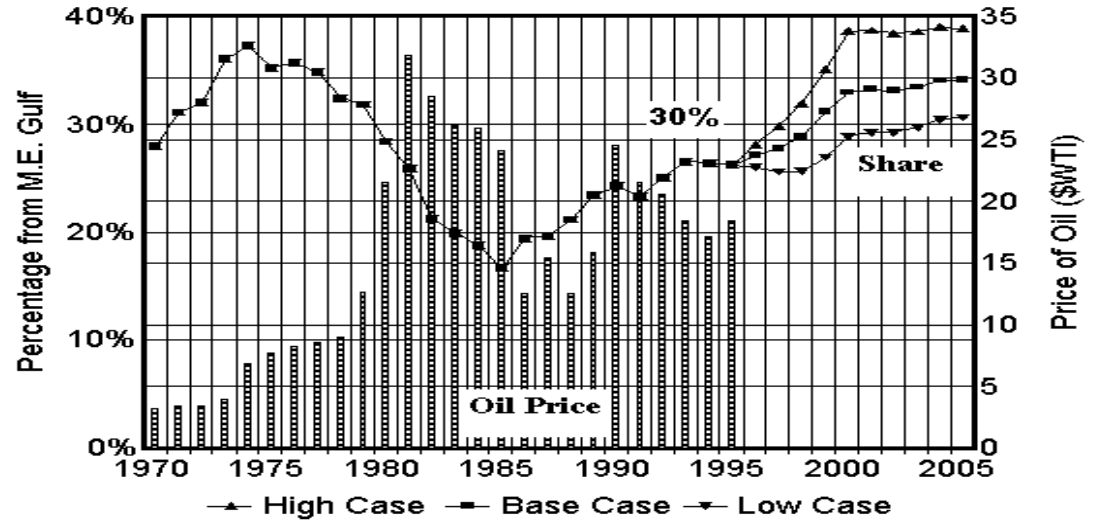
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World regions with CO2 assets could:

- meet emissions trading requirements
- get more from depleted oil fields;
- manufacture hydrogen at no greenhouse costs; and also
- earn greenhouse credits.

SWING SHARE & OIL PRICE

alternative scenarios



Oil peaked August 2004: This 1982 graph (often referred to as the "Hubbert Curve") is based on an Ultimate Recovery of conventional oil of 1750 Gb (Giga = Billion barrels), and depicts alternative scenarios of production. The Swing Case assumes a price leap when the share of world production from a few Middle East countries

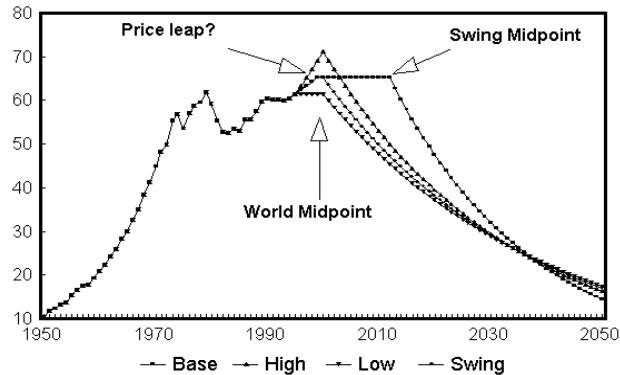
reaches 30 per cent. This is expected to curb demand, leading to a plateau of output until the Swing countries reach the midpoint of their depletion, when resource constraints force down output at the then depletion rate [from *The Twenty First Century, The World's Endowment of Conventional Oil and its Depletion*, by Dr. Colin Campbell, 1996].

Others nations pay more for energy: Those regions with out waste dump assets would may more for energy in the post Kyoto world. They would see their ability to deploy CO2 waste dumps, or (carbon capture) Carbon Capture Systems (CCS) systems constrained by a lack of places to dump CO2.

Winners and losers: Some had limited waste dump options and other regions had plenty for the whole 21st century: the sites counted:

- geological storage of CO2 within on-shore and off-shore deep saline formations;
- depleted oil fields;
- depleted gas fields; and
- coal basins based on calculated volumes and costs.

Global economic implications: The authors examined;



In his original 1956 paper, Hubbert used a logistic curve to describe U.S. oil production. Hubbert pointed out that it would require an infinite amount of oil to keep up with a fixed-percentage annual increase”.

- regional and global economic implications of the distribution of sources and sinks; and
- how the relative abundance of CCS opportunities in a region influenced the adoption of other emissions-mitigation technologies.

A First-order Global Geological Co2-Storage Potential Supply Curve And Its Application In A Global Integrated Assessment Model

Oil era winds down: Hubbert's Peak hit at August 2004

4

The 2004 prices appear to support the view that oil past its peak supply point in August 2004, when *Hubbert's Peak* hit at 2004.7, that is, August 2004. This was detailed a new look at the 1982 analysis,

Geological CO2-storage potential by region (petagrams of C).

	Coal Basins	Depleted Oil Poolss	Gas Basins	Deep Saline Formations (On-shore)	Deep Saline Formations (Off-shore)	Total
USA	16	3	10	745	248	1,022
Canada	1	0	1	273	68	344
Western Europe	1	2	11	20	39	73
Japan	0	0	0	0	0	0.3
Australia and New Zealand	8	0	3	56	130	196
Former Soviet Union	5	6	70	101	378	560
China	4	1	2	90	9	106
Middle East	0	9	52	61	4	126
Africa	2	4	17	32	63	118
Latin America	1	4	13	51	15	85
Southeast Asia	7	1	8	33	49	97
Eastern Europe	1	0	2	29	3	35
Korea	0	0	0	0	0	0.3
India	2	0	2	51	51	105
TOTAL GLOBAL CAPACITY: ALL GRADES	48	31	190	1,540	1,057	2,867

Winners and losers in 14 world areas: CO2 capture and storage (CCS) will take place at the local and regional scale and will compete with other mitigation options. Some regions have high rates of carbon emission and relatively limited potential storage-reservoir capacity and always exhibit high storage costs, eventually exceeding \$200/tonne, regardless of the concentration at which atmospheric CO2 is stabilized and the degree to which maximum potential geological storage is assumed to be available. The model - MiniCAM sub-divided the world into the 14 economic provinces. It calculated regional estimates of CO2-storage loads (i.e. the amount of CO2 needing to be stored at any point in time, mapped to potential geological reservoirs within each of these regions across the five classes of geological CO2 reservoirs

considered. Then, a value was set. Concentrations were stabilized by introducing a value on the emission of carbon to the atmosphere in the form of a tax in the model uniformly across all 14 regions with same marginal cost of a ton of emissions consistent with a perfect global cap-and-trade regime.

A First-order Global Geological Co2-Storage Potential Supply Curve And Its Application In A Global Integrated Assessment Model J.J. Dooley 1*, S.H. Kim 1, J.A. Edmonds 1, S.J. Friedman 2, and M.A. Wise 1 1 Battelle/Pacific Northwest National Laboratorys Joint Global Change Research Institute, 8400 Baltimore Ave., Suite 201, College Park, MD, 20740. USA 2 Energy and Environmental Directorate, Lawrence Livermore National Laboratory Livermore, CA. USA

which supports his analysis with the addition of population analysis. *Hubbert's Peak - The impending Oil Shortage*, a revision of the long-reviled - but accurate - predictions of Hubbert, in 1956 and 1982.

New analysis: In a revision, by Kenneth Deffeyes, published by Princeton University Press in 2002, Deffeyes noted the parallel between studies of population growth and Hubbert's oil predictions. "Up through 1955, there was a widespread assumption that the U.S. oil industry would always be able to keep up with a consumption increase of 5 per cent per year.

The 1956 paper: In his original 1956 paper, Hubbert used a logistic curve to describe U.S. oil production. Deffeyes said: "Most of us at the time were puzzled, "became we presumed all bell-shaped curves to be Gaussian until proven otherwise, In a paper Published in 1982, Hubbert finally justified his use of the logistic curve. It had an appealing symmetry in the underlying mathematics. In his 1982 paper, Hubbert refers to the original Verhulst papers and goes through a complete derivation of the mathematics.

And a 1982 paper: In this 1982 paper, Hubbert developed a clever way of making a graph that turns a logistic curve into a straight line. Deffeyes said "However, neither Hubbert nor later workers seem to have used the technique to plot oil data". Deffeyes has done this and it supports Hubbert's premise.

Reference: *Hubbert's Peak The impending oil Shortage Revision* by Kenneth Deffeyes. Princeton University Press 2002.

Valuable waste-dump real estate: The most valued, those closest to fossil fuel sources

The seventh International Conference on Greenhouse Gas Control Technologies (GHGT-7), held Vancouver, Canada 5-9 September, 2004 used a MiniCAM mode to cost regional representations for the capacity and cost of CO2 storage in five reservoir types:

- depleted oil plays;
- coal beds;
- depleted gas basins;
- on-shore deep saline formations; and
- off-shore deep saline formations.

Each of these types is in turn was disaggregated into four discrete grades of the storage resource. Each grade was described by its own cost of storage and a maximum extent of potential storage. It did not consider potential CO2-storage capacity of deep, saline-filled basalt flows, nor black shales or storage of CO2 in the oceans.. Capture technology (CCS) technology was assumed available for electric power generation and energy transformation.

Seventh International Conference on Greenhouse Gas Control Technologies (GHGT-7), Vancouver, Canada 5-9 September 2004. www.ghgt7.ca

EU CO2 value for CO2 injection into North Sea oil reservoirs aquifers: sensitive to oil price

A technic-economic model for CO2 injection into North Sea oil reservoirs and aquifers using a large-scale infrastructure for CO2 transportation to the oil provinces was presented to the *Seventh International Conference on Greenhouse Gas Control Technologies (GHGT-7)*, Vancouver, Canada, 5-9 September 2004.

The North Sea scenario: An injection scenario included most of the Norwegian oil reservoirs in the North Sea oil reservoir. In the scenario, 67.2 million tonnes of CO2 were injected annually over 40 years.

Cost of CO2 pumping: The Enhanced Oil Recovery (EOR) needed CO2 delivered to export terminals that fed CO2 into the transportation infrastructure. But delegates heard, when this was compared to the cost of CO2 capture from industrial flue gasses (e.g. a low estimate of US\$25/tonne) and transportation from point sources to the export terminals (e.g. US\$4/tonne), it was seen that the use of CO2 for EOR can cover only a fraction of the total costs associated with CO2 capture, transport and storage.

Value of CO2 sensitive to oil price: The value of CO2 is sensitive to the oil price. It can be increased if more oil reservoirs are connected to the infrastructure (e.g. Danish and British fields).

CO2 waste-dumps a double winner: raise oil production 12 to 17pc, so value of CO2 to rise with oil price

Projects worldwide had demonstrated that CO2 injection was a powerful method to enhance the oil production from water-flooded reservoirs, the *Seventh International Conference on Greenhouse Gas Control Technologies* (GHGT-7), Vancouver, Canada 5-9 September, 2004 heard on average the CO2 floods included in SINTEF Petroleum Research's database with 115 CO2 injection projects had resulted in incremental oil recoveries in excess of 12 per cent and 17 per cent of original oil in place (OOIP) for sandstone and carbonate reservoirs, respectively. In this context the average incremental oil production estimated in this study appear to be modest. As seen above, significant amounts of CO2 are deposited in aquifers.

Value of CO2 to rise with oil price: The conference heard "If a larger proportion of the CO2 can be used for oil recovery, the purchase price of CO2 would increase. This price was also dependent on the oil price and the profitability required by the oil producers.

The Seventh International Conference on Greenhouse Gas Control Technologies (GHGT-7), Vancouver, Canada 5 - 9 September, 2004

Ten new CO2 dump projects get legs at Melbourne waste-dump roadshow

Ten collaborative projects were proposed by Members at the Meeting of the Carbon Sequestration Leadership Forum (CSLF) Ministers 13-16 September, Melbourne for CO2 capture, transport and storage.

The ten projects were:

- ARC Enhanced Coal-Bed Methane Recovery Project (Canada, United States and United Kingdom). The objective of this project is to evaluate, from both economic and environmental criteria, a process of CO2 injection into deep coal beds for simultaneous sequestration of the CO2 and liberation (and subsequent capture) of coal-bed methane.
- CANMET Energy Technology Centre (CETC) R&D Oxy-fuel Combustion for CO2 Capture (Canada and United States). The objective of this project is to demonstrate oxyfuel combustion technology with capture of a high-purity CO2 stream suitable for enhanced oil recovery and to provide information for the scale-up, design and operation of industrial and utility plants based on the oxyfuel concept.
- CASTOR (European Commission, France and Norway). The objective of this project is to attempt to validate, from process, economic, legal, and public acceptance

perspectives, post-combustion capture and storage of CO2 with a goal of achieving a major cost reduction in CO2 capture cost.

- CO2 Capture Project, Phase II (United Kingdom, Norway, Italy, and United States). The objective of this project is to continue the development of new technologies to reduce the cost of CO2 separation, capture, and geologic storage from combustion sources such as turbines, heaters and boilers.
- CO2 Separation from Pressurized Gas Stream (Japan and United States). The objective of this project is to evaluate processes and economics for CO2 separation from pressurized gas streams with gas separation membranes.
- CO2SINK (European Commission and Germany). The objective of this project is to test and evaluate CO2 capture and storage in order to better understand the science and processes involved in underground storage of CO2 and to provide experience for use in development of future regulatory frameworks for geological storage of CO2.
- CO2STORE (Norway and European Commission). The objective of this project is to demonstrate, as a follow-on to the current Sleipner project, monitoring to track CO2 migration to undertake additional studies to gain further knowledge of geochemistry and dissolution processes.
- Frio Project (United States and Australia). The objective of this project is to

demonstrate CO2 sequestration in an on-shore underground saline formation in order to verify conceptual models and monitoring methods, demonstrate that no adverse health, safety or environmental effects will occur, and develop experience necessary for larger-scale experiments.

- ITC CO2 Capture with Chemical Solvents (Canada and United States). The objective of this project is to demonstrate CO2 capture using chemical solvents, with a goal of developing improved cost-effective technologies for separation and capture of CO2 from flue gas.
- Weyburn II CO2 Storage Project (United States, Canada, and Japan). The objective of this project is to utilize CO2 for enhanced oil recovery at a Canadian oil field, including monitoring of CO2 migration within the oil field, with a goal of determining the overall performance and risks in using CO2 for enhanced oil recovery.

<http://www.cslforum.org/>

7

Secret programs come out of the cave: Warm fuzzy CO2 waste dump Policy Group to examine “public outreach”

CO2 capture, transport and storage technologies are not widely known among the general public throughout

the world. Yet, public acceptance and support based on a clear and accurate understanding of all aspects of these technologies, including the safety and environmental dimensions, is vital, said the *Ministerial Communiqué* from the Meeting of the *Carbon Sequestration Leadership Forum* 13-16 September, Melbourne.

My secret's no secret anymore: The group was “convinced of the necessity of an open and transparent operation of the CSLF.

- Accordingly we welcome the proposal of the Policy Group to create and administer a Stakeholder Engagement Register and to use the CSLF website and other appropriate media to create an ongoing two-way dialogue with stakeholders.
- *We ask the Policy Group to consider ways to make public the work of the CSLF in a timely manner”.*
- *Informing the public is thus a critical need for the acceptance of carbon dioxide capture, transport and storage.*

<http://www.cslforum.org/>

17 nations agree on CO2 dumps in Ministerial Communiqué 13-16 September

We, the Ministers of the CSLF Members, meeting in Melbourne, reaffirm our commitment to the CSLF

as a framework for international cooperation in research and development for the capture, transport and storage of carbon dioxide (CO2).

The 17 members: Australia, Brazil, Canada, China, Colombia, European Commission France, Germany, India, Italy, Japan, Mexico, Norway, Russian Federation, South Africa, United Kingdom and the United States.

Fossils fuels rescue:

- *For the foreseeable future it is likely that fossil fuels will continue in widespread use throughout the world.*
- *Therefore, the considerations that stimulated the creation of the CSLF remain of vital importance.*
- *It may enable CO2 capture, transport and storage technologies to be developed as one of the options for addressing greenhouse gas emissions and promoting sustainable development worldwide.*

Carbon Sequestration Leadership Forum Ministerial Communiqué from Meeting of the Carbon Sequestration Leadership Forum (CSLF) Ministers 13-16 September, Melbourne <http://www.cslforum.org/>

Nine different concepts for natural gas fired power plants with CO2 capture compared

Nine different concepts for natural gas fired power plants with CO2 capture were compared based on cycle

performance. In a paper to the seventh International Conference on Greenhouse Gas Control Technologies (GHGT-7), held Vancouver, Canada 5-9 September, 2004, the cycles were described as one post-combustion, six oxy-fuel and 2 pre-combustion concepts.

How it works: A common basis for the comparison of all concepts was defined and employed in heat-and mass-balance simulations of the various concepts. As turbine cooling impacts the performance at high turbine inlet temperatures, a simplified model was applied in the simulations. It was shown that the concepts, in which emerging technologies (the MSR-H2, the AZEP, the SOFC+GT and the CLC cycles) AZEP, exhibited the best performance with respect to efficiency.

Seventh International Conference on Greenhouse Gas Control Technologies (GHGT-7), Vancouver, Canada 5 - 9 September, 2004. www.ghgt7.ca

Lack of data in residential and commercial sectors leads to difficulties in emissions projections, Japan tells UN

At the recent UNFCCC Workshop on emissions projections Takaaki Ito, Ministry of Environment, Japan, said the national Guideline for Measures to Prevent Global Warming, adopted in March 2002, was being updated.

Difficulties in Japanese projections: He described methods used by Japan to project emissions of different sectors. Ito highlighted three problems:

- projecting emissions for the land-use change and forestry (LUCF) sector;
- estimating business as usual emissions; and
- lack of data in the residential and commercial sectors.

Few prepared for EU emissions trading start in five months

Mohamed T. El-Ashry, former CEO & chair, Global Environment Facility, in paper to the 19th *World Energy Congress*, Sydney, Australia 2004, last week said a survey had shown few were prepared for the EU emissions trading scheme, while:

- 61 per cent of respondents had identified measures to reduce emissions;
- only 40 per cent had calculated the costs involved;
- barely one third had established an internal control and reporting scheme for emissions trading; and
- as few as 26 per cent had developed procedures to reconcile emissions with allowances;

- a mere 19 per cent of respondents claimed to have resolved accounting and reporting issues related to the ETS.

Gas price to rise?: "Most expect that the launch of the ETS will also increase energy and power prices. Respondents predict a rise in the price of natural gas - estimated at around 20 per cent over the next two to three years.

Electricity prices to rise? "An average increase of 15 per cent is anticipated".

EU emissions trading delayed?

Ernst & Young conducted a survey in April 2004 gathering opinions from companies in the sectors affected by the EU emissions trading scheme from seven countries (Germany, the UK, France, Italy, Spain, the Netherlands and Poland), according to Richard Wilson, global industry leader Energy, Chemicals and Utilities, Ernst & Young.

Belief that ETS will not start on time: "Around 40 per cent of respondents were in the power industry," Wilson said. "This research identifies a number of issues with the scheme itself and with companies' preparations for its introduction. There is a widespread belief across Europe that the EU-wide scheme will not start on time and will be ineffective in delivering the EU's emissions reductions targets.

Companies believe scheme ineffective:

"Under half of the respondents believe that the scheme will commence as scheduled.

- 60 per cent consider that the scheme will not deliver the promised emissions reductions;
- only 35 per cent believe that a liquid market for emissions trading will emerge in the Initial Phase;
- 80 per cent of companies either do not know, or are unwilling to comment upon, what level of allowances they expected to receive in the Initial Phase;
- almost a quarter of all respondents have not dealt with the strategic and financial consequences of emissions trading nor identified how they could benefit from it.

Electricity sector more prepared: "However, companies in the electricity generation sector do appear more prepared than those in other affected industrial sectors."

Reduction projects must be operational by 2007 to reap most rewards: World Bank

9

The 'Linking Directive', currently under discussion at the European Parliament, would allow JI and CDM credits to be used in the EU-ETS. The lead time for developing JI/CDM projects meant that companies faced a race against time to make the most of this aspect of flexibility.

Must be operational by 2007: Three to seven years was a typical period from identification and licensing of JI/CDM projects through to operation and delivery of the first emissions reductions (ERs). As the World Bank pointed out "for projects to deliver a significant proportion of their ERs by 2012, they need to be operational by 2006 or 2007 at the latest, and thus be contracted by at least 2006"

(Source: p. 26, *State and Trends of the Carbon Market 2003*, PCIplus Research/World Bank).

Reference: Emission critical, Connecting carbon and value strategies in utilities, Global Utilities Insight 2004, by PricewaterhouseCooper.

Canadian energy utility: First CO₂ geosequestration trade

Entergy of Canada now held the distinction of conducting the first geologic carbon sequestration trade by a utility.

First utility to seek carbon credits: Entergy was the first US utility to seek carbon emissions credits from an enhanced oil recovery geological sequestration project.

Total credits equate to 100,000t: Traditional sequestration projects sought by Entergy and other American utilities have centred on carbon sequestration through reforestation. This project, however, captured and injected CO₂ vent gases that would otherwise be emitted into the atmosphere into oil bearing formations. Total amount of carbon credits will equal 100,000 metric tons.

Reference: Coal21. September 2004. Contact: Phone: 02 6273 6044. Fax: 02 6273 6060. Email: info@coal21.com.au. http://www.coal21.com.au

Combined cycle plants with carbon dioxide separation not viable before 2020: Siemens

How credible is the prospect of commercially viable new coal technology in a meaningful time frame? One strong source of information was the giant Siemens Ltd manufacturing company, which had a long history and extensive experience in providing power generation plants here and around the world.

Siemens an industry leader for turbines:

Overall, Siemens had provided 49 steam turbine generators and five gas turbine plants for customers in Australia - the more recent including the 300 MW Oakey gas plant in Queensland (completed in 1999) to three 500 MW brown coal-fired turbine generators for the Loy Yang complex in Victoria in the late 1980s.

Renewables supplement CO₂ dumps: "In the future," Siemens Power Generation general Manager David Pryke said, "increased utilisation of non-fossil-based power generation using nuclear and renewable energy sources like wind farms will be supplemented by a process of pre-combustion separation of carbon dioxide for fossil fuel plants. Safely stored underground, this carbon

dioxide will be permanently removed from the climate cycle and therefore will substantially reduce emissions from their current levels."

Combined cycle plants not viable now: He said Siemens expected combined cycle plants with carbon dioxide separation would not become viable before 2020. "Until then engineers will endeavour to attain incremental increases in the efficiency of conventional power plants."

Reference: Energy Supply Magazine, September 2004, p. 9.

Japan goes nuclear due to Kyoto: phase-out of coal, oil

Japan would continue to pursue nuclear power as a big contributor to its electricity supply despite last month's accident that killed four workers and injured seven at Kansai Electric's nuclear power station in Mihama, according to *The Australian* (9/9/2004, p. 28).

Kansai president focused on problems: Kansai president Yohsaku Fuji, also chair of the Federation of Electric Power Companies of Japan, was to have delivered a paper to the World Energy Conference in Sydney but instead remained in Japan to manage the aftermath of the accident, the worst in Japan's nuclear power industry's history.

Nuclear now accounts for 31pc of power: His paper said that ever since the oil supply crises of the 1970s, Japan's electrical utilities

had been diversifying the fuels used in thermal power generation. The result was that by 2002

- nuclear power accounted for 31 per cent of total power generation;
- LNG 27 per cent, coal 22 per cent;
- oil 9 per cent;
- hydro 9 per cent; and
- in 1973, oil-fired thermal power accounted for 71 per cent of Japan's generation capacity.

Nuclear essential to cut emissions: Fuji said Japan's electricity industry aimed to cut carbon dioxide emissions by 20 per cent on 1990 levels by 2010. This meant it was essential to build more nuclear power plants while making maximum use of existing nuclear facilities.

Also committed to renewables: This policy stood alongside a commitment by the electricity industry to pursue renewable energy resources such as solar and wind power. Fuji's paper said that by the end of 2002 Japan's solar power capacity was 640 megawatts, 48 per cent of the world's total solar power capacity.

Projected direct costs of fusion electricity 50pc more than coal

The prediction of the absolute cost of fusion-generated electricity in more than 50 years from now required a realistic assessment of the uncertainties, according to scientists working on the ITER fusion program based in Germany.

Projected direct cost at 70 mECU(95)/kWh:

"Detailed studies were therefore carried out, covering a range of assumptions for the key physics and technology parameters affecting the economic performance of a power plant, they said. "The results indicate that the projected direct costs of fusion electricity are in the range 50-100 mECU(95)/kWh, with a most probable value of 70 mECU(95)/kWh.

Fusion expensive, but better abatement: "This may be compared to published projections of the direct costs of electricity from other possible future technologies in the second half of this century. The expected direct costs of fusion electricity are about fifty percent higher than those of coal (without emission abatement costs) or fission, but become competitive with 'clean coal', when emission abatement costs are included. Renewables vary greatly in their cost prospects and their range."

Reference: European Fusion Development Agreement. WEC, Sydney September 2004. ITER, *The Major Step Towards Fusion Energy For The World* ITER, *Vetape Essentielle Pour Energie De Fusion Sur Terre*. Prof. Minh Quang Tran, Dr. Federico R Casci. EFDA Close Support Unit, Garching, Germany. <http://www.efda.org>

Chicago Climate Exchange announces carbon futures: European Climate Exchange Carbon Financial Instruments

The Chicago Climate Exchange, the world's first multi-national and multi-sector marketplace for the reduction and

trading of greenhouse gas emissions, and the International Petroleum Exchange (IPE), announced today the signing of a formal Cooperation and Licensing Agreement for the listing of cash and futures contracts in European Climate Exchange Carbon Financial Instruments on the IPE.

Milestone agreement: On April 12, 2004, CCX and IPE had signed a Letter of Understanding. Under the agreement, a series of futures contracts on ECX CFIs relating to the EU Emissions Trading Scheme will be launched by the end of the year, with cash products to follow in early 2005. Both the cash and futures products will be listed by the IPE and traded on the IPE's electronic platform, under license from CCX. It is intended that the products will be cleared by LCH.Clearnet Ltd.

More efficient market: In conjunction with this significant agreement, CCX announced the establishment of its wholly owned subsidiary ECX, which will serve as a sales and marketing office headquarters in Amsterdam. The office will be led by Peter Koster, who previously served as chief executive officer of Fortis Bank UK.

For more information, please see <http://www.theinterchange.com>. Alison Herring - IPE Press Officer, Phone: +44 (0)20 7265 3620

Emissions allowance trading begins before EU-ETA rules released: Prices almost double and more trades expected

Even ahead of the exact rules of the EU-ETS being known, trading of allowances had already begun.

Small trades initially: Not surprisingly, this pre-compliance trading had been thin, as companies used relatively low volume trades to gain experience in the markets, frame agreements with counterparties and test their internal system.

Prices double over 2003: The trend so far had been an upward drift in bid-offer spreads, with prices nearly doubling from Euro dollar 6/t CO₂ in Spring 2003 to more than Euro dollar 12/t CO₂ in Winter 2003. However these initial figures related to a very illiquid market, with less than 50,000t CO₂ allowances traded every week.

More trades expected: Once national allocation plans and compliance rules became clearer, the market was likely to witness greater trading activity and experience genuine price discovery. Certainly the response of European utility leaders to the *Global Utilities Insight 2004* report indicated that there would be a significant number of companies seeking to trade in the new market.

Net buyers outstrip net sellers: Nearly half said that it was too early to tell, but 32 per cent of respondents felt confident enough to say that they would definitely be an 'active trader participant' in the marketplace. Among the respondents the number of companies expecting to be net buyers significantly outstripped net sellers.

Power generation emissions to increase by 11bn tonnes: Energy industry challenge of more demand, less emissions

The power generation industry was facing the challenge of having to increase its output by about 60 per cent over the next fifteen years while continuing to reduce emission, especially the CO₂ produced by the ever increasing share of fossil fuels, according to Klaus Voges, president, Siemens Power Generation Group.

Unacceptable for 1.6m to be without energy: "Economic growth and sustainable development require access to affordable power in all countries around the globe. It is not acceptable that about 1.6 billion people still have no access to modern forms of energy like electric power.

Fossil fuels are still essential: "While the Kyoto Protocol pushes for lower CO₂ emissions, even the most promising

technological development shows that fossil fuels will continue to be the backbone of power generation to 2020 and beyond.

CO2 emissions from power gen to rise:

"Today we assume that - despite a marked increase in the use of renewables like wind and biomass - the CO2 emissions produced by power generation will rise from eight billion tonnes to about 11 billion tonnes in 2020.

Reference: World Energy Council. Global Energy Official Publication of the 19th World Energy Congress, Sydney, Australia 2004.

Carbon dioxide emissions could double by 2050, says World Business Council for Sustainable Development

Global carbon dioxide emissions could double by 2050 if energy-saving measures were not universally introduced, an international energy report released in Sydney on 6 September showed, according to *The Sydney Morning Herald* (7/9/2004, p. 5).

Natural gas, nuclear energy, renewables:

The document *Energy and Climate Change*, released by the World Business Council for Sustainable Development at the World Energy Congress, reported on energy trends for the next 46 years. It highlighted natural gas, nuclear energy, renewable energy, bio-

products and low energy appliances as tools to help reduce fast-growing levels of carbon dioxide.

Emissions could double by 2050: Speaking at the conference, a delegate from the Geneva-based council, Anne Lauvergeon, said carbon growth was difficult to halt. "To give figures, in 2000 the world emitted around eight gigatonnes of carbon," Lauvergeon said. "Under a business-as-usual scenario, in 2050 emissions could double to reach around 16 gigatonnes ... so if we don't act now, our future may become out of control."

Sydney's Energy congress "well above the pass mark"

The World Energy Congress had exceeded organisers' expectations and deserved well-above a pass mark, according to *The Australian* (8/9/2004, p. 29).

Standard of papers extraordinary: "We issued a worldwide call for papers last August," said Jim Starkey, executive director of the World Energy Congress running in Sydney, "and we got 500 proposals. The quality of papers finally accepted was extraordinary. Every presentation being made to the 2500 delegates and 100 representatives of international news media, is well above the pass mark."

Congress looks to the future: "The immediate problems - the price of crude oil,

possible interruptions in supply - are being discussed," Starkey said, "but the congress theme is looking beyond the immediate day-to-day issues. We're trying to find solutions for what, with today's level of knowledge, seem intractable problems."

How it would work: It would retrofit an existing coal-fired boiler - the CS Energy, Callide A 30MW Unit - owned by the State of Queensland. Stage one would capture 150,000 tonnes of CO2 to send to an unspecified waste-dump. Stanwell, and Tarong were listed as project participants.

And air-blown IGCC unit: In another project at the conference Hiroyasi Onishi and Teruo Nagai of the Clean Coal R&D Co Ltd, Japan proposed demonstration tests on a 250 MW air-blown IGCC unit.

Reference: World Energy Congresses were established by the London-based World Energy Council. Australian emissions. The CO2CRC disputed this and claimed 600 years of CO2 storage.

Germans not permitted extra emissions in nuke switch off

Under the EU burden-sharing agreement member states agreed to individual greenhouse gas (GHG) emissions reduction targets so the whole community could meet the EU's Kyoto Protocol obligations. A range of complex issues have worked to make this a difficult goal according to a report by German law firm Freshfields.

Cost an issue: Such targets were agreed with an eye to both the past and the future. The formulation of the NAPs has brought to the fore questions as to how achievable these national targets are, and, in particular, who should bear the burden of achieving them.

Calls to re-evaluate: The reality of what the EU ETS could mean for national industries hit home when consultation on the proposed allocations under the draft NAPs commenced. This led to calls from some quarters for a possible re-evaluation of Kyoto commitments. The EU Energy Commissioner, Loyola de Palacio, was reported to have 'openly challenged' the EU's commitment to the Kyoto Protocol and to have suggested that the EU should look at other ways of achieving emissions reductions while maintaining the competitiveness of its industry.

More than numbers: An analysis of the percentages agreed by individual member states under the EU burden-sharing agreement provides little insight as to the true 'burden' agreed by a member state without an understanding of the reality of achieving such goals in that particular member state. Germany, for example, agreed to reduce its GHG emissions to 21 per cent of 1990 levels for the period 2008-12. Such a high target was deemed acceptable as reunification had seen reductions from the 1990 baseline and its substantial efforts to increase efficiency in the East.

Tough without atoms: Changes since then have made it seem more difficult. Its decision to phase out nuclear power is likely to result in increased CO2 emissions. The current German NAP provides for an extra allocation of 1.5 million tonnes of CO2 as compensation for additional emissions necessarily resulting from the closure of two nuclear power plants. The EU has rejected Germany's current NAP.

Shut down Spain: By contrast, Spain has been permitted to increase its emissions by 15 per cent. However, projected Spanish emissions are much higher than this and, as there is a close correlation between the increase of GHG emissions in Spain and its economic growth, to halt emissions arguably would be tantamount to halting economic growth.

Moving goalposts: With 12 new members, a radically different energy picture and competitive pressure from Asia mounting on Europe's global trade, there are many factors working against a smooth passage for the next steps in European emission trading. Keenly aware of the costs of untrammelled development Europeans are determined to see the scheme work, however, and progress continues.

A sustainable world: The European Energy Exchange, for example, announced last week that it would commence testing the software and systems for emissions trading. While cynics in the fossil fuel industry snipe at the

resource poor region's attempts to reduce its reliance on fossil fuel, environmentalists around the world applaud the efforts to ensure we all have a future.

Reference: A Breath of Fresh Air, By Deborah Watterson and Nicholas Rock Freshfields Bruckhaus Deringer, <http://www.freshfields.com>