THE CARBON CREDIT EXCHANGE

www.carboncredex.com

A WORKABLE SOLUTION FOR EMISSIONS REDUCTION

WORKBOAT ASIA
SINGAPORE 2003

SOCIETAT DE LEASING, INFORMATICA I REPRODUCCIO D'ANDORRA, S.A.
(SOLEIRA, S.A.)

LA MASSANA,
PRINCIPAT D'ANDORRA

INTRODUCTION

SOLEIRA, S.A. is a broad based financial services company that has restructured to participate in the current e-commerce environment.

In particular, this restructuring of SOLEIRA, S.A. created an effective emissions (carbon credits) trading centre for management of trade related to greenhouse gas emissions. Physically based in Andorra, a small independent principality, situated in the Pyrenees between Spain and France with a unique commercial environment. The “on-line carbon credit trading exchange and registry”, **carboncredex.com,** is uniquely structured and offering an International Commercial Centre for effective carbon credit trading and registration.

SOLEIRA, S.A. has a vast consultative base. With technically capable executives with expertise in the fields of sustainable development, forestry, land use management, environmental management, cadastral management, database management, geographic information systems, mechanical and marine engineering, ISO 14000 auditing, banking and legal conveyancing.

The founders of **carboncredex.com** have more than 100 years of combined experience in the fields of forestry, GIS, land tenure and environmental studies. The company draws upon this experience to guarantee the trading of "Carbon Credits" with a philosophy based on totally fair and equitable practises. This “in-house” expertise specialises in large quantity data management enabling conformity and compliance with GreenHouse Gas (GHG) regulation at an international scale.

carboncredex.com provides this fair trading register with a set of regulations; guidelines and technical support that ensures the "tradeable objects" are real and quantifiable.

THE CARBON CREDIT EXCHANGE ETHOS

Human beings have been living in cities for well over 6000 years and it is expected that nearly half of the world’s population will live in urban areas by the end of the year 2000 (United Nations, 1992). This staggering level of urbanisation has serious implications for the environment.

At the global scale, the United Nations recognises that urbanisation of society is part of the development process of nations (United nations, 1992) and has established a series of agencies to address the environmental, social and economic issues.

It is not well understood that there exist important ecological constraints on human activity at various levels ranging from the local to the global. Human processes and alterations of the biosphere now approach the physical scale of natural processes at the planetary level.

The greenhouse effect and ozone depletion are consequences of the urbanisation and industrialisation processes that consume raw materials and energy, and produce damaging waste products. Climate change is a product of the Industrial Age and society continues to place the resolution of the problem at the feet of the next generation. The Carbon Credit Exchange recognises that responsibility and in collaboration with willing participants strives to achieve significant change for the benefit of our industrialised way of life.

SUSTAINABILITY

The Carbon Credit Exchange - **carboncredex.com,** is about sustainability in its widest context and a commitment to responsible action by ALL sectors of the community.

A SUSTAINABLE SOCIETY requires an awareness of factors that contribute to the capacity of the earth to assimilate human intergenerational impacts. The greatest perceived threat is carbon dioxide (CO_2), a by-product released when fossil fuels such as coal and gas are burned to make electricity, run automobiles, and power other features of our industrial economy. In simple terms, carbon dioxide traps the sun's heat inside the earth's atmosphere in much the same as a greenhouse traps warm air resulting in the potential for global warming. The contributing issues are being addressed by International Organisations in such a way as to enable the results of the interaction between biodiversity and economic impacts to be reduced.

In 1987, The World Commission on Environment and Development (The Brundtland Commission) exposed the concept of sustainable development and promoted it to centre-stage in global politics. In the report, "Our Common Future", the Commission framed the "growth versus environment debate" and defined the context of sustainable development as:

> **"meeting the needs of the present without compromising the ability of future generations to meet their own needs."**

Over a number of years, what evolved from that Commissions Report were what are now commonly referred to as the Bellagio Principles, a set of principles that were agreed to following meetings of an international group of practitioners and researchers from five continents who came together at the Rockefeller Foundation's Study and Conference Centre in Bellagio, Italy in November 1986.

The following principles resulted and were unanimously endorsed.

1. GUIDING VISION AND GOALS
2. HOLISTIC PERSPECTIVE
3. ESSENTIAL ELEMENTS
4. ADEQUATE SCOPE
5. PRACTICAL FOCUS
6. OPENNESS
7. EFFECTIVE COMMUNICATION
8. BROAD PARTICIPATION
9. ONGOING ASSESSMENT
10. INSTITUTIONAL CAPACITY

ABOUT THE KYOTO PROTOCOL

The Kyoto Protocol reflects a comprehensive plan to reduce six greenhouse gas emissions, including carbon dioxide (CO2), between 2008 and 2012. In December 1997, more than 150 nations met in Kyoto, Japan, to negotiate the terms of the Kyoto Protocol, a global climate agreement under the U.N. Framework Convention on Climate Change. It was open for signature from 16 March 1998 to 15 March 1999 at United Nations Headquarters, New York.

The finer details of the operational aspects of the PROTOCOL are still being developed by the UNFCCC but in any event provide sufficient detail and motivation to move through to an effective emissions trading environment. The process moves on positively from Marrakech.

STATUS OF SIGNATORIES and RATIFICATION OF THE CONVENTION

The text of the Convention was adopted at the United Nations Headquarters, New York on the 9 May 1992; it was open for signature at the Rio de Janeiro from 4 to 14 June 1992, and thereafter at the United Nations Headquarters, New York, from 20 June 1992 to 19 June 1993. By that date the Convention had received 166 signatures. The Convention entered into force on 21 March 1994. Those States that have not signed the Convention may accede to it at any time.

KYOTO EMISSION AUDITS

carboncredex.com estimates that there is a value of more than **€**50 million (of **excess** to the permitted emissions for emitters equivalents at EU levels) per annum of unaccounted consumed oil related products in Australia alone. This figure is calculated from estimates of the number of "unaccounted for" litres of oil products sold in Australia. Where is this oil? There are numerous suggestions as to where this oil finally ends up. But mostly it is illegally disposed of directly into

the environment because it is waste after all and there is a cost of some type to dispose of the waste oil in a registered place.

One of the many issues facing the effective introduction of the KYOTO PROTOCOLS to date is the inability to account for and quantify the full spectrum of emissions creation. Whilst this aspect is not quantifiable, then the emission reduction targets are less accurate and there is an overall loss of confidence by politicians, business leaders and the public in the emissions accounting system. This inability to account for and quantify the emissions data is only a transitory phase and already the European Union parliament has processes and regulations in place to meet both fully and partially the targets that have been agreed to at the many Conference Of Parties (COP)

The Carbon Credit Exchange has set, as one of its goals, identification of the “oil consumer” and the volume of oil purchased at the point of sale (POS). Utilising Article 12 of the KYOTO PROTOCOLS, carboncredex.com can, with its patented technology, integrate from the POS, the “oil products” consumption to an individual level and equate that to emission generation. With this information to hand, an individuals’ consumption, use and disposal pattern of an “oil product” can be determined and the carbon debt or credit tabulated.

One may suggest that this is a draconian measure. However it is already possible and is being achieved now at a corporate level. Some parties are already in the program and aggregating carbon credits that can be debited against other segments of their organisation.

Utilising the **carboncredex.com** auditing and validation process, the credits can be registered with the Carbon Credit Exchange to form part of an aggregated pool of carbon credits that are an investment relevant to the principles of sustainable development.

EMISSIONS TRADING

Emissions trading is an economic incentive-based alternative to command-and-control regulation. In an "emissions trading program", emitters of a particular pollutant (most often an air pollutant) are given permits to release a specified number of tons of that pollutant. The government issues only a limited number of permits consistent with the desired level of emissions. The owners of the permits may keep them and release the pollutants, or reduce their emissions and sell the permits. The fact that the permits have value as an item to be sold or traded gives the owner an incentive to reduce their emissions.

THE CARBON CREDIT EXCHANGE STRUCTURE

In order to ensure that the CARBON CREDIT EXCHANGE (**carboncredex.com,**) has the necessary expertise, SOLEIRA, S.A. has assembled by invitation, a core group of affiliates with demonstrated capacity to identify ethical business opportunities. This group enhances the integrity and viability of the trading exchange. Additionally, the inclusion of associates with internationally recognised credentials will provide **carboncredex.com,** with credibility both as a financially rigorous and technologically aware organisation.

The Board of Directors in collaborate with participating companies will ensure competent management and maintenance of accurate records, of Clean Development Mechanism (CDM) projects, silviculture techniques, and sustainability of sequestrated carbon Emission Reduction Units.

Additional research will be outsourced to competent research and academic institutions when required.

The structure of the Board and advisers is illustrated on the following page.

DIRECTORS, SECRETARY AND ADVISERS

Board

John Alan Newlyn Bodger, Chairman and Chief Executive Officer
Dr. Peter J. Mack, Non Executive Director
Charles Peaty, Non Executive Director
Rajive Sahai, Executive Director and Chief Engineering Officer
Andrew Jamie Bodger, Executive Director and Chief Technical Officer
Timothy Julian Bodger, Executive Director and Chief Research Officer

all of
la Massana,
Principat d'Andorra

Company Secretary and Registered Office
Jesus Betriu Coma

la Massana,
Principat d'Andorra

Nominated Adviser

Banca Privada d'Andorra
Placa Rebes 7
Andorra la Vella
Principat d'Andorra

Reporting Accountants and Auditors
To be confirmed

Solicitors to the Company
Betriu and Bourgard Advocats
Placa Rebes-Vinyeta, num. 2,A
Andorra la Vella
Principat d'Andorra

Bankers to the Company
Banca Privada d'Andorra
Placa Rebes 7
Andorra la Vella
Principat d'Andorra

Patent and Intellectual Property Agents
Mr Tony Rackham,
Lloyd Wise and Company
COMMONWEALTH HOUSE,
1-19 New Oxford Street,
London WC1A 1LW
United Kingdom

DIRECTORS TECHNICAL PROFILES

JOHN ALAN NEWLYN BODGER
Alan's involvement in "Land Use Management" commenced during his time in the Town Planning Department of WA where he was responsible for preparing the review for streamlining subdivisional procedures and amendments to the Strata Titles Act and the Town Planning and Development Act.
His witnessing of the disappearance of most of the northern wetlands to urban development sparked his interest and subsequent degree in environmental science and conservation.
A long period as a senior lecturer in Engineering and Associated Studies (TAFE External Studies) specialising in surveying, cartography, environmental and maritime studies culminated with his appointment as Associate Director (Academic) North Metropolitan College of TAFE.
Alan has established and now operates his own private consultancy, both in Australia and overseas specialising in the following areas. Computer graphics and land information system consultant; both in Australia and Hong Kong. Consultancy clients were Systems Research Institute of Australia, Data Switch Technology, Mineral Mapping Australia, Advanced Concepts (Hong Kong Ltd), Intersearch (Hong Kong Ltd).
Planning consultant specialising in strategic planning and environmental and land use management utilising geographic information systems. Projects included the Pilbara Study, Cockburn National Estate Study, Cockburn Wetlands Study, Caversham Urban Development plan for the Swan Valley etc.

CHARLES PEATY BSc. (For)
Since graduating from the University of Wales, Charles Peaty has had extensive experience in all aspects of forestry in areas as far spread as the mountain forests of Wales to the arid lands of the Middle East.

As a Professional Forester with the U.K. Forestry Commission, he managed extensive mountain forests, both Government and private. He was Director, Economic Forestry Management Services Ltd, London, the then largest commercial forestry management consultants in the U.K. and Europe, and, Consultant and Director of Timber Growers Organisation of the U.K. He lectured on forest design and management at Northerwood House Forestry Education Centre, Lyndhurst, was a Board Member of two major national parks in the U.K., Snowdownia and Pembroke Coast and Consultant to National Parks Planning Board (U.K.) representing private forestry.

On coming to Western Australia in 1966 he worked as a Professional Forester with the W.A. Forests Department before founding Tree and Plantation Services Pty Ltd, originators of private investment forestry in Western Australia and creators of some 10,000 hectares of new forests and 5 nurseries Australia wide. In 1979 he created and incorporated Men of Trees Society of W.A. This concept has since been followed by five other States.

1981 to 1989 saw him specialising in low rainfall (250mm - 500mm) cheap, fast tree planting and maintenance, without watering, on farms in over 45 shires throughout Western Australia. This speciality continues today.

Currently Charles Peaty is forestry consultant, manager and contractor to many private clients within Western Australia and from overseas. He has consulted on rehabilitation and environmental issues to major mining companies such as Griffin Coal, Greenbushes Tin, Worsley Alumina etc.

Charles Peaty was the founding chairman of the West Australian Regional Manufacturers Association, a Life Member of the Royal Forestry Society and a Member of: Australian Institute of Foresters, Society of Foresters, International Tree Crops Institute, World Goodwill; Founder director of the then Australian Development Institute (now Australian Forest Growers)

RAJIVE SAHAI (1st Class STEAM and MOTOR, Post Graduate Diploma Shipping and Offshore Exploration)
Rajive brings considerable expertise to carboncredex.com through his extensive training and operating experience. Following his years at sea progressing to the position of Chief Engineer, Rajive become a consultant and technical adviser to a number of companies engaged in the maritime and engineering fields.

During this time, Rajive was responsible for: Planning, Scheduling, Monitoring, Implementing all Design, Installation, Commissioning and Maintenance Programs in addition to Crisis Management, Risk Management and Safety and the Implementation of Company Policies, Strategies, Schedules, Codes, Procedures, Practices and Quality Management.

Rajives experience also embraces the development of New Management Operating and Training Systems utilising Modern Management Techniques along with Data Processing, Information Retrieval and Management Reporting using Databases, Knowledge Bases, Artificial Intelligence and Expert Systems and Appraisal of Performances against estimates of Manpower, Budgets and All Key Performance Indicators for Business.

CARBON CREDIT EXCHANGE FUNCTIONALITY

SOLEIRA, S.A. has established the **carboncredex.com** as a venue for INTERNATIONAL EMISSION TRADING within parameters that are evolving and generally being adopted by the overseeing agencies. At the present time the issues that influence EMISSION TRADING are:

TRADABLE OBJECTS
UNITS OF TRADING
ELIGIBILITY CRITERIA
REPORTING REQUIREMENTS
TRACKING REQUIREMENTS
LIABILITY

These issues are the current Guiding Principles for **carboncredex.com.** The exchange will require confirmation that Emission Reduction Units (credits) are real, surplus, retrospectively quantifiable, verifiable and unique. As a consequence, trading of Emission Reduction Units (credits) will be constantly reviewed to ensure their environmental benefit and will not be traded for trading sake.

All actions taken by all parties operating on the **carboncredex.com** will comply with the letter and intent of all laws and regulations both of their local, national and international jurisdictions.

As a service to the wider community, **carboncredex.com** will, over time, because of the wide range of data being collected, identify issues related to trading among emitters from different industries and different jurisdictions. The issues will be recorded in a Register of Issues.

For the purpose of the registry the following definitions will be used;

1. For the purposes of the present annex the definitions contained in Article 1 [(1)] and the provisions of Article 14 shall apply. Furthermore:

   (a) An **"emission reduction unit"** or "ERU" is a unit issued pursuant to the relevant provisions in the annex to decision -/CMP.1 *(Modalities for the accounting of assigned amount*s) and is equal to one metric tonne of carbon dioxide equivalent, calculated using global warming potentials defined by decision 2/CP.3 or as subsequently revised in accordance with Article 5;

   (b) A **"certified emission reduction"** or "CER" is a unit issued pursuant to Article 12 and requirements there-under, as well as the relevant provisions in these modalities and procedures, and is equal to one metric tonne of carbon dioxide equivalent, calculated using global warming potentials defined by decision 2/CP.3 or as subsequently revised in accordance with Article 5;

   (c) An **"assigned amount unit"** or "AAU" is a unit issued pursuant to the relevant provisions in the annex to decision -/CMP.1 *(Modalities for the accounting of assigned amount*s) and is equal to one metric tonne of carbon dioxide equivalent, calculated using global warming potentials defined by decision 2/CP.3 or as subsequently revised in accordance with Article 5;

   (d) A **"removal unit"** or "RMU" is a unit issued pursuant to the relevant provisions in the annex to decision -/CMP.1 *(Modalities for the accounting of assigned amount*s) and is equal to one metric tonne of carbon dioxide equivalent, calculated using global warming potentials defined by decision 2/CP.3 or as subsequently revised in accordance with Article 5;

(e) **"Stakeholders"** means the public, including individuals, groups or communities affected, or likely to be affected, by the proposed clean development mechanism project activity.

1. In the context of this annex, "Article" refers to an Article of the Kyoto Protocol, unless otherwise specified.

To ensure that there are real monetary values attached to the ERU's, **carboncredex.com** uses the European Union (EU) value of **€**40 per tonne of **excess** to the permitted emissions for emitters as its estimated value for ERU's (carbon credits). This value is valid for the period 2005-2008 when the value increases to **€**100 per tonne. The marketplace will determine trading prices.

Emission trading is seen as the province of large emitters and most legislation is directed to these groups. As part of the **carboncredex.com** register, small quantities of ERU's from groups, individuals, companies, government agencies and those who practice carbon accounting (and those that wish to) can accumulate their carbon credits in the Carbon Credit Pool or ERU Pool where carboncredex.com will trade on their behalf, the aggregated ERU's. The aggregated ERU's will then be in commercial volumes, with full certificated and verified authenticity.

THE PROCESS

To ensure that the Emission Reduction Units (credits) exist, **carboncredex.com** has created a 'real-time' Register that tracks the creation, transfer, use and retirement of credits created by trading on the exchange. These records will be available to anyone who at any time will be able search the database for the required information and determine for a fee:

Who created the emissions reductions in a geographic area/region and who owns them?
What reductions have been created, transferred, used, or retired and who owns them?
What reductions are still available and who owns them?
When were reductions created, transferred, used, or retired and who owns them?
Where were the reductions created (precise geographic location)?
Where were the reductions used (precise geographic location)?
How were reductions created or used (precise geographic location)?
How many reductions were created, transferred, used, or retired (precise geographic location)?
How many reductions are still available (precise geographic location)?

The expertise available to **carboncredex.com** has seen the development of its own Patented reporting and certification system (the "Register") that will enable these and any additional criteria to be fulfilled to the current and future requirements of compliance.

REGULATIONS

Certification of the "tradeable objects" is our prime focus and our emphasis will be on the producer to show that these objects are real and have been developed in accordance with the principles of the appropriate ISO standards. The **carboncredex.com** database using advanced GIS and imaging software will enable, with the appropriate certification from the ISO 14000 and EMAS auditor, a certificate to be issued that guarantees those particular "tradeable objects".

The certificate will be available to the ERU Producer and the Emitter and a record kept on the **carboncredex.com** database for referencing purposes.

Basic Guiding Principles

1. Emission Reduction Units (credits) will be real, surplus, retrospectively quantifiable, verifiable and unique.
2. Trades of Emission Reduction Units (credits) will be reviewed to ensure their environmental benefit.
3. All actions taken by all parties in **carboncredex.com** will comply with the letter and intent of all laws and regulations.
4. Actions taken by parties in **carboncredex.com** will have no negative environmental impact.
5. **carboncredex.com** will identify issues related to trading among emitters from different industries and different jurisdictions.
6. Issues will be resolved, as much as possible, through a consensus-based multi-stakeholder process.

REGISTRATION

The Carbon Credit Registrar will operate a central registry of original carbon credit certificates, with a certified copy issued to individual owners. Search of the Register will provide proof of ownership of tradeable objects. Lodgement of appropriate documentation will enable variation of ownership on registered certificates.

CERTIFICATION

A **carboncredex.com** Certificate of Compliance will be issued to the purchaser of the emission reduction unit (ERU) validating and ensuring that those "ERU credits" exist. To ensure regulatory compliance, only certificates of verification issued by professionals, holding appropriate accreditation in assessment of greenhouse gas emissions will be accepted.

All trades will also be required to provide evidence of indemnity insurance equivalent to the value of the trade.

One group who are actively working with **carboncredex.com** on certification is the international group, **URS**. A joint project that is progressing, audits large enterprises oil usage regimes and then verifies and certifies environmental compliance of the oil management system and the consequential creation of any ERU's and their subsequent registration with **carboncredex.com**

CARBON CREDIT EXCHANGE FEES

Income for the exchange will be generated from two sources, the advertising registry of Affiliate Members and Emission Trading.

EMISSION TRADING
The **carboncredex.com** will charge a DEALING FEE of 5.0% of the Total carbon credit transaction, with the **carboncredex.com** receiving 3.5% as its share of the fee and if a Broker is involved the Broker, the balance of 1.5%.

Producers of Emission Reduction Units (ERU's) who wish to participate in the CERTIFIED CARBON CREDIT POOL or ERU POOL, a pool of un-traded carbon credits from small producers, can register their interest at **carboncredex.com** for a once only fee of €2 per tonne (once only registration fee) to mutualise their production. When these pooled credits are traded, the DEALING FEE is applicable.

AFFILIATE MEMBERS

AFFILIATE MEMBERS of the **carboncredex.com** are individuals or groups who are actively engaged in the business of greenhouse gas emissions and have an interest of some form in the **carboncredex.com**.

Our stated goal is to promote a globally sustainable economy within the context of a CO_2 Emissions Trading environment using vision, strength of mind, teamwork and persistence as the framework.

carboncredex.com draws together those persons and organisations with the experience, expertise and skill necessary to assist in achieving this goal.

FINANCE
ACCOUNTANTS
ADVISERS
CONSULTANTS
INVESTMENTS
BANKING

ERU PRODUCERS
FORESTRY
AGRICULTURE
HORTICULTURE
MANUFACTURERS
TECHNOLOGISTS

EMITTERS
PUBLIC UTILITIES
PRIVATE UTILITIES
SME's
LE's

QA AUDITS
ISO 19000
ISO 14000
ISO 9000
EMAS

BROKERS
CARBON CREDIT
STOCK
FUTURES

INSURERS
INSURANCE
RISK MANAGEMENT
RE-INSURANCE

GIS, MAPPING, ETC
GIS SOFTWARE
GIS HARDWARE
GPS
CARTOGRAPHERS
PHOTOGRAMMETRY
SURVEYORS

GO's
INTERNATIONAL GOVERNMENT
NATIONAL GOVERNMENT
STATE/COUNTY GOVERNMENT
REGIONAL GOVERNMENT
LOCAL GOVERNMENT
AGENCIES OF ALL GOVERNMENT SECTORS

NGO's
PRIVATELY FUNDED ORGANISATIONS
GOVERNMENT FUNDED ORGANISATIONS
PUBLIC SUBSCRIPTION FUNDED ORGANISATIONS
INDIVIDUALS
ASSOCIATIONS

EDUCATION
RESEARCH INSTITUTIONS
TERTIARY INSTITUTIONS
TECHNICAL AND VOCATIONAL INSTITUTIONS
INSTITUTES OF TECHNOLOGY

LEGAL
LAWYERS
ADVISERS

SERVICES
CONTRACTORS
EQUIPMENT SUPPLIERS
ENGINEERING
SEED AND SEEDLING

CONSULTANTS
NATURAL RESOURCE MANAGEMENT
ENVIRONMENTAL
SOCIAL
ECONOMISTS
STATISTICAL
AGRICULTURAL
METEOROLOGICAL
FORESTRY
ENERGY
ENGINEERING

Those persons wishing to become registered as Affiliates with **carboncredex.com** are charged an annual registration fee set out in the following table

Small Company	**€100**	(less than 100 employees)
Medium Company	**€200**	(more than 100 less than 1,000 employees)
Large Company	**€2000**	(more than 1000 employees)
Association:	**€100** **€200**	(less than 500 members) (more than 500 members)
Government: Federal, State, County, Regional, City, Local or Municipal	**€200** **€100**	(per government department Federal, State or County) (+**€10** per 1000 population for City, Municipal or Local)
Consultant-Broker Large-scale trade-brokering companies	**€100** **€2000**	(less than 100 employees and contractors) (more than 100 employees and contractors)
Consultant - Non-brokering companies such as engineering, management and environmental consultants	**€100** **€2000**	(less than 100 employees and contractors) (more than 100 employees and contractors)
Professional Firms - Financial, legal and accounting firms.	**€100** **€2000**	**(**less than 100 employees and contractors) (more than 100 employees and contractors)

EDUCATION and TRAINING SEMINARS

The important nature of Sustainable Development and Emissions Trading is obviously to the fore in carboncredex.com agenda. As a service to industry and the wider community, carboncredex.com provides education and training seminars. Fees upon application.

HOW DOES PROTXL FIT INTO THE EMISSIONS TRADING PROGRAM?

As one of **carboncredex.com** projects that comply with KYOTO PROTOCOL Article 12, **carboncredex.com** equates reduced oil consumption to ERU's for each and every participant in the PROTXL OIL MAINTENANCE SYSTEM.

Reduced oil consumption not only saves money, (by using less oil!) it also removes the financial and social liability of groups, individuals, companies and government agencies to legally or illegally dispose of its waste oil. This is another cost saving to the consumer of oil and fits with the ethos and spirit of the ISO 19000 standards of Corporate Social Responsibility. In addition, government (at all levels) will not have to provide managed disposal facilities for waste oil and hence the saving is not only in monetary terms but also the environmental and social costs are at worst reduced and at best eliminated for those consumers/participants in the **carboncredex.com**/PROTXL Oil Maintenance System.

With reference to a particular case, the participant in the system will need to establish an audit program to identify each and every item involved in their asset register involving the "PROTXL OIL MAINTENANCE SYSTEM" together with that items unique maintenance cycle. Data gathered from this "audit" enables **carboncredex.com** to quantify the volume of oil used over the "whole of life" cycle for the particular device or on an annual basis. **carboncredex.com** will then equate the saved oil into ERU's for inclusion into the Carbon Credit Pool or ERU Pool. The aggregated ERU's will then be in commercial volumes, with full certificated and verified authenticity and available for sale.

For example, a trial currently underway with an agricultural haulier. The maintenance cycle of the vehicles has been set for the oil change to occur every five weeks whether the oil needs changing or not. This period was selected because it coincided with the manufacturers oil change interval and was convenient for planning vehicle use. The details of the process follow.

UNITED KINGDOM TRIAL

KEN RAINTHORPE AND SON - RESEARCH TRIAL

ROAD TRANSPORT

INTRODUCTION

It is proposed to carry out a trial of the PROTXL Oil Maintenance System on three vehicles owned and operated by Ken Rainthorpe and Son. The trial is one of a series of trials instigated to demonstrate the improved performance of road vehicles using the PROTXL Oil Maintenance System.

This trial will be established to validate, under European operating conditions, the performance of the PROTXL Oil Maintenance System. The information generated by the trial will be used for marketing the products and be used as “benchmark” tests for future research into the use of oil filtration systems with “long life” oils and the consequential engine operational performance and the environmental benefits accrued from the reduction in the use of and then the disposal of the waste oil.

In this particular trial the vehicles being used are DAF brand prime movers. Each of the vehicles is a DAF X95 prime mover with a 450HP turbo diesel power plant. Full vehicle specifications are available from Richard Rainthorpe.

The basic trial will be undertaken using three near identical prime movers each operating under their normal timetabling and work loads. It is intended that the project will be evaluated for the improvements in engine operating efficiency and performance, reduced operating costs, the reduction in the quantity of engine oil used and cost savings both in the reduction of the quantity of engine lubricating oil used and the disposal of the waste oil.

The filter system installation will be performed by Ken Rainthorpe and Sons workshop staff to the PROTXL specifications.

TRIAL SPECIFICATIONS

Prime mover number one (#1) is "brand new" and will use synthetic oil and the PROTXL filter system installed. The oil filters will be changed at the manufacturers required oil change interval and the oil tested.

Prime mover number two (#2) is aged 12 months. This unit will use synthetic oil and the existing filter system will remain. Oil and filter will be changed at the manufacturers required oil change interval and the oil tested.

Prime mover number three (#3) will be operated on its current regime with the exception of the oil being tested at each oil and filter change. The oil manufacturer for this vehicle is **Elf** and the existing oil type documented. Oil and filter will be changed at the manufacturers required oil change interval and the oil tested.

DATA Collection will be via the form illustrated at FORM 1A (Appendix 1). This form will be completed by the testing laboratory with the time and date of sample and the results inserted in the section shaded on the form.

The service manager for Ken Rainthorpe and Son will complete the **remainder of the form** and forward a copy to both carboncredex.com and PROTXL for record and evaluation purposes.

From the data collected a **C**ost **B**enefit **A**nalysis (CBA) will be prepared by PROTXL for the three vehicles and projected over the whole fleet. The CBA will not cost in the accrued environmental benefits until such time as there are satisfactory regulations in place.

The test period can be established in this instance as a service every five (5) weeks for an agreed period of time, say 4 cycles to begin with.

ENVIRONMENTAL BENEFITS

The trial has been underway now for ten weeks or two cycles of the normal oil change. Each vehicle has an oil capacity of 50 litres. The trial is now concentrated on one vehicle using a fully synthetic oil.

At the present time there has been no oil change only the original manufacturers oil filter element change as well as the PROTXL filter element change and a nominal top up of 4 litres of oil. There is a present net saving of 92 litres of oil used. This is a real money cost saving. There is also the net saving of 92 litres of oil that is not collected for disposal. This is also a real money saving. The government in one form or another does not have to provide a managed waste oil disposal site. This is a real money saving activity for the government. The environment has not been affected by the 92 litres of oil to date because it has not been used to produce greenhouse gas emissions in any form. And finally, there are ERU's accruing for Ken Rainthorpe and Son Transport.

It is estimated that over a full year there will be a net saving of 500 litres of lubricating oil in the operation of a single vehicle operating for an average of 50 hours per week. The ERU's are accruing, the environment is benefiting from the reduced use of a non-renewable resource and the reduced impacts of waste oil disposal. AND finally Ken Rainthorpe and Son are saving money whilst all of this is happening.

Appendix 1

DATA SHEET

FORM 1B

Ken Rainthorpe and Son **PROTXL OIL MAINTENANCE SYSTEM EVALUATION**				
ENGINE NUMBER:				
ENGINE SIZE (litres)				
POWER RATING:				
ENGINE TYPE:				
FILTER TYPE:				
OIL TYPE (and MANUFACTURERS I.D.):				
SERVICE DATE:				
VEHICLE I.D.:				
UNIT HOURS				
OIL HOURS				
WATER % w/v				
FUEL DILUTION % w/v				
TOTAL BASE NUMBER mg/g				
SOOT INDEX				
IRON ppm				
LEAD ppm				
COPPER ppm				
MOLYBDENUM ppm				
CHROMIUM ppm				
ALUMINIUM ppm				
NICKEL ppm				
TIN ppm				
SILICON ppm				
SODIUM ppm				
ZINC ppm				
CALCIUM ppm				
MAGNESIUM ppm				
OIL VOLUME litres				
OIL VOLUME (TOP UP) litres				
COMMENTS:				

Appendix 2

KYOTO PROTOCOL

GLOSSARY OF TERMS

A

abatement is the reduction of the degree or intensity of emissions.

Activities implemented jointly – see Joint Implementation.

Adaptability refers to the degree to which adjustments are possible in practices, processes, or structures of systems to projected or actual changes of climate. Adaptation can be spontaneous or planned, and be carried out in response to or in anticipation of changes in conditions.

Additionality refers to the issue of whether greenhouse gas emissions reduction or sequestration in a Joint Implementation or Clean Development Mechanism project occurs over and above the baseline and constitutes a new reduction that would not have otherwise occurred without the existence of the project.

Allocation is the division of emissions permits or allowances among greenhouse gas emitters for the purpose of establishing a market in tradable permits. There are several possible methods for allocating permits, including "grandfathering" and permit auctioning.

Annex I parties, or *Annex B parties*, in climate change negotiations refer to industrialised countries that are trying to return their greenhouse gas emissions to 1990 levels by the year 2000 as per Article 4.2 of The Kyoto Protocol.

AOSIS refers to the Alliance of Small Island States. It is an ad hoc coalition of low-lying and island countries that are particularly vulnerable to sea-level rise and that also share common public policy positions on climate change. The 42 members and observers are American Samoa, Antigua and Barbuda, Bahamas, Barbados, Belize, Cape Verde, Comoros, Cook Islands, Cuba, Cyprus, Dominica, Federated States of Micronesia, Fiji, Grenada, Guam, Guinea-Bissau, Guyana, Jamaica, Kiribati, Maldives, Malta, Marshall Islands, Mauritius, Nauru, Netherlands Antilles, Niue, Palau, Papua New Guinea, Samoa, Sao Tome and Principe, Seychelles, Singapore, Solomon Islands, St. Kitts & Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Tonga, Trinidad and Tobaga, Tuvula, U.S. Virgin Islands, and Vanuatu.

Assigned amounts are binding emissions reductions commitments agreed upon by Annex B countries in The Kyoto Protocol that are based on 1990 baseline emissions.

Auctioning of emissions permits is a method by which permits for greenhouse gas emissions may be allocated among emitters and firms in a domestic emissions trading regime based upon willingness to pay for these permits. Supporters of this method of emissions trading assert that the advantage of auctioning is that it would provide governments with revenue and provide price signals to the new and developing market for permits. Critics contend that auctioning's disadvantage is that it may be less politically acceptable to those entities that would stand to gain from grandfathering of permits.

B

banking entails saving emissions permits or Certified Emissions Reductions for future use in anticipation that these will accrue value over time.

Benefit-cost analysis is an economic technique applied to public decision making that attempts to quantify in dollar terms the advantages (benefits) and disadvantages (costs) associated with a particular policy. For example, a policy that requires a power plant near the Grand Canyon to install pollution

abatement equipment would reduce air emissions from the plant and improve the visibility at the Grand Canyon for visitors (a benefit), but would increase the cost of electricity to customers (a cost).

Binding targets refer to environmental standards that are to be met in the future.

Bubble refers to the idea that emissions reductions anywhere within a specific area count toward compliance. For example, if a plant with multiple emissions sources is treated as being "under an emissions bubble," regulators assess only the total emissions of the plant, not the emissions of each individual source, in determining compliance.

C

CAFÉ standards require automakers to meet a sales-weighted *Corporate Average Fuel Economy* level for its fleets of new cars and light trucks sold each year. Meeting the standard generally requires selling several higher-mileage vehicles to offset the sales of each vehicle with moderate fuel economy. One standard governs passenger cars, and another governs light trucks. The standards took effect in 1978 as a response to the 1970s Arab oil embargoes to help reduce American demand for imported oil and promote energy conservation.

Carbon sequestration generally refers to capturing carbon – in a carbon sink, such as the oceans, or a terrestrial sink such as forests or soils – so as to keep the carbon out of the atmosphere.
For further reading on carbon sequestration, see Carbon Sinks in the Post-Kyoto World*,* by Roger A. Sedjo, Brent Sohngen, and Pamela Jagger.

Carbon sink – see carbon sequestration.

Carbon taxes discourage the use of fossil fuels and aim to reduce carbon dioxide emissions by placing a surcharge on the carbon content of oil, coal, and gas.

Certified Emission Reductions (CERs) or Certified Emission Reduction Units (CERUs) are verified and authenticated units of greenhouse gas reductions from abatement or sequestration projects which are certified by the Clean Development Mechanism.

Clean Development Mechanism (CDM) is a modified version of Joint Implementation that was included in The Kyoto Protocol for project-based activities in developing countries. In Article 12.2 of the Protocol, the parties established the CDM for the purposes of assisting developing countries in achieving sustainable development and helping Annex I parties meet their emissions limitation and reduction obligations. Under the supervision of an executive board, private and public funds may be channelled through this mechanism to finance projects in developing countries. As in the case of JI, but with slightly different language, any party "may involve private and/or public entities" in the regime. One innovative aspect is that a share of the proceeds from project activities is to be used to cover the administrative expenses of the clean development mechanism. Another part of those proceeds will be used to help particularly vulnerable developing countries meet the costs of adapting to a changing climate. As the Protocol stands now, developing country commitments are restricted to voluntary participation in CDM and the undertaking of general obligations such as the formulation of national programs and political as well as scientific cooperation among each other.
For further reading on the CDM, see The Clean Development Mechanism: A Primer*,* by Michael Toman and Marina Cazorla.

Climate change can be caused by an increase in the atmospheric concentration of greenhouse gases which inhibits the transmission of some of the sun's energy from the earth's surface to outer space. These gases include carbon dioxide, water vapour, methane, chlorofluorocarbons (CFCs), and other chemicals. The increased concentrations of greenhouse gases result in part from human activity – deforestation; the burning of fossil fuels such as gasoline, oil, coal and natural gas; and the release of CFCs from refrigerators, air conditioners, etc.

co-control benefit refers to the additional benefits derived from an environmental policy that is designed to control one type of pollution, while reducing the emissions of other pollutants as well. For example, a policy to reduce carbon dioxide emissions might reduce the combustion of coal, but when coal combustion is reduced, so too are the emissions of particulates and sulfur dioxide. The benefits

associated with reductions in emissions of particulates and sulfur dioxide are the co-control benefits of reductions in carbon dioxide.

Command-and-control regulation requires polluters to meet specific emission-reduction targets and often requires the installation and use of specific types of equipment to reduce emissions.

Commitment periods are a range of years within which parties to The Kyoto Protocol are required to meet their GHG emissions reduction target, which is averaged over the years of the commitment period. The first commitment period will be 2008-2012.

Conference of Parties (COP) is the supreme body of the UN Framework Convention on Climate Change. It comprises 170+ nations that have ratified the Convention. Its first session was held in Berlin, Germany, in 1995, and is expected to continue meeting on a yearly basis. The COP's role is to promote and review the implementation of the Convention. It will periodically review existing commitments in light of the Convention's objective, new scientific findings, and the effectiveness of national climate change programs.

Contingent valuation method is a survey based economic method that is often used to quantify in dollar terms the benefits (or costs) of an environmental policy.

D

decision framework is a way of organising and evaluating information.

Developing countries, or *less developed countries (LDCs),* are those countries which are in the process of becoming industrialised but have constrained resources with which to combat their environmental problems.

Differentiation in the context of the Framework Convention refers to differing national circumstances that might imply differing obligations. It can refer to North-South distinctions, or to differences within the rich Annex 1 countries. The differences can reflect population, income, economic composition, or energy endowment.

Discounting is a method used by economists to determine the dollar value today of a project's future costs and benefits. This is done by weighting money values that occur in the future by a value less than 1, or "discounting" them. Because environmental decision makers are increasingly forced to evaluate policies with costs and benefits that will be spread out over tens – perhaps hundreds – of years, discounting is used to help evaluate the value of measures that deal with problems such as stratospheric ozone depletion, global climate change, and the disposal of low- and high-level radioactive wastes.

Double dividend refers to the notion that environmental taxes can both reduce pollution (the first dividend) and reduce the overall economic costs associated with the tax system by using the revenue generated to displace other more distortionary taxes that slow economic grow at the same time (the second dividend).

Downstream refers to any point in the economy, and in particular, at the level of energy consumers rather than suppliers. It is commonly interpreted to be industrial boilers, electric utilities and other major energy users, but also applies, in theory, to all consumers of gasoline, coal, electricity etc. Conversely, *upstream* refers to the point (or close to it) where fossil fuels enter the economy. In the U.S., it means at the input to oil refineries, at coal processing plants and where natural gas enters pipelines.

E

ecosystem is the complex of plant, animal, fungal, and micro-organism communities and their associated non-living environment interacting as an ecological unit. Ecosystems have no fixed boundaries; instead, their parameters are set according to the scientific, management, or policy question being examined. Depending upon the purpose of analysis, a single lake, a watershed, or an entire region could be considered an ecosystem.

Emissions are pollutants released into the air or waterways from industrial processes, households or transportation vehicles. *Air emissions* pertain to atmospheric air pollution; *water emissions* refer to pollutants released into waterways.

Emissions leakage is a concept often used by policymakers in reference to the problem that emissions abatement achieved in one location may be offset by increased emissions in unregulated locations. Such leakage can arise, for example, in the short term as emissions abaters reduce energy demand or timber supply, influencing world prices for these commodities and increasing the quantity emitted elsewhere; and it can arise in the longer term, for example, as industries relocate to avoid controls.

Emission taxes are taxes levied on air or water emissions, usually on a per ton basis. Emission taxes provide incentives for firms and households to reduce their emissions and therefore are a means by which pollution can be controlled. The greater the level of the emissions tax, the greater the incentive to reduce emissions.

Emissions trading is an economic incentive-based alternative to command-and-control regulation. In an emissions trading program, sources of a particular pollutant (most often an air pollutant) are given permits to release a specified number of tons of the pollutant. The government issues only a limited number of permits consistent with the desired level of emissions. The owners of the permits may keep them and release the pollutants, or reduce their emissions and sell the permits. The fact that the permits have value as an item to be sold or traded gives the owner an incentive to reduce their emissions.

Energy security is a term used to describe a variety of issues from the economic cost of oil supply disruptions to the cost of military expenditures to secure international trade.

Environmental equity *or environmental justice* refers to the environmental protection for all citizens so that no segment of the population, regardless of race, ethnicity, culture, or income, bears a disproportionate burden of the consequences of environmental pollution.

EU bubble in the context of international climate change negotiations refers to the notion that the European Union (EU) as a whole would accept some aggregate limit on carbon reductions but that the limit would not have to be shared pro rata by all members. One could then have a weaker reduction limit for, say, Portugal than Germany, provided that the total reflected the internationally agreed-upon goal (eg., stabilisation at 1990 levels in 2010). In effect, a bubble allows the EU to achieve differentiation of national standards – something that is quite controversial in the negotiation process.

The generic concept of “bubble” refers to the idea that emissions reductions anywhere within a specific area count toward compliance. For example, if a plant with multiple emissions sources is treated as being “under an emissions bubble,” regulators assess only the total emissions of the plant, not the emissions of each individual source, in determining compliance.

Evapotranspiration is the loss of water from the soil both by evaporation and by transpiration from the plants growing in the soil and rises with air temperature.

Externalities occur when the activity of one person has an inadvertent impact on the well-being of another person. Many aspects of environmental degradation, such as air pollution, global warming, loss of wilderness, and contamination of water bodies, are viewed as externalities of economic transactions.

F

flexibility mechanisms as established by The Kyoto Protocol seek to increase the flexibility and reduce the costs of making emissions reductions; the three primary mechanisms contained within the Protocol are the Clean Development Mechanism, emissions trading, and Joint Implementation (or activities implemented jointly).

Forest dieback refers to a high incidence of decline and individual tree death due to a change in climate conditions that makes trees vulnerable to disease and insect predation.

Fossil fuels include coal, petroleum and natural gas.

Fuel cycle refers to the total life of a fuel in all its uses and forms. For example, the fuel cycle of coal is extraction; transportation; combustion; air emissions, and ash removal, transportation and disposal.

G

general circulation models are complex computer simulations of climate and its various components used by researchers and policy analysts to predict climate change. Typically run on "super computers," these models can approximate future climates and give some clues to how climate has changed or might change over time.

General equilibrium theory demonstrates the advantage of looking beyond first-stage effects. In the context of climate policy, it implies that the various parts of an economic system are interrelated, and the net effect of an action may be markedly different from the initial (and intended) effect.

Geographic information systems (GIS) are organised collections of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyse and display all forms of geographically referenced information. GIS is being used by many researchers in the environmental field to view a number of different indicators simultaneously as data layers on a geographic grid. By associating data of all kinds with points on a map, GIS can illustrate patterns and trends that might otherwise be incomprehensive. For example, using GIS, a researcher can map multiple health indicators at and around a specific toxic waste site.

Global warming is the progressive gradual rise of the earth's surface temperature thought to be caused by the greenhouse effect and responsible for changes in global climate patterns.

Global Warming Potentials (GWPs) are an index created in The Kyoto Protocol that allows for equal comparison of the various greenhouse gases due their varying power to accelerate global warming and/or the duration of their presence in the atmosphere.

Grandfathering of emissions permits is a method by which permits for greenhouse gas emissions may be allocated among emitters and firms in a domestic emissions trading regime according to their historical emissions. Supporters of this method of emissions trading assert that this would be administratively simple but some critics argue that this method would reward firms with high historical emissions and unfairly complicate entry into markets by new firms and emitters.

Greenhouse effect is the progressive, gradual warming of the earth's atmospheric temperature, caused by the insulating effect of carbon dioxide and other greenhouse gases that have proportionately increased in the atmosphere. The greenhouse effect disturbs the way the Earth's climate maintains the balance between incoming and outgoing energy by allowing short-wave radiation from the sun to penetrate through to warm the earth, but preventing the resulting long-wave radiation from escaping back into the atmosphere.

Greenhouse gases include the common gases of carbon dioxide and water vapour, but also rarer gases such as methane and chlorofluorocarbons (CFCs) whose properties relate to the transmission or reflection of different types of radiation. The increase in such gases in the atmosphere, which contributes to global warming, is a result of the burning of fossil fuels, the emission of pollutants into the atmosphere, and deforestation.

H

hot air in recent climate change negotiations refers to reductions in greenhouse gas emissions, for example, in the former Soviet Union, due to economic collapse, as opposed to intentional efforts to curb emissions.

I

incentive-based regulation uses the economic behaviour of firms and households to attain desired environmental goals. Incentive-based programs involve taxes on emissions or tradable emission permits. The primary strength of incentive-based regulation is the flexibility it provides the polluter to find the least-cost way to reduce emissions.

Industrialised countries are characterised by relative political stability and long-term industrial success. Their per capita income is comparable to those of Canada, Northern Europe, and the United States, and they have achieved a higher level of economic and environmental sustainability than developing countries because of higher levels of capital and natural resources.

Intergenerational equity in the context of environmental policy refers to the fairness of the distribution of the costs and benefits of a long-lived policy when those costs and benefits are borne by different generations. In the case of a climate change policy designed to reduce greenhouse gas emissions, the costs of the emissions reductions will be borne by the current and near term generations, while the benefits of an unchanged climate will be enjoyed by far distant generations.

Internalising the externality is an economic concept where the polluter directly bears the cost created by his pollution.

Irreversibilities refer to changes that, once set in motion, cannot be reversed, at least on human time scales.

J

Joint Implementation (JI), or *activities implemented jointly*, is a concept where industrialised countries meet their obligations for reducing their greenhouse gas emissions by receiving credits for investing in emissions reductions in developing countries. Proponents of joint implementation argue that such an international trade in emissions credits would achieve greenhouse gas reductions in industrialised countries at much lower costs while providing foreign investment benefits to developing countries.
For further readings on JI, see the Perspectives on Policy forum, *Whither Joint Implementation?*

JUSSCANNZ refers to the non-European Union industrialised countries that meet periodically to discuss various issues related to climate change. These countries include Japan, the United States, Switzerland, Canada, Australia, Norway, and New Zealand.

K

Kyoto forests refer to forests that comply with the specifications of the Kyoto Protocol. Under Article 3, carbon sequestration will be credited only for forests planted after January 1, 1990 and only for carbon sequestered during the commitment period of 2008-2012.

The Kyoto Protocol is an international agreement struck by 159 nations attending the Third Conference of Parties (COP-3) to the United Nations Framework Convention on Climate Change (held in December 1997 in Kyoto, Japan) to reduce worldwide emissions of greenhouse gases. Delegates to COP-3 agreed to the following specific provisions:

> *Developed Countries* – Thirty-eight developed countries agreed to reduce their emissions of six greenhouse gases. Collectively, developed countries agreed to cut back their emissions by a total of 5.2 percent between 2008 and 2012 from 1990 levels. The six gases include carbon dioxide, methane, nitrous oxide, and three ozone-damaging fluorocarbons not covered by the Montreal Protocol that banned global chlorofluorocarbons (hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride). The European Union agreed to reduce their emissions by 8 percent below 1990 levels; the United States signed on to a 7 percent reduction; and Japan agreed to a 6 percent reduction. Some countries, including Russia and Ukraine, are not bound to make any reductions while countries with smaller economies such as Iceland, Norway and New Zealand are allowed to actually increase their emissions. Australia was also allowed to increase greenhouse gas emissions.
>
> *Countries with Economies in Transition* – Countries undergoing the process of transition to a market economy but that are also classified along with the EU, Japan and the U.S. as Annex I parties to the Convention – including the Czech Republic, Hungary, and Poland, among others – face smaller reductions.

Developing Countries – Countries which are in the process of becoming industrialised but have constrained resources with which to combat their environmental problems – which include China and India – have no formal binding targets, but have the option to set voluntary reduction targets.

L

leakage refers to emissions abatement achieved in one location that is offset by increased emissions in unregulated locations.

M

MAPPS model is a global biological and geographical model which simulates the potential natural vegetation that can be supported at any site in the world under a long-term steady-state climate. Its acronym stands for *mapped atmosphere-plant-soil.*

N

newly-industrialised economies refer to regions, primarily in southeast Asia and the Pacific Rim, that have experienced rapid economic growth rates in the last several decades. These include the economies of Malaysia, Indonesia, South Korea, Taiwan, Hong Kong, and Singapore.

Nitrogen dioxide (NO2) is a form of air pollution that is a brownish gas produced when nitric oxide emitted from power plants combines with oxygen already in the atmosphere. It can damage trees and lead to acid rain, which can harm lakes and streams and also corrode exposed materials. In the presence of sunlight and volatile organic compounds, NO2 can contribute to the formation of ground-level ozone, or smog.

Nitrogen oxides (NOX) are often mentioned in discussions of nitrogen-based air pollution as a reference to both nitric oxide (NO) and nitrogen dioxide (NO2). In addition to particulates and sulfur dioxide, NOX is one of the major electricity-related pollutants. It can transform to nitrates in the atmosphere (which is a fine particulate).

Nonlinearities occur when changes in one variable cause a more than proportionate impact on an other variable.

Non-revenue-raising instruments are environmental polices that do not raise revenue as a by-product of their environmental regulation. Traditional command-and-control regulations are non-revenue-raising and stand in contrast to instruments like emission taxes which raise revenue.

O

OECD refers to the Organisation for Economic Cooperation and Development. It includes Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Korea, Japan, Luxemborg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

Ozone at the ground level is a form of air pollution that is produced when nitrogen oxides and hydrocarbons react in sunlight. It is not to be confused with stratospheric ozone, which is found 9 to 18 miles high in the Earth's atmosphere and protects people from harmful radiation from the sun. Ground-level ozone pollution, or smog, is mainly a problem during hot summer days.

P

particulate matter (PM) is a form of air pollution that includes soot, dust, dirt and aerosols. It has readily apparent effects on visibility and exposed surfaces, and can create or intensify breathing and heart problems and lead to cancer and premature death.

Policy stringency is the strict adherence to policy goals and desired results by all relevant parties. An example of environmental policy stringency is typically measured as a targeted reduction in carbon dioxide emissions.

Polluter pays is the principle which states that those who cause industrial pollution should offset its effects by compensating for the damage incurred, or by taking precautionary measures to avoid creating pollution.

Precautionary principle in the context of the Framework Convention on Climate Change refers to the idea that action to forestall large-scale, irreversible damage from climate change is warranted even though the risks of climate change are not yet fully understood. The precautionary principle thus puts a premium on the long-term safeguarding of the world's climate system, even in the face of uncertainty about the impacts and the need to bear near-term costs of mitigation.

Q

R

renewable resources are energy sources that do not use exhaustible fuels. Sources of renewable energy include water, wind, solar energy and geothermal energy, as well as some combustible materials, such as landfill gas, biomass, and municipal solid waste.

Restructuring refers to changes in the ownership or internal operation of a public utility, and is often used to describe the broader concept of increased competition in the electricity industry. It aims to separate the functions of *generation* – the process used to create electricity where some form of energy is expended to drive a turbine, which in turn drives a generator which in turn produces electric current; *transmission* – the process of conducting the flow of electricity at high voltages from the points of generation to the locations of groups of electricity users; and *distribution* – the process of transforming high-voltage electricity to lower voltages and then physically delivering it to households, industrial facilities, etc.

revenue-raising instruments in environmental policy include emissions taxes, which are levied against producers of pollution; and tradable emissions permits, which can be bought or sold by coal-burning electric utilities and other industries.

Revenue-recycling occurs when the revenue raised by an environmental policy is used to reduce other distortionary taxes or government deficits or is rebated to households.

S

satellite remote sensing is the collection of data on land use, industrial activity, weather, climate, geology and other processes through Earth observations from satellites in outer space.

Sensitivity is the degree to which a system will respond to a change in climatic conditions.

Sinks – see carbon sequestration.

Subsidiary Body for Implementation (SBI) assists the COP in the assessment and review of the effective implementation of the Convention. It is open to participation by all parties and is comprised of government representatives who are experts on matters related to climate change and reports regularly to the COP on all aspects of its work. Under the guidance of the COP, the SBI assesses the overall aggregated effect of the steps taken by the parties in the light of the latest scientific assessments concerning climate change and assists the COP in the preparation and implementation of its decisions.

Subsidiary Body for Scientific and Technological Advice (SBSTA) provides the COP and its other subsidiary bodies with timely information and advice on scientific and technological matters relating to the Convention. It is comprised of government representatives competent in the relevant field of expertise and must report to the COP on all aspects of its work.

Sulfur dioxide (SO2) is a form of air pollution that is a gas. It results from the combustion of fuels that contain sulfur. SO2 is most prevalent in the combustion of coal.

Supplementarity refers to whether parties of The Kyoto Protocol, while using flexibility mechanisms such as emissions trading to lower greenhouse gas mitigation costs, also institute adequate domestic energy and other policies for ensuring the achievement of long-term greenhouse gas reduction goals.

Sustainable development is a broad concept referring to the need to balance the satisfaction of near-term interests with the protection of the interests of future generations, including their interests in a safe and healthy environment. As expressed by the 1987 UN World Commission on Environment and Development (the "Brundtland Commission"), sustainable development "...meets the needs of the present without compromising the ability of future generations to meet their needs."

T

tax-interaction effect can occur when environmental policies, such as emission taxes or permits, and the conventional tax system interact. This effect is the cost of the overall reduction in employment and investment caused by environmental policies, which exacerbate the distortionary effects of pre-existing taxes on labour and capital.

Technology-forcing regulations are requirements and standards set by governments to catalyse environmental research and development. Some examples include corporate average fuel economy (CAFÉ) regulations and other energy efficiency requirements.

Technology transfer in the context of climate change policy most often refers to the process by which energy-efficient technologies and processes developed by industrialised nations are made available to the less-industrialised nations. These transfers may be conducted solely through the efforts of private parties or may involve governments and international institutions.

Title IV of the Clean Air Act Ammendments of 1990 set goals for the electric utility industry to reduce annual sulfur dioxide (SO2) emissions by 10 million tons and annual nitrogen oxides (Nox) emissions by 2.0 million tons from 1990 levels by the year 2000. Beginning in the year 2000, total utility SO2 emissions are then limited to 8.9 million tons and total industrial SO2 emissions are expected to be 5.6 million tons. Title IV's control of SO2 emissions instituted two important innovations in U.S. environmental policy. First, it introduced the SO2 emissions trading program where firms are given permits to release a specified number of tons of SO2. The government issues only a limited number of permits consistent with the desired level of emissions. The owners of the permits may keep them and release the pollutants, or reduce their emissions and sell the permits. The fact that the permits have value as an item to be sold or traded gives the owner an incentive to reduce their emissions. Second, it established an average annual cap on aggregate emissions by electric utilities. This cap was set at about one-half of the amount emitted in 1980. The emissions cap represents a guarantee that emissions will not increase with economic growth. Title IV used a more traditional approach in setting NOX emission rate limitations for coal-fired electric utility units, although emission rate-averaging among commonly-owned and operated utilities provides them with some flexibility in compliance. Hence, there is no cap on NOX emissions, but Title IV is expected to result in a 27 percent reduction of NOX from 1990 emission levels.

Tradable emissions permits are used in an environmental regulatory scheme where the sources of the pollutant to be regulated (most often an air pollutant) are given permits to release a specified number of tons of the pollutant. The government issues only a limited number of permits consistent with the desired level of emissions. The owners of the permits may keep them and release the pollutants, or reduce their emissions and sell the permits. The fact that the permits have value as an item to be sold gives the owner an incentive to reduce their emissions. See also emissions trading.

U

United Nations Framework Convention on Climate Change (UNFCCC) is the center-piece of global efforts to combat global warming. It was adopted in June 1992 at the Rio Earth Summit, and entered into force on March 21, 1998. The Convention's primary objective is the "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man-made) interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner."

Upstream refers to the point (or close to it) where fossil fuels enter the economy. In the U.S., it means at the input to oil refineries, at coal processing plants and where natural gas enters pipelines. Conversely, *downstream* refers to any point in the economy, and in particular, at the level of energy consumers rather than suppliers. It is commonly interpreted to be industrial boilers, electric utilities and other major energy users, but also applies, in theory, to all consumers of gasoline, coal, electricity etc.

V

vulnerability defines the extent to which climate change may damage or harm a system. It depends not only a system's sensitivity but also on its ability to adapt to new climatic conditions.

W

X

Y

Z

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