REGIONAL SUSTAINABLE DEVELOPMENT ADDRESSING CLIMATE CHANGE

a report from the

Network of Regional Governments
for Sustainable Development (nrg4SD)

to be presented at the

United Nations Framework Convention on Climate Change (UNFCCC)
Tenth Session of the Conference of the Parties (CoP 10)

Buenos Aires, Argentina
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The Network of Regional Governments for Sustainable Development-nrg4SD is composed of Regional Governments and Associations of Regional Governments, which are considered as bodies that are "in touch", efficient and representatives of strategic territorial extensions. The mission of the Network is a commitment to Sustainable Development world-wide, following the criteria established in the Gauteng Declaration of the 31st of August 2002, during the Johannesburg World Summit for Sustainable Development (WSSD).

The Network has the following basic objectives: (i) to represent Regional Governments at a global level; (ii) to promote Sustainable Development at the regional government level throughout the world; (iii) to share information and experience concerning Sustainable Development policies with Regional Governments throughout the world; (iv) to promote understanding, collaboration and association between its members; (v) to seek international recognition of the contribution to Sustainable Development made by Regional Governments and (vi) to obtain representation at International Organisations and National Governments.

All Regions and/or Associations of Regional Governments that agree to the Gauteng Declaration of the 31st of August 2002 can be Members of the Network of Regional Governments for Sustainable Development-nrg4SD, subject to approval by the Steering Committee. In addition, stakeholders can participate as Associate Members, with a right to be heard but without voting rights. The term Region is understood in a broad sense as a territory where a system of government exists which is the major and first level of political subdivision, above the municipal level, within a state that is represented in the United Nations Organization. The term stakeholders shall be understood in a broad sense that includes non-governmental organizations, universities and academic institutes, trade unions, trade associations and others.

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Summary

The first part of the report, “Case Studies within nrg4SD” gathers the contributions of the regional governments of the Basque Country, Flanders, Goiás, North Rhine-Westphalia, São Paulo, Wales and Western Australia.

In the framework of the Kyoto flexible mechanisms and the European legislation in this field, the Basque Government proposes the creation of a regional legal structure to coordinate Basque Industry’s CO_2 demands with the CO_2 supply by enhancing partnerships within the Network of Regional Governments for Sustainable Development (nrg4SD).

The Flemish contribution explains how the European and International legislation on Climate change is implemented in the Federal State of Belgium, specially the European Directive 2003/87/EC establishing an emissions trading scheme in the European Union where the regions are at the forefront. This contribution presents the experience of the Government of Flanders and the analysis of the European Emission Trading Scheme from a Flemish perspective.

The Brazilian State of Goiás presents two case studies on the use of waste for energy generation in productive processes, reducing emissions CO_2 from displaced fossil fuels, in line with the guidelines of the Clean Development Mechanisms.

Being the first power-generating State in Germany, the Government of North Rhine-Westphalia presents its system of matched measures in the fields of facilitation, consultation, further training and promotion with the purpose to support climate protection by means of renewable energy and efficient power technologies.

In its contribution São Paulo goes through the different regional initiatives to combat climate change, its important experience in using and producing renewable energies, linking these issues also with achievement of the Millennium Development Goals and the promotion of partnerships both with developed and developing regions.

The National Assembly for Wales exposes its new policies and programs about efficient, economical and environmentally acceptable energy generation from renewable and no-renewable sources, aimed at breaking the current link between increasing prosperity and raising CO_2 emissions.

Finally, Western Australia Government presents its Greenhouse Strategy which establishes research programs to better adapt to the changing climate, delivers greenhouse-related policy commitments and creates a Greenhouse Unit to enable Western Australian interests to be represented nationally and internationally.

The second part of the report, “Cross-cutting issues” includes the proposals made by the UNCCD, the State of Sao Paulo and the region of Tuscany on climate change related topics having influences worldwide.

Bearing in mind the main impacts of global warming on dry lands, the effects of desertification on the ecosystems and society, and that climate change and desertification are processes that feed each other, the UNCCD highlights the need of long-term mitigation and rehabilitation strategies to prevent or minimise desertification in drylands.

The Brazilian State of Sao Paulo proposes that developing countries without renewable energies take advantage and move directly to the cleaner options, instead of learning by doing or accepting obsolete technologies, as to promote sustainable development in their rural areas and considering that where deforestation is a reality, dominant wood-based fuels can not be taken as an environmentally sound source of energy.

In the framework of the mechanisms to reduce emissions developed since the adoption in 1997 of the Kyoto Protocol, the Brazilian Government proposes to increase the use of new renewable sources to 10% as a share of world energy matrix by 2010, understanding that renewable energies are advantageous for sustainable development but also for enhancing the equity between the rich and the poor.

Lastly, and within the context of the EU Emissions Trading Scheme, the region of Tuscany presents a proposal to develop the capacity of Regional Governments to broaden the scope of application of emissions trading through articles 24 and 28 of the Directive of new sectors and clusters of small and medium entrerprises.

1. Foreword

Since the agreement on the United Nations Framework Convention on Climate Change (UNFCC) was signed in 1992, addressing climate change has become one of the priorities of the global agenda on sustainable development. Precisely, now, that thanks to the recent ratification of the Kyoto Protocol by the Russian Federation, this Protocol will enter into force on 17 February 2005.

The Tenth Conference of Parties of the United Nations Framework Convention on Climate Change (COP 10) to be held in Buenos Aires, 6-17 December 2004, will gather the Parties as well as accredited stakeholders to work together to analyze the situation of this Framework Convention after 10 years in order to identify the accomplishments and future challenges, the impacts of climate change, the required adaptation measures, the technology to combat climate change and the suitable policy actions and their impacts.

Conscious of the important role of regional governments in mitigating climate change at the sub-national level, the regional governments[1] and associations of regions of the Network of Regional Governments for Sustainable Development (nrg4SD)[2] want to contribute actively at the COP10 by introducing, in a side-event of this COP, different regional contributions and by releasing this report, where some regional governments of nrg4SD present their actions, experiences and proposals to combat the adverse effects of climate change.

Nrg4SD was formed by the regional governments that attended the Johannesburg World Summit on Sustainable Development, to share information and experience about sustainable development policy-making at the regional level of governance. Moreover, nrg4SD promotes understanding, collaboration and partnerships in sustainable development and seeks greater international recognition of the importance of the contribution which regions make to sustainable development.

Working together in partnership is a key activity of the global network nrg4SD and, as a result of that, many of nrg4SD member regions and associations of regions have shown their clear commitment to collaborate at the international level in combating climate change, involving both developed and developing regions.

[1] For the purposes of nrg4SD the term Regional Governments will be understood as the level of governance of the territorial political subdivision immediately below the central government of an individual State represented at the United Nations.

[2] All information on nrg4SD and its activities is available in English, Spanish and French at http://www.nrg4sd.net/

This report has been launched as a result of the Latin American and Caribbean nrg4SD Second Conference held in Recife in August 2004 and gathers the contributions of the regional governments of São Paulo, Flanders, Goias, the Basque Country, North Rhine Westphalia, Tuscany, Wales and Western Australia in addressing climate change at the sub-national regional level with a view to identifying common grounds to tackle the problem of climate change and the increasing emissions of greenhouse gases. Moreover, the report also includes a contribution of the United Nations Convention to Combat Desertification (UNCCD).

Special thanks to the United Nation Environment Programme (UNEP) for its support in delivering this report, to the United Nations Convention to Combat Climate Change for its written contribution and to São Paulo, specially to Oswaldo Lucon advisor of the State Environmental Secretariat, for the coordination of this report.

2. Case Studies within the nrg4SD

The Case Studies aim to show regional initiatives addressing the mitigation of the negative effects of Climate Change. Also, views and proposals for cooperation and policies are presented in this Chapter.

2.1. Basque Country, Euskadi: the Basque Carbon Fund[3]

A public initiative promoted by the Basque Government in favour of the environment, the Basque industry and development cooperation.

Background

The **Kyoto Protocol**, developed in the United Nations Framework Convention on Climate Change, is the first attempt to place quantitative restrictions on the continual increase in Greenhouse Gases emissions (hereinafter, GGs) and above all, CO_2. The Protocol intends to mark a point of reflection in development to date, forcing a change in production methods and consumption at a global level, which would guarantee the end of the climate change threat caused by human action in this industrial age.

The scheme established for this purpose is complex. The idea is to impose a "net" limit to developed countries' emissions and those of countries undergoing the process of transition to a market economy. In summary, it could be described as follows:

*Emissions for the period 2008-2012= (1990 emissions*Permitted development) + Credits from flexible mechanisms*

That is, the average emissions from a country in the period 2008-2012 may not exceed its emissions from 1990 plus (or minus) the increase (or reduction) that the Protocol allows for each country.

In order to avoid the situation where a rigid application of this rule may mean excessive limitations, and bearing in mind that, for global warming purposes it is indifferent whether the emission is produced in one country or another, so-called flexibility mechanisms are allowed. Through these, a country with limits may acquire reductions carried out in other countries or buy the rights to emission from countries that have a margin to do so.

The **flexible mechanisms** admitted by the Protocol (and excluding carbon sinks) are the joint implementation and clean development mechanisms and the trading of emission units. The first refer to reductions in countries without quantitative reduction limits and the second to reductions in countries with quantitative reduction limits. The emissions trade refers to the possibility of buying allowances between developed countries without the need for reduction projects.

The **European Union** has not only taken on the reduction commitment by ratifying the Kyoto Protocol, it has also developed legislation (Directive 2003/87/EC) in which each country's commitment is transferred to its industrial sector, allowing emission rights to be purchased between the affected industrial installations. Likewise, it is

[3] By Sabin Intxaurraga Mendibil, Minister for Planning and the Environment of the Basque Government.

developing legislation which will allow industrial installations to use clean development mechanisms and joint implementation mechanisms to relax their limitations.

The **Basque Government** has not eluded the challenges that the climate change or greenhouse gases restriction policies may suppose.

- With regard to the first: the Basque Environmental Strategy for Sustainable Development has established the limiting of influence in climate change as one of its objectives. The Basque Government has also proposed the objective of fulfilling the objectives on the reduction of GGs emissions agreed in the Kyoto Protocol for the year 2012, and setting different commitments for this purpose.

- With regard to ongoing policies, the Basque Government considers that the European Union's decision to lead this process can only be considered as positive, and in accordance with the development model based on the Welfare State. Nevertheless, it is important that in its operating mechanisms, its possible repercussions in terms of distortion of the competition between member States and delocalisation are taken into account, combining the fulfilment of the Kyoto objectives with the maintenance of economic growth and job creation.

Greenhouse gas emissions in the Basque Country

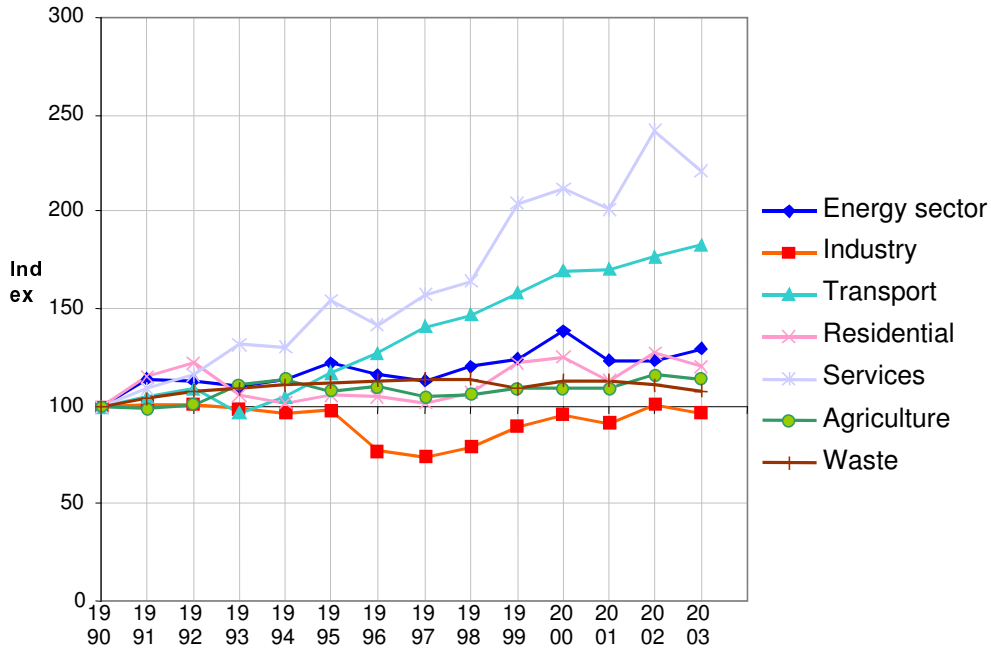
In the framework of the obligations that both Europe (8% reduction) and Spain (maximum increase of 15%) have acquired with the Kyoto Protocol, the Basque Government's objective is to limit the increase in GGs to 15% on the base year. This objective was met until the year 1999 in which, due to significant economic growth (increase in the GDP of 48% until 2002), the emissions started to outrun the planned growth path. According to data from our most recent inventory (2003), the increase on 1990 is 28% above the 1990 emissions.

Although this increase is the smallest of all the Spanish Autonomous Communities, which as a whole have grown around 40%, the excess emissions will require allowances to be acquired through the flexibility mechanisms (CDM and JI) of approximately the equivalent of two and a half million tons of CO_2 every year within the period 2008-2012.

The main part of the deviation came about in the years 1999 and 2000, with the emissions having been established since then. The total of this deviation is due to sector 1 IPCC energy, which includes both stationary and mobile (transport) fuel processes.

In a sector distribution of the deviations, it is transport, both of goods and passengers, and transformation of energy that has most contributed to the deviation of the Kyoto objectives. To be specific, the transport sector's growth for the period 1990-2003 was 85% and the energy transformation's growth was 102%.

On the other hand, industrial emissions diminished 25% in the same period.



Development of GG emissions by industrial sectors in the Basque Country 1990/2003

Installations affected by the Emissions Trading Directive in the Basque Country Autonomous Community.

In accordance with the latest Allocation Plan drawn up by the Spanish Government, in the Basque Country there will be a total of 73 installations affected by emissions trading. A slightly smaller figure is foreseeable, due to some adjustments in the iron and steel industry and in the cogeneration sectors and paper industries.

	Affected installations
Electricity generation installations	5
Large co-generations	10
Refineries	1
Iron and steel industry	18
Cement	3
Lime	2
Fried products	1
Glass	3
Pulp, paper and cardboard	30
TOTAL	***73***

The scarcity of emission rights is generalised, although not pronounced. That is, practically all companies will have to acquire rights or credits, although in most cases the figures will not be critical.

The existence of an important local medium-sized industry without a multinational base offers the disadvantages that the introduction of flexible mechanisms may entail, in the absence of compensatory measures. The joint implementation and clean development mechanisms mean a clear competitive advantage for industries with

multinational infrastructure, which may obtain cheap credits from their installations in third countries.

CO2 emission reduction investment in third countries, Basque Carbon Fund.

As we indicated above, in order to allow industrial installations to avail themselves of the flexible mechanisms in the framework of the Emissions Trade established by the European Directive 2003/87, the European Parliament and the Council are working on a Directive proposal to implement and coordinate these instruments with Directive 2003/87.

Both mechanisms are based on carrying out projects in third countries and allow the creation of credits when the projects carried out in these countries have entailed a reduction in the emissions that would not have happened if the project had not been carried out. The projects must produce real, quantifiable, long-term benefits with regard to the mitigation of climate change and contribute to the fulfilment of the sustainable development objectives of the country where the projet has been carried out.

The proposal intends to transfer, albeit with limitations, the Kyoto flexible mechanisms to the European market. The European Union were to organise these mechanisms in such a way that, should the Kyoto Protocol not enter into force, they themselves would assume responsibility for their operation, aside from the United Nations Framework Convention on Climate Change.

Through these mechanisms, the industry's annual costs of fulfilment could be reduced by between 25% and 60%, according to a Study carried out for the European Commission by the Institute of Energy Policy and Economics of the University of Grenoble.

The predictions included in the aforementioned study do actually reveal the possible mass introduction of credits from JI/CDM projects, which could mean 85% of the total credits created. The study also determines that countries with a greater capacity to supply credits will be China, countries from the former USSR, and others from Africa and Asia. There is also evidence of a high potential of credit creation in Latin American countries.

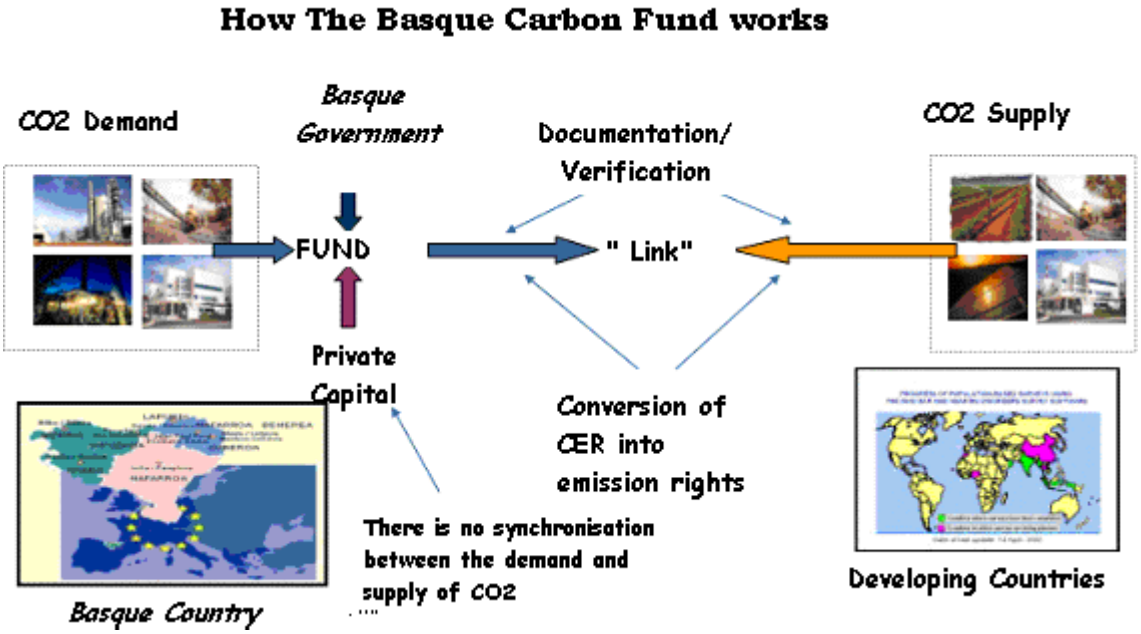
In the light of the fact that these mechanisms could mean both an opportunity as well as a threat to Basque industry in the absence of compensatory mechanisms, the Basque Government has decided to take on the creation of a Basque carbon fund to help its industry to access these mechanisms.

The idea is to create a legal structure that will coordinate Basque industry's CO_2 demands with the CO_2 supply from flexible mechanisms. In order to do so, the participation of the financial sector is considered to be crucial in order to guarantee financial assistance to match the supply and the demand of these mechanisms when needed.

One of the fund's main assets would be the prior existence of projects that the different departments of the Basque Government are carrying out in other countries.

At this regard, a special mention should made to the different agreements that, in the framework of the Network of Governments for Sustainable Development (nrg4SD), the Basque Government maintains with other regional governments which might also wish to convert environmental recovery actions in exchangeable carbon credits. Through these cooperation agreements the Basque Government has committed its support to environmental recovery actions on clean production, environmental repair and access to good practice and environmental management systems. The Basque Government also contributes with its sound and successful experience on voluntary environmental agreements, based on the positive collaboration and trustworthy relationship between all parties involved, i.e. public entities and the Basque industry.

The fund's plan could be summarised in the following diagram:



2.2. Flanders: the European Emission Trading Scheme - a Flemish perspective[4]

Introduction to the Flemish NAP

The European Directive 2003/87/EC establishing an emissions trading scheme in Europe[5] aims to introduce a CO_2-emissions trading system on 1 January 2005. Each of the participating companies is allocated a quantity of CO_2-emission allowances. Every emission allowance gives the right to emit 1 tonne of CO_2 At the end of each year in a trading period (the first period runs from 1 January 2005 to 31 December 2007) a company must be able to present exactly as many CO_2-emission allowances as the amount of CO_2 it has emitted during that year. By purchasing allowances a company can acquire a larger CO_2-emission allowance. If a company thinks it will have too many CO_2-emission allowances, it can sell those excess CO_2-emission allowances.

To implement this directive, every Member State must draw up a national plan, determining the CO_2-emission allowances that will be allocated to each company. In view of the distribution of competences in Belgium, four allocation plans are drawn up, including this Flemish plan. In Belgium a major part of the majority of the environmental and energy policy is made at the regional level. Since climate change policy is a combination of both environmental and energy issues the competence on climate change mitigation measures is mostly situated at the regional level. Therefore there exists no single Belgian allocation plan. The Belgian allocation plan consists of 3 regional plans (Brussels capital region, Walloon region and Flanders) and a plan from the federal government.

An allocation plan must be drawn up before the start of any trading period. The allocation plan for CO_2-emission allowances for 2005-2007 indicates the total number of CO_2-emission allowances available in the Flemish Region for the participating companies in the first trading period 2005-2007, and how many allowances the Government of Flanders intends to allocate to each individual company.

A regional NAP and ANNEX III of the emissions trading directive

a) The Flemish burden sharing and climate change program

In perspective of the European burden sharing agreement[6] with regard to the fulfilment of the Kyoto Protocol, the Belgian reduction objective for the emissions of greenhouse gases was set at 7,5 % below the emissions in 1990. This reduction

[4] By Tomas Wyns, Flemish Government

[5] Directive 2003/87/EC of the European Parliament and the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Directive 96/61/EC. PB L 275 of 25 October 2003.

[6] Decision 2002/358/EC of the Council of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder. PB L 130 of 15 May 2002.

objective must be complied with in the period 2008-2012 (= first commitment period of the Kyoto Protocol)[7].

In view of the distribution of competences in Belgium, this reduction objective had to be divided between the Regions and the federal state. On 8 March 2004, an agreement was reached thereon between the federal government and the community and regional governments of Belgium in the Consultation Committee. According to this agreement, it is the Regions (including the Flemish Region) which are responsible for presenting a certain quantity of allowances under the Kyoto Protocol during the period 2008-2012. The quantity of allowances which must be presented on average every year during this period was determined for each Region[8] (see Table 1).

	annual average quantity of allowances to be allocated	corresponds to an x% adjustment compared to CO_2-eq emissions in 1990
Flemish Region	83,37 Mton CO_2-eq.	-5,2 %
Walloon Region	50,23 Mton CO_2-eq.	-7,5 %
Brussels Capital Region	4,13 Mton CO_2-eq.	+3,375 %

Table 1: The division of burdens of the Belgian Kyoto reduction objective between the Regions in accordance with the agreement of 8 March 2004

This division of burdens assigned more allowances[9] to the three Regions than Belgium is assigned under the Kyoto Protocol. In order to compensate for this deficit (estimated at 2,46 Mton CO_2-eq. per year for the period 2008-2012, according to the figures for the inventory at the time that the agreement was concluded), it was agreed that the Federal Government would acquire additional allowances by making use of the flexibility mechanisms of the Kyoto Protocol. The Federal Government would also introduce additional internal federal policy measures to support the reduction efforts of the Regions.

The agreement also provides that the Flemish Region (and the other Regions) can determine the extent to which and the way in which they use flexibility mechanisms themselves, in order to acquire additional allowances.

Therefore, according to the agreement, the Flemish Region must limit the emission of greenhouse gases in the period 2008-2012 to an average of 83,37 Mton CO_2-eq. per

[7] The greenhouse gas emissions in Belgium in 1990 are multiplied fivefold for that purpose, and then a reduction percentage of 7,5 % is applied. This calculation results in the "Assigned Amount" for Belgium for the first commitment period 2008-2012. The "Assigned Amount" is the total quantity of allowances which a country with a reduction objective is allocated under the Kyoto Protocol.

[8] This division of burdens was based on 146,24 Mton CO_2-eq. emissions in Belgium in 1990, divided between the Flemish Region (87,95 Mton CO_2-eq.), the Walloon Region (54,30 Mton CO_2-eq.) and the Brussels Capital Region (3,99 Mton CO_2-eq.). The final calculation of the emission allowances indicated in Table 1 for each region will be based on the final emission figures for the reference year 1990, which must be submitted by Belgium at the latest on 31 December 2006.

[9] "Allowances" refers to AAUs (=Assigned Amount Units).

annum as a contribution to achieving the European obligation under the Kyoto Protocol.

The figures of the inventory of greenhouse emissions in 1990 in the Flemish Region have already changed since the agreement was concluded on 8 March 2004. According to the latest figures on the inventory of greenhouse gas emissions in the Flemish Region in 1990, these were actually 88,419 Mton CO_2-eq. (compared to the 83,38 Mton CO_2-eq. in the agreement of 8 March 2004), and consequently the reduction objective of -5,2 % means that the Flemish Region must limit the emissions of greenhouse gases to an average of 83,82 Mton CO_2-eq. per annum in the period 2008-2012.

The quantity of emission allowances that can be allocated to the ET-companies (= Emission Trading companies) are calculated below, on the basis of the reduction potentials in the non ET-sectors and on the basis of the Flemish Kyoto reduction objective of an average of 83,82 Mton CO_2-eq. in the period 2008-2012.

This analysis ensures that the total quantity of emission allowances to be allocated to industry and energy production will not jeopardise the achievement of the Flemish Kyoto reduction objective.

The scenario below is followed for this purpose:

1. the Kyoto objective of the Flemish Region will be achieved in 2010 (-5,2 % compared to emissions in 1990): in 2010 the greenhouse gas emissions will amount to 83.821 kton CO_2-eq.;
2. the reduction potentials indicated in the draft Progress Report 2004 of the Flemish Climate Policy Plan 2002-2005 will be achieved (cf. "reduction potential" and "fuel potential" calculations)
3. with regard to the CO_2-emissions resulting from energy production, the Kyoto 7 scenario of the CREG is reference scenario: the expected CO_2-emissions in 2008 are used from this scenario, and the CO_2-emissions are presumed to develop in a linear way from the actual emissions in 2003 to 2008 (and 2012).

The BAU-scenarios and reduction potentials which are used for the sectors and installations that do not fall under the ET-directive are based on a number of different studies and plans.

Most calculations are based on the Flemish Climate Policy Plan 2002-2005 and its annual Progress Reports[10]. This plan and its progress reports incorporate a series of projects which should lead to greenhouse gas reductions in the Flemish Region.

The CO_2-emissions (BAU) from agriculture are also based on the draft Progress Report 2004, taken from the official emission inventory in 2002, which was submitted to the European Commission in December 2003 and to UNFCCC in April 2004.

[10] Can be consulted on http://lucht.milieuinfo.be

The CO_2-emissions from transport (BAU and fuel potential) are calculated on the basis of a recent study by the VITO research agency[11].

The CO_2-emissions (BAU) from "other" industries concern emissions from waste incineration without electricity production and non-energy CO_2-emissions in non-industrial sectors. The figures are taken from various studies[12].

In addition, the calculation of the number of emissions which do not fall under the scope of application of the directive on ET-companies is made on the basis of a recent study commissioned by AMINAL[13].

	2010
Total cap greenhouse gases (A)	**83.821**
Emissions required for:	
CH_4, N_20 and F gas emissions (B)	**14.378**
BAU	17.038
reduction potential	2.660
reduction potential compared to BAU	15,61%
CO_2-emissions (C)	**32.305**
of which::	
agriculture	**1.873**
BAU	1.873
fuel potential	n.a.
fuel potential compared to BAU	n.a.
transport	**12.831**
BAU	15.578
fuel potential	2.747
fuel potential compared to BAU	17,63%
households	**13.391**
BAU	14.307
fuel potential	916
fuel potential compared to BAU	6,40%
service sector	**4.017**
BAU	4.625
fuel potential	608
fuel potential compared to BAU	13,15%

[11] Calculations of CO2-emissions from traffic and transport for input in the Flemish climate plan 2004. VITO, March 2004.

[12] Draft Flemish energy and CO_2-emissions balance for 2002 (version of 17 May 2004) and Ecolas study (version 17 May 2004).

[13] Ecolas (2004). Support for the Flemish allocation plan for CO_2-emission allowances.

other	**193**
BAU	193
fuel potential	n.a.
fuel potential compared to BAU	n.a.
CO_2-cap for energy production and industry (=A-B-C) (D)	**37.138**
non ET-companies in industry (E)	**2.301**
BAU	2.859
fuel potential	558
fuel potential compared to BAU	19,52%
emissions of ET-companies not subject to the ET-directive (F)	**6.053**
emissions required for the ET-companies (from bottom-up)	**35.155**
Balance to be completed	**-6.371**

Additional information on the calculation of the scenario

CH_4, N_2O and F-gases

9 Emission reduction policy on fluorinated greenhouse gases for cooling installations
- Introduction of a regulation for the homologation of cooling technicians
- Additional regulations for the exploitation of cooling installations
- Inspection campaign on the use of substances which break down ozone and fluorinated greenhouse gases

10 More stringent regulations with regard to the valorisation of landfill gases and maintaining the compulsory flaring off of landfill gases

12 Reduction plan for nitric acid and caprolactam production

Transport

n.a. Sustainability scenario of the mobility plan (50% included)

n.a. ACEA agreements (100% included)

n.a. Biofuels directive (100% included)

Households

2 Action Plan renewable energy: heat pump and solar boiler

6 RUE-Action Plan in households
- Introduction of an energy performance regulation and certificates
- Creation of subsidy programmes for the implementation of the RUE-decree
- RUE-public service obligations for the distribution network managers of electricity
- Energy policy agreement or RUE-obligations for suppliers of fuels
- Fiscal deduction for RUE-investments in income tax (federal measure): 50 % included (own calculations, that is: potential included of improvement in energy

performance in new buildings and renovated housing, of insulation in existing housing (roof insulation, HR glass, insulation of walls and temperature control, replacement of electrical heating and heating using coal), long-life bulbs, water-saving showerheads, energy meter and A-label appliances)

15 Action Plan for the efficient maintenance of heating systems

Service sector

7 RUE-Action Plan in the service sector
The introduction of subsidy programmes for the implementation of the RUE-decree
The implementation of cluster energy in accordance with the municipal and provincial environmental agreement (local government setting an example)
RUE-public service obligations for the distribution network managers of electricity and the energy policy agreement or RUE-obligation for suppliers of fuel
The introduction of an energy performance regulation for new and thoroughly renovated buildings (energy-saving potential included for swimming pools, care homes, schools, administrative buildings: relighting, improving insulation, natural ventilation)

Industry

4 RUE-Action Plan in industry, coke factories and refineries
Benchmarking covenants
RUE-public service obligations for the distribution network managers of electricity and the energy policy agreement or RUE-obligation for suppliers of fuel
Audit covenants
The introduction of an energy performance regulation for new and converted industrial buildings

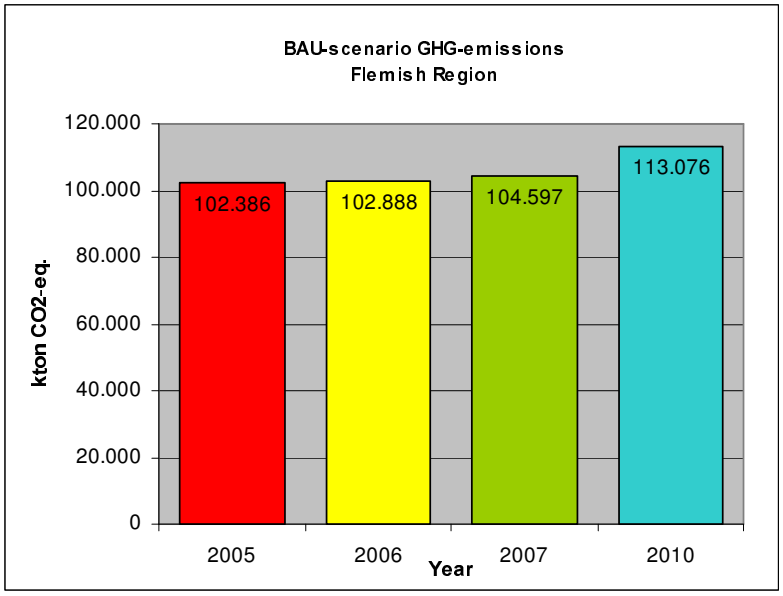
5 Decision on energy planning for classified installations

Electricity production

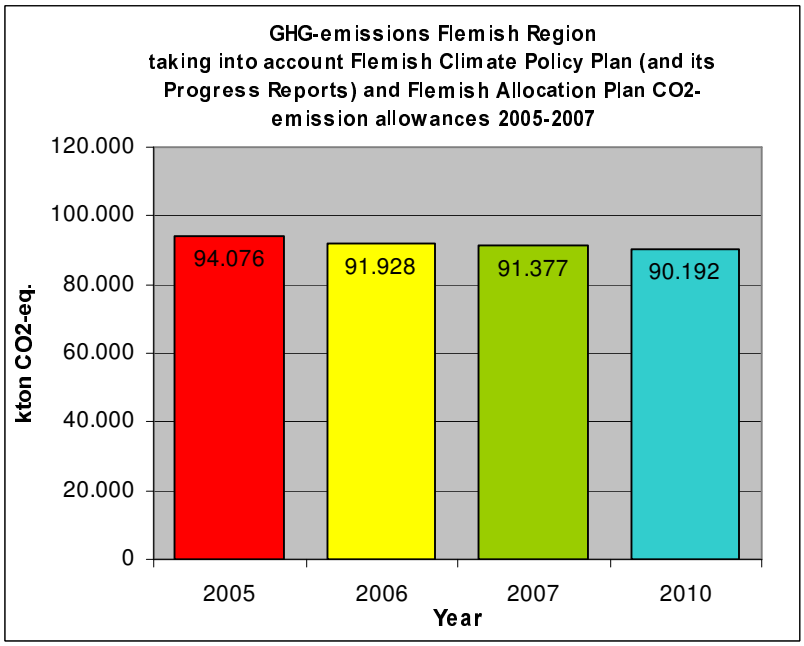
2 Renewable Energy Action Plan: green electricity certificates and promotion (green electricity objective: wind at sea, wind on land, biomass, organic biological fraction of residual waste, and to a small extent: water power and solar power)

3 CHP Action Plan: co-generation of heat and power certificates and promotion

BAU-scenario GHG-emissions in the Flemish Region

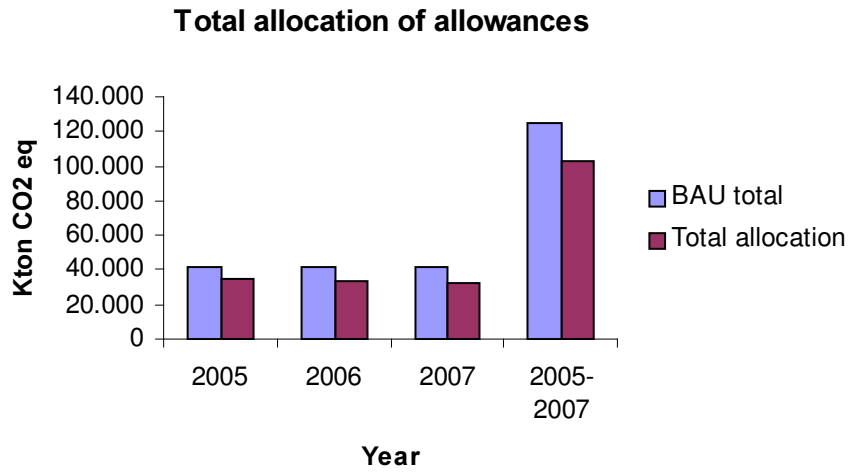


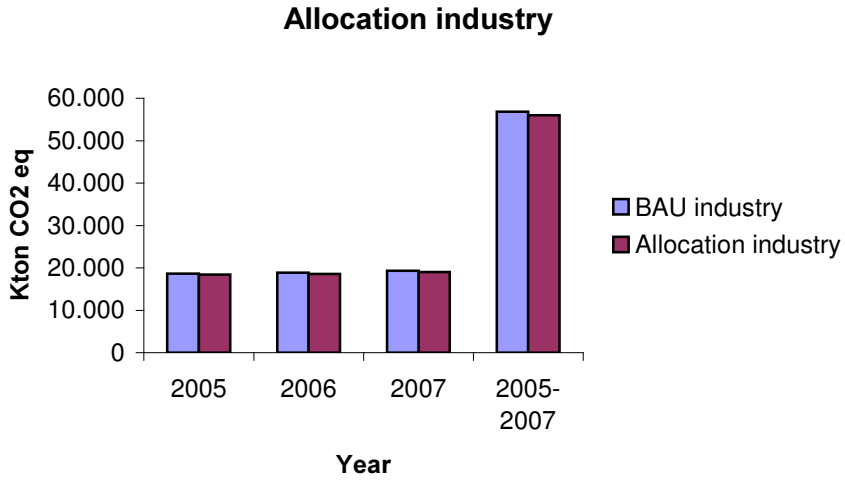
GHG-emissions in the Flemish Region after taking into account the Flemish Climate Policy Plan 2002 2005 (and its Progress Reports) and the Flemish Allocation Plan CO_2-emission allowances 2005-2007

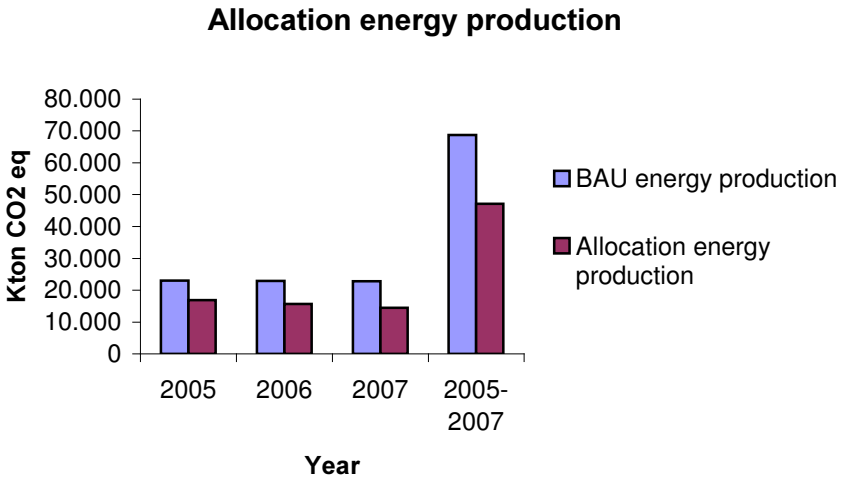


b) The allocation of allowances in Flanders for the EU ETS trading period 2005-2007

	2005	2006	2007	2005-2007
BAU Total	**41.662**	**41.751**	**42.121**	**125.534**
BAU industrial sector	*18.646*	*18.841*	*19.322*	*56.809*
BAU energy production	*23.016*	*22.910*	*22.799*	*68.725*
Allocated allowances industry	*18.440*	*18.534*	*19.035*	*56.009*
Allocated allowances energy	*16.953*	*15.699*	*14.445*	*47.097*
Total allocated allowances	**34.583**	**33.356**	**32.574**	**103.106**
New entrant reserve				**1.519**







c) Potential to reduce emissions

With regard to determining the total number of emission allowances to be allocated to the sectors, the technical and economic potential for reduction was taken into account as far as industry was concerned, because the allocation is based on the progress in energy efficiency which is agreed upon in the context of the benchmarking covenant[14] and determined in the energy plan. If there are no specific data for the installation in the context of that covenant, the reduction is based on a general estimate of the potential for reduction. As regards the electricity sector, the potential for reduction is one of the elements for determining the total quantity of allowances.

The potential for reduction was also used as a criterion for the allocation at the level of the installation. For installations for the production of electricity the allocation is based on a strict and general benchmark based on the most efficient fuel and technology. For industry the same principles apply as for determining the total quantity of emission allowances.

Other issues relating to implementing an emission trading scheme

a. Implementing legislation

An emission trading scheme cannot work without the proper legislation in place. An allocation plan isn't sufficient to make the system work. Since there is no community legislation on emission trading each member state has to make the legislative provision on emission trading. In Belgium this is as it is the case for the allocation plan the competence of the regions[15].

Following issues had to be regulated in Flemish (environmental) law by means of an emission-trading bill:
-the introduction of a permit to emit greenhouse gases;
-the obligation to operators to hand in the appropriate amount of emission allowances;

[14] More information on the Flemish benchmarking agreement can be found at www.benchmarking.be
[15] The only exception being the establishment of a national emission trading register which is done by the federal government.

-the procedure and legislative status of the Flemish allocation plan;
-the issuance of allowances;
-the monitoring and reporting provisions;
-the sanctioning regime;

b. The greenhouse gas permit

According to the emissions trading directive, each operator has to obtain a greenhouse gas permit. This permit describes the installation, the way it is being operated and how the CO_2 emissions from this installation will be monitored.

In Flanders the government has chosen not to introduce a separate greenhouse gas permit but to integrate this permit in the existing environmental permits. This is done to reduce the administrative burden on the operators of installations.

Hence, the introduction of a GHG permit in Flemish legislation is only visible through an amendment of the law on the environmental permits.

c. The obligation to hand in the appropriate amount of emission allowances

The most important obligation for operators of a GHG installation is the requirement to hand in an amount of allowances that is equivalent to the emission of CO_2 out of this installation. This has to be done on a yearly basis.

An operator that doesn't fulfil this obligation will be sanctioned under the provisions of the directive (see below). Furthermore an operator who violates the rules of the emission-trading scheme also risks sanction within the environmental permitting legislation. It can happen that an operator loses his environmental permit.

d. The procedure and legislative status of the Flemish allocation plan

As stated above, there was no legislative basis for emission trading in Flanders. Hence, there was no basis for introducing an allocation plan and distributing emission allowances.

The construction of a national allocation plan has to follow certain procedures (e.g. introduction to a public consultation) before it can be submitted to the European commission. These procedures were implemented in the Flemish emission-trading bill.

Furthermore this bill sets the criteria (ANNEX III of the emission-trading directive) to which a Flemish allocation plan has to oblige.

e. The issuance of allowances

The allocation plan states how many allowances each installation will receive. At a certain moment in time these allowance will have to be issued (i.e. given) to the operators. In Flanders the operators will (in the first trading period of 3 years) receive one third of the total allowances allocated. This is a safety measure. It prevents companies from receiving all allowances and closing a plant while still holding on to the emission allowances.

New entrants are new installations or extensions of existing installations. Those new entrants will receive emission allowances when they start operating in Flanders. The emission allowances for these new entrants, comes from an emission allowance reserve established by the Flemish government.

f. Monitoring and reporting of CO_2 emissions

A state of the art monitoring and reporting of CO_2 emissions in an emission trading system is essential. This is important to prevent voluntary or involuntary mistakes in the accounting of emission allowances.
Flemish companies will have to provide the government with a verified monitoring protocol. This protocol states how the CO_2 emissions of the concerned installations will be monitored.

Furthermore, each operator has to submit, on a yearly basis, a CO_2 emission report to the government. This report has to be verified by an independent verifier. The CO_2 emissions report will be used to state the amount of allowances that an operator has to submit.

g. The sanctioning regime

The emission trading directives foresees following sanctions for operators that won't submit enough emission allowances:

-there is a fine of 40EUR per tonne of CO_2 equivalents missing
-the operator still has to submit the missing amount of CO_2 allowances
-the names of the operators with deficit accounts will be published.

h. Registries

Finally an emission trading scheme isn't complete without a place (registry) where emission allowances can be submitted to the government and from where emission allowances can be traded.

Following the registries regulation of the European Commission, the federal government is developing a National register for emission allowances. This registry will be used by the different regions in Belgium. It are however only the regions that can order any changes to the registry. They are responsible for the allocation, the issuance and withdrawal of allowances of the operators within the registry.

2.3. Goiás: Use of Bioenergy for Clean Development Mechanism[16]

The State of Goiás, Brazil has two case studies to present to the nrg4SD. These use in its productive process techniques that support to the guidelines proposed in the CDM, Clean Development Mechanism, through the use of wastes for energy generation, reducing CO_2 emissions from displaced fossil fuels.

The first case is the company named Brazil Verde, located in Ipameri. It is a reforestation company whose production is destined mainly to packaging and pallets for transportation of mechanical parts. Production process generates a large volume of wastes, until then discarded.

This waste, after having size reduction, was utilized as biofuel for ovens in steel industries located in the neighbor state of Minas Gerais. The company has invested in machinery, construction to protect from moisture and transportation elements for the ground material to the trucks. Such elements and process management guaranteed to the generated wastes to have low moisture content, allowing good combustion conditions. From the reduced waste generation, the company has increased its revenues with the sales of byproducts.

The second case study is the energy co-generation project from the company Jalles Machado, a sugar and alcohol producer located in Goianésia, 170 km from the State capital, Goiânia. Goianésia has 49,724 inhabitants and an economy based in agriculture. The Jalles Machado plant was pioneer in the state to apply solid wastes management for improving air quality and producing clean energy. During the production of alcohol and sugar, the plant obtains as byproduct the sugarcane bagasse, which corresponds to 25% of the total weight of the green sugarcane plant and to one third of its energy content. It is common to use bagasse for the plant own energy needs, with very little attractiveness for commercial scale generation. Also the sugar manufacturers' culture is more related to working only with the sugar and the alcohol business, for two products that can be stocked and with great production variation. These are not the characteristics of the electricity market, which needs a constant production. In the contrary, electricity cannot be stored or utilized for speculation. Thus, plants generating energy only for subsistence represents a disadvantage to the country, due to the wasted potential.

The most known technology for energy generation from biomass is the Rankine cycle, where the turbine receives the hot gases generated during the combustion. Residual heat supplies the productive processes, such as boilers in the sugar and alcohol industries. The Jalles Machado sugarcane mill cogeneration process produces electricity which is interconnected to the Brazilian grid. The project is divided in three different stages. In the first, the generation capacity was increased through a new counter pressure generator, which in 2001 allowed selling 3,877 MWh. The second was the substitution of the boiler for another more efficient, resulting in

[16] By Alessandro Belisário, Public Manager of Góias State; Hugo Araújo Godinho, Natural Resources Manager of Goiás State; and Osmar Pires Martins Jr., President of the Goiás State Environmental Agency.

more 8,985 MWh of sales. In the last phase it was installed a 28 MW counter pressure generator and another 42 kgf/cm² high efficiency boiler, substituting the previous 21 kgf/cm² one.

Due to the increase in the electricity demand and to the privatization of the hydroelectric sector, it has been observed in the country an increased electricity production based on fossil fuels, mainly natural gas. Thus, this project collaborates for the reduction of greenhouse gas - GHG - emissions, operating in the margin of the Brazilian electric grid, postponing the needs for thermoelectric fossil fueled plants.

Another activity related with the decreased GHG emissions in Jalles Machado plant is the substitution of diesel motors used in the irrigation of sugarcane plantations - a need of this sector - by other electric, utilizing the surplus from cogeneration in an economically feasible way. This project has started on April 2001, with an estimated 25 years lifespan. In the first seven years, a reduction of 13.75 tons of CO_2 was foreseen from this project, plus 116.85 tons of CO_2 estimated reductions from the electricity biomass cogeneration displacing oil fuels.

These cases are just some of the initiatives from the productive sector in the State of Goiás, which aims at adapting its practices to a sustainable development model, more specifically committed to the CDM foreseen in the Kyoto Protocol. Finally, such practices join economical objectives with the environmental conservation, providing social returns.

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2.4. North Rhine-Westphalia: Climate Protection in NRW[17]

North Rhine-Westphalia is the number one power-generating state in Germany and, being the European centre of the power industry, feels particularly responsible for climate protection.

As early as in 1992, in the year of the Rio Conference, North Rhine-Westphalia was the first German State to present a climate report and has, since, consistently been translating this report into practice. With the **North Rhine-Westphalian 2001 Climate Protection Concept**, North Rhine-Westphalia expressly committed itself to implementing the German Government´s objectives and measures at the State level and, additionally, taking regionally specific action. The Climate Protection Concept of the State of North Rhine-Westphalia comprises measures in terms of Federal and State policy with a reduction potential of approximately 32 million tons of carbon dioxide equivalent emissions in the State of North Rhine-Westphalia. At present, the Climate Protection Concept is being updated and will be re-issued in early 2005.

In North Rhine-Westphalia, a system of matched measures, which is unique in Germany, was established in the fields of facilitation, consultation, further training, and promotion. Its purpose is to support climate protection by means of the use of renewable energy and efficient power technologies.

In order to facilitate the creation of a network between the players involved and the coordination of measures, North Rhine Westphalia established, with the **"NRW State Initiative on Future Energies",** an exemplary institution whose purpose is to use and enlarge the research and development potential of future-oriented energy technologies and energy-related services, in particular in the fields of biomass, solar energy, geothermal energy, methane, fuel cell and hydrogen technologies, as well as power station engineering.

The provision of information and advice to the public at large and specific target groups is an important pillar of climate policy from the point of view of North Rhine-Westphalia. This is why the State has an **Energy Agency** since 1990 which provides energy-related advice in particular to companies and municipalities. The **North Rhine-Westphalian Consumer Centre** supplies information and advice on power and climate-related issues to private persons.

Approximately 330 **municipal energy concepts** have been supported with State funds in North Rhine-Westphalia since 1982. With the **2000plus Action Programme** "Energy in North Rhine-Westphalia Municipal Scope of Action", this support was developed further to become a specific action programme with a view to mobilising municipal activities in the field of energy saving. The 2000 plus Action Programme

[17] By Ernst Christoph Stolper, Head of the Department "Basic questions, planning and co-ordination, One-World-Policy" of the Ministry Of Environment and Conservation, Agriculture and Consumer Protection.

has been launched for a period of 5 years and a financial volume of 3.85 million Euros.

More than 10,000 industrial and business establishments with almost 1.5 million employees constitute a decisive economic factor for the State of North Rhine-Westphalia. **By promoting energy concepts oriented towards specific branches of industry**, the State government supports not only studies related to individual companies, but also efforts to improve the efficient use of energy in selected industries and lines of business. If 10 % of the recommended measures are implemented every year, CO_2 emissions may be reduced by approximately 1.5 million tons by 2010.

With the **REN Programme** to promote the development, demonstration, production and application of efficient and renewable energy technologies, North Rhine-Westphalia has funded more that 50,000 projects with approximately 600 million Euros since 1987. This triggered private investments of more than approximately 3 billion Euros in the power industry.

In addition to the REN Programme, a promotion programme to improve the efficiency of the thermal utilisation of wood (**Hafö Wood Sale Promotion Guideline**) was launched in 1998. More than 1700 advanced, wood-fired heating systems were funded on the basis of this programme up to 2004.

With currently 2200 facilities and a total generating capacity of 1910 megawatts (as per 30th June, 2004), North Rhine-Westphalia is the number one inland State as far as the **use of wind power** is concerned. North Rhine Westphalia is the leading region in Germany with respect to the increase in the use of photovoltaic systems, biomass utilisation and the use of solar heat.

North Rhine-Westphalia is also active in the fuel sector. The market share of biodiesel is, at present, approximately 2.8 % of the diesel used in Germany. North Rhine-Wesphalia produces and consumes the largest portion: Three facilities have a combined production capacity of 235,000 tons of biodiesel per year. This makes it possible to replace, even now, approximately 4.3 % of the diesel fuel consumed in North Rhine-Westphalia.

North Rhine-Westphalia is the international pioneer with respect to **the use of coal mine methane**. This applies to methane production from hard coal mines which have been closed-down and those which are still being operated. Even now, dozens of plants with an output of 150 megawatts of electrical power are being operated in North Rhine-Westphalia. Investments of more than 150 million Euros have already been made. If the entire coal mine methane potential in North Rhine-Westphalia is used this may lead to an annual reduction by 3.6 million tons of carbon dioxide equivalent emissions.

To modernise the lignite power stations in North Rhine-Westphalia, the State government has agreed on a **Power Station Modernisation Programme** with the companies concerned. After being fully implemented, this programme will reduce specific CO_2 emissions (CO_2 per ton of lignite used) by 27 % as compared with 1990 levels.

The State of North Rhine-Westphalia specifically supports the modernisation, safeguarding and expansion of co-generation. By stepping up the use of industrial and public **co-generation,** CO_2 emissions may be reduced by 5.2 million tons in North Rhine-Westphalia by 2010.

To tap the energy saving potential in the housing sector, North Rhine-Westphalia entered into an **Agreement on CO_2 Reductions in the Housing Sector** with the largest companies of the construction and housing industry in the State in 2001. The purpose of this Agreement is to reduce emissions in the buildings owned by the construction and housing industry and the property of the State of North Rhine-Westphalia by 10 % by the year 2005 (on the basis of 2000 levels) by means of the thermal insulation of buildings, the modernisation of heating and hot water systems and the use of solar power systems on roofs.

In the field of waste management, North Rhine-Westphalia is expecting a reduction of methane emissions by 84 % by the year 2010 due to the **discontinuation of dumping untreated municipal waste and the capturing of the remaining landfill gas**. This corresponds to a reduction of 6.7 million tons of carbon dioxide equivalent emissions.

The State of North Rhine-Westphalia is currently developing a State-wide **climate monitoring scheme** to continually observe the development of emissions and check to what extent reduction targets have been attained.

2.5. São Paulo: actions and contribution on climate change and sustainable development[18]

Introduction

Within the Climate Regime, as a developing country, Brazil does not have specific emission reduction obligations. Notwithstanding, as a signatory of the United Nations Framework Convention on Climate Change (UNFCCC), the country is committed to develop national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol; to formulate and implement regional programmes containing measures to mitigate climate change; and to promote and cooperate in the development of clean technologies.

Thus, there are two beliefs that must be reconsidered in Brazil: first, the idea that climate change is merely a scientific and environmental concern, as if the subject does not encompass any political and economic aspects. Second, that climate change is basically an industrialised countries problem, in which Brazil doesn't need to develop any mitigation commitment, notably considering the high levels of GHG emission owing to deforestation in the country.

It's important to point out that Brazil can be seriously affected by climate change impacts. According to the 3rd IPCC's Synthesis Report (2001, p. 271), the greenhouse effect tends to intensify natural climate events such as El Niño e La Niña, provoking higher occurrence of dry periods. In this way, global warming can be expected to increase the risk of biodiversity loss and higher periods of drought and, consequently, the intensification of poverty conditions, social-economic problems, reduction of crop yields by shortening the crop cycle, affecting directly the Brazilian agriculture sector, which is considered one of the most important in country economy.

The perspective of increase in Brazil's contribution to global warming and the predicted negative impacts caused by this event justify not only the country participation in the international global warming negotiations under the UNFCCC umbrella, but also regional initiatives. In such context the State of São Paulo should assume a central role. Considering this background, the purpose of this article is to present a general view of São Paulo contribution to national GHG emission, the opportunities for Climate Change policies and call São Paulo to take the lead in the national process of establishing such policies.

[18] By Fernando Rei, Oswaldo Lucon, Suani Teixeira Coelho and José Goldemberg, Sao Paulo Environmental Secretariat

São Paulo Contribution to National GHG Emissions

São Paulo is the most industrialised and urbanised state in the country due to its historical development, playing a central role in Brazilian economy. With a population of almost 35 million inhabitants, that corresponds to 22% of Brazil, most of which living in the three biggest metropolitan regions – Santos, Campinas and São Paulo city –, the state accounted for 35.5% of Brazilian GNP and 11% of the South American GNP (SMA, 2002), which represented US$231,2 billion in 2000.

The high level of urbanisation and industrialisation in the State demands growing consumption of energy and natural resources, particularly considering the perspectives of continuous economic growth in the next years, that means a high contribution in the regional GHG emissions. The perspective of increase in the economic activity based on fossil fuel consumption, especially in the industry and transport sectors, is matter of concern if real efforts of mitigating Climate Change are to be pushed forward.

In 2000, the state of São Paulo participation in the total national energy consumption was 26.8%, the highest one compared with other states. This significant consumption is due to particularly two sectors: the industrial, contributing with 34.4% of the state energy consumption, and transport, participating with 30.2%. The industrial sector increased its energy demand in 2.7% during the period between 1980-2000 and the transport sector energy consumption increased 4.2% between 1993-2000. In 2001, 13 millions of vehicles circulated in the state of São Paulo. Only in the metropolitan region of São Paulo city, there are almost 7 millions of vehicles, one of the highest global rates.

Industrial energy demand is provided from several sources. Fuel oil, diesel, LPG and process residuary fuels are important sources for process heat, with natural gas gaining significant participation more recently. The highest amount of electricity is generated by hydro power plants, but there is also some thermo power plants, using fossil fuels and sugar cane bagasse. The reduction of hydroelectric potential in the State tends to yield diversification of primary sources, being of great potential the increased participation of sugarcane biomass in cogeneration plants within the sugarcane agroindustry and natural gas in thermoelectric and cogeneration plants. In the transport sector, the major part of the energy comes from fossil fuels, specially diesel and gasoline. Despite a decrease in the numbers of ethanol-powered vehicles, gasoline, however, is a blend with sugarcane ethanol in the proportion of 25% ethanol – 75% gasoline. Natural gas participation in transport has also increased through passenger cars and public transport utilities.

As the two major energy consumers in the State, and considering the strong participation of fossil fuels in this consume, industry and transport sectors justify their important contribution to GHG emissions. In fact, household, commercial and agriculture sectors, together, don't represent more than 5% of total emissions, while industry and transport were responsible for almost 70 $MtCO_2$ in 2000.

With little tradition in cattle breeding, the State of São Paulo counted with an estimated herd of 16.2 million head in 1994, against a national estimate of 233.9

million, making the state emissions in this sector small when compared to the rest of the country. The same is not true for the agricultural sector, strongly characterized by the presence of sugarcane culture, in which the pre-harvest burning of cane fields is still a very common practice, resulting in significant emissions of CH_4 e N_2O (Macedo, Leal e Silva, 2004).

Originally compounded by two main biomes – Atlantic Rainforest (81%) and Cerrado (12%) – the state forests have suffered drastic devastation, mainly in the 1970's and 1980's, owing to the expansion of urban agglomerates, agriculture and intense industrialization process. Nowadays, the Atlantic Rainforest remainders are found in an extremely critical situation, corresponding to some 7% of the original area. Nevertheless, for the first time since the beginning of monitoring activities, there was an observed reversion situation on the deforestation. This is a sign that federal and state policies aiming at forest conservation and recovery are being effective, as discussed ahead.

For those reasons, the State of São Paulo is the major GHG emitter in the country, contributing with almost 40% of total national emissions, being undoubtedly revealed its co-responsibility in the prosecution of adequate policies to confront the climate change challenge.

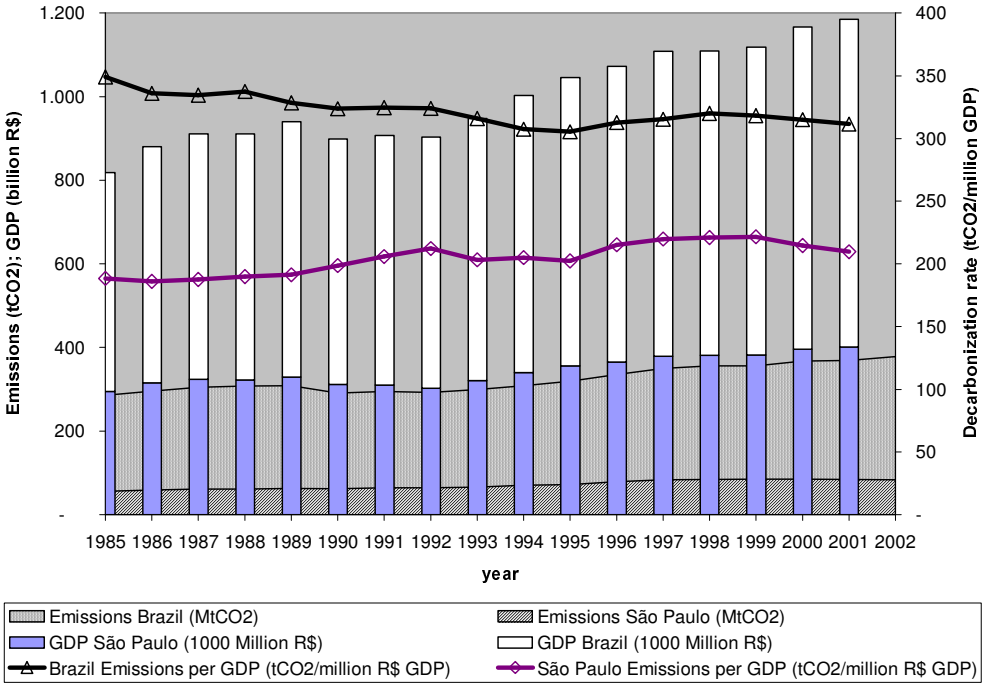
Mitigation Initiatives in the State of São Paulo

Taking into account São Paulo contribution to national GHG emissions, as well as its economic and political importance in Brazilian context, and considering the dynamic inherent to climate change that presupposes the inter-relation among several different environmental, socio-economic and political aspects, it should be expected that São Paulo had an adequate climate change policy.

Historically the growth in GHG emissions in Brazil is 2% per year. Although precise numbers for this growth rate do not exist for São Paulo it is estimated to be 1% per year.

Economic growth in Brazil (as measured by GDP) is 3% per year and in São Paulo at 3%. The issue here is not reduce economic growth to reduce GHG emissions but how to promote economic growth and at the same time reducing GHG emissions.

Figure 1 shows the evolution of the carbon index for Brazil and São Paulo.



Source: authors calculations based on: Brazilian Energy Balance 2002, São Paulo State Energy Balance 2002, Central Bank National Report 2001 and SEADE 2002.

In fact, the State has continuously played a central role in facing this problem. A great evidence of this was the establishment, in 1996, of PROCLIMA, the state climate change program. São Paulo has also promoted a series of policies and programmes with leadership at national level, providing positive consequences in the mitigation of Climate Change, such as the ozone depletion controlling program, new vehicle emissions controlling program and the promotion of Clean Production Environmental Chambers, co-ordinated by CETESB.

Besides these programmes, the State of São Paulo has progressively developed the necessary legal framework to regulate the use and exploitation of state natural resources, with direct positive consequences in climate change mitigation. It can be cited: (a) the delimitation and creation of several preservation areas and conservation units localized in the Atlantic Rainforest; (b) legislation with incentives to the recomposition in riparian forests; (c) legislation phasing out the sugar cane burning practices.

We list here a number of measures that are being taken to accelerate decarbonization. Some of them could be used to generate CDM credits. For others this might be some difficult because of problems in defining the baselines.

1. Waste Management Sector

   São Paulo has considerable participation in methane emissions generated by anaerobic digestion of solid waste and liquid effluents due to its elevated population and industrial activity. The estimated methane emission in São Paulo, taking into account generation of 20,000 t/day of domestic solid residues, is approximately 7 kg CH_4/inhabitant.year, superior to the national value. Despite the fact that around 95% of the

population in urban areas is attended by waste collection services, in the majority of the municipal districts the incorrect disposal in open areas still prevail, aggravating methane emissions from decomposition.

Integrating domestic solid waste management policies and climate change mitigation measures, improving the waste disposal areas and landfills, and using the landfill gas to generate energy are measures to reduce such emissions.

The disposal of urban waste in sanitary landfills allows the generation of electricity burning methane, which is then converted into CO_2. An example is "Aterro Bandeirantes". Avoiding the emission of 40 thousand tones of CH_4 per year has the net effect of reducing CO_2 emissions (as measured by GWP[19]) by a factor 21. The potential of electricity production on São Paulo State landfills can reach 340 MW in the year 2006.

2. Transportation Sector

It is important to encourage the gradual substitution of heavy fossil fuels by other less pollutant fuels, such as the alcohol and natural gas, using the alcohol produced in the state and the existing distribution of natural gas.

It can be mentioned the case of São Paulo city, where the public transportation system is testing less pollutant technologies such as hybrid diesel-electric. Light vehicles are witnessing a booming use of gasoline-ethanol flexible fuel vehicles (vehicles which can run on any blend of gasoline/alcohol).

The expansion of sugarcane planted area in São Paulo is estimated to enhance in 50% of 2003/2004 season, reaching 4 million hectares until 2010/2011 season, which corresponds to a ethanol production about 13 billion litres.

This expansion occurred without deforestation, with sugarcane replacing other crops and cattle regions.

Each fleet of 1,000 diesel buses emits 100 ktC per year. A hybrid technology can abate part of such emissions generating credits. An ethanol vehicle reduces 1 tC/year when replacing gasoline car. Furthermore, the Brazilian market of flex fuel vehicles – light vehicles able to run with pure alcohol, pure gasoline or any blend of alcohol-gasoline (gasohol) is growing since its introduction, in May 2003, nowadays the sales of these vehicles represents about 20% of the market share.
Other systemic approaches that could save fossil fuels are rapid transit corridors, according to a study developed by the National Public Transportation Association due to traffic jams the operational costs of buses in São Paulo City increase about 16% (IPEA/ANTP, 1998).

[19] An index representing the combined effect of the differing times greenhouse gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation. (source: http://unfccc.int/essential_background/glossary/items/2639.php#G

3. Industrial Sector

Another option corresponds to strengthening Clean Production initiatives, in order to implement mitigation actions in the industrial sector, prescribing the intelligent use of natural resources, the identification of wastes, the productive process evaluation and fuels substitution for cleaners and renewable ones. In order to achieve this goal, environmental education and awareness about the necessity to establish rational consumption paths are necessary, principally in the highest levels of administration.

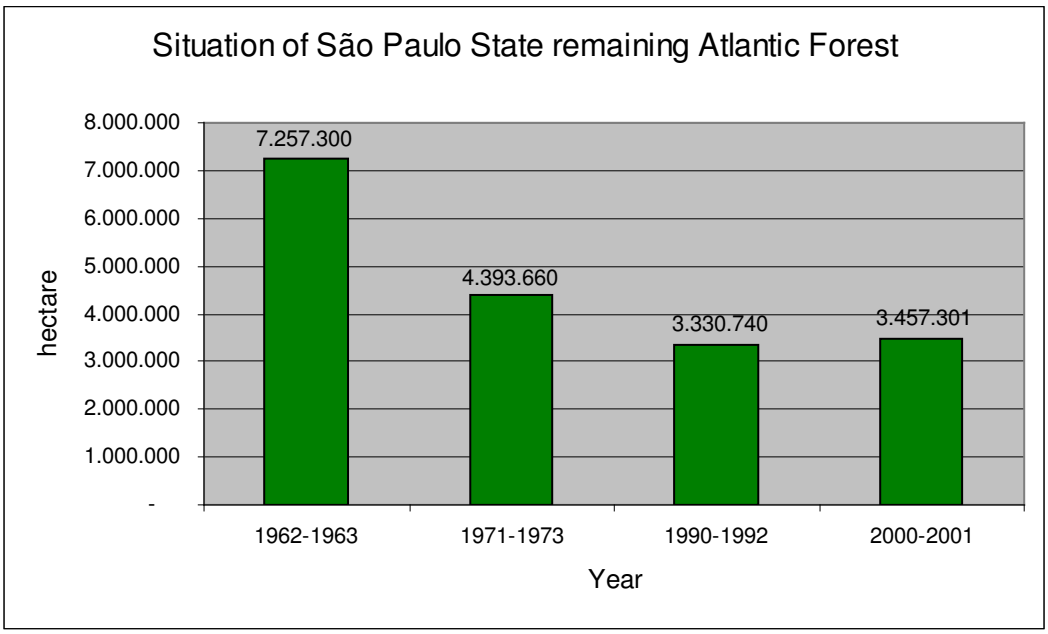
The first initiative on emission compensation implemented in São Paulo State in 2002 was the application of a governmental decree which allowed a petrochemical industry, installed in the metropolitan region of São Paulo City, to enlarge its productive area.

The recent emission offset legislation in São Paulo State - Decree 48.523/ 2004 allows sustainable economic development. The Decree permits new licences due to emission compensation in the non attainment areas, the abatement credits must be issued by the Environmental Agency (CETESB). This mechanism is a CDM-like system, applied to NOx, PM, SO2 and CO. The air quality targets will be applied in license renewing, orienting economic activities towards cleaner production and fuels.

4. Land Use, Agriculture and Forest Sectors

São Paulo is emphasising forestation projects, notably considering its social benefits. Indeed, according to Cerri et al. (2000), the potential to recompose original vegetation, in São Paulo, was estimated in 18,500 km^2, which could result in 92.5 MtC sequestration during a period of 20 years.

Figure 2 below represents the lost of São Paulo State original Atlantic Forest. It can be noted, during the last years, a slight alteration on the deforestation tendency (3.8% growth).



Source: São Paulo (Estado), 2003

The mitigation strategies would be essentially the to establishment of incentives to recuperate degraded agricultural area; to implement recomposition of riparian forests (in São Paulo State there is 1 million hectares of deforested riparian forests, which could capture about 80 million tonnes of carbon in 30 years) the and other vegetal areas; to provide hydrological watersheds management plants, to carry out environmental management instruments, including: rural planning, integrated soil, water and air conservation measures, environmental education, rural cooperatives. Due to the ethanol expansion, sugarcane cultures is expected to grow more 50% by the next 2-4 years – this is a challenge for land use management.

5. Electricity

São Paulo State is promoting the use of renewable energy, taking into account the state biomass potential 3,500 MW (CENBIO, 1999). This is the case of cogeneration by sugar-cane bagasse. Producing annually 200 millions tonnes of sugar-cane, São Paulo has the potential to obtain 10TWh/year using the sugar-cane bagasse. The biomass use promotes the decentralized generation of energy and produces a positive effect creating jobs, specially in rural areas.

After all, considering that the policies and directives presented require wide and effective participation of the whole society, especially the direct involved sectors, and taking into account that this involvement presupposes commitment from the industrial sector and awareness of the population about the seriousness, conseq7uences and responsibilities related to climate change, it behoves the State the fundamental role of conducting this process.

Final remarks

Amongst the challenges for São Paulo, there are those related to achieving the Millenium Development Goals in its own territory, as well as in Brazil as a whole. Several initiatives may also address the mitigation of emissions of greenhouse gases. For example, improved transportation systems reduce local air pollution. Better waste management allows more landfills to recover methane and reduces waste dump sites. Access to energy reduces unsustainable fuelwood use.

São Paulo has a leadership position in the field of renewable energies. In the State was first was conceived the so-called Brazilian Energy Initiative, the proposal for a global 10% share of renewable energy by 2010. It was first approved in May 2002 by the Environmental Ministers of the Latin America and Caribbean Regions, then officially taken and discussed at the 2002 Johannesburg World Summit for Sustainable Development (WSSD) as a mandatory multilateral Type I initiative. Although the WSSD final Plan of Implementation does not explicitly mention this target, the Initiative was crucial to creating the momentum for the relationship among the issues of Energy, Environment and Development.

São Paulo also participates in several Type II voluntary initiatives proposed at the WSSD, such as the Renewable Energy and Energy Efficiency Partnership (REEEP), the Global Network for Energy and Development (GNESD), the International Atomic Energy Agency (IAEA) Initiative for Modelling Sustainability Country Profiles, the Johannesburg Renewable Energy Coalition (JREC) and the Network of Regional Governments for Sustainable Development (nrg4SD).

In the Bonn Renewables 2004 Conference, a major event proposed by the German Prime Minister Gerhard Schroeder in the closing of the 2002 WSSD, the nrg4SD has promoted a side-event, hosted by the Government of North Rhine- Westphalia.

In this side event was discussed how to increase cooperation - and how to measure it. São Paulo has contributed with ambitious proposal: "to increase, from 2004 to 2010, by 2% the share of renewable energies in the joint balance of the nrg4SD participating regions, based on the International Energy Agency criteria for the Total Primary Energy Supply - TPES"

The advantages reflect in a huge potential for cooperation, either with more developed regions (North-South and South-North) or with developing (South-South). In terms of North-South, São Paulo could cooperate in terms of technology transfer and capacity building on subjects like polluted sites, air pollution management or biodiesel technology. South-North cooperation could be, for example, expanding the use of sugarcane ethanol in vehicles. South-South is mainly in terms of information exchange, capacity building and technology transfer.

Such initiatives at State, Province or other sub-national levels can be implemented in a fast way, helping achieving the objectives of the Kyoto Protocol.

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2.6. Wales: Climate Change[20]

Introduction

Some Climate Change cannot now be avoided but we can act to limit its effects by reducing greenhouse gas emissions. At Kyoto in 1997 the world's developed countries agreed to reduce their combined emissions of the six main greenhouse gases by 5.2% below 1990 levels over the period 2008-2012.The gases covered by the so called Kyoto Protocol include Carbon Dioxide, Methane, Nitrous Oxide, Hydro fluorocarbons, Perfluorocarbons and Sulphur Hexafluoride.

The European Union agreed to a cut of 8% to be met jointly, which after redistribution led to the UK agreeing to a cut of 12.5 %. The UK also set a domestic goal of an additional reduction in carbon dioxide emissions to 20% below 1990 levels by 2010.

The National Assembly for Wales is committed to playing its part in developing and delivering a climate change program which meets the Kyoto target and moves the UK towards its domestic goal of a 20% reduction in carbon dioxide emissions by 2010.

The Assembly does not underestimate the size of this challenge. It is aware of the problems facing Wales and the rest of the UK if action is not taken to deal with the causes of climate change – views reinforced by recent weather events. But it cannot operate alone. Its contribution will build on the partnerships that it has developed with business, local government, the Environment Agency, and the voluntary sector, with action being taken on the basis of who does what best.

The Assembly has a duty under section 121 of the Government of Wales Act 1998 to promote sustainable development. It is the only Government in Europe to have such a constitutional duty. Sustainable Development provides a framework for the development of policies and actions across the Assembly. Wales' wildlife, habitats, landscapes and historic buildings are important to its prosperity, well being and culture, and need to be treasured, managed and protected in a way that does not hinder economic or social development. Where possible, policies will be developed which deliver effective protection of the Welsh environment and contribute to tackling global environmental threats such as climate change.

For a long time the prosperity of Wales has been well below the UK and European averages. The Assembly is addressing this problem. Through the use of European Regional Development Funding (ERDF), it is aiming to achieve higher rates of economic growth over the coming decade. Environmental sustainability is one of the cross cutting themes which has been built into the Welsh ERDF program. Action plans put forward for funding under the program will be assessed against criteria such as their contribution to reducing carbon dioxide emissions, stabilizing traffic growth and contributing to a wide range of environmental targets. Priority for ERDF funding will be given to those projects that deliver economic prosperity while contributing to

[20] By the Welsh Assembly Government

the overall environmental objectives of the program. The challenge is to accelerate the rate of economic growth whilst protecting the environment and improving the quality of life for those who live and work in Wales.

It is now commonly accepted that increasing prosperity leads to a rise in consumer demand for goods and services, which is ultimately linked to increasing carbon dioxide emissions. For future development in Wales, this link needs to be broken. From the energy perspective, this means focusing on efficient, economical and environmentally acceptable energy generation from renewable and non-renewable sources. Advanced information and communication technologies offer the opportunity to develop a knowledge-driven economy and to minimize environmental impacts. Current policies and programs are focusing on working with industry to ensure the most effective and environmentally sound use of existing and future technologies.

Impacts of climate change in Wales

The UK Climate Impacts Program scenarios forecast that Wales in 2080 will be, on average, 1.1° C to 2.9° C warmer than at present, and that there will be:

- more frequent storms;
- a rise in sea level;
- increased rainfall and greater inflow to estuaries and the sea;
- changes of rainfall pattern during the year - wetter winters and drier summers; and
- increased evapotranspiration.

The National Assembly commissioned a scoping study in summer 1999 to review existing information and research studies relevant to Wales, and to identify the main priorities for future research and policy development and the findings were launched in February 2000.

The scale of future climate change is uncertain, making adaptation planning difficult. It is important to plan to adapt both for extreme events as well as the changes in average conditions. The rate of climate change is also likely to be a key factor in determining the ability of natural ecosystems to adapt and survive. Three main impacts have been identified:

- changes to the natural and built heritage;
- effects on economic activities; and
- effects on the water environment.

Large areas of Wales are protected because of their sensitive ecosystems and landscapes. For example, there are over 1,000 Sites of Special Scientific Interest (SSSIs) covering about 10.7% of Wales, together with three National Parks and five Areas of Outstanding National Beauty covering 25% of Wales. The northward migration of species sensitive to climate change can only occur to other favourable habitats where corridors exist for migration. The impact of climate change on natural ecosystems could include the loss of arctic alpine plants such as the rare Snowdon Lily. Sea level rise could impact on natural habitats in estuaries, saltmarshes and sand dunes. About 550 km of the Welsh coastline is designated as Heritage Coast. Although Biodiversity Action Plans have been initiated in Wales, in many cases

understanding of the sensitivity of species and habitats to climatic change is poor, making it difficult to predict the impacts or manage the consequences.

Economic impacts will depend to some extent on the effect climate change has elsewhere. For example, impacts on the tourist industry will depend on the effects of climate change on other popular holiday destinations. Climate change could make some areas of Wales more favourable for arable crops, but less favourable for dairy farming. Insurance costs could rise in areas susceptible to storm and flood damage. Much of the population and existing industrial development in Wales could be affected as it is located along the southern and northern coasts. Sea level rise, increased intensity of rainfall and increased frequency of storms could all have a strong cumulative effect on these areas.

Water resources are also likely to be a significant issue, particularly with the demand for summer supplies increasing and the prospect of reduced seasonal rainfall. Balancing water supply and water demand will require careful planning to maintain river flows while preventing the drying out of wetlands and the potential damage to the biodiversity of protected sites in Wales.

Following the initial scoping study, further studies are being initiated to derive indicators of climate change in Wales, and to examine the impacts of climate change on upland land uses.

Raising awareness

The Assembly will continue to develop its Business and Environment campaign and will be pressing messages for energy saving, recycling and cutting down on unnecessary car use. Keep Wales Tidy and Going for Green promote community action that can include measures that reduce carbon dioxide emissions. Their Sustainable Communities initiative incorporates measures like traveling sensibly and practices such as composting waste rather than landfill in an overall more sustainable lifestyle. Setting targets for carbon dioxide reductions are intrinsic parts of the Sustainable Communities projects.

Work to tackle and adapt the changes brought about by climate change will be progressed by further developing the partnerships with other organisations that have already been established by the Welsh Assembly Government.

The Air and Environment Quality Branch, part of the Environment Division in the Environment, Planning and Countryside Department, is responsible for climate change policy in Wales. It is committed to raising awareness of climate change; to improving the understanding of its impacts; and to progressing measures aimed both at tackling emissions and adapting to some of the unavoidable consequences.

In October 2003, the Welsh Assembly Government issued its first Climate Change Newsletter giving a quick synopsis of issues currently affecting Wales.

Action on adaptation

Flooding and other natural hazards

One of the most likely effects to which Wales will have to adapt in the future is sea level rise. Current projections estimate that around the Welsh coast, increases will be in the range of 25 to 30 cm by 2050, slightly more in the south than the north. An allowance of 5 mm per annum over the life of a scheme is now built into all new coastal defenses where appropriate, or otherwise the defenses are constructed to enable increases in height to be incorporated in the future.

The Welsh coastline is also expected to be subject to increased storminess . As well as increasing the risk of flooding of low-lying areas, such events will increase the rates of erosion of the higher ground. This will be especially so where the coastline is composed of softer materials but this is likely to be limited as much of the Welsh coastline is composed of relatively hard rock.

Beyond the life of coastal protection schemes being built now, which are assumed to have a working life of around 50 years, reducing the risk of flooding and coastal erosion by building larger and higher defenses may not be sustainable. More radical measures may be needed and, in part to address this issue, Shoreline Management Plans are being prepared for the Welsh coastline. These will help to identify those lengths of coastline where it may not be sustainable to defend. This policy is likely to be most effective where plans can be made for the long term future, where just allowing nature to take its course and retreating the defended line may be the most appropriate option. By undertaking these plans, those responsible for land use planning will be able to avoid new development in "at risk" areas. Local authorities and land owners will be able to plan for the future knowing what are the most likely scenarios. Shoreline Management Plans will be reviewed regularly by local authorities to ensure that the latest information on climate change is used in the decision making process.

While there are predictions of increases in inland rainfall over winter months, the effect of extreme weather conditions that lead to flooding is uncertain. At present, no allowances are being made for increased fluvial flooding, but the National Assembly's High Level Targets require a start to be made on Catchment Flood Defense Management Plans, intended to be the fluvial counterparts of Shoreline Management Plans. These will enable land use planners to avoid development in the most vulnerable flood plain areas.

In Wales, increased rainfall could also have an effect on land stability. There are numerous relict landslips left after the last glaciation, many of which are active or only marginally stable. Research has been undertaken to enable an assessment to be made of the potential for land slipping in the South Wales coalfield valleys.

A demonstration project has been established in the Rhondda valley in South Wales. The land slipping research has been integrated with the planning system to enable investigations to be targeted at vulnerable areas so that unstable areas can be avoided when development takes place. This work will hopefully be extended to other valleys in South Wales.

Land Use

The potential effects of climate change must be considered and built into all aspects of the planning process so that it is sufficiently responsive to cope with the impacts of change as they arise. Climate change considerations will therefore need to be more fully integrated into the Assembly's land use planning guidance.

Current land use planning policy is contained in 'Planning Policy Wales' (March 2002) which provides the strategic policy framework for the effective preparation of local planning authorities' development plans. This is supplemented by 20 topic based Technical Advice Notes (Wales) (TANs). Those which cover topics of particular relevance to climate change are TAN(W)14, *coastal protection*, which provides technical guidance on coastal flood risk and coastal defenses, and TAN(W)15, *development and flood risk*. A TAN on planning pollution control and waste management is in preparation. Following the review of planning policy guidance, the technical guidance contained in TANs is to be revised to reflect changes to the policy document and the effects of climate change. The Assembly is also committed to the preparation of a new national spatial planning framework for planning, setting a clear context for sustainable development and environmental quality.

Moving to a low carbon economy

Climate change is the greatest international sustainable development challenge, with enormous consequences for our future lives and livelihoods if we fail to address it. Climate change in many ways goes to the heart of the way we live because it is influenced by our use of energy, natural resources and land in modern society and economy. The goal now is to move towards a `low-carbon` economy. We also need to take action that allows us to adapt to the effects of climate change in its many guises, be it flooding, storm damage, sea level rise or pressure on water resources.

We are working with the UK Government and the other devolved administrations on the review of the UK climate change programme. Although Wales has traditionally been heavily dependent on energy for its industries, it has tremendous natural potential for renewable and alternative energy. We have already set a target of having 10% of our energy from renewable sources by 2010 as part of our contribution to the international goal of reducing emissions by 60% by 2050. Recently issued draft planning guidance on a strategic approach for renewable energy development will significantly contribute to delivering that target.

Moving to a low carbon economy is not enough on its own. It is also vital to conserve Wales' current natural stores of carbon. The overwhelming majority of this – some 500 million tonnes – is in the soil, particularly peaty upland soils, and is at risk of being released to the atmosphere if it dries out.

We will take our work on climate change forward significantly by:

- implementing the Energy Efficiency Action Plan across all sectors by **November 2004**
- driving forward our clean energy policies in Wales, by publishing by **December 2004** and implementing a clean energy action plan, which will include establishing an increased role for Wales in developing next generation renewables technologies

- developing community renewables and innovative energy projects through stakeholders and agencies with the benefit of European funding support by **January 2005**
- with Carbon Trust Wales, WDA and others, implementing a step change in the adoption of the latest energy efficiency techniques, and small scale renewable energy generation in buildings of all types in Wales. This will build on the Carbon Trust's study of the profile of energy use and carbon emissions in Wales, due in **spring 2005**
- with DTI, Carbon Trust and others, strengthening the knowledge/research base in Wales for emerging marine energy and hydrogen economy systems, including participating in a renewables strategic environmental assessment of Welsh waters – by **mid 2005**
- ensuring that our developing policies on farming, forestry and the countryside, help to conserve the carbon stored in Welsh soils
- ensuring that lighting for trunk roads employs renewable technologies to deliver at least 20% energy saving
- commissioning a study to explore the feasibility of offsetting the carbon generated by induced traffic arising from Assembly road schemes.

2.7. Western Australia: Greenhouse Strategy[21]

What is the greenhouse effect?

The 'enhanced greenhouse effect' is an alteration of the world's climate system caused by increasing levels of certain gases in the Earth's atmosphere. Scientists believe the enhanced greenhouse effect is already causing higher average air temperatures in the lower atmosphere, changed rainfall patterns and rising sea levels resulting from warmer oceans and ice melting from glaciers and Arctic and Antarctic ice sheets. Climate changes due to the enhanced greenhouse effect are often referred to as 'global climate change' or 'global warming'.
Atmospheric concentrations of greenhouse gases have increased significantly since the Industrial Revolution about 250 years ago. Australia emits about one per cent of global emissions, a small proportion of the total, but one of the highest on a per capita basis. Western Australia emits about 12 per cent of Australia's emissions with emissions increasing at about 2.8 per cent per year since 1990. Most of Western Australia's greenhouse gas emissions result from fossil fuel use and livestock production.
Over the last decade the Western Australian Government, industry and community have worked together to significantly reduce land clearing, conserve remnant vegetation and undertake revegetation works. As a result the land use change and forestry sector in Western Australia changed from being a net emitter of greenhouse gases into a net sink between 1990 and 2002. The contribution of this sector in offsetting a portion of the State's emissions as organic carbon sinks will continue to be important for some decades.

What impact will the greenhouse effect have on Western Australia?

Impacts of global climate change are difficult to predict at a sub-continental or regional level or for particular time scales. However, international global climate models suggest that as atmospheric greenhouse gas concentrations continue to rise, Western Australia will become warmer and rainfall patterns will change. The South West is likely to receive less rainfall.
These changes to the State's climate could directly affect agriculture, forestry, health, biodiversity, water resources, energy demand and tourism. There could be indirect but significant impacts on fisheries and industrial development.

What is being done about the greenhouse effect?

International agreements aim to limit atmospheric greenhouse gas concentrations to levels below those at which unacceptable impacts would occur. The Kyoto Protocol assigns emission targets to developed nations, including Australia. Australia's Kyoto emission target is not greater than 108 per cent of the nation's 1990 emissions on

[21] By the Western Australian Government.

average between 2008 and 2012. Although the Federal Government has stated it will not ratify the Kyoto Protocol, it has indicated the 108 per cent target will be achieved.

What is Western Australia's position on Kyoto Protocol ratification?

The Western Australian Government recognises the significant weaknesses and limitations of the Kyoto Protocol, yet believes the Protocol represents an essential step towards the global approach necessary to prevent dangerous climate change.
The Western Australian Government calls upon the Federal Government to ratify the Kyoto Protocol and will support national measures to meet the Kyoto Protocol target that recognise Western Australia's circumstances and interests.

What does the Western Australian Greenhouse Strategy outline?

In 2002, Western Australia established a Greenhouse Task Force to prepare a Western Australian Greenhouse Strategy to ensure the State's industry and community could contribute to reducing global greenhouse emissions and effectively respond to any opportunities and challenges generated by climate change.
The Task Force consulted with industry, the community and Western Australian Government agencies in preparing the Strategy.
The final Western Australian Greenhouse Strategy provides a comprehensive response to the greenhouse issue.
The Strategy is based on leadership, research, and public and industry engagement. It establishes research programs to enable the State to better adapt to the changing climate, delivers the Western Australian Government's greenhouse-related policy commitments and establishes a Greenhouse Unit in the Department of the Premier and Cabinet to enable Western Australian interests to be represented nationally and internationally. The Greenhouse Unit will coordinate implementation of the Strategy and enable the State to more effectively develop and advocate State greenhouse and climate change policy initiatives.
Western Australia's Greenhouse Strategy defines several objectives for its strategic response to global climate change. The objectives of the Strategy are to:
maximise opportunities for a sustainable future for Western Australians;
create voluntary market-based measures to enable all emitters to access least-cost greenhouse emissions abatement initiatives;
establish a realistic and effective long term commitment to addressing climate change;
ensure all sectors contribute to solutions; and
enable Western Australia to contribute to national and international solutions on a cost-effective and equitable basis.
The Strategy will be reviewed in 2008. The eight main elements of the Strategy follow.

1. Government leadership

The Western Australian Government will work to minimise its own contribution to climate change by demonstrating emission reductions, thereby helping industry and the community to determine and implement effective responses.

Targeted purchasing by the Western Australian Government will help generate desired market opportunities.
The existing *Energy Smart Government* program aims to achieve a 12 per cent reduction in stationary energy (or non-transport energy) use in Government agencies by 2006-07, using 2001-02 as the base year.
The Strategy commits the Western Australian Government to purchasing the equivalent of five per cent of its electricity from cost effective renewable sources by 2006-07.
Government agencies and trading enterprises will annually report greenhouse gas emissions to the Western Australian Greenhouse Gas Inventory from 2005-06 and from 2006-07 lodge greenhouse gas estimates for the coming year and develop strategies to minimise anticipated emissions.
New Western Australian Government housing will aim to exceed minimum energy efficiency requirements.

2. Reducing greenhouse emissions

It is important that greenhouse gas emission reductions are achieved across all sectors. Action is needed to increase awareness and engagement, and establish programs that will yield short, medium and long-term emission reduction benefits.
The industry and electricity sectors together are responsible for producing about 57 per cent of the State's greenhouse gas emissions. The Strategy aims to encourage the development of market-based mechanisms in these sectors to achieve lowest cost emission reductions and protect Western Australia's economic and environmental interests. As larger markets offer greater opportunities for more cost effective options to be realised, the Strategy strongly emphasises the value of a national approach to addressing greenhouse gas emissions and the importance of access to international market opportunities. There are several actions to enable major Western Australian greenhouse gas emitters to prepare for such market-based mechanisms:
The Strategy will require major industrial emitters to report greenhouse gas emissions annually to a Western Australian Greenhouse Gas Inventory, lodge greenhouse gas emission estimates for the coming year, and develop strategies to minimise anticipated emissions. This will involve public reports every three years and triennial audits.
A Greenhouse Abatement Fund to hold and deal with organic sequestration rights and credits generated by Government institutions will be created.
A Greenhouse Registry with the ability to certify and document organic sequestration claims and emission reductions by industry and Western Australian Government institutions will be established.
The Western Australian Government will support the development of confident and viable national and international trading markets. Western Australia will determine its own preferred emission abatement framework that best suits the State's circumstances and promote this in any national negotiations.
The Strategy promotes the expansion of the sustainable energy sector and industries based on renewable energy sources in Western
Australia. It includes a range of mechanisms aimed at developing a competitive renewable energy sector that capitalises on the opportunities and resources in Western Australia, while working within the framework created by the Commonwealth Government Mandatory Renewable Energy Target (MRET) scheme. An increase in the MRET is supported.

Waste management produces about 2.5 per cent of the State's emissions. Enhanced implementation of the *Strategic Direction for Waste management in Western Australia* and targeted research on waste separation options are supported.
Energy use in households and commercial operations is responsible for generating about 16 per cent of Western Australia's greenhouse gas emissions. The Strategy outlines a series of actions and proposals to reduce energy demand and greenhouse gas emissions from these activities by increasing energy efficiency of buildings and appliances.
Transport generates about 16 per cent of Western Australia's greenhouse gas emissions. The Strategy aims to reduce transport emissions through travel demand management programs such as the *TravelSmart* initiative, traffic management strategies, investment in infrastructure that will promote energy efficient transport options such as the new MetroRail Project in Perth's southern suburbs, fuel efficiency and low greenhouse gas emission fuels. The Strategy also includes actions for further integration of land use and transport planning.
Agriculture produces about 28 per cent of Western Australia's greenhouse gas emissions. The Strategy outlines actions to investigate emissions from agriculture to enable producers and land managers to develop and implement focused and efficient actions to reduce the emissions associated with their business practices. Many agricultural practices that reduce greenhouse gas emissions also promote increased productivity and sustainability. The Strategy supports development and promotion of low emission agricultural practices.

3. Carbon sequestration

Carbon sequestration resulting from plantation establishment, revegetation or increased soil carbon can offset greenhouse gas emissions from fossil fuel use or other sources. These activities can also generate other benefits, including salinity and erosion control and biodiversity protection. The value of rights arising from organic carbon sequestration could promote revegetation.
The Strategy contains a series of actions aimed at promoting nationally consistent carbon rights legislation, more accurate and efficient carbon accounting for plantations and revegetation, and revegetation which delivers a range of natural resource management benefits beyond carbon sequestration.
Geological sequestration of carbon dioxide is an emerging option for storing carbon dioxide removed from a natural gas stream or an industrial waste stream. It offers significant promise for reducing the net greenhouse gas emissions from an operation. The Strategy includes actions to investigate several technical, regulatory and risk-management issues associated with geological sequestration and promote community and stakeholder knowledge about it.

4. New opportunities

Global climate change will generate new opportunities for Western Australia's businesses and residents. Some of these opportunities are being pursued, such as revegetation for organic carbon sequestration, while others will only become evident as climate conditions evolve. The Strategy includes actions to help enable Western Australia to take advantage of new opportunities.

5. Adaptation

Global climate change is already occurring and is projected to continue for many years, even if greenhouse gas emissions were immediately and significantly reduced. A vast range of impacts are likely, affecting community health, regional water resources, biodiversity and climate dependent industries such as agriculture, forestry and fisheries.
The Strategy contains a set of projects to generate and communicate information to enable Western Australia to prepare for unavoidable changes to the State's climate conditions. Projects include continuation of the Indian Ocean Climate Initiative and investigating biodiversity impacts and farming and forestry system requirements of future climate scenarios.

6. Local government and community involvement

Local governments and community groups can make significant contributions to address the greenhouse effect. The effectiveness of such groups arises from their capacity to make decisions and to take direct action on matters affecting their own responsibilities. Many local governments are involved in Local Agenda 21 programs or are members of the Cities for Climate Protection (CCP™) campaign.
The Strategy contains actions to encourage local governments to participate in greenhouse initiatives.

7. Research

The Strategy is based on a philosophy of informed action. Research forms a major part of every element of the Strategy. The Strategy gives responsibility for monitoring international, national and Western Australian climate change research activities and findings and recommending further research to the Greenhouse Unit.

8. National and international representation

Global climate change is already being addressed by international agreements to which nations, including Australia, are parties. These agreements can affect Western Australia in many ways, including our industrial development opportunities and the value of our carbon sequestration initiatives. The Strategy includes actions to ensure the State's circumstances are recognised when Australia negotiates international agreements or develops national greenhouse policies, and when international rules are formed for matters associated with global climate change.

3. Cross-Cutting Issues

After the 2002 Johannesburg World Summit for Sustainable Development and with the proximity of the Kyoto Protocol entering into force, discussions on sustainability have broadened at all levels.

The following papers are some contributions from the nrg4Sd Regions for the debate.

3.1. United Nations Convention to Combat Desertification, UNCCD: the inter-relationship between greenhouse gas emissions and desertification[22]

Introduction

Desertification and climate change are supposed to be inter-related phenomena. One of the impacts which global warming may have on the surface of the Earth is to exacerbate the world-wide problem of desertification. In the other hand, desertification can improve the climate variability at regional level and maybe the climate change at global level. A decrease in the total amount of precipitation in arid and semi-arid areas could increase the total area of drylands and thus the total amount of land potentially at risk to desertification. In addition, desertification may enhance regional warming, through a variety of climate feedbacks.

The inter-relationship between desertification and greenhouse gas emissions is the main concern of this paper.

General overview on the issues regarding desertification and climate change

Land degradation occurs all over the world, but it is only referred to as desertification when it takes place in drylands. This is because these areas are especially prone to more permanent damage as different areas of degraded land spread and merge together to form desert-like conditions.

Drylands cover over 30% of the total land area around the world (6,150 million hectares). Drylands are defined as those areas where precipitation is low and where rainfall typically consists of short, erratic, high-intensity storms. Almost 70% of these drylands are affected by land degradation, which support more than 1,5 billion people.

Traditional farming and grazing techniques, suitable for wetter regions, are becoming increasing less sustainable owing to inadequate precipitation in these areas. Desertification was defined by the international community as the degradation of land in arid, semi-arid, and dry sub-humid areas caused primarily by human activities and climatic variations. This definition is part of the UN Convention to Combat Desertification and does not refer to the expansion of existing deserts. It occurs because dryland ecosystems, which cover over one third of the world's land area, are extremely vulnerable to over-exploitation and inappropriate land use. Poverty, political instability, deforestation, overgrazing, and bad irrigation practices can all undermine the land's productivity.

The impacts of desertification on the ecosystems and society

[22] by Heitor Matallo Jr, UNCCD.

As mentioned before desertification can undermine the land's productivity as well as improve the vulnerability of the communities living in the dryland areas, particularly the poor population. As main impacts of desertification process in the communities we can mention the following:

a) Desertification reduces the land's resilience to natural climate variability. Soil, vegetation, freshwater supplies, and other dryland resources tend to be resilient. They can eventually recover from climatic disturbances, such as drought, and even from human-induced impacts, such as overgrazing. When land is degraded, however, this resilience is greatly weakened. This has both physical and socio-economic consequences.

b) Soil becomes less productive. Exposed and eroded topsoil can be blown away by the wind or washed away by rainstorms. The soil's physical structure and bio-chemical composition can change for the worse. Gullies and cracks may appear and vital nutrients can be removed by wind or water. If the water table rises due to inadequate drainage and poor irrigation practices, the soil can become waterlogged, and salts may build up. When soil is trampled and compacted by cattle, it can lose its ability to support plant growth and to hold moisture, resulting in increased evaporation and surface run-off.

c) Vegetation becomes damaged. The loss of vegetation cover is both a consequence and a cause of land degradation. Loose soil can sandblast plants, bury them, or leave their roots dangerously exposed. When pastures are overgrazed by too many animals, or by inappropriate types, edible plant species may be lost, allowing inedible species to invade.

d) Some of the consequences are borne by people living outside the immediately affected area. Degraded land may cause downstream flooding, reduced water quality, sedimentation in rivers and lakes, and siltation of reservoirs and navigation channels. It can also cause dust storms and air pollution, resulting in damaged machinery, reduced visibility, unwanted sediment deposits, and mental stress. Wind-blown dust can also worsen health problems, including eye infections, respiratory illnesses, and allergies. Dramatic increases in the frequency of dust storms were recorded during the Dust Bowl years in the US, in the Virgin Lands scheme area in the former USSR in the 1950s, and in the African Sahel during the 1970s and 1980s.

e) Food production is undermined. Desertification is considered a major global environmental issue largely because of the link between dryland degradation and food production. A nutritionally adequate diet for the world's growing population implies tripling food production over the next 50 years. This will be difficult to achieve even under favorable circumstances. If desertification is not stopped and reversed, food yields in many affected areas will decline. Malnutrition, starvation, and ultimately famine may result. The relationship between soil degradation and crop yields, however, is seldom straightforward. Productivity is affected by many different factors, such as the weather, disease and pests, farming methods, and external markets and other economic forces.

f) Desertification contributes to famine. Famine typically occurs in areas that also suffer from poverty, civil unrest, or war. Drought and land degradation often help to trigger a crisis, which is then made worse by poor food distribution and the inability to buy what is available

Considering the improvement of the drylands vulnerability it can be said that it requires flexibility to be able to adapt to natural changes in climatic conditions.

In the past a range of techniques has been employed to protect valuable water resources, vegetation, soil quality and crops. However, economic and political pressures as well as changing cultures, population sizes and trends towards more settled communities have resulted in increasing mismanagement of land and the failure to adapt to fluctuations in climate.

This often leads to the adoption of land use practices unsuitable for the existing climatic regimes, or the over-intensification of existing practices until they become damaging to the land.

Over cultivation of crops and excessive tilling of the land leads to exhaustion of soil nutrients. The pressure to exploit the land in this way can be brought about by increases in food demand due to an increasing population, and monetary pressures such as the development of a cash-crop economy.

Soils, especially those of a sandy nature exploited in this way can become prone to wind erosion, whilst overcultivation of clay soils may well cause water erosion leading to land degradation. Low levels of technical know-how can often be a major cause behind poor land management practices such as irrigation. Poverty and underdevelopment are also major factors that contribute to desertification. This does not mean however that this process couldn't be found in developed countries as Spain, Australia and the United States.

Greenhouses gas emissions, the climate change phenomenon and the impacts on environment and society

Climate change is an integral part of the earth's climate system. In the past, particularly during the Pleistocene ice age, agriculture was considered impossible because climate was cold, variable and very dry over large areas and the atmospheric levels of CO2 were low. During the Holocene more appropriate conditions for agriculture arose, particularly referred to the improvement of the CO2 and the stabilization of the climate. This atmospheric warming during the transition from Pleistocene to Holocene is considered as a "natural warming"[23].

The principal reason for humanity to be concerned about global warming is that it is now occurring during our lifetimes, rather than at the geological timescales of the past. Industrial revolution is considered as the "turning point" for the manmade environmental conditions for the new era of global warming. Of course there are different views of the impacts of the global warming on the planet, namely positive and negative views.

The main impacts of the global warming in the different aspects of the environment and society are:

[23] Approximately every 100,000 years Earth's climate warms up temporarily. These warm periods, called **interglacial periods**, appear to last approximately 15,000 to 20,000 years before regressing back to a cold ice age climate. At year 18,000 and counting our current interglacial vacation from the Ice Age is much nearer it's end than it's beginning. (Source: Global warming: a chilling perspective)

a) Agriculture - The increasing human population has led to a rise in the demand for food. As more land comes under agricultural cultivation there will be more pressure on natural ecosystems. Climate change will affect agricultural yield directly because of alterations in temperature and rainfall, and indirectly through changes in soil quality, pests, and diseases. In particular, the yield of cereals is expected to decline in many parts of the world. In the higher latitudes (in the northern countries) agriculture will benefit with the rise in temperature as the winter season will be shorter and the growing seasons longer. This will also mean that pests that will move towards the higher latitudes as the temperatures rise.

b) Weather - A warmer climate will change rainfall and snowfall patterns, lead to increased droughts and floods, cause melting of glaciers and polar ice sheets, and result in accelerated sea- level rise. Rising warmth will lead to an increase in the level of evaporation of surface water; the air will also expand and this will increase its capacity to hold moisture. This, in turn, will affect water resources, forests, and other natural ecological systems, agriculture, power generation, infrastructure, tourism, and human health. An increase in the number of cyclones and hurricanes over the last few years has been attributed to changes in temperature.

c) Sea level rise - Coastal areas and small islands are among the most densely populated parts of the world. The heating of oceans, and melting of glaciers and polar ice sheets, is predicted to raise the average sea level by about half a meter over the next century. Sea-level rise could have a number of physical impacts on coastal areas, including loss of land due to inundation and erosion, increased flooding, and salt-water intrusion. These could adversely affect coastal agriculture, tourism, freshwater resources, fisheries and aquaculture, human settlements, and health. Rising sea levels threaten the survival of many low-lying island nations, such as the Maldives and Marshall Islands.

d) Health - Infectious disease is the second major threat that global warming poses to human health. As temperatures rise, disease-carrying mosquitoes and rodents move into new areas, infecting people and other living bodies in their habitat. Scientists at the Harvard Medical School have linked recent US outbreaks of dengue ("breakbone") fever, malaria, hantavirus and other diseases to climate change.

e) Forests and wildlife - Ecosystems sustain the earth's entire storehouse of species and genetic diversity. Plants and animals in the natural environment are very sensitive to changes in climate. The ecosystems that are most likely to be affected by this change are the ones in the higher latitudes, the tundra forests. Polar regions will feel the impact of warming more than others. Interiors of continents will experience more warming than the coastal regions.

f) Marine life - Corals are known as the tropical forests of the oceans and sustain diverse life forms. As ocean waters in the tropics become warmer, the damage to coral reefs seems to be increasing. These corals are very sensitive to changes in water temperature, which causes bleaching. Zooplanktons, small organisms that float on the sea surface are declining in numbers, reducing the number of fish and sea birds that feed on these organisms.
Unless we slow and ultimately reverse the buildup of greenhouse gases, we will have decades, not millennia, to try to adapt to radical changes in weather patterns, sea

levels and serious threats to the environment and the economy. Increased flooding, storms and agricultural losses could devastate our economy. Plants and animals that cannot adapt to new conditions will be come extinct.

Conclusion: The impacts of global warming on drylands

It is supposed that global warming would affect drylands in different ways. As mentioned before we have here different views (negative as well as positive) on the impacts climate change would provoke on drylands.

For some of authors, climate change contributes to increase greenhouse gas concentrations in the atmosphere. In doing so, it is expected to increase the variability of weather conditions and extreme events. Many dryland areas face increasingly low and erratic rainfalls, coupled with soil erosion by wind and the drying up of water resources through increased regional temperatures. This enhanced variability will place greater strain on already stressed environments.

It is supposed that in the areas under desertification the soils are exposed due to an intensive process of deforestation. As a result, more CO2 is released to the atmosphere, the soil temperature is increased and the level of evapo-transpiration is intensified. This process can change the weather at local level and for this reason some regions in the tropics and subtropics are affected by a higher frequency of droughts.

There is another interpretation of this phenomenon as a helpful process that contributes to the rehabilitation of the drylands. The explanation is based on the relationship of the biomass productivity and the rise of CO2 concentration. Some research data shows that the rise of CO2 concentration is accompanied by the rise of biomass. The researchers found that the doubled CO2 (from 350 ppm to 700 ppm) significantly increased the total biomass from 25 percent to 70 percent depending upon plant type.

As we can notice, there is no consensus about this issue. However, the general perception shared by the scientific community as well as the users of natural resources is that we are facing a great deal: desertification and climate change are processes that are feeding each other and getting worse all around the world. Despite the inability to quantify accurately all the feedback mechanisms involved in the complex interactions between desertification processes, greenhouse gas emissions, and global climate change, our understanding of many of these interactions is improving. According to available data, we know that savanna fires presently account for about 30 percent of the total carbon and 20 percent of the total nitrogen emissions from global biomass burning. Drylands burning is thought to contribute around 10 percent of total gross global emissions of these two elements.

Dryland deforestation and accelerated soil loss from wind and water erosion are also reducing the ability of dryland ecosystems to store carbon, further contributing to the cumulative build-up of atmospheric carbon dioxide as well as reducing soil-moisture storage capacity. Unless effective long-term measures to control desertification are taken, global warming and increased evaporation are likely to affect the water balance in dryland regions. If local and regional soil moisture levels decline as a result of

higher temperatures and higher rates of evapo-transpiration, the inevitable result will be a progressive decline in plant biomass. To avoid these global effects (not to mention the local ones, such as food insecurity), long-term mitigation and rehabilitation strategies are needed throughout the world's drylands to prevent or minimize desertification.

The IPCC third assessment report points out in general terms the relevance of agriculture and forestation as important means for carbon emissions mitigation. In this context we can assume the role of drylands to the mitigation process since it represents one third of total area of the planet and the area affected buy desertification is around 25% of this figure. Measures for restoring areas affected by desertification could be very substantive in terms of carbon sequestration.

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3.2. Sao Paulo: Leapfrogging the energy ladder[24]

Wood-based fuels are the dominant source of energy for over 2 billion people, particularly in households in developing countries, where the dependence on such fuels is much greater, as much as up to 80 percent in some subregions of Africa (FAO, 2003). Wood and charcoal are vital to the nutrition of poor rural and urban households in developing countries. They are often essential for industrial and sub-industrial production, as well as to generate electricity.

Although in developed societies woodfuel can considered an environmentally sound source of energy with a nearly closed carbon cycle, this is not what happens in most of the world, where deforesting is a reality. Also, firewood indoor use in primitive devices is a major cause of pollution, causing serious hazards to the human health, particularly to the most exposed: women, small children and the elderly.

However, firewood is very cheap - often free. Gathering fuelwood is in many cases time consuming for the poorer, which are the most affected by the problems related to this energy source. With better incomes, consumers shift to modern energy carriers or to more convenient and energy-efficient conversion devices (Figure 1).

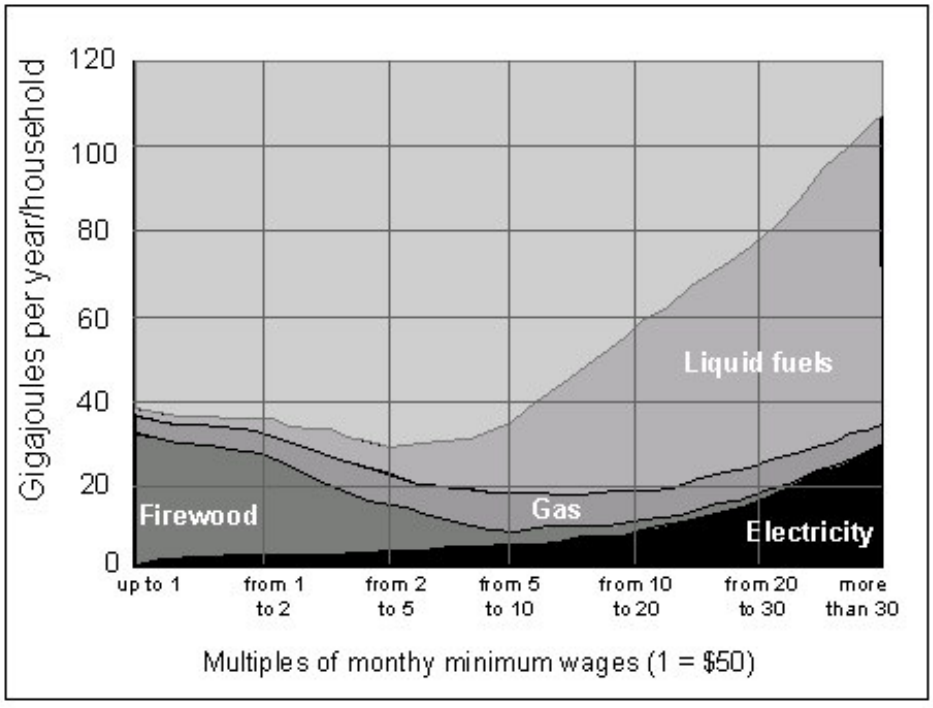


Figure 1. Energy use according to family income in Brazil. Source: : UNDP, UNDESA and WEC (2004)

[24] by Oswaldo Lucon and Suani Teixeira Coelho, Sao Paulo Environmental Secretariat.

For cooking and other heating purposes, the lowest rungs on the energy ladder involve use of dung or crop residues, with fuelwood, charcoal, kerosene, and liquefied petroleum gas (LPG) or natural gas representing successively higher rungs. For lighting, the lowest rung is represented by fire, followed in turn by liquid-fuelled (such as kerosene) lamps, gas lanterns, and electric bulbs. To do mechanical work, consumers shift from human and animal energy to diesel fuel and electricity as soon as they become available, because they are almost always more cost-effective. Often a synergy between modern energy carriers and more efficient end-use devices occurs.

The concept of leapfrogging is a key strategy for promoting sustainable development in rural areas of developing countries. It involves skipping rungs to reach the top positions of the energy ladder, through introducing modern energy carriers more rapidly than the expected *business-as-usual*. It involves providing:

(a) improved technologies and cleaner fuels for cooking (Figure 2)

(b) rural electricity - grid-based or decentralized - at sufficiently low cost, improving life quality, providing better paying jobs and helping to stem migration to urban settlements.

(c) liquid fuels and electricity to mechanise agriculture;

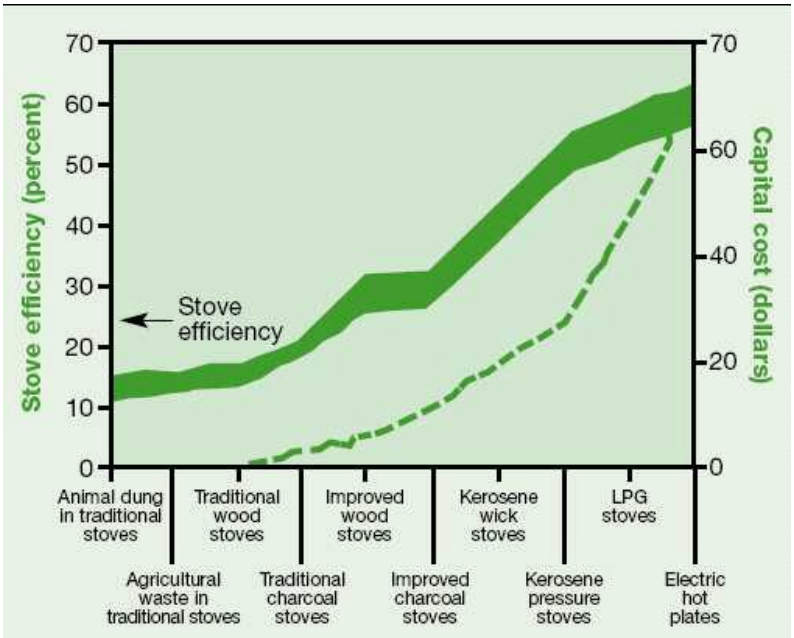


Figure 2 - Cooking stoves *leapfrogging* (or climbing the energy ladder efficiently through learning from the other countries experiences). Source: UNDP, UNDESA and WEC (2002)

Although non-renewable, fossil fuels such as kerosene and LPG are an important step in the ladder which produces fewer greenhouse gas emissions per unit of energy service than biomass fuels primitively used. The amount of LPG needed to support cooking for the current unserved population of 2 billion is trivial at the global level. The cooking needs of the 2 billion people not served by modern fuels correspond to about 120 million tonnes of oil equivalent of LPG a year—which equals 1 percent of global commercial energy consumption or 3 percent of global oil

consumption. This is less than is currently lost flaring natural gas in oil fields and refineries.

Leapfrogging this step, the use of kerosene and LPG can then be substituted total or partially by biogas (obtained from the digestion of suitable biomass feedstocks by anaerobic bacteria), producer gas systems, reforested charcoal burned in modern devices, vegetable oils or even, according to the case, more advanced options.

At the top of the energy ladder, electricity is highly efficient and convenient for several applications like lighting, communication, refrigeration and mechanization. But it has to be made available at a compatible cost for the most needing ones. In many cases, large scale infrastructures for electricity production (such as large hydro plants), transmission and distribution cannot provide such benefit without heavy subsidies that overburden the society as a whole. In this case, it is more recommendable to stay a little bit behind in the ladder (with, for example, LPG).

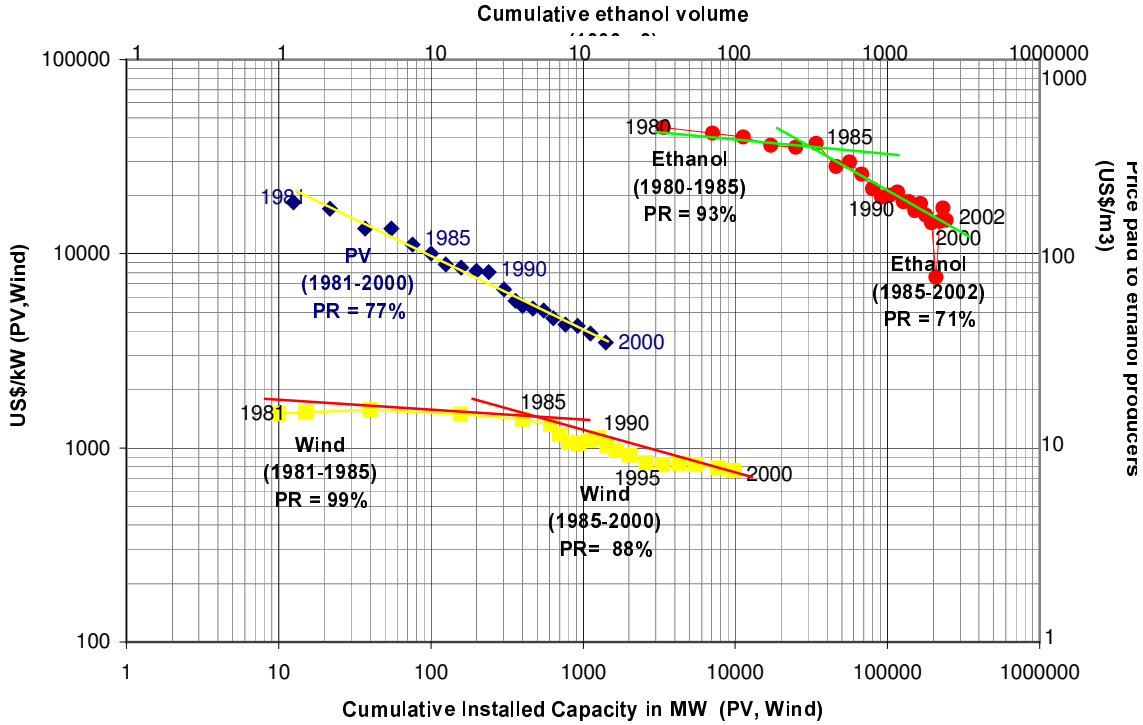
The *leapfrogging* concept it is also applicable to transportation. A country that has leaded gasoline and high sulfur fuels can skip the stages of cleaner fossil fuels (less polluting but still net carbon emitters) to renewable fuels (which also saves carbon releases to atmosphere), or in even a step forward to efficient public transportation in a systemic approach. Ethanol, for example, has achieved a stage of development which allows competitiveness in Brazil. This is the result of adequate policies and investments that allowed high amounts of fuel to be produced, decreasing their costs and making them comparable to those from gasoline (see Annex 1).

Although energy efficiency improvements can be achieved also with fossil fuels, there are obvious limitations in terms of carbon emissions, not to mention long-term security of supply. Anyway, some countries are investing huge amounts of resources in R&D for cleaner coal or ultra-low sulfur diesel. Developing countries without renewable resources can take advantage and move directly to the cleaner options, instead of learning by doing and accepting passively obsolete technologies.

Leapfrogging is not an imposition of technologies from the developed to the developing. On the contrary, such initiatives have to be connected very closely with the economic potentialities of each region. It involves benchmarking a process that succeeded in the past 50 years in countries that achieved successful rural development: fuelwood burning was first improved, then replaced by kerosene, then by liquefied petroleum gas (LPG), then shifted to other forms of energy like electricity.

Supplying modern energy services to the 2 billion people who still cook with traditional solid fuels and lack access to electricity is probably one of the most pressing problems facing humanity today. Renewables play an important role in this challenge and it is very difficult to tackle the problem without the support from developed nations. As happened with the Brazilian ethanol, the development of other technologies require incentives and commitments - both in the supply and in the demand sides - that act direct and positively in their learning curves (Figure 3).

Figure 3. Experience Curves for Photovoltaics, Windmills, Gas Turbines, and Ethanol Production (UNDP, UNDESA and WEC, 2004)



Acting on the learning curve requires high levels of production and consumption. Relating to leapfrogging, this can be achieved through:

(a) channelling resources to R&D;
(b) through cooperation (*ie*, at low cost and without creating dependancy), providing to the developing countries access to these technologies;
(c) expanding consumption markets in developed countries through free trading (*ie*, lifting barriers to environmentally sound energies);
(d) information exchange, networking and enhanced capacity building (to raise awareness and to combat myths against modern renewable energy sources) and, most of all;
(e) access to patient capital.

Technological developments alone will not improve access or promote greater equity. New institutional measures are also needed, including financing to cover the initial capital costs of devices and equipment. Energy initiatives will be most successful when integrated with other policies that promote development. And because local populations will ultimately use, maintain, and pay for energy services, they should be involved in making decisions about energy systems.

Annex - CASE STUDY: The Brazilian Ethanol Learning Curve

Ethanol is produced through the fermentation of agricultural products such as sugarcane, corn, and manioc, among others. Most of ethanol produced in the world is from sugarcane, mainly in Brazil. The Brazilian Alcohol Program (PROALCOOL) was established in 1975 for the purpose of reducing oil imports by producing ethanol from sugarcane and presented positive environmental, economic and social aspects. It has become the most important biomass energy program in the world. In the 1975-2002 period, production of ethanol raised from 0.6 to 12.6 million cubic meters, with an increasing productivity of sugarcane crops. In Brazil, ethanol is used in cars as an octane enhancer and oxygenated additive to gasoline (blended in a proportion of 20 to 26% anhydrated ethanol in a mixture called gasohol) or in dedicated hydrated ethanol engines. Local air pollution improved significantly with the adoption of ethanol. Lead and aromatic hydrocarbons (like benzene) were eliminated and the sulphur content reduced, as well as carbon monoxide emissions. Acetaldehydes from alcohol are 100 times less toxic than gasoline's formaldehydes. Only in the year 2000, 9.2 million tones of carbon dioxide were avoided due to the gasoline replacement by ethanol. Since February 1999, prices are not controlled by the government and hydrated ethanol is sold for 60 to 70 percent of the price of gasohol at the pump station, without subsidies, due to significant reductions in production costs. The Brazilian ethanol is already competitive internationally with the gasoline (Rotterdam prices). In US, ethanol made from corn is also used as a high-octane fuel in vehicles. There, a similar program is being started and the number of vehicles using ethanol is increasing. But because ethanol in Brazil is produced from sugarcane, it presents the lowest production cost in the world. This is due not only to high agricultural and industrial productivity, but also to the extremely favorable energy balance of the alcohol production (11:1), compared to the corn ethanol from the US (1.8:1). Even so, because of support from corn-growing states and the U.S. Departments of Energy and Agriculture, ethanol fueled vehicles are increasing. Auto-manufacturers began in 1997 to produce flexible fuel cars and pickup trucks that could use any blend of ethanol or gasoline. The consumer can freely choose which fuel will use. In Brazil, the flexible fuel fleet is booming and the technology can be considered mature at practically no extra cost. Ethanol production generates 36 more jobs per unit of energy produced than coal, 50 than hydropower and 152 than the oil industry. A job can be created in the ethanol industry in Brazil wirth around US$ 15k, one of the lowest industrial costs in the country *(Goldemberg, Coelho, Nastari and Lucon, 2004).*

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3.3. Sao Paulo: From Johannesburg to the CoP10: addressing the unsustainable use of fuelwood[25]

The United Nations Framework Convention on Climate Change was opened for signature at the Rio de Janeiro in June 1992 and entered into force in 1994. To achieve the Convention´s objectives, the Kyoto Protocol was adopted in December 1997, committing Annex I Parties to individual, legally-binding targets to limit or reduce their greenhouse gas emissions, adding up to a total cut of at least 5% from 1990 levels in the "commitment period" 2008-2012. Targets cover emissions of the six main greenhouse gases, namely carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). Accounting all changes in emissions and removals by "sinks", activities of afforestation, deforestation and reforestation, which emit or remove carbon dioxide from the atmosphere, are also covered by the so-called LULUCF (land use, land-use change and forestry) sector.

Innovative mechanisms were conceived under the Protocol to help the developed countries (Annex I Parties) to reduce the costs of meeting their emission targets by achieving or acquiring reductions more cheaply in other countries than at home. One of these, the clean development mechanism (CDM), also aims to assist developing countries in achieving sustainable development by promoting environmentally-friendly investment in their economies from industrialized country governments and businesses.

In order to enter into force, the Protocol must still be ratified by Parties to the Convention which accounting for 55% of carbon dioxide emissions from this group in 1990, but most Annex I Parties have been reluctant to do so. By 2005 the Annex I Parties were expected by the Protocol to have made demonstrable progress in meeting their commitments. However, the complexity in mechanisms and negotiations have sensibly delayed these achievements. While some nations feel threatened by the potential economic repercussions of response measures, other are highly vulnerable to the adverse effects of climate change and require a prompt international response.

At the tenth anniversary of the Convention, a tentative to bring the Protocol into force was made in time for the World Summit on sustainable Development (WSSD) in Johannesburg. At this conference was clear that the humanity could not wait for the results of Kyoto. There was a clear sense of urgency in broadly addressing the global sustainability problems, even beyond climate change. For this reason and for the first time, energy was treated as a special chapter in the debated agenda.

The Brazilian Government took, first successfully to the Latin American and the Caribbean regions, then to the rest of the world, an ambitious proposal: an increase of “the use of new renewable sources to 10% as a share of world energy matrix by

[25] by Oswaldo Lucon, Suani Teixeira Coelho and José Goldemberg, Sao Paulo Environmental Secretariat.

2010". Such modern sources included sustainable hydropower, geothermal energy, wind energy, all forms of solar energy, marine energy and modern biomass (*ie*, excluded fuelwood from deforestation).

Compared to the complexity of Kyoto mechanisms, this commitment is clear and straightforward. More than this, it is destinated to the rich and to the poor. Modern renewable energy sources are the key not only for the Kyoto Protocol, but also for sustainable development in a broader sense: they enhance diversity in energy supply markets; secure long-term sustainable energy supplies; reduce local and global atmospheric emissions; create new employment opportunities offering possibilities for local manufacturing and enhance security of supply since they do not require imports that characterize the supply of fossil fuels.

During the 2002 WSSD, the discussion on renewable energy faced not only strong opposition from some countries (like the US, Japan and the OPEC, which large consumers and producers of fossil fuels), but also some doubts among countries. Developing countries, especially African, feared that targets and timeframes for renewable energy would interfere in their autonomy for burning woodfuels. Meanwhile, Scandinavian nations stated that all their woodfuel could be considered renewable energy, for it comes from planted forests.

This problem persists: there is no current energy database distinguishing sustainable from unsustainable fuelwood. The International Energy Agency (IEA) describes with good precision the shares of fossil and nuclear fuels. Geothermal, wind and solar renewable sources are allocated in an unique category, as well as the hydro data which do not distinguish by plant size. This however is satisfactory for carbon emission matters; the greatest difficulty is in the category named *combustible renewables and waste (CRW)*, encompassing both renewable and non-renewable (therefore unsustainable) shares of the biomass sources. Globally, combustible renewables and wastes (CRW) represented 11% of the total 415 EJ of world primary energy supply in 2000 (IEA, 2002). Non-renewable biomass is basically woodfuel from deforestation, leading to significant net carbon emissions - and other severe environmental impacts.

Also, the United Nations´ Food and Agriculture Organization (FAO) has established a wood energy information system with statistics of consumption, yet without the percentage of such fuels that comes from renewable and sustainable practices.

The information provided by FAO on deforestation does not allow the allocation for sustainable energy use. However, it permits some rough estimations for carbon emissions from deforestation and comparisons with fossil fuel burning and other industrial activities, as those shown in the Table 1. Countries are displayed in four rankings:

1) an estimate for carbon emissions from net deforestation[26]: a list where large developing countries with tropical forests are unfortunately in the first positions;

[26] two important observations: (1) in fact, a good part of this wood is not burned, but used for other purposes; even so, carbon will be released during the life cycle and not replaced and; (2) this consideration does not addresses biodiversity, since it does not segregate native forests replaced by monocultures

2) emissions from fossil fuel burning, fossil fuel burning, gas flaring and cement production: the most known (and well accepted) list

3) the added carbon emissions from the previous categories: to note the relevance of deforestation in some cases and;

4) an also ranked n index of deforestation over total emissions by country: although seeming not too much important in terms of global carbon emissions, this index shows clearly the which countries need assistance to change their unsustainable needs of fuelwood.

Under the Convention on Climate Change, parties should act to protect the climate system "on the basis of equality and in accordance with their common but differentiated responsibilities and respective capabilities." This includes two fundamental elements: (1) the common responsibility of States for the protection of the environment, or parts of it, at the national, regional and global levels and; (2) the need to take into account the different circumstances, particularly each State's contribution to the evolution of a particular problem and its ability to prevent, reduce and control the threat (CISDL, 2004).

However, this principle should not be used by any country - developing or developed - to justify inaction. This is in practice what is happening: while some countries account carbon emissions since the 1700´s, others avoid changing their present unsustainable and voracious consumption patterns. While some countries countries expect huge donations for costly infrastructure (and in many cases corruption), other are providing "petty" assistance, hidden behind pilot projects with expected self-replicability.

There is no other answer to this, but strong commitments, at all levels. The best, surely desirable, would be at country level, followed by international banks and other development organisms. Unfortunately, in many cases countries stick to the need of consensual positions, which weakens the final compromises.

But there are solutions. One of these are the Renewable Portfolio Standards, targets and timetables for renewable energy adopted voluntarily, such as those adopted by the European Union, the Latin American and Caribbean region, China or even the state of Texas in the US. The other is *leapfrogging*, or climbing the energy ladder skipping intermediate levels. This one is specially important to countries where deforestations rapidly advances.

Another important win-win solution is the open trading of biofuels, a cleaner form of energy that can be produced specially in tropical countries, replacing oil imports throughout the world. Biofuels for internal use are also an interesting example of *leapfrogging*, when they replace deforested wood and fossil fuels.

The need for a consensus affected severely the WSSD Final Plan of Implementation, which intended to provide a *top-down* solution to achieve the Millennium Development Goals through the so-called Type I Initiatives. Now, the hope now is in the Type II voluntary partnerships, such as the Network of Regional Governments for Sustainable Development (nrg4SD).

Encompassing both developed and developing regions, the Network can be a powerful instrument to provide tangible collaboration to achieve sustainable development and to combat climate change.

Table 1: Estimates of carbon emissions by country, 2000

Country	(1) C emissions from deforestation (kt Ceq)	(2) C emissions from fossil fuel burning, cement production and gas flaring (kt Ceq)	(3) =(1)+(2) Total C emissions (kt Ceq)	(4) = (1)/(3) share of deforestation in total	(5) Ranking position according to (1)	(6) Ranking position according to (2)	(7) Ranking position according to (3)	(8) Ranking position according to (4)
United States	-10476	1528796	1518320	-1%	101	1	1	86
China	-27542	761586	734045	-4%	102	2	2	96
Russian Fed	-1890	391664	389774	0%	98	3	3	82
Japan	-66	323281	323215	0%	79	4	4	74
India	-694	292265	291572	0%	92	5	5	80
Germany	0	214386	214386	0%	62	6	6	61
Brazil	120645	83930	204575	59%	1	18	7	35
UK	-323	154979	154656	0%	81	7	8	79
Mexico	8519	115713	124232	7%	11	11	9	53
Canada	0	118957	118957	0%	63	8	10	62
Indonesia	44608	73572	118180	38%	2	21	11	41
South Korea	45	116543	116588	0%	60	10	12	60
Italy	-555	116859	116304	0%	91	9	13	81
Saudi Arabia	0	102168	102168	0%	64	12	14	63
Australia	4019	94094	98113	4%	22	14	15	54
France	-1426	98917	97491	-1%	97	13	16	88
Ukraine	0	93551	93551	0%	65	15	17	64
South Africa	162	89323	89485	0%	57	16	18	58
Iran	0	84689	84689	0%	66	17	19	65
Poland	-423	82245	81822	-1%	85	19	20	83
Spain	-516	77220	76704	-1%	90	20	21	84
Turkey	-407	60468	60061	-1%	84	22	22	85
Venezuela	12699	43054	55753	23%	7	25	23	49
Thailand	812	54216	55028	1%	47	23	24	56
Malaysia	12146	39414	51560	24%	8	26	25	47
North Korea	0	51544	51544	0%	67	24	26	66
Argentina	4845	37715	42560	11%	18	29	27	51

Country	(1) C emissions from deforestation (kt Ceq)	(2) C emissions from fossil fuel burning, cement production and gas flaring (kt Ceq)	(3) =(1)+(2) Total C emissions (kt Ceq)	(4) = (1)/(3) share of deforestation in total	(5) Ranking position according to (1)	(6) Ranking position according to (2)	(7) Ranking position according to (3)	(8) Ranking position according to (4)
Egypt	-53	38817	38764	0%	78	27	28	77
Netherlands	-15	37900	37885	0%	75	28	29	75
Czech Rep	-31	32416	32385	0%	77	31	30	76
Uzbekistan	0	32376	32376	0%	68	32	31	67
Kazakhstan	-1076	33099	32024	-3%	95	30	32	94
DR of Congo	29925	494	30419	98%	3	84	33	1
Pakistan	263	28604	28867	1%	55	33	34	57
Nigeria	18308	9866	28174	65%	5	53	35	29
Belgium	25	27905	27930	0%	61	34	36	59
Colombia	9310	15955	25265	37%	9	48	37	43
Peru	16476	8063	24539	67%	6	56	38	26
Greece	-188	24455	24268	-1%	80	35	39	87
Algeria	-506	24404	23898	-2%	89	36	40	90
Philippines	2537	21160	23697	11%	30	38	41	52
Romania	-465	23548	23083	-2%	86	37	42	89
Zambia	22126	498	22624	98%	4	82	43	2
Sri Lanka	516	20834	21350	2%	50	39	44	55
Iraq	0	20834	20834	0%	69	40	45	68
Israel	0	17221	17221	0%	70	41	46	69
Singapore	0	16115	16115	0%	71	46	47	70
Austria	-500	16607	16107	-3%	88	42	48	93
UA Emirates	0	16079	16079	0%	72	47	49	71
Portugal	-470	16330	15860	-3%	87	43	50	92
Libya	-25	15591	15566	0%	76	50	51	78
Chile	-1340	16239	14899	-9%	96	44	52	98
Vietnam	-858	15683	14825	-6%	94	49	53	97
Norway	-380	13623	13243	-3%	82	51	54	91
Ecuador	5172	6946	12118	43%	16	57	55	40
Cote d'Ivoire	8613	2859	11472	75%	10	60	56	18
Bulgaria	-380	11556	11176	-3%	83	52	57	95
Belarus	-5120	16144	11024	-46%	100	45	58	101
Bolivia	7366	3020	10386	71%	13	59	59	23
Myanmar	7367	2497	9864	75%	12	63	60	19
Cameroon	7271	1785	9056	80%	14	65	61	16
Zimbabwe	4480	4040	8520	53%	20	58	62	38
Guatemala	5009	2698	7707	65%	17	61	63	28
Cuba	-798	8437	7639	-10%	93	55	64	99
New Zealand	-2116	8752	6636	-32%	99	54	65	100
Madagascar	5675	619	6294	90%	15	81	66	7
Panama	4186	1729	5915	71%	21	67	67	24
Nicaragua	4709	1020	5729	82%	19	77	68	15
Sudan	2877	1425	4302	67%	27	71	69	27

Country	(1) C emissions from deforestation (kt Ceq)	(2) C emissions from fossil fuel burning, cement production and gas flaring (kt Ceq)	(3) =(1)+(2) Total C emissions (kt Ceq)	(4) = (1)/(3) share of deforestation in total	(5) Ranking position according to (1)	(6) Ranking position according to (2)	(7) Ranking position according to (3)	(8) Ranking position according to (4)
Ghana	2640	1609	4249	62%	28	68	70	33
Uganda	3708	416	4124	90%	24	88	71	9
Benin	3413	442	3855	89%	25	86	72	11
Liberia	3724	109	3833	97%	23	98	73	3
Kenya	1116	2553	3669	30%	41	62	74	46
Guyana	3099	436	3535	88%	26	87	75	12
Angola	1674	1747	3421	49%	35	66	76	39
Mongolia	1200	2046	3246	37%	40	64	77	42
Nepal	2126	928	3054	70%	31	79	78	25
Botswana	1859	1051	2910	64%	33	76	79	31
Honduras	1549	1307	2856	54%	37	72	80	36
Paraguay	1814	999	2813	64%	34	78	81	30
Malawi	2538	209	2747	92%	29	93	82	4
Tanzania	1365	1175	2540	54%	38	74	83	37
Ethiopia	790	1522	2312	34%	48	69	84	44
PNew Guinea	1639	662	2301	71%	36	80	85	22
Belize	1899	213	2112	90%	32	92	86	8
Senegal	338	1140	1478	23%	53	75	87	48
Uruguay	0	1476	1476	0%	73	70	88	72
Sierra Leone	1251	154	1405	89%	39	94	89	10
Guinea	998	353	1351	74%	42	89	90	20
Togo	814	490	1304	62%	46	85	91	32
Kyrgyzstan	0	1266	1266	0%	74	73	92	73
Mozambique	880	322	1202	73%	44	91	93	21
Cambodia	966	145	1111	87%	43	96	94	13
C. African Rep.	848	74	922	92%	45	99	95	5
Mali	767	152	919	83%	49	95	96	14
Namibia	219	497	716	31%	56	83	97	45
Laos	411	113	524	78%	52	97	98	17
Somalia	501	na	501	na	51	102	99	102
Niger	62	323	385	16%	59	90	100	50
Chad	328	34	362	91%	54	101	101	6
Guinea-Bissau	110	72	182	60%	58	100	102	34

(1) Carbon from **deforestation** was estimated by multiplying the annual change (in 1000 ha.) in forestries by the amount of wood biomass in forests (tonnes/ha) for each country (FAO, 2004) , by 25% (*ie*, considering 50% of dry wood with 50% of carbon contained)

(2) Carbon from **fossil fuel burning, gas flaring and cement production**, from Gregg Marland et. al, 2004

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3.4. Tuscany: a Pilot Initiative of Regional Governments to Broaden the Scope of EU Emissions Trading[27]

The EU's Institutions and its Member States have undertaken a number of actions to build the legislative framework and the economic environment which can make the Kyoto Protocol's commitments become operational. Among such actions, the establishment of an EU Emissions Trading Scheme (EU-ETS) is especially relevant, in that it is designed to set in motion a major market mechanism which will mobilize large-scale private sector financing for the abatement of GHG emissions. The EU Directive No. 2003/87 sets the rules of the EU's Emissions Trading Scheme.

Regional governments have a key role not just in legislating on environmental matters, but also on the hands-on implementation of environmental policies, which may prove especially relevant in addressing climate change. This is most important where such policies require a high degree of cooperation by the public, which is required to change its behaviour and consumer patterns for the project to ultimately succeed. These institutions have the capability to develop and implement effective policies which may lead to GHG abatements in the major sectors which are presently not covered under the EU's emission trading Directive.

The present proposal is designed to develop the capacity of Regions to broaden the scope of application of emissions trading within the EU and outside its boundaries through the "opting in" under article 24, and "grouping" under 28 of the Directive of new sectors and clusters of small and medium entities. In particular the project is intended to reach the following objectives by the 1st of January 2008:

· *Knowledge of the feasibility of opting in for priority sectors;*
· *Knowledge and forecasting ability on the market for CERs and ERUs;*
· *Capability to monitor emissions of the priority sectors and to certify abatements;*
· *An enabling legislative and public consensus on the initiative;*
· *Significant pilot applications with extra-European regions.*

There are obstacles, however, which need to be overcome before the "opting in" of such sectors can take place. We can envisage four factors of a certain relevance:

· *Certification and monitoring;*
· *Deployment and diffusion of appropriate technologies and best practices*;
· *Risks and Penalties;*
· *Market uncertainties*.

In developing the present project, the Regions concerned will pool their financial resources, technical know how and best practices, to multiply results and obtain economies of scale. They will together pursue access to state of the art technologies and efficient models of intervention.

[27] By the Government of Tuscany Region

The project will be implemented in three phases, starting in September 2004 and ending in December 2007, and nine clusters of activities will be promoted. The project will be directed by a Steering Committee, composed of representatives of the participating regions and it will be managed by a Project coordinator, will have a focal point in each Region.

Thus the project will support the Regional governments in defining their strategy and policy options in readiness for the Directive deadline, and in the process develop, deploy and diffuse technical knowledge and best practices to reduce GHG emissions. Outside the EU, the project will create new employment opportunities, transfer of new technologies and improvement of professional skills.

Important social benefits are also expected in terms of poverty alleviation, and the initiative will contribute to diminish the risk of social conflict caused by competition for scarce natural resources.

4. Conclusion

According to the Gauteng Declaration[28], the founding Charter of the global Network of Regional Governments for Sustainable Development (nrg4SD), the members of the Network are committed to sustainable development as outlined in the Agenda 21 and the Rio Declaration, and the United Nations' Millennium Declaration and each and every region in the world should contribute to sustainable development, as described in the 27 Principles of the Rio 1992 Declaration[29].

Nrg4SD has already undertaken some important initiatives with an especial impact in the field of climate change such as: (a) the process to agree on a limited set of common regional indicators level with a view to identify where actions are more effective; (b) nrg4SD policy papers on renewable energies and Sustainable Forest Management; (c) the organization of technical visits to North Rhine Westphalia and Bilbao; (d) debating strategies for the EU and their effects on developing regions and (f) a pilot initiative of regional governments to broaden the scope of EU emissions trading.

This report aims to be a "living document" where new contributions from different regions will be included. At the same time, it is considered as a crucial source of information for future proposals of action promoted by nrg4SD and addressed not only to its members but also to the local, national and international level with a view to create all synergies possible for achieving the common goal of addressing climate change and, ultimately, ensuring the sustainable development in the world.

[28] http://www.nrg4sd.net/ENG/Network/Documents/gauteng.htm

[29] The Rio Principles can be summarizes as: (1) human beings are central in sustainable development; (2) sovereignty of States; (3) equity in the right to development, both for present and future generations; (4) environmental protection considered together with development; (5) cooperation amongst States; (6) priority to the needs of most vulnerable developing nations; (7) common but differentiated responsibilities co conserve, protect and recover Earth's ecosystems; (8) reduction and elimination of unsustainable production and consumption patterns; (9) cooperation for knowledge and technology exchange; (10) full public participation and access to information; (11) effective environmental legislation, reflecting the applicable environmental/developmental context; (12) cooperation for an open economic system based on sustainable development; (13) the polluter pays principle; (14) prevention against transfers of harmful economic activities or products; (15) the precautionary principle; (16) internalization of externalities; (17) impact assessment; (18) notification of disasters; (19) information for harmful products and activities; (20) wide women participation in the process; (21) youth mobilization; (22) indigenous communities effective participation; (23) protection to the oppressed; (24) protection against conflicts; (25) peace and sustainable development are independent and inseparable; (26) peaceful resolution of disputes under the UN Letter; (27) good faith and partnership for development.


Network of Regional Governments
for Sustainable Development
nrg4SD