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EUROPEAN RENEWABLE ENERGY POLICY AND OPPORTUNITIES PROVIDED BY CDM

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ASIA PRO-ECO PROJECT "The way forward for the use of wood and agricultural waste for energy production in S.E. Asia"

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1 INTRODUCTION

Energy policy came to the forefront in Europe with the oil crisis of the 1970s. Before then, governments had largely invested in electrification and had created large integrated monopolies that generated, transmitted and distributed electricity.

In most countries in Western Europe governments were primarily engaged in nuclear power development. In some countries governments also involved themselves in the supply of oil, coal and/or natural gas. Renewable energy sources, with the exception of hydropower in countries having significant hydropower potential (e.g. Italy, Sweden, etc.), attracted very little interest.

In the last thirty years the situation has changed. Nowadays, there are considerable concerns in Europe over security of energy supply, environmental issues, competitiveness of the European economies, and regional development. Imports of oil and natural gas are expected to grow from, respectively, 80 % and 46 % of total consumption in 2000 to 93 % and 73 %, respectively, in 2020 [DG TREN, 2003][1]. Increased use of energy carriers produced from domestic, renewable flows of energy is one way to reduce import dependence. The other major option is to increase the efficiencies of energy and material use [Jochem et al., 2002].

Support for renewable energy technology development has also been seen as a way to build a competitive industry that will have a global market, as alternatives to conventional energy sources are increasingly sought. For example, development at regional and local level could be supported by the use of land-intensive renewables, primarily biomass.

The European Union (EU) was one of the strongest proponents of the Kyoto Protocol for reduction of greenhouse gases emissions, and assumed, for the first commitment period, 2008-2012, an emission reduction obligation of 8 % (below the 1990 level). Although this represents a significant first step, much deeper global emission reductions would have to follow to achieve the objective of the United Nations Framework Convention on Climate Change (UNFCCC)[2]. To achieve the first commitments, the EU member states have shared the responsibilities between member states in the so-called European bubble[3].

European Union's strategy to reach greenhouse emission reductions in energy sector, one of the most significant for Kyoto compliance, relies on three major pillars: (1) more efficient use of energy, especially as regards end uses, (2) increased utilization of renewable energy, and (3) accelerated development and deployment of new energy technologies – particularly next-generation fossil fuel technologies that produce near-zero harmful emissions (e.g. by means of CO2 sequestration techniques).

Increased use of renewable energy is thus deemed as extremely important to reduce dependence on extra-UE energy sources as well as reduce the environmental challenges European Union is facing. Another important target is the development of an industrial (for technologies and infrastructures creation) and service (for energy production and distribution) sector which could contribute to make EU economy grow in the future[4].

[1] The gradual phasing out of nuclear energy in several Member States will increase the Community's energy dependency on extra-EU sources.

[2] Besides, in Europe concerns remain about environmental pollution, especially small particulates in the air (the so-called PM 10 and PM 2.5, particles with a diameter smaller than 10 and 2.5 micrometres, respectively) and other pollutants being estimated to cause significant damage (e.g. NOx, polycyclic aromatic hydrocarbons - PAH, etc.).

[3] Under the Kyoto Protocol (Article 4, 1997) parties are allowed to meet their commitments jointly.

[4] Overall competitiveness is also being promoted through liberalisation of the EU electricity and gas markets as well as by separation of energy production, transportation, and distribution activities. For fostering competitiveness of the EU economy and concomitant income and added value creation, the promotion of one internal market at Union level is considered essential. Cross-border trade on level playing-field terms would foster competition.

2 EU RENEWABLE ENERGY POLICIES

2.1 Energy situation in the European Union

Primary energy consumption in the EU-15 was 62.8 EJ (1500 million tonnes of oil equivalent, Mtoe) in 2001.
Contributions from different sources for 1990 and 2000 are shown in **Table 1**, together with projections in a baseline scenario to 2030. Electricity generation was 2600 TWh in 2000 and is, in this scenario, projected to grow to 3800 TWh in 2030.
In the baseline scenario for the EU-15, presented by DG TREN [2003], population is expected to grow from 379 million in 2000 to 389 million in 2030, remaining, thus, essentially stable. Gross domestic product (GDP) is projected to grow from 8.545 trillion euros in 2000 to 16.920 trillion euros in 2030, corresponding to an average growth rate of 2.3 % per year. The energy intensity is projected to decline from 7.1 to 4.3 PJ per million (M) euros in the same period. The contribution of renewables would remain below 10 %, missing the target set by the EU. Estimates of International Energy Agency (IEA, World Energy Outlook 2002) for EU are more conservative as regards GDP, projected to reach 14.689 trillion euros in 2030 (average growth rate of 1.9% per year), and also as regards decline of energy intensity, which is deemed to be around 5 PJ per million (M) euros in 2030. The result is, thus, roughly the same as regards primary energy demand projected for 2030, i.e. about 72 EJ in DG TREN estimates and 74-75 EJ in IEA estimates[5].

Table 1: Gross inland energy consumption (in EJ) in the European Union (EU-15), and projected consumption in the baseline scenario (DG TREN 2003).

	1990	**2000**	**2010**	**2020**	**2030**
Solids	12.69	8.88	6.99	7.54	9.34
Oil	22.86	24.58	25.00	25.42	25.33
Natural gas	9.30	14.19	19.09	22.19	23.28
Nuclear	7.58	9.34	9.63	8.33	7.54
Electricity	0.08	0.17	0.13	0.13	0.13
Renewables	2.76	3.68	5.11	5.82	6.45
Total	55.31	60.84	65.99	69.38	72.02
of which					
Hydro	0.93	1.16	1.18	1.24	1.26
Biomass	1.24	1.51	2.14	2.45	2.75
Waste	0.50	0.78	1.02	1.10	1.06
Wind	0.004	0.08	0.56	0.76	0.99
Solar and others	0.004	0.013	0.06	0.10	0.19
Geothermal	0.09	0.138	0.16	0.17	0.20
Total renewables	2.76	3.68	5.11	5.82	6.45
Renewables as % of total inland consumption	*5.0*	*6.1*	*7.8*	*8.4*	*8.9*

The Renewable Energy White Paper (EU, 1997), indeed, stated that indigenous renewable sources of energy would have to play an important role in improving energy supply security. It set an indicative target of 12% for the share of renewables in the EU's primary energy portfolio in year 2010, more than double this share in 1995[6].

[5] IEA is more optimistic for renewables development, projected at 11% (2% hydro + 9% others) of total demand in year 2030.
[6] The total investment in renewables over the period 1997-2010, required to reach the aforementioned EU objective is put at € 165 billion. Some 58% (€ 95 billion) would be 'incremental', i.e. accounted for by the higher investment cost of renewables.

Renewables exploitation is required to reduce dependence on oil and natural gas. The supply of gas in Europe risks creating a new situation of dependence[7]. Geographic gas import diversification is presently quite poor with Russia and Algeria accounting for 41% and almost 30% of the EU's natural gas imports. A number of Member States, and in particular most new member countries, are entirely dependent on a single gas pipeline that links them to a single supplier country.

2.2 Renewable Energy Policies

After a delicate negotiation process, EU renewable[8] energy policy-making culminated in the adoption of two renewables-specific directives. The first [EU, 2001[9]] provides a Union framework for the promotion of electricity from renewable sources, while the second [EU, 2003[10]] addresses the promotion of biofuels and other renewable (automotive) fuels. We will refer to these directives in what follows as the RES-E Directive[11] and the RF Directive respectively.
On the other hand, there is no regulatory framework yet to accelerate the growth of the market for RES heating and cooling. However, the development of such a framework may build on the foundations laid by the Directive on the Energy Performance of Buildings [EU, 2002[12]] and the Directive on the Promotion of Co-generation of Useful Heat and Electricity [EU, 2004[13]].

European policy and associated legislation issued to effectively promote renewables development is based on several mechanisms that, taken altogether, can foster the comprehension of renewable technologies, the spreading of knowledge about renewable energy and the realization of projects. Among these mechanisms, the most important, which are considered in all of the above-mentioned directives, are the following:

- economic incentives (e.g. feed-in tariffs, quota obligations - i.e. green certificates, tendering/bidding schemes, investment subsidies and fiscal measures);
- promotion of research activity on innovative technologies (e.g. gasification technology for biomass)
- definition of clear and effective planning procedures for renewable plants siting (e.g. guidelines for regional/local planning);
- communication of the value of green energy to users (e.g. guarantee of origin for renewable electricity).

Although an effective development of renewables sector must derive from the combination of all the above-mentioned factors, economic incentives constitute, needless to say, the main assistance that renewable energies must be given to become competitive with respect to conventional energies.

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[7] In this view, completion of the internal market will stimulate, among others, gas-to-gas competition. This, in turn, may lead to an uncoupling of the price of gas from the price of oil, which is subject to high fluctuations.
[8] EU legislation defines *renewable energy* as all non-fossil sources, including biogases, biomass, geothermal, hydro-power, landfill gas, sewage treatment plant gas, solar and wind. In particular, electricity is classified as being produced from RES if it is obtained from plants using solely renewable energy sources, as well as the proportion of electricity produced in hybrid plants that use conventional energy sources.
[9] Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market.
[10] Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels and other renewable fuels for transport
[11] The RES-E directive sets indicative targets for the share of RES-E in total electricity consumption at Union and Member State levels, broadly in accordance with the white Paper target fixed in 1997. If the overall share of renewable energy sources in total primary energy supply in the EU is to reach 12% in year 2010, within that year the renewable energy share in electricity consumption has to be 22.1%. The latter objective is broken down into a differentiated indicative (non-binding) percentage for each Member State.
[12] Directive 2002/91/EC of the European Parliament and of the Council of 16th December 2002 on the energy performance of buildings.
[13] Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market.

Substantial cost reductions in the past few decades in combination with adoption of subsidies by Member States' governments have made a number of renewable energy technologies (RETs) competitive with fossil-fuel technologies in specific applications[14] (**Table 2**).

Table 2: Comparison of costs for electricity generation, Conventional vs. renewable technologies. Source: Macchi-Chiesa-Bregani, 2003.

		Installation cost	Capital recovery factor	Availability	**Fuel costs**	O&M (two components: electricity dependent and capacity dependent)		**Electricity costs**
	η	euro/kW		Hours/yr	**Euro/kWh**	euro/kWh	euro/kW-yr	**euro/kWh**
Coal (Ultra Super Critical) cycles	0,435	1.100	0,150	7.250	**~0,01 (1)**	0,0045	18	**~0,04**
Repowering combined cycle	0,555	350	0,150	8.000	**~0,025 (1)**	0,0025	9	**~0,035**
New combined cycle	0,565	430	0,150	8.000	**~0,025 (1)**	0,0025	9	**~0,036**
Cogeneration natural gas	0,605	500	0,150	6.000	**~0,023 (1)**	0,0055	7	**~0,031**
Wind generator	–	1.000	0,150	2.000-2.500	**–**	–	8	**0,07-0,10**
Biomass	0,25	2.000	0,150	7.000	**0,01-0,06 (2)**	0,0045	10-15	**0,05-0,12**
Nuclear	–	2.000	0,133	8.000	**~0,004**	0,0080	32	**~0,05**

(1) Price for carbon and natural gas is assumed respectively as 1.37 and 3.90 euro/GJ LHV (natural gas 0,14 euro/Nm^3)
(2) It is assumed that for biomass residues (waste) only transportation cost is paid to the supplier (1 cent€/kWh), though some residues may even have a negative cost, that is, combustion plants are paid to incinerate them.

Economic incentives established by national governments, however, have to comply with European Union market-based approach for industrial and service activities. In the case of renewable energies, a level playing-field for European renewable energy suppliers has been regarded as essential to foster a swift market-based penetration of intra-Union renewable sources of energy in the EU. This was ensured by a Union-wide regulatory framework on state aid.
In 2001 the European Commission adopted an amended set of Union guidelines for assessing whether aid administered by member states for environmental protection is or is not compatible with the common market [EU, 2001][15]. The guiding principle in assessing aid for renewable energy, contained in the Community Guidelines on State Aid for Environmental Protection, is that the beneficial effects of such measures on the environment must outweigh the distorting effects on competition [Point 5][16].
However, state aid for renewables should result in an overall increase of renewable energy sources and not in shifts from one renewable energy technology to another or from one member state with less favourable renewable energy incentives to another with more favourable state aid in place for renewable energy sources.

[14] Substantial cost reductions can still be achieved for most technologies. However, making these RETs fully competitive will require further research, technology development and market deployment and an increase in production capacities to mass production levels [Johansson et al., 2004]
[15] European Union (2001): Community guidelines on State aid for environmental protection. OJ C 37. Brussels. February 2001. These guidelines will cease to be applicable on 31 December 2007.
[16] Explicit reference is made to the possibility of state aid for promoting the use of renewable sources of energy and combined heat and power production by way of tax exemptions or reductions [Point 24]. ‘‘Where it can be shown to be necessary’’ investment grants in support of renewable energy up to 100% of the eligible costs[3] are possible, although in this case, the installations concerned will not be entitled to receive any further support [Point 32]. The Commission should be notified of this aid by the member state concerned and re-notified every 10 years. It is then up to the discretion of the Commission to determine on a case-by-case basis whether or not the support measures concerned are not in breach of any Union legislation and approve/reject the decision accordingly.
Operating aid may be justified to cover the difference between the cost of producing energy sources and the market price for energy [Point 56]. Furthermore, state aid justified by avoided external costs is not allowed to exceed 0.05 euro/kWh.

3 EU BIOMASS POLICY

As recalled in previous paragraphs, biomass constitutes the main renewable energy source on which European States may rely to fulfil their targets of green energy consumption and green electricity generation.
Biomass, however, must be clearly classified according to sector of derivation and type of materials concerned. A correct classification is extremely important because different types of biomass have diverse characteristics that determine the cost of supply and other management and logistics aspects, as well as the real availability of these materials as fuels. A simple classification is presented in **Table 3**.

Table 3: Classification of biomass types and resources.

Supply sector	Type	Example	Utilisation sector
Agriculture	Dry lignocellulosic agricultural residues	Straw	Tradeable, electricity and heat
	Dry lignocellulosic energy crops	Short-rotation wood, miscanthus	Tradeable, electricity and heat
	Livestock waste	Manure	Non-tradeable, waste
	Oil, sugar and starch energy crops	Oil seeds for methylesters	Tradeable, transportation
		Sugar/starch crops for ethanol	Tradeable, transportation
Forestry	Forestry byproducts	Wood blocks, wood chips from thinnings	Tradeable, electricity and heat
Industry	Industrial residues	Industrial waste wood	Tradeable, electricity and heat
		Fibrous vegetable waste from virgin pulp production and from production of paper from pulp, including black liquor	Non-tradeable, waste
		Wet cellulosic industrial residues and slaughter house waste	----
	Industrial products	Pellets, bio-oil (pyrolysis oil), ethanol, biodiesel	Tradeable, electricity and heat, transportation
Waste	Parks and gardens	Prunings, grass	Tradeable, electricity and heat
	Contaminated waste	Demolition wood	Non-tradeable, waste
		Biodegradable municipal waste	Non-tradeable, waste
		Biodegradable landfilled waste, landfill gas	Non-tradeable, waste
		Sewage sludge	Non-tradeable, waste

To understand biomass (and, more in general, renewable energies) potential, the following definitions are considered:

- Theoretical potential: determined by energy flow.
- Technical potential: determined by technical constraints.
- Realistic potential: determined by non-technological factors/constraints.
- Realisable potential at a certain point in time: takes into account maximum market growth rates over all countries.

Every step results in a reduction of the potential, due to various constraints. This is illustrated in **Figure 1**.

Several studies have been conducted in the last years to evaluate the potential of energy generation from biomass.
Taking into account geographical and land-use conditions as well as technical and economic concerns, Hoogwijk [2004] investigated the global and regional potential of biomass, wind and solar PV energy. The results on biomass are shown in **Table 4**. For Western Europe (‘‘OECD Europe’’) the figure ranges from 10 to 20 %, and for Eastern Europe from 30 to 50 %.
For other regions in the world, notably Oceania, the former USSR, Canada, South America and East Africa, much higher ratios (above 1) are found, indicating that in the longer term most of the biomass used in Europe might originate from these regions.

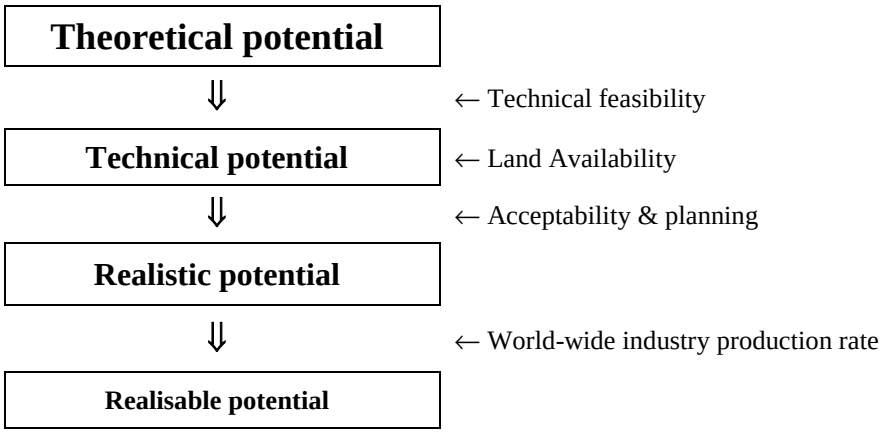

Figure 1: Methodology for definition of potentials

Table 4: Potential future contribution of primary biomass to world energy consumption and consumption in Western and Eastern Europe

	Waste and residues in 2020-2050 (EJ/yr)[1]	Energy crops in 2050 (EJ/yr)[2]			
		below 1 $/GJ	below 2 $/GJ	below 4 $/GJ	Total geographical potential
Western Europe[4]	NA[3]	0	3-6	9-15	9-16
Eastern Europe[5]	NA[3]	0	6-8	6-9	8-9
Total world	30-90	8-16	129-272	177-438	302-675

[1] Estimates from literature; the figures include forest and crop residues, in some studies also animal and municipal solid wastes.
[2] Assuming different scenarios on land use following the marker scenarios A1, A2, B1 and B2 of Nakicenovic et al., [2000].
[3] No figure available.
[4] Includes Andorra, Austria, Denmark, Faroe Islands, Finland, France, Germany, Gibraltar, Greece, Holy See, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Spain, Sweden, Switzerland, and United Kingdom.
[5] Includes Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Slovakia, Slovenia, and Yugoslavia.

Some six years have lapsed since the publication of the White Paper. Recent RES-energy supply trends suggest that the White Paper indicative target of 12% RES contribution to total primary energy supply in the EU by year 2010 will most likely be under-achieved by a big margin.
Hitherto, with the notable positive exceptions of foremost wind energy and possibly also – if certainly to a lesser extent - geothermal, most renewable energy branches cannot live up to the high ambition level enunciated in the White Paper. The White Paper projections for year 2010 suggest that, among other renewables, biomass would contribute the lion’s share, 5.65 EJ or 8.5%, to total primary energy supply.
For this to happen, biomass energy supply would have to increase by 3.77 EJ over year 1995’s level. The White Paper provides the following elaboration for this increment:

- Biogas (methane gas obtained by anaerobic digestion of livestock manure, agro-industrial effluents, sewage treatment, landfills) → 0.63 EJ.
- Solid fuels (wood and agricultural residues) → 1.26 EJ.
- Energy crops dedicated to biofuels production (rape seed, sugar beet, etc.) → 0.75 EJ.
- Solid cellulosic energy crops (short rotation forestry, miscanthus, etc.) for heat and/or power → 1.13 EJ.

Recent trends suggest the following. The biogas 'target' will not be met, mainly because of a phasing out of landfills, subsequent to recently introduced EU legislation fostering waste incineration.
Biogas production used for heat or electricity stood at 0.01 EJ (2304 ktoe) in 2000. The UK, a country with as yet a fair amount of landfills, is the leading country in the EU.
The EU's odd 100 million hectares of forested area yielded 1.98 EJ (47.3 Mtoe) of primary solid biomass energy in year 2000. EurObserv'ER (EurObserv'ER, 2002) deems 2.60 EJ (62 Mtoe) in 2010 achievable, an amount possibly on the optimistic side. Yet it is far below the 4.19 EJ (100 Mtoe) needed for meeting the White Paper target.
The White Paper expectations of biofuels will not be met in spite of the adopted Renewable Fuels Directive (above mentioned). Production in 2000 stood at 0.03 EJ (191 kt ethanol and 700.6 kt biodiesel). The indicative target of the recently adopted Renewable Fuels Directive boils down to 0.73 EJ (17.48 Mtoe), comparable to the White Paper projection of 0.75 EJ (18 Mtoe). As a result, all indications suggest that biomass is set to lag behind the White Paper projections by a considerable margin.

3.1 Incentive schemes

The policy instruments that are in place in the different Member States to promote generation of electricity from renewable sources (and, then, biomass) are all based on two main principles. The instruments either affects the supply or the demand of renewable electricity, and the focus either on the production of electricity or on the installed capacity of renewable electricity plants (see **Figure 2**)

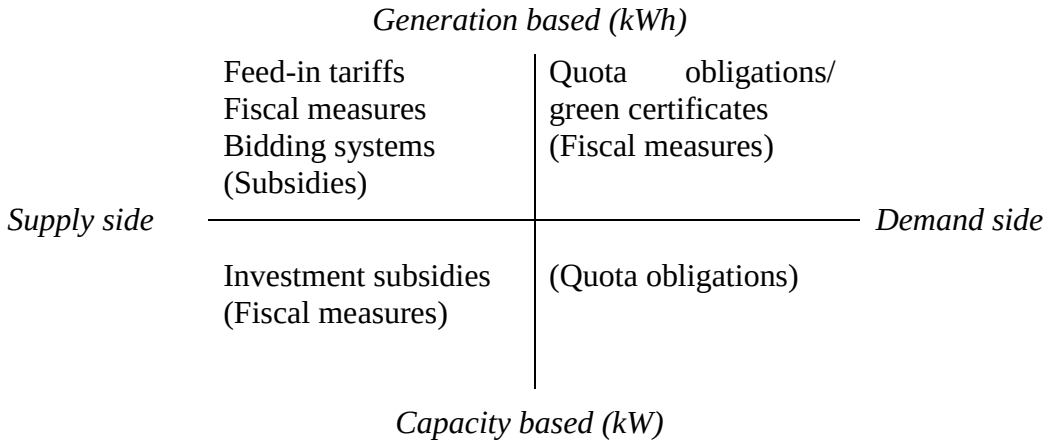

Figure 2: Classification of incentive schemes.

Within this categorisation, there are basically three main instruments to promote renewable electricity. These instruments are feed-in tariffs, quota obligations in combination with a green certificate system, and tendering/bidding schemes. Besides the three main instruments there are complementary mechanisms possible, like investment subsidies and fiscal measures.

Feed-in tariffs

Feed-in tariffs are a commonly used policy instrument for the promotion of renewable electricity production. The term feed-in tariff is used both for a regulatory, minimum guaranteed price per unit of produced electricity to be paid to the producer, as well as for a premium in addition to market electricity prices. Regulatory measures are usually applied to impose an obligation on electricity utilities to pay the (independent) power producer a price as specified by the government. The tariff may be supplemented with subsidies from the state. The level of the tariff is commonly set for a number of years to give investors security on income for a substantial part of the project lifetime. Many different adaptations of the instrument are applied.
A feed-in tariff can be based on the avoided cost of the utility that has the purchase obligation, or on the end price to the consumer. However, the level of the tariff need not have any direct relation with either cost or price, but can be chosen at a level to motivate investors for green power production.

Quota obligations/green certificates

Quota obligations are used to impose a minimum production or consumption of electricity from renewable energy sources. The government sets the framework within which the market has to produce, sell, or distribute a certain amount of energy from renewable sources. The obligation is imposed on consumption (often through distribution companies) or production. Governments may choose to establish 'technology bands' in order to protect technologies from strong competition by lower cost options. The quota can usually be traded between companies to avoid market distortions. A tradable green certificate is needed for this system. These green certificates provide an accounting system to register production, authenticate the source of electricity, and to verify whether demand has been met.

Bidding systems

Bidding procedures can be used to select beneficiaries for investment support or production support (such as through feed-in-tariffs), or for other limited rights- such as sites for wind energy. Potential investors or producers have to compete through a competitive bidding system. The criteria for the evaluation of the bids are set before each bidding round. The government decides on the desired level of electricity from each of the renewable sources, their growth rate over time, and the level of long-term price security offered to producers over time. The bidding is accompanied by an obligation on the part of electricity providers to purchase a certain amount of electricity from renewable sources at a premium price. The difference between the premium and market price is reimbursed to the electricity provider, and is financed through a non-discriminatory levy on all domestic electricity consumption. In each bidding round the most cost-effective offers will be selected to receive the subsidy. The mechanism therefore leads to the lowest cost options.

Investment subsidies

Investment subsidies can help to overcome the barrier of a high initial investment. This type of subsidy is commonly used to stimulate investments in less economical renewable energy technologies. Investment subsidies are usually 20-50% of eligible investment costs, but in some cases subsidy is given over the total eligible investment sum, however within the limitations of the Community guidelines on State aid for environmental protection. Loans with a low interest rate can also be considered as investment subsidies.

Fiscal measures

Some EU countries support renewable electricity by means of the fiscal system. These schemes may take different forms, which range from rebates on general energy taxes, rebates from special

emission taxes, proposals for lower VAT rates, tax exemption for green funds, to fiscal attractive depreciation schemes, which must be in line with the Community guidelines on State aid for environmental protection.

It must be said that all of these mechanisms are permitted within the contest of the Renewable Electricity Directive[17].

Feed-in tariffs are permitted provided that it is demonstrated (as it has been the case for German Law on Renewable Electricity) that they are correctly defined to favour development of renewable technologies without excessive state aid and they are progressively modified (i.e. reduced) to take into account renewable technologies improvement and cost reductions.

In recent years, however, several EU Member States have assessed the possibility of introducing a green certificates mechanism[18]. Member States choices are presented in **Table 5**.

Table 5:EU countries with feed-in tariffs or quota systems (green certificates) in December 2004. Sources: Bechberger et al. 2003; Reiche 2003; Reiche 2002; www.aroges.org

Country	Feed-in tariff	Quota obligation + certificate trading	Biomass incentive (cent€/kWh)
Austria	●		**Solid biomass and waste with large biogenic fraction:** 10.2-16.0 € cents /kWh (10-2 MW), 6.5 € cents /kWh (hybrid plants) **Fuels including biogenic wastes:** 6.6-12.8 € cents /kWh (10-2 MW) 4.0-5.0 € cents /kWh (hybrid plants) **Liquid biomass:** < 200 kW 13.0 € cents /kWh; > 200 kW 10.0 € cents /kWh **Biogas**: 10.3 – 16.5 € cents /kWh **Sewage and landfill gas** 3.0 - 6.0 €cents /kWh
Belgium	● [1]	●	**Biomass and other RE:** 2 € cents/kWh (**Certificate minimum price)**
Cyprus	●		**Biomass, landfill and sewage**: 6,3 € cents/kWh
Czech Republic	●		**Biomass and biogas:** 8 € cents/kWh (year 2003)
Denmark	●	○	**Solid Biomass:** A settlement price of 4 € cents/kWh is guaranteed for a period of ten years. Additionally and as a guarantee these plants receive 1 € cent/kWh in compensation for an RE certificate. **Biogas:** A settlement price of 4 € cents/kWh is paid **Waste:** A settlement price of 1 € cent/kWh is paid
Estonia	●		Electricity price for renewable energy 1.8 times the residential price, so the price for renewable energy is: 5,2 € cents /kWh. This price is paid for 7 years for biomass.
Finland	●		**Biomass:** 4,2 € cents /kWh

[17] Support schemes: "1. *Without prejudice to Articles 87 and 88 of the Treaty, the Commission shall evaluate the application of mechanisms used in Member States according to which a producer of electricity, on the basis of regulations issued by the public authorities, receives direct or indirect support, and which could have the effect of restricting trade, on the basis that these contribute to the objectives set out in Articles 6 and 174 of the Treaty*."

[18] Green certificates can be defined in terms of advantages and disadvantages with respect to feed-in tariffs. Advantages are: 1) efficiency improvements show up in GC-prices directly; 2) strong regulation of capacity development; 3) no governmental subsidisation - the consumers are going to pay; 4) international trade with green certificates is possible. Disadvantages are: 1) only the most competitive renewable technology is promoted; 2) the national market should have a minimum volume; 3) higher investment risk: The GC market comprises both market risk and reliability of politicians; 4) uncertainty on how green certificates interplay with other greenhouse gas reduction instruments

Country	Feed-in tariff	Quota obligation + certificate trading	Biomass incentive (cent€/kWh)
France	●		**Biomass:** Standard rate of 4,9 € cents/kWh, premium up to 6 € cents/kWh **Sewage and landfill gas:** Standard rate of 5,5 € cents/kWh, premium up to 6 € cents/kWh **MSW:** Standard rate of 3,5 € cents/kWh, premium up to 4 € cents /kWh For renewable energy installations up to 12 MW, guaranteed for 15 or 20 years. A tendering system is in place for renewable energy installations > 12 MW.
Germany	●		**Biomass:** up to 500 kW: 10 € cents/kWh, up to 5 MWp: 9 € cents/kWh, up to 20 MWp: 8,6 € cents/kWh, **Landfill gas, sewage gas**: up to 500 kW: 7,7 € cents/kWh, form 501 kW to 5 MW: 6,6 € cents/kWh
Greece	●		Feed-in tariff of about 7,8 € cents/kWh on the islands and 7 € cents/kWh on the mainland
Hungary	●		Energy generated from renewable energy resources must be purchased between 6 and 6,8 € cents/kWh
Ireland	Tendering scheme		Target purchase prices **Biomass:** 6.412 € cents/kWh up to 8 MW **Biomass-CHP:** 7.0 € cents/kWh up to 28 MW **Biomass-anaerobic digestion:** 7.0 € cents/kWh up to 2 MW
Italy		● [2]	Certificate prices up to 9.74 €ct/kWh, 2004. (Certificates are issued only for plants producing more than 50 MWh per year.)
Latvia	●		The annual purchase tariff for small hydro power as well as for power plants using waste or biogas is set at the average electricity sales tariff.
Lithuania	●		Average energy prices since February 2002: **Biomass** 6.9 € cents/kWh
Luxembourg	●		**Biomass, biogas:** 2.5 up to 3 MW, 10 years
Malta			---
Netherlands	●		Tariff 2004 / Tariff 2005 Mixed biomass and waste: 2.9 / 2.9 Pure biomass large scale: 5.5 / 7 Small-scale biomass < 50 MWe 8.2 / 9.7
Poland		●	Not yet enforced
Portugal	●		Tariffs (€ cents/kWh) year 2005 / new tariff **Wood Biomass (residual)** 7.2 / 10.5 **Animal biomass** 7.2 / 10 **Biogas** 7.1 / 10 **Solid Waste** 7.2 / 7.2
Slovenia	●		**Biomass** up to 1 MW: 6.98 €c/kWh; **Biomass** above 1MW: 6.76 €c/kWh
Slovakia			---
Spain	●		RES producers may choose between a fixed preferential tariff or a (variable) premium price on top of the market price. Investment support is also provided. Tariffs are specified for plants 50MW. Year 2003 (€ cents/kWh) premium price / feed-in tariff **Primary Biomass**[3]: 3.32 / 6.85 **Secondary Biomass:** 2.51 / 6.05
Sweden		●	Certificates prices will be settled by supply and demand. Forecasts show expected prices in the range of 1.3 – 1.6 € cents/kWh for certificates traded.

Country	Feed-in tariff	Quota obligation + certificate trading	Biomass incentive (cent€/kWh)
United Kingdom		●	Green certificate system: the non-compliance 'buy-out' price for 2003-2004 is set at approx 4.5 € cents/kWh (buy-out price will be annually adjusted in line with the retail price index) Climate Change Levy: renewable electricity is exempted from the climate change levy on electricity of approx. 0.63 € cents/kWh)

● = deployed promotion instrument; ○ = introduction is planned; [1] only in the Flanders region and only for photo-voltaic; [2] up to April 2005, the value of green certificates has been established by the GRTN, which could also issue uncovered green certificates (with no counter-value of renewable energy production) in order to prevent potential system malfunctions in the initial phase of the market due to considerable demand and insufficient availability of green certificates. Thus, in the first phase, the maximum price of a certificate has been equal to the value of those issued by the GRTN. The sale price of the green certificates held by the GRTN was 8.24 € cents /kWh in 2003, 9.74 € cents /kWh in 2004; [3] Primary biomass: that is used directly from nature; the clearest examples are the energy crops, the forest and the agricultural residues (pruning, straws...). Secondary biomass, still being matter of biological origin, is the result of transformation processes made by men: residues of wood industry, slurry and other animal residues, organic waste, etc.

3.2 Standardisation of biofuels

Standardisation of biofuels is an important factor to foster the development of the market of biomass for energy.

Bioenergy can be produced from resources of different origin and chemical composition. These can be classified by their origin in the following broad areas:

- Agricultural products (such as energy crops) and residues (such as straw and olive stones from the agro-food industry).
- Forestry products (such as wood from thinnings, short rotation forestry) and residues (such as tops and branches left in the forest) and also residues, wastes, products and by-products from forest-based industries and operations such as bark, sawdust and fibre sludge
- Waste streams generated by the consumer society (such as sorted biodegradable fractions of municipal and industrial solid waste and sludge).

Solid biofuels and/or dedicated energy crops may contain substances that can create significant pollution if used in inappropriate systems. Examples are chlorine in straw (from fertilisation with potassium chloride) and forest products from coastal locations (sea spray), cadmium in energy crops like willows (natural Cd in the soil is effectively taken up by the crop) or heavy metals. Biofuels with a "natural" content of chlorine may produce dioxins during thermo-chemical conversion and can show similarities with fuels derived from several waste streams. With this knowledge about biofuels, it is extremely important to identify and define different properties, standardise the accepted levels and have the right methods and tools to measure these properties.

Traditionally biofuels have been used in the form of fuel-wood for heating and cooking in households. The forest-based industries like the sawmills and the pulp and paper industries have always used residues such as bark, sawdust, shavings, black liquor and fibre-products for in-house energy production.

As a result of national energy policies aiming at sustainable development, biofuels are traded between producers and users. An international trade has been developed between the EU countries and also with countries outside the EU. At present, the international trade inside the EU has reached almost 1 Mtoe/year. The trade covers products like wood chips, wood pellets, wood-logs and by-products from sawmills.

The trade of biofuels for energy production is under development and the market is increasing rapidly at the moment. A major problem for a dynamic and sustainable market is that the quality of the traded biofuels varies extremely among the various producers. The consequence is that the users are reluctant to buy fuels when the quality and composition can not be specified and

the manufacturers of equipment do not guarantee their equipment for biofuels that do not follow a specification.
The absence of European standards is a major barrier to develop the market for solid biofuels. A market which is necessary for the European Union to reach its targets for the deployment of bioenergy.
Standardisation of solid biofuels will help to regulate the market and to provide confidence to fuel producers and fuel users. Standards on solid biofuels with respect to quality and properties will make it possible to find the optimum utilisation of different biofuels with respect to protecting the environment. In addition, standards on solid biofuels will improve the efficiency of biomass utilisation because the users will be able to procure fuels of a quality corresponding to the specifications of their equipment.

3.2.1 Mandate to European Committee for Standardization - CEN

Based on the above issues, the European Commission proposed a mandate to CEN for the elaboration of standards in the field of solid biofuels.
The Mandate (M 298, European Commission, 2000) was assigned taking into consideration that:
1. waste is defined in Directive 75/442/EEC on waste,
2. incineration of municipal waste is regulated by Directives 89/369/EEC and 89/429/EEC for new and existing municipal incineration plants, respectively
3. the European Commission examined in the Directive 75/442/EEC under which conditions a waste ceases to be a waste and becomes a product
In the Mandate it is underlined that wastes or products not originating from the sources in the list below are explicitly excluded from this mandate:

- Products from agriculture and forestry
- Vegetable waste from agriculture and forestry,
- Vegetable waste from the food processing industry,
- Wood waste, with the exception of
  - wood waste that may contain halogenated organic compounds or heavy metals as a result of treatment;
  - treated wood originating from building and demolition waste
- Cork waste

Description of the mandate

The Commission assigned to CEN to produce a coherent set of European standards for solid biofuels with the aim of satisfying the requirements mentioned above, namely the creation of a stable market for solid biofuels and for the related equipment.

In CEN Technical Committee 335 – Solid Biofuels, the foreseen standards are organised under such a structure that they would provide adequate and clear delineation among the various types of fuels, their origin and their fitness for use in specific applications[19]. The standards structure should give the market and the legislative authorities the possibility to distinguish between renewable and fossil fuels. The standards should define sampling and measuring procedures for those pollutants and impurities that are expected to be present in the biofuels. This is allowing regulatory authorities and end users to assess the technical and environmental aspects of solid biofuels combustion.

Standards

More in detail the required standards refer, among the others, to:

- terminology, definitions and descriptions

[19] However, in the Mandate it is underlined that a material fulfilling certain standard specifications does not automatically qualify as a product.

- fuel specifications and classes
- fuel quality assurance
- sampling, sample preparation, preparing sampling plans and sampling certificates
- bulk density, particle density
- content of volatile matter
- ash melting behaviour
- particle size distribution
- density of pellets and briquettes
- durability, mechanical durability of pellets and briquettes
- moisture content
- ash content
- calorific value
- oxygen (O) content
- carbon, hydrogen and nitrogen content
- sulphur and chlorine content
- water soluble content of chloride, sodium and potassium
- major elements content (Al, Si, K, Na, Ca, Mg, Fe, P and Ti)
- minor elements content (As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mo, Mn, Ni, Pb, Se, Te, V and Zn)

3.3 Agricultural and forestry policies

3.3.1 Agriculture

As explained in previous sections, Agriculture and Forestry are the main sectors-providers of biomass. In these contexts, energy use competes with other uses (food, feed).
For instance, there are crops like oil-plants (rapeseed, sunflower), roots and beets (for alcoholfuels), cellulose plants (cereales, high grasses, trees) that may have an energy destination[20]. Besides, farmers or transformers produce offals from plant use, but also from animals (slaughter offals like fat and meals). And the gasification of manure is possible.

Recently, CAP reform has increased market orientation of agriculture. Better opportunities are then provided for farmers to adapt production to increasing demand for biomass. With the new Regulation (1782/2003[21]), EU's farmers will get a single payment per farm and they can, in principle, produce whatever they want. Also energy crops grown on set-aside[22] land will receive payments under the new Single Payment Scheme. Energy crops grown on non set-aside land will receive payments under the new Single Payment Scheme plus the new energy crops payment, consisting of € 45/ha. This applies for a maximum area of 1.500.000 ha. The aid will only be granted in respect of areas whose production is covered by a contract between the farmer and the processing industry except where the processing is undertaken by the farmer on the holding. All crops (except sugar beet) are eligible for support, including some multi-annual. However, the system is not applicable within simplified premium system in new Member States

[20] The EU Directive on Bio-fuels will help the farmers to develop some of such crops.
[21] Council Regulation 1782/2003 of 29. September 2003, published in OJ L 270 from 21.10.2003.
[22] At the moment, set-aside rate of 10% (compulsory rate) results in EU15 area of about 4 million ha. In the year 2004/05 there has been a temporary reduction to 5% (2 millions ha). In addition, voluntary set-aside was about 2.3 million ha in 2003/04. Set-aside land currently used for energy crops was about 0.9 million ha in 2003. 2/3 of energy crop production on set-aside consists of oilseeds in France and Germany. Other important producers are UK, Spain and Denmark. Establishment of set-aside entitlements will be done on the basis of historic references within the single farm payment scheme. Set-aside entitlements shall be activated only if accompanied by an *eligible hectare put into set-aside* (excluding permanent grassland). Set-aside areas must cover at least 0.1 hectare in size and be at least 10 meters wide (for duly justified environmental reasons a width of 5 meters may be accepted). Area under set-aside may be subject to rotation. Organic producers will be exempt from the set-aside obligation.

The results of the first year (2004) of application of energy crops support (45€/ha for a maximum area of 1.500.000 ha) are presented hereafter[23]:

- EU 25: around 300.000 ha (of 1.5 millions)
- France 129.000 ha
- Germany 109.000 ha
- UK 30.000 ha
- Sweden 13.600 ha
- Spain 7.000 ha
- Denmark 4.900 ha
- Austria 4.100 ha
- Finland 3.500 ha
- Slovenia 300 ha
- Less than 300 ha: Irland, Netherlands, Belgium, Italy, Greece, Portugal

3.3.2 Forestry

Since the publication by FAO and UN/ECE of the Temperate and Boreal Forest Resources Assessment in 2000 ([TBFRA 2000]), a full set of comparable data on forest cover and forest cover change is now available for Europe, CIS[24], North America, Australia, Japan and New Zealand. All figures that follow are based on TBFRA 2000. They are only applicable to forests and not to "other wooded land" (OWL)[25].

EU forests cover approximately 113 million hectares, or 36 percent of the land area, while EU OWL accounts for another 23 Mha (TBFRA 2000). Between the countries exist large differences in forest cover, ranging from 9 (Ireland) to over 72 percent (Finland).

The forest area in the ten new EU Member States covers 23.5 million hectares, or 33 percent of their land area. Poland is most rich in forests – in absolute terms (9 million hectares). In relative terms the forest cover ranges from 1 (Malta) to 55 (Slovenia) percent. The new EU Member States have a share of 17 percent of forests in the European Union of the twenty-five (EU25).

EU forests are expanding: in 1990-2000 the area under forest cover in Europe has increased by 3.40 M ha, i.e. an annual increase in area of 340.000 ha (TBFRA 2000, based on country sources for different multi-year periods around 1995). 50% of this increase derives from new plantations, while 50% originates from natural expansion of the forests.

The ratio between yearly fellings and net annual increments is, on average, about 60% (in EU 15), 302 and 483 million cubic meters, respectively. In some Member States, however, this ratio is below 40%. In the new Member States the ratio is slightly higher, i.e. 64.8 percent (125 million cubic meters of net annual increment and 81 million cubic meters of annual fellings).

65-70% of forests are in private ownership in EU 15 whereas 25% are privately owned in New EU Member States. 75% in New EU Member States is state owned while only 30-35 % in the EU15.

Overall in the European Union, forest holdings are rather small, especially compared to agriculture lands holdings. In many of the Central and Eastern New EU Member States countries up to almost

[23] European Biomass Action Plan, External Stakeholders Meeting, 4 March 2005, "Common Agricultural Policy Perspectives for Biomass Production". Willi Schulz-Greve, unit G.1 - Studies and overall approach - European Commission - DG Agriculture

[24] Commonwealth of Independent States. All of the former republics of the USSR except the Baltic states had become members of the CIS.

[25] OWL: permanent status characterized by presence of > 10 % crown cover < 5 m height at maturity (scrub, maquis, matorral etc..) or 5-10 % crown cover > 5 m height at maturity (wooded pasture – agroforestry systems).
FOREST : crown cover > 10 % and mature height > 5 m , including clearings , cuttings streams and water bodies.

90 percent of private forest owners will own forest of less than 3 ha in size (MCPFE, 2003). This poses specific problems for a cost-effective and a sustainable management of the forest resources. Transition to a market economy and the simultaneous emergence of private forest ownership will need considerable change of the foundations of forest policy formulation and implementation.

Aspects that are emerging in the last years are limited market for small sized wood (because of thinning delay) and availability of land due to CAP reform (in upland areas)
Forestry biomass supply scenario is presented in **Table 6**.

Measures that can be thought of to successfully accomplish reported targets are:

- Classic afforestation (no result expected before 2010)
- Fast growing plantations (+ 21 Mm³/y by 2010, much more in medium term)
- Dedicated energy crops (very effective in short term but few examples > 15-20 m³/ha/y)
- Adapting management in existing forests to raise output:
    - 75 % util. rate >100 Mm³/y extra output
    - removing more logging residues
    - facilitating pre-commercial thinnings
- Changes in use of small roundwood (possible competition for resource > higher prices / effects on global market positions)
- Land use changes: (Long Term option)
    - restoring degraded forest (+ 100 Mm³/y)
    - making OWL productive (+ 8 Mm³/y)
- Production Forestry Policy: + 90 Mm³/y (long term)
    - 25 % nature conservation
    - 50 % multifunctional
    - 25 % production only

Table 6: Expected biomass inputs for RES E + RES H / 2010. Source: DG Environment.

	Total Biomass Demand	Covered by agric. sector	Covered by wood	Of which wood residues	Of which forest biomass	Total forest biomass demand
	Mm3/a					Mm3/a
RES E in 2002	38	8%	92%	77%	23%	8
RES H in 2002	103	1%	99%	88%	12%	12
Current total	142	4	138	117	21	21
Share	100%	3%	97%	82%	15%	15%
BAU Scenario						
RES E in 2010	81	27%	73%	75%	25%	15
RES H in 2010	114	5%	95%	87%	13%	14
Total	214	28	186	151	35	35
Share	100%	13%	87%	71%	16%	16%
VP Scenario						
RES E in 2010	180	45%	55%	58%	42%	41
RES H in 2010	133	12%	88%	82%	18%	21
Total	313	97	216	154	62	62
Share	100%	31%	69%	49%	20%	20%

BAU= Business As Usual
VP = Voluntary Policy

Finally, it must be emphasized that forestry biomass has to be somehow integrated in energy policies, by, among different possibilities:

- raising incentives for afforestation, thinning
- favourable tax regimes for biomass energy
- increasing co-operation among forest owners
- designation of biomass production areas
- specific support schemes for energy crops /coppice

3.4 Authorisation procedures, waste definition, co-firing

European Policies and Legislation on renewable energy takes into account the often difficult process of authorisation that power plants may face[26].
As regards biomass, problems in the authorization procedures are usually associated with the fact that it is not always possible to draw a clear distinction between biomass and waste.
Waste Incineration Directive (2000/76/EC) only excludes from its scope plants which utilize some typologies of forestry, agriculture and industry residues:

(a) Plants treating only the following wastes:
(i) vegetable waste from agriculture and forestry,
(ii) vegetable waste from the food processing industry, if the heat generated is recovered,
(iii) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and the heat generated is recovered,
(iv) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating, and which includes in particular such wood waste originating from construction and demolition waste,
(v) cork waste

Other kinds of biomass (e.g. poultry litter, manure, etc.), on the contrary, are only utilisable in plants that are formally classified and authorised as incinerators, which, often, constitutes an important barrier to the development of these plants.
Besides, different kind of residues (from forestry or agriculture) are, in principle, classified as waste before they enter the biomass plant and so they have to be managed according to waste legislation, which entails a specific authorization and specific competences in the field of waste management for the power generation company that is running the biomass plant.

Related to this issue, the question of co-firing is to be considered. Co-firing means that biomass is not the only fuel utilized in the power plant. If the other fuel is waste derived fuel, then an

[26] Directive 2001/77/EC on renewable electricity, for instance, claims that:
1. Member States or the competent bodies appointed by the Member States shall evaluate the existing legislative and regulatory framework with regard to authorisation procedures or the other procedures laid down in Article 4 of Directive 96/92/EC, which are applicable to production plants for electricity produced from renewable energy sources, with a view to:
— reducing the regulatory and non-regulatory barriers to the increase in electricity production from renewable energy sources,
— streamlining and expediting procedures at the appropriate administrative level, and
— ensuring that the rules are objective, transparent and non-discriminatory, and take fully into account the particularities of the various renewable energy source technologies.
2. Member States shall publish, not later than 27 October 2003, a report on the evaluation referred to in paragraph 1, indicating, where appropriate, the actions taken. The purpose of this report is to provide, where this is appropriate in the context of national legislation, an indication of the stage reached specifically in:
— coordination between the different administrative bodies as regards deadlines, reception and treatment of applications for authorisations,
— drawing up possible guidelines for the activities referred to in paragraph 1, and the feasibility of a fast-track planning procedure for producers of electricity from renewable energy sources, and
— the designation of authorities to act as mediators in disputes between authorities responsible for issuing authorisations and applicants for authorisations.

authorisation for incineration will be required and incentives (feed-in tariffs or green certificates) will, in principle, be only assigned to biomass fraction[27]. Also in the case of co-combustion with coal, incentives will only be assigned to the biomass fraction. It is also possible that a certain threshold is defined as minimum percentage of biomass utilisation.
Incentives to biomass mixed to waste or coal may be lower than those guaranteed to pure biomass generation, as reported in **Table 5**, for some EU countries. Besides, co-combustion plants may be excluded by other complementary measures to promote green electricity, like fiscal exemptions or guarantees of origin of renewable electricity. For instance, in the Netherlands, co-combustion do not qualify for exemption from REB (regulating energy) tax for green electricity products purchase and REB production subsidy and therefore do not qualify also for the receipt of green labels.
In UK, co-firing with biomass that attracts ROCs (Renewable Obligation Certificates) will be subject to increasing restrictions:

- any biomass can be co-fired until 31 March 2009 with no minimum percentage of energy crops;
- at least 25% of co-fired biomass must be energy crops from 1 April 2009 until 31 March 2010;
- at least 50% of co-fired biomass must be energy crops from 1 April 2010 until 31 March 2011;
- at least 75% of co-fired biomass must be energy crops from 1 April 2011 until 31 March 2016.

Co-firing ceases to be eligible for ROCs after this date.

3.5 Promotion of heat and co-generation

As underlined before, utilisation of biomass for heat production is deemed to be an important part of bio-energy generation.
Residential and tertiary energy consumption absorbs an important share of EU final energy uses. About two thirds of this consumption is associated with heating. So, as regards residential users, there seems to be a possibility of bioenergy expansion, especially to substitute electricity with biomass and to provide supply to new users.
Besides, in EU 25 there is almost 50% of steam self production out of total steam generations. In this sector bioenergy could play an important role in the future, even only for industries where bioenergy is generated as a by-product (e.g. in the production of woody products, in the agro-food industry, etc.).
As regards distributed heating, it can be identified a consistent potential in EU new Member States (NMS), where there is a larger opportunity (with respect to, e.g., utilisable land) for fossil fuel (coal and oil) substitution with renewables (biomass) than in EU-15 (**Figure 3**).

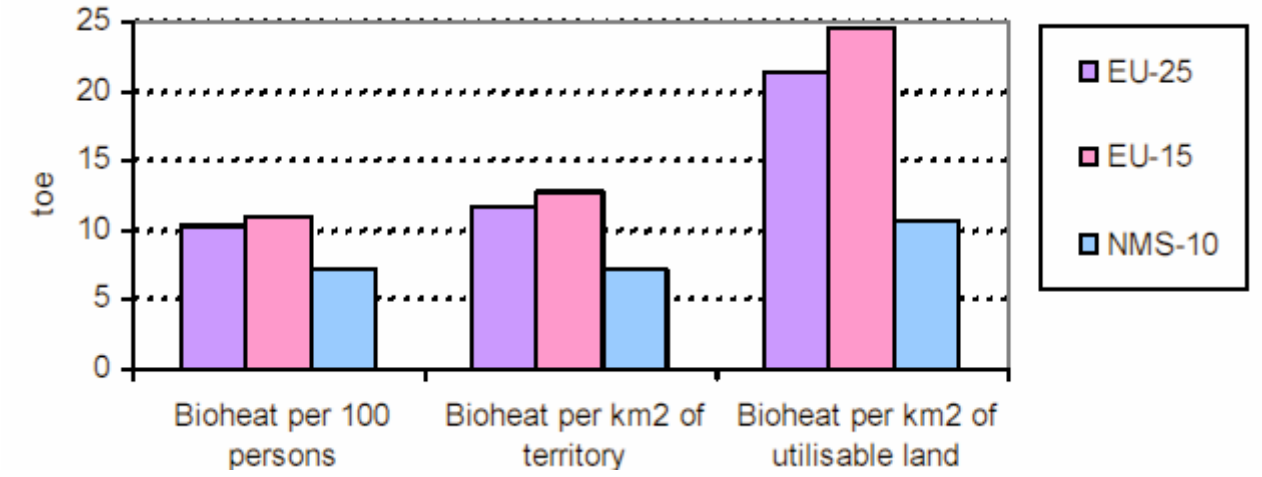

Figure 3: Bioheat generation in EU States, with respect to persons, territory and utilisable land. Source: European Biomass Action Plan, External Stakeholders Meeting, 4 March 2005.

[27] In some cases, e.g. Italy, the same incentive as for renewables is assigned to waste combustion, to favour development of this technology.

Heat-only or electricity-only generation from biomass make already a positive contribution to European renewable energy, security of supply and Kyoto targets. For a number of reasons, they may sometimes be the only viable option and in these cases the construction of heat-only or electricity only installations is currently promoted in EU Member States.
Nonetheless, the European Cogeneration Directive requires to analyse heat demands that are suitable for cogeneration from renewables, with a particular view to cogeneration from biomass.
Amongst other things, this analysis should consider "the type of fuels that are likely to be used to realise the cogeneration potentials, including specific considerations on the potential for increasing the use of renewable energy sources in the national heat markets via cogeneration" (Annex IV of the Directive).

Two good examples of how an effective biomass co-generation promotion could be achieved are given by Germany and the Walloon Region in Belgium.
- In Germany, cogeneration installations obtain an additional € 0.02 per kilowatt-hour of electricity fed into the electricity network (as it is observable in **Table 8**), if they burn gas produced from biomass gasification. This bonus is in addition to the usual remuneration.
- In Belgium, the Walloon Government has introduced a successful "green electricity certificates" system, under which the use of renewable energy sources in a cogeneration process is eligible for twice the amount of green certificates compared with heat-only or electricity-only generation from renewables.

Two further EC initiatives are contributing to promote heat and co-generation from renewable sources and especially from biomass:

- the Directive on the energy performance of buildings (2002/91/EC), supporting, among others, the application of renewable heating applications.
- The Directive on the taxation of energy products and electricity (2003/96/EC)**,** specifying minimum tax rates and permitting tax exemptions for energy products and electricity from renewable sources.

An important aspect of bio-heat promotion concerns authorisations for the use of bio-fuels in civil and residential boilers, a problem already mentioned in the report. It is often the case that national laws have not yet drawn a clear distinction between biomass and waste materials, so that for administrative authorities at local level it is not easy to understand if a biomass residue can be handled and utilised in residential boilers in a safe and environmentally sound manner.

Pellets

Compressed wood or other biomass in form of pellets have been studied throughout Europe and promoted to facilitate the use of biomass at residential level. However, while the markets for utilising wood pellets in the northern European countries are well established and still expanding, the markets in southern Europa are still in their virgin state. In this sense, the success of wood pellets in European Countries such as Austria, Denmark and Sweden, has yet to be replicated elsewhere. In Southern European countries, the lack of available wood waste means that pellets from agricultural residues ("agri-pellets") are the most promising solution.

In the vast majority of the European countries, there are few or no laws written specifically for pellets. Often these come under the jurisdiction of only very general biomass laws. Presently only few European countries like Austria, Sweden and Germany have official standards specifically for compacted biomass fuels. Other countries with significant pellet markets like Denmark and Finland have decided to wait for the completion of a common European pellet standard. Comprehensive work has been done on defining standard methods for analysing and classifying pellets and are defined in the report of CEN/TC 14961. In **Table 7** the most commonly used standards together with the new CEN classification system of pellets are listed.

Table 7: Standards for pellets.

COUNTRY	STANDARD
Austria	ÖNORM M1735 (briquettes and pellets)
Sweden	SS 187120 (pellets) and SS 187121 (briquettes)
Germany	DIN 51731 (briquettes and pellets)
European Union – CEN TC 335 'Solid Biofuels'	CEN/TS 14961 "Annex A" Examples of specifications for high quality classes of solid biofuels recommended for household usage

4 COUNTRY CASES OF RENEWABLE/BIOMASS ENERGY PROMOTION

In this chapter some exemplars of recently adopted policies and regulations to promote renewable, and especially biomass, energy are presented. These refer to different EU Member States (Germany, UK, Italy, Belgium) that have planned and are planning to exploit biomass for energy generation and have thus defined specific mechanisms to support and encourage this exploitation.

4.1 Revisions of feed-in tariffs for biomass electricity – Germany

In Germany, in 2000, the Renewable Energy Sources Act ("Erneuerbare Energien-Gesetz", EEG-2000) replaced the Electricity Feed-in Act[28]. As a consequence of the developments described above, under the new EEG, feed-in prices were no longer linked to electricity retail prices, but fixed for 20 years. The cap on the share of electricity from RES was abolished. Instead, the total amount of feed-in reimbursements were distributed evenly among all high voltage grid operators and equally among all electricity consumers there. Furthermore, the feed-in tariffs for some RES such as wind were planned to be decreased annually for plants installed after 1st January 2002.
The EEG guaranteed preferential prices with respect to the favoured group (the RES producers), but with the special feature of financing by the end-users of electricity. The incentive was a positive sanction in the form of guaranteed payments for the total amount of electricity produced. In the EEG, two important and innovative features were implemented:
• Decrease of tariffs - supporting technology learning: from 2002 on, new installations receive lower tariffs. From 2003 on, new installations of these types receive tariffs lowered at the same rate, and so on for the following years. This is to retain the incentive for manufacturers to systematically reduce production costs and to offer more efficient products every year. The rate of decrease is based on the empirically derived progress ratios (from the theory of technology learning) for the different technologies.
• Stepped nature of tariffs - supporting financial efficiency: the tariffs for the different technologies defined in the act are determined based on the yield / generation costs of each particular plant. This feature is especially important for wind energy but applies to other RES as well, e.g. to biomass with respect to plant size and fuel type. Investors in wind power at sites above a reference value receive a substantially lower feed-in tariff starting 5 years after installation. At sites with below

[28] The Electricity Feed-in Act was introduced in 1991. It mandated that grid operators pay 80 % of (average historical) electricity retail prices as feed-in tariffs for electricity generated by certain Renewable Energy Sources (RES). Furthermore, it required electricity suppliers to accept the electricity fed into the grid. The Electricity Feed-in Act in its later stage had a cap to prevent very uneven burdens for regional grid operators: a grid operator had to pay these feed-in prices until the share of electricity from RES reached the cap of 5 %. Nevertheless, this regulation still had an asymmetric impact on the utilities operating the grid. For example, the wind turbines which benefited most under the Energy Feed-in Law are concentrated in Northern Germany. Thus, grid operators in the North were at a (slight) competitive disadvantage, which caused a problem, especially after electricity market liberalisation. Furthermore, the falling electricity (retail) prices resulting from liberalisation also led to lower feed-in prices for electricity from RES. This started to undermine their economic basis, in particular that of the numerous wind turbines which had been installed in the previous years. Thus, an intensive debate arose about the future of the Electricity Feed-in Act.

average wind yield, the time period for the higher feed-in tariff is prolonged. This feature leads to a lower level of promotion at sites with very good wind conditions and higher promotion levels under less advantageous wind conditions. Therefore the price of the tariff mirrors the cost resource curve of the technology. This results in a reduction of the producer profit and therefore in lower transfer costs for society. Furthermore, the feed-in tariffs are reviewed every two years according to the new act, first in 2007 and then every four years in the light of technological and price developments; feed-in tariffs for new sites installed at a later point in time can be modified accordingly. For every single site, the date of *expiration* is twenty years after the date of installation.

Current legislation (amended EEG / August 2004)

In year 2004, a detailed target for the share of renewables in electricity production of at least 12.5 % (2010) and at least 20 % (2020) was set in order to underpin the importance of long-term stability of the German RES-E policy. The revised act intends to improve the integration of RES plants into the electricity system and provides incentives for operators of RES plants and grid operators to participate in a power management of RES facilities. Furthermore the priority right for access and connection to the grid has been enforced.
In the case of bioenergy, the tariffs have been adjusted to increase market competitiveness, in particular for small-scale biomass plants. Furthermore, special incentives are provided for the use of innovative technologies, plant/crop-based renewable resources and CHP.

Table 8: Current tariff structure of the EEG for Biomass, from August 2004.

Type of biomass	**General**	**Renewable resources [1]**	**CHP**	**CHP + innovative tech. [2]**	**Waste wood from 1.7.2006**	
Plant dimension	€/MWh					Decrease*
< 150 kW	115	175	135	155	39	1.5%
150 -500 kW	99	159	119	139		
500 kW - 5 MW	89	129 (114 for wood)	109	129		
5 MW - 20 MW	84	84	104	104		

[1] a) from plants or parts of plants which have originated from agricultural, silvicultural or horticultural operations or during landscaping activities and which have not been treated or modified in any way other than for harvesting, conservation or use in the biomass plant; b) from manure within the meaning of Regulation (EC) No 1774/2002 of the European Parliament and of the Council, as amended by Commission Regulation (EC) No 808/2003, or from vinasse generated at an agricultural distillery pursuant to Article 25 of the Spirits Monopoly Act as promulgated in the Federal Law Gazette Part III No. 612-7, last amended by Article 2 of the Act of 23 December 2003 (BGBl. I p. 2924), if that vinasse is not subject to any other recovery requirements pursuant to Article 25(2) No. 3 or paragraph (3) No. 3 of that Article of the Spirits Monopoly Act or c) from both substance categories.
[2] "……. if the biomass is converted by thermochemical gasification or dry fermentation and if the gas used for power generation is processed to reach the quality of natural gas or if the electricity is produced by fuel cells, gas turbines, steam engines, organic Rankine cycles, multi-fuel plants, especially Kalina cycles, or stirling engines……"
* Reduction of tariffs every year for new installed systems

4.2 Recent advances in biomass energy promotion – Italy: tariffs for small-scale plants (< 1MWe) and regulation for the use of biofuels in industrial & civil boilers

In Italy some recently issued decrees, concerning energy sector, fuels regulation and specifically renewable electricity are contributing to enhance the diffusion of renewable energy projects, especially biomass.

4.2.1 Tariffs for small-scale renewable power plants

Law 239/04 (on Energy Sector) and Decree 387/03 (for application of Directive 2001/77/EC on renewable electricity) have introduced concessions and inventives for small-scale renewable or co-

generative[29] power plants (< 1 MWe, also called "distributed generation"). Economic conditions for purchase of renewable electricity by GRTN (National Transmission Network. Administrator are presented hereafter (**Table 9**)

Table 9: Economic remunerations for renewable electricity (Green Certificates not considered here)

Electricity produced by	*Remuneration*
< 10 MWe (programmable or not, any date of entering into operation	Selling price to Distribution Companies, guaranteed miminum price for first and second million of kWh yearly generated by plants < 1 MWe
≥ 10 MWe non-programmable, put into operation after 1 April 1999*)	Selling price to Distribution Companies
≥ 10 MWe non-programmable, put into operation before 1 April 1999*)	Selling price to Distribution Companies (No Green Certificates)
Hybrid plants < 10 MWe	Selling price to Distribution Companies for kWh qualified as renewable; for other kWh: selling price to Distribution Companies if plant is cogenerative, otherwise unitary variable cost guaranteed for electricity generated by thermoelectric plants utilising commercial fossil fuels
≥ 10 MWe Programmable and hybrid plants	Price is determined by bids in the electricity market

* Date of beginning of Green Certificates Scheme

Selling prices to Distribution Companies is determined by Acquirente Unico (Single Buyer[30]) in relation to different rate periods or as undifferentiated prices (average in the period considered). Recently determined selling prices, together with rate periods for year 2005, are reported in **Table 10**.

Table 10: Selling prices to Distribution Companies. Figures for year 2004 and January 2005

	2004									*2005*
	april	*May*	*june*	*july*	*august*	*septemb*	*octob*	*novemb*	*decemb*	*january*
	€ cents/ kWh									
F1			**10,1**	**10,9**	**10,1**	**12,6**		**16,1**	**13,4**	
F2	**6,6**	**6,7**	**7,4**	**7,1**	**6,6**	**6,6**	**6,6**	**6,6**	**5,6**	**9,1**
F3	**6,4**	**6,0**	**3,8**	**4,7**	**6,0**	**6,2**	**6,2**	**5,0**	**4,5**	**7,2**
F4	**3,8**	**3,9**	**4,3**	**4,5**	**4,5**	**4,0**	**3,5**	**3,6**	**4,0**	**4,2**

Rate periods 2005 (DELIBERA AEEG 235/04)

	MONDAY-FRIDAY																						
Hours:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1-9 January	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4
10 jan-11 mar	F4	F4	F4	F4	F4	F4	F4	F2	F2	F2	F2	F2	F3	F2	F2	F2	F2	F2	F2	F2	F3	F4	F4	F4
14 mar-29 apr	F4	F4	F4	F4	F4	F4	F4	F3	F2	F2	F2	F3	F3	F3	F3	F3	F3	F3	F3	F3	F3	F4	F4	F4
2-31 may	F4	F4	F4	F4	F4	F4	F4	F3	F2	F2	F2	F2	F3	F2	F2	F2	F2	F3	F3	F3	F3	F4	F4	F4
6-30 june	F4	F4	F4	F4	F4	F4	F3	F2	F1	F1	F1	F1	F2	F2	F1	F1	F1	F2	F2	F2	F2	F2	F4	F4
1-29 july	F4	F4	F4	F4	F4	F4	F3	F2	F1	F1	F1	F1	F2	F2	F1	F1	F1	F2	F2	F2	F2	F2	F4	F4
1-5 august	F4	F4	F4	F4	F4	F4	F4	F3	F2	F2	F2	F2	F3	F2	F2	F2	F2	F3	F3	F3	F3	F4	F4	F4
6-21 august	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4
22 aug-16 sept	F4	F4	F4	F4	F4	F4	F3	F2	F2	F1	F1	F1	F2	F2	F2	F1	F1	F2	F2	F2	F2	F3	F4	F4
19 sept-18 nov	F4	F4	F4	F4	F4	F4	F4	F3	F2	F2	F2	F3	F3	F3	F3	F2	F2	F2	F2	F3	F3	F4	F4	F4
21 nov -7 dec	F4	F4	F4	F4	F4	F4	F4	F3	F2	F2	F2	F2	F3	F3	F2	F2	F1	F1	F2	F2	F3	F4	F4	F4
12-23 december	F4	F4	F4	F4	F4	F4	F4	F3	F2	F1	F1	F2	F3	F3	F2	F2	F1	F1	F2	F2	F3	F4	F4	F4
24-31 december	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4

[29] According to Law 239/2004, micro-cogeneration plants (< 1 MWe) are subject to simplified authorisation procedures.
[30] It is the company which is vested with the task of procuring electricity for captive customers under criteria of continuity, security and efficiency of electricity supply, thereby passing the benefits from liberalisation of the sector onto such customers.

	SATURDAY-SUNDAYAND WEEK HOLIDAYS (*)																							
1 gen - 31 dic	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4	F4
(*) 1-6 january, easter monday, 25 april, 1 may, 2-3 june, 15 august, 31 october, 1 november, 8, 9, 25 and 26 december																								

As mentioned in **Table 9**, for renewable power plant < 1 MWe (including waste to power plants and excluding hybrid plants), there are minimum guaranteed prices for the first two millions of kWh generated, which are defined for different brackets:

- For first 500.000 kWh (generated per year): 95 € / MWh;
- From over 500.000 to 1.000.000 kWh: 80 € / MWh;
- From over 1.000.000 to 2.000.000 kWh: 70 € / MWh;
- Over 2.000.000 kWh: selling price to distribution companies (per rate period or undifferentiated)[31].

4.2.2 Regulation for the use of biofuels in industrial and civil boilers

The Decree of the President of the Council of Ministers 8th March 2002 (DPCM 08/03/2002) establishes the characteristics of fuels for industrial[32] and civil combustion plants, as well as some technical plant specification.
This decree includes a specific section for "Biomass", which has emerged as very important to regulate and also to promote the use of biofuels in energy (electricity and heat) generation.
Typologies of biomass enumerated in this section are:

(a) Vegetal material deriving from dedicated crops;
(b) Vegetal material deriving from exclusively mechanical treatment of agricultural non-dedicated crops;
(c) Vegetal material deriving from silvicultural interventions, forestry maintenance and pruning;
(d) Vegetal material deriving from exclusively mechanical treatment of virgin wood and consisting of barks, sawdust, shavings, chips, edgings, billets, granulated and rejected virgin wood, granulated and rejected virgin cork, non-contaminated billets;
(e) Vegetal material deriving from exclusively mechanical treatment of agricultural products.

In the decree, conditions for the utilisation of biomass in combustion plants are given, together with emission limits, depending on plant dimensions (**Tables 11** and **12**).

Table 11: DPCM 08/03/2002, Emissions limits for Biomass combustion.

	≥ 35 ÷ ≤ 150 kW	**> 0,15 ÷ ≤ 3 MW**	**> 3 ÷ ≤ 6 MW**	**> 6 ÷ ≤ 20 MW**		**> 20 MW**	
	(mg/Nm^3, O_2 @ 11%)						
Particulate matter	200	100	30	30		30	10
TOC	-	-	-	30		20	10
CO	-	350	300	250	150	200	100
NO_x [i]	-	500	500	400	300	400	200
SO_x [i]	-	200	200	200		200	

i Expressed as NO_2 and SO_2 respectively

Hourly average | Daily average

[31] 40% of these prices are updated yearly according to ISTAT index (consumer prices index), to take into account inflation rate.

[32] Industrial plants include power plants.

Table 12: Further controls required by DPCM 08/03/2002 to ensure, in normal working conditions, respect of emissions limits.

	1-3 MW	3-6 MW	6-20 MW	> 20MW
Fuel automatic feeling system	MANDATORY			
Continuous measurement in combustion chamber (T, O_2) and automatic regulation of air/fuel		MANDATORY		
Pilot burner			MANDATORY	
Continuous measurement: T, CO, NOx, steam			MANDATORY	
Continuous measurement: dust, TOC				MANDATORY

Recently, a revision of the decree has been necessary to explicitly include a biomass material (olive pomace) which is subject to a non-mechanical treatment (process with hexane) that, however, do not compromise an environmentally sound utilisation in civil or industrial boilers[33].

4.3 Introduction of Green Certificates for renewable electricity based on CO_2 emissions – Walloon Region, Belgium

In Wallonia the green certificate system came into effect on October 1st 2002. The quota for the first obligation period ending on 31 December 2003 was set at 3%. This percentage will increase by one point per year till 2007 – 4% in 2004, 5% in 2005, 6% in 2006 and 7% in 2007.

A Green Certificate is assigned for a given quantity of avoided CO_2 emissions (**1 GC = 456 kg CO2 avoided),** compared with the best reference technologies[34], and through the use of:

- a renewable energy source (production of electricity)
- a cogeneration unit,

which means one green certificate per MWh for wind, small-hydro, biomass (in principle) or solar PV but 3.3 MWh for a natural gas cogenerator and 6.2 MWh for a fuel oil cogenerator.
Green certificates are valid for five years. Those suppliers which fail to reach each quarter the annual quota are obliged to pay a fine per green certificate missing (75 € till 30 june 2003 and 100 € thereafter). The amount of the fine indicates the theoretical ceiling price of the certificates.

Thus, there is a Single Green Certificate mechanism for quality cogeneration and electricity from renewable energy sources. This permits to have greater liquidity of the Green Certificates' market and the possibility to integrate complex processes (different types of fuel, hybrid installations, renewable or non renewable fuels, partially or fully combined with cogeneration, etc.).
It also raises the need for a common denominator of CO_2 saving.

As regards biomass, it can be noted that conventional CO_2 emissions are different for diverse categories of materials, as reported in **Table 13**.

[33] A further revision might be, in this sense, required for other materials, like, e.g., grape pomace, which, though not contaminated, are processed in non-strictly mechanical processes and then often are treated as waste excluded from the application of the decree by local administrative authorities, the ones that must release authorisations for biomass utilisation.

[34] Generation of 1 MWhe in a combined cycle power plant (with reference to STAG technology, i.e. trade name designation for the GE product line of combined-cycle systems) fuelled by natural gas, with 55% efficiency, produces 456 kg of CO_2 (~ 124 kg of C)

Table 13: CO2 emissions coefficients of primary energy sources defined in Wallonia GC scheme.

Energy Sources	**Conventional value (kg CO_2/MWhp)**
FOSSILE	
Gas	251
Diesel	306
Light/medium/heavy fuel oil	310
Extra heavy fuel oil	320
Coal	385
NON FOSSILE	
Wind/photovoltaic/organic biodegradable materials*	0
Wood grown for energy destinations	45
Other types of wood	23
*** NOTE: if necessary, the following elementary operations associated with the preparation of the organic materials will be also considered**	
Operation	*Conventional value (kg CO_2/MWhp)*
Cutting of wood	4
Drying of wood	10
Transportation of wood on a distance of less than 100 km	5

It can be noted that there are some difference with respect to the recent German legislation (see **4.1**) on renewable electricity promotion. In Germany only non-treated plants from agricultural/silvicultural operations (so-called renewable resources) plus manure and vinasse are subject to the best conditions (not considering CHP option), whereas in Belgium all organic biodegradable materials are considered as carbon neutral. Wood energy crops are, furthermore, in Belgium, less subsidised than wood residues because of associated CO_2 emissions, while in Germany they (as renewable resources) are more remunerated.

4.4 Recent advances in biomass energy promotion – UK

In UK, current scheme for renewable electricity promotion, which is a renewable certificates scheme (*Renewables Obligation Order 2005*), permits qualification and attribution of certificates (to the biomass fraction) to plants which utilise "mixed" waste (biomass and non-biomass waste) only if the fraction of non-biomass waste is treated by means of *Advanced Conversion Technologies*, that is gasification, pyrolysis or anaerobic digestion (or any combination thereof).
Besides, fiscal and other incentive schemes for bio-heat generation are being discussed.

5 THE OPPORTUNITIES PROVIDED BY THE CDM AND FUTURE CARBON TRADING IN SE ASIA

5.1 Introduction

The matter considered here is the "*Clean Development Mechanism"*, which is part of a package of measures that were agreed at Kyoto in 1997 by 200 countries to limit the growth of emissions to atmosphere of gases (carbon dioxide, methane, etc.) emanating from the combustion of fossil carbonaceous fuels (coal, mineral oil, "*natural gas"*, etc.)[35].
CDM is an important issue for European Renewable Energy Policies insofar as it is to be utilised by European actors (companies and national governments) to promote renewable energy (and other) projects in developing countries to reduce GHG emissions. In fact, the European carbon market is EU-wide but taps emission reduction opportunities in the rest of the world through the use of CDM and JI (see below). A key option to reduce world-wide environmental impact (i.e. greenhouse gases) of energy production is indeed the application of proven and efficient technologies for biomass conversion in countries where the projects for emissions reductions can be decidedly less

[35] These gases are hereinafter called Greenhouse Gases (GHG) because of their so-called Greenhouse Effect on climate-change.

costly (in terms of investment/cost per unit of CO_2 reduction, €/t) than within European States. Moreover, this opportunity could lead to penetration of European (clean) technologies in different parts of the world, enhancing the situation of the European renewable technologies sector.
In this sense, the European Union Member States will probably in the next years look at countries in SE Asia as potential hosts of CDM projects that could lead to significant and cost-effective GHG emissions reductions and to corresponding carbon credits to be used in EU market.

5.2 Flexible mechanisms introduced in the Kyoto protocol

In Rio de Janiero in 1992, the United Nations agreed a Framework Convention on Climate Change (UNFCCC). Representatives of the countries that are parties to that Convention then met annually to develop secure mechanisms to counter climate-change, while taking due account of the many complex issues raised[36].

Five years later this process of development led to the *"Kyoto Protocol"*, which represents a binding commitment by its signatories to take specified actions. It set quantified targets for emissions of GHG in developed countries, and established the *"Kyoto Mechanisms"* (KM) to provide means for developed countries to meet those targets and, at the same time, to assist developing countries.

Those developed countries that have ratified the Protocol and thereby accepted emissions-reduction targets, may meet those targets by a combination of activities within their own boundaries and those covered by the KM, which fall into three categories:

Joint Implementation (JI);
(a) CDM; and
(b) International Emissions Trading (IET).

JI allows a country that has, under the Kyoto Protocol, accepted a reduction in emissions (Emission reduction unit – ERU) of GHG, or a target for limitation of such emissions (a so-called *"Annex-1 country"*), to meet part of its obligations by carrying out eligible activities in another Annex-1 country.
CDM is similar, but allows an Annex-1 country to meet part of its obligations by carrying out eligible activities in developing countries that have not accepted obligations under the Kyoto Protocol (i.e. non-Annex-1 countries). Those activities entail the development and implementation of projects that will result in reductions of emissions of GHG overseas, thereby generating credits for Certified Emissions Reductions (CER) that can be sold on the carbon-market (see Section 2.2), and which can therefore provide extra income-streams for developers.

5.3 The development and implementation of CDM projects

To be accepted within the agreed framework for CDM, projects must be developed within the following step-wise framework (**Figure 4**Errore. L'origine riferimento non è stata trovata.).

In general terms, the aim for developers is to find a particular contest in industrial/civil sectors (energy generation, waste management, specific industrial sectors, like iron and steel, cement, glass, ceramics as well as paper, etc.) in which, by applying an innovative (e.g. renewable) technology, GHG reductions are obtained and the project can earn credits for CERs.

[36] For example, there is a great disparity between developed and developing countries in the amounts *per capita* of fossil fuels used and GHG emitted.

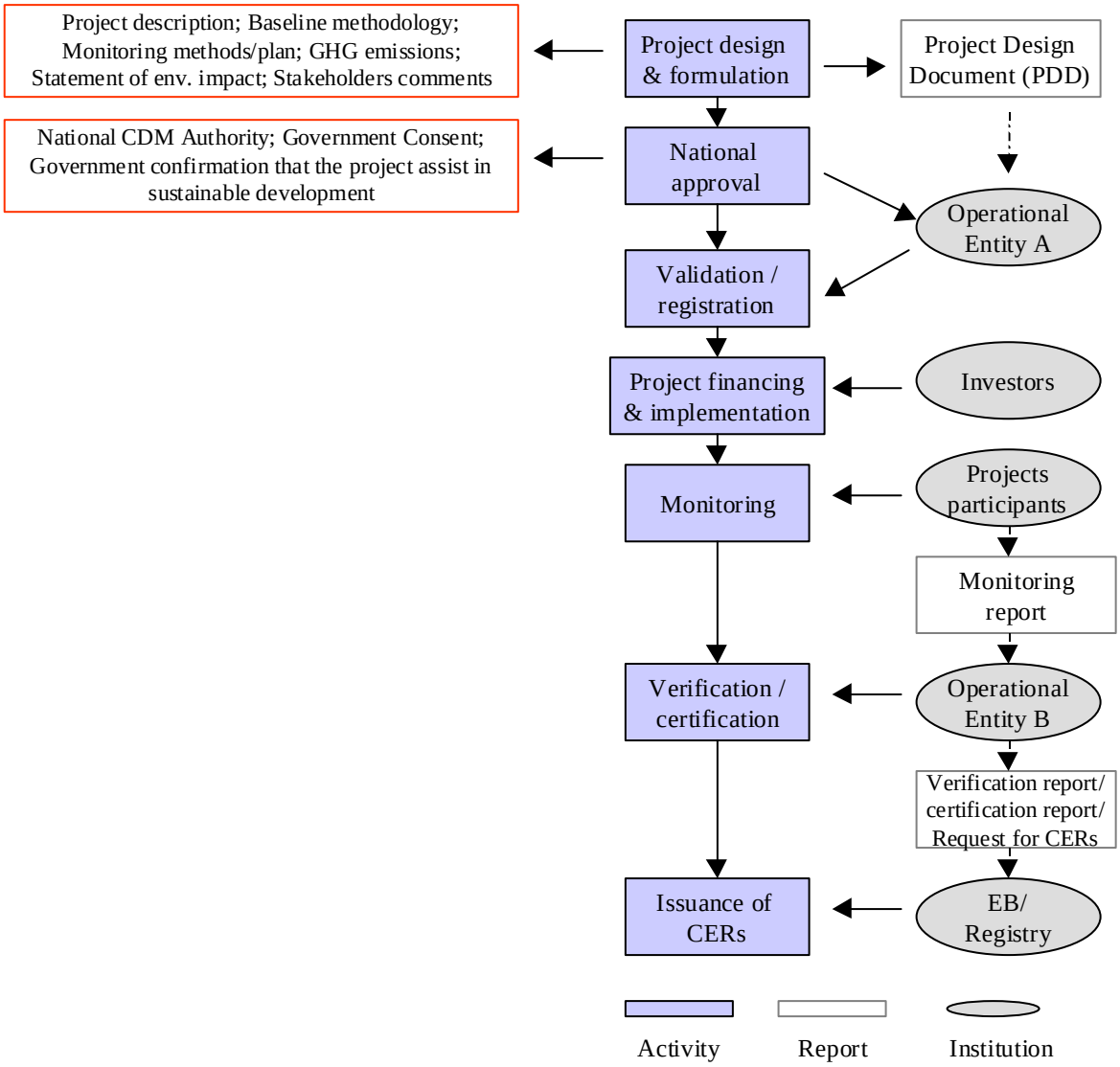

Figure 4: Project cycle of CDM.

Therefore, a preliminary step to undertake a CDM project is to assess project additionality with respect to current conditions.

"A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity."

CDM – Executive Board (EB, UNFCCC/CCNUCC[37]) defined a "Tool for the demonstration and assessment of additionality", which is dated October 22nd 2004. Scheme proposed by EB is presented in **Figure 5**.

[37] United Nations Framework Convention on Climate Change - Convention-cadre des Nations Unies sur les changements climatiques

Step1: identify baseline alternatives and show they are in compliance. Project participants may choose to apply either step2 or step3
Step2: show the proposed project activity is less attractive w/o CDM
Step3: explain the proposed project activity faces barriers
Step4: discuss prevalence of similar activities
Step5: explain it relieves existing financial hurdles or other barriers if the project is approved as a CDM activity

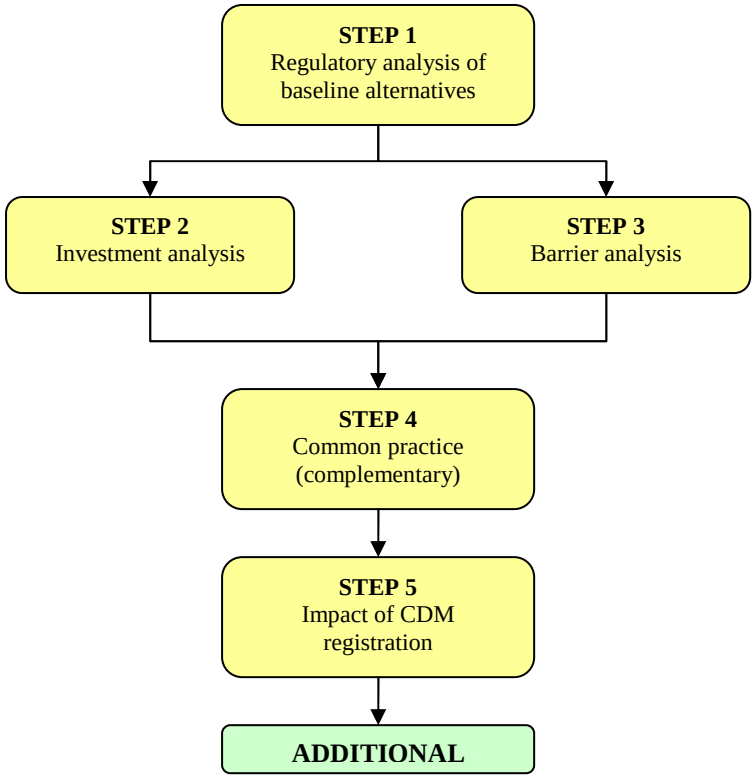

Figure 5: Additionality scheme proposed by EB

A wide range of technologies may be considered in the context of CDM projects and, certainly in the case of the more complex technology-trains, a more thorough study may be necessary to establish feasibility. Furthermore, a check must be made to ensure that the proposed project fully complies with any requirements imposed by the host-country.

If the feasibility-study indicates that it is possible in principle to develop a CDM project, the next step is to prepare a Project Design Document (PDD[38]) to set out the following information:

A general description of the activity.

(a) The baseline case (see above).
(b) Duration of the project/period expected for earning CER.
(c) The methodology and plan for monitoring.
(d) Calculation of emissions of GHG from the various relevant sources.
(e) Environmental impacts.
(f) Comments from stakeholders.

If there appears to be no methodology that has already been approved by UNFCCC for assessing (a) the baseline case, and (b) the proposed improved project, in terms of its emissions, the developer must propose a new methodology to UNFCCC for its approval. The same requirement for approval by UNFCCC applies also to the methodology and plan for monitoring.

Developers will also be required to provide information about the environmental impacts of each project, including trans-boundary impacts where applicable. In those cases where there may be significant impacts, a full Environmental Impact Assessment must be undertaken, and the report submitted to UNFCCC.

[38] A format for the PDD, and guidance for its drafting, can be down-loaded from the UNFCCC's Web-site at: http://cdm.unfccc.int/Reference/Documents.

The next step for the developer is to submit the PDD for validation to a "*designated operational entity*" (DOE) that has been approved by UNFCCC. If the methodology that has been used for the baseline case is one that has already been approved by UNFCCC, the DOE will validate it immediately. But, if a new methodology has been proposed, the DOE will submit this and the rest of the PDD to the UNFCCC's CDM Executive Board (EB) for review and approval.
The whole process of preparing and submitting for approval the PDD can be handled by the developer or by specialised consultants[39].

Registration of approved projects signals formal acceptance of them by the EB. This is a prerequisite for the verification, certification and issuance of certificates for "*certified emission reductions*" (CER).

After approval, the project must be implemented in accordance with the PDD, including all aspects of monitoring set out therein.

The monitored reductions in emissions of GG must be periodically determined and verified by another DOE (i.e., except in the case of small projects, a DOE that is independent of the validator), which will then certify those reductions in a report to the EB, which will then issue the CC accordingly; the CC can then be sold into the market.

5.3.1 Methodologies for CDM Projects

At UNFCCC site it is possible to see a complete list of methodologies presented for CDM projects (http://cdm.unfccc.int/methodologies/PAmethodologies).
Some methodologies have already been approved by CDM Executive Board, while newly proposed methodologies are continuously being evaluated through a multi-stage process (see **ANNEX A**).

5.3.2 Methodologies for small scale CDM project activities

The Marrakech Accords[40] establish the possibility of introducing fast-track modalities and procedures for small-scale projects, recognising that the sustainable development benefits of these projects can be high but that these projects may not have the economies of scale or levels of emissions reduction that larger projects enjoy[41].
The definitions of small-scale projects, set out in the Marrakech Accords, are as follows:

1. Renewable energy project activities with a maximum output capacity equivalent of up to 15 MW (installed or rated capacity[42]); type I category covers renewable energy projects including: Solar, wind, hybrid systems, biogas or biomass, water, geothermal and waste.
2. Energy efficiency improvement project activities which reduce energy consumption on the supply and/or demand side, by up to the equivalent of 15 GWh per year; type II covers supply side projects and end-use projects including residential, service, industry, transport, agricultural machineries and cross-cutting technologies which result in improvement in per unit power for the service provider or in reduction of energy consumption in watt hour in comparison with the approved baseline.

3. Other project activities that reduce anthropogenic emissions by sources and that directly emit less than 15 kilotonnes of CO2 equivalent per year. Type III covers agricultural projects, fuel switching,

[39] Further information on the process of validation and on DOE is available on the UNFCCC's Web-site at: http://cdm.unfccc.int/Reference/Procedures and: http://cdm.unfccc.int/DOE. A list of DOEs can be found on: http://cdm.unfccc.int/DOE/list.
[40] COP 7, Marrakech, Morocco, November 2001.
[41] It may be the case, at least in the first compliance period (2008 - 2012), that the CDM market is limited, and that larger projects could 'crowd' out the smaller projects, due to the comparatively higher price of the emission reductions generated by small-scale projects.
[42] On contrary, the load factor which would affect the real output is not taken into consideration.

industrial processes and waste management. Possible examples in the agricultural sector include improved manure management, reduction of enteric fermentation, improved fertilizer usage or improved water management in rice cultivation.

In order to reduce transaction costs for small-scale CDM, modalities and procedures are simplified as follows:

(a) Project activities may be bundled or portfolio bundled at the following stages in the project cycle: the project design document, validation, registration, monitoring, verification and certification. The size of the total bundle should not exceed the limits set out for the three project types (i) to (iii) above;
(b) The requirements for the project design document are reduced;
(c) Baseline methodologies by project category are simplified to reduce the cost of developing a project baseline;
(d) Monitoring plans are simplified, including simplified monitoring requirements, to reduce monitoring costs; and
(e) The same operational entity may undertake validation, and verification and certification.

A simplified baseline and monitoring methodology listed in Appendix B of Annex II to decision 21/CP.8 (FCCC/CP/2002/7/Add.3) may be used for a small-scale CDM project activity if the project participants are able to demonstrate to a DOE that the project activity would otherwise not be implemented due to the existence of one or more of the following barriers:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

But these simplifying measures do not necessarily address the issues that concern buyers and traders. It will probably be necessary for one developer to aggregate projects so that sufficient CERs are on offer with adequate security to draw the attention of market-actors. Otherwise, perhaps several developers can find a secure way to act in a concerted entity.
A couple of examples of the scale of expectations for CER for various types of projects are given in **ANNEX B**.

5.4 The market-value of CER

It is important to realise that (a) the market for Carbon credits is young and thus illiquid at present; and (b) the rules and policies for trading in carbon are slightly different in various markets, but that such differences are likely to be ironed out over time. So, for example, whereas other states in the EU-ETS have used a tonne of carbon dioxide (CO_2) as the standard unit of emissions of GHG, the UK has used carbon. And, whereas the EU-ETS refers only to emissions of (CO_2), the UNFCCC's systems offer credits for reductions in emissions of six GHG[43].

[43] To take account of their effects on climate-change relative to the influence of CO_2, factors are applied to the other five GHG, and the totality is then expressed as "*equivalent carbon dioxide*" (CO_2e). For example, one powerful GHG is methane (CH_4), which is taken to have, volume for volume, 21 times more intensive effects on global warming than CO_2.

Prices in European Trading Scheme (ETS)

Prices on the early trades of the EU ETS have reached values around 12-14 € in the end of year 2003-beginning of 2004, then they have been between 7 and 10 € in the second half of year 2004, but have increased substantially in 2005 (**Figure 6, a**) and overcome the value of 20 € in June 2005. However, as regards recent prices, it can be said that they have been rather volatile in June and July 2005 (**Figure 6, b**)[44], as the market is just starting to develop.

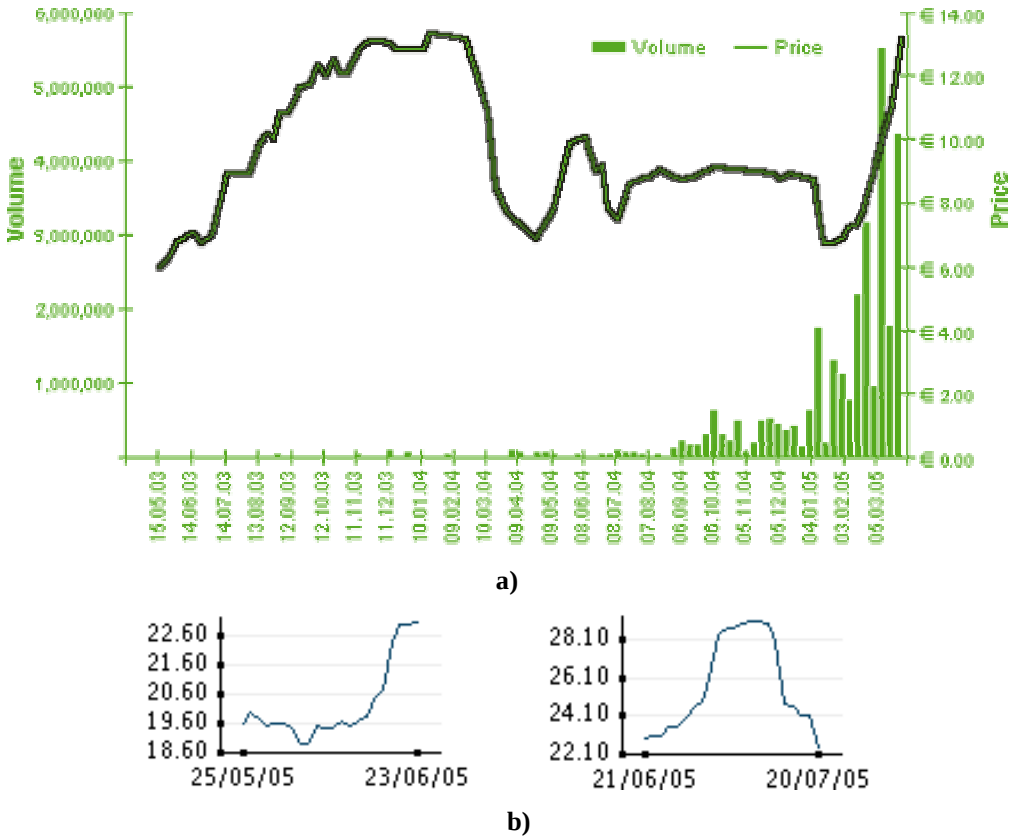

Figure 6: Prices of CO2 emissions in European Trading Scheme (ETS), €/t. a) Period May 2003-March 2005; b) Period 25/05-20/07, year 2005. Source: PointCarbon[45]

CER/ERU Prices

The most important early buyers of carbon-credits have been large institutional bodies like the World Bank's Prototype Carbon Fund (WBPCF) and national governments, such as the Dutch Government's *Carboncredits.nl* Programme. According to publications of the CCPO (Climate

[44] In the UK, the Government's Department of the Environment, Food and Rural Affairs has estimated that the real cost of emissions of fossil carbon is about £70/tonne (i.e. about 28 Euros/tonne of CO_2), but the existing relevant environmental tax on electricity in the UK – the Climate Change Levy (CCL) – has been set at £4.30/MW_eh, which is equivalent to £37/tonne of carbon, and thus to about 15 Euros/tonne of CO_2. Incidentally, the CCL is not levied on residential users, who consume a very large quantity of fossil fuels for heating, etc. Furthermore, although it is levied on industrial companies, they can achieve large reductions in their tax-bills by engaging in approved programmes for promoting energy-efficiency, etc.

[45] Point Carbon's volume-weighted assessment is based on over-the-counter (OTC), brokered trades. Every day, active brokers in the EU emissions trading scheme volunteer to supply their market information at close of market to Point Carbon. Each broker acts with the permission of their management. The brokerages act independently from each other and the information they provide is confidential and held by Point Carbon. The data is not circulated outside Point Carbon and is used solely for compiling the market assessment. The price refers to one EU allowance, equivalent to one metric tonne of carbon dioxide emissions. Adopted methodologies are Volume-weighted methodology or Bid-offer close methodology.

Change Projects Office, 2004), the WBPCF was offering about 3 Euros/tonne of CO_2e about a year ago, but was planning to introduce another scheme that would offer a higher price for credits that demonstrate a high level of community benefits. CCPO's document also refers to a Dutch system that then offered a range of values, from a maximum of about 3 Euros/tonne of CO_2e for a project entailing flaring methane at a landfill, to a maximum of about 5 Euros/tonne of CO_2e for projects generating electricity from renewable sources.
Current prices of flexible mechanisms certificates (CER and ERU) are, indeed, much lower than ETS certificates. Range of prices found for ERs, VERs, CERs[46] and ERUs from January 2004 to April 2005, are reported in **Figure 7**[47].

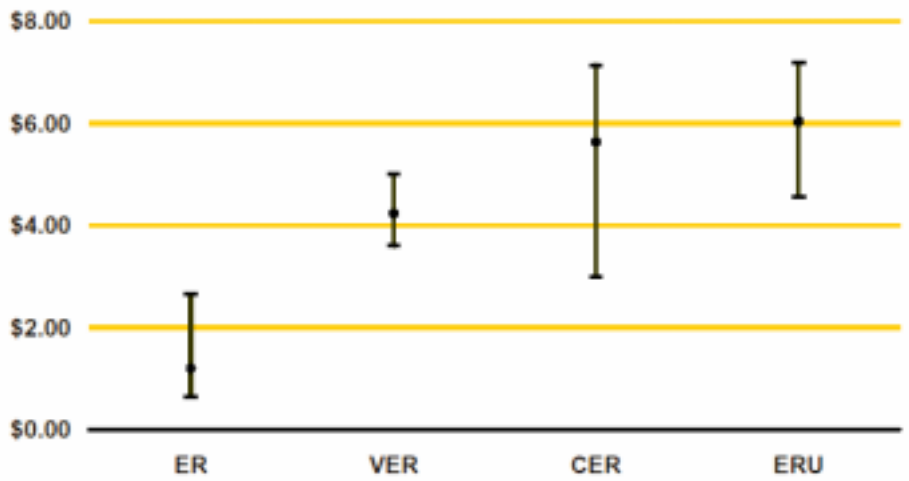

Figure 7: average prices for non-retail project-based ERs (period january 2004-april 2005; in US $ per tCO_{2e}). Source: IETA, 2005.

Most recent reports from Point Carbon (a major international carbon broker) point to recent upward movement in the CER price — driven increasingly by demand for them within the EU trading system. The June issue of the CDM & JI Monitor reports CER offer prices in the 5 to 7 Euro range (for abatement certificates from yet-to-be-registered CDM projects), and trades for registered CERs occurring at above the 10 Euro mark[48].
Prices depend on structure, vintage, creditworthiness of seller (sometimes also buyer). CERs are created through the successful operation of an eligible project. They are lower than EUA prices due to risks affecting the CER/ERU creation (JI/ CDM eligibility, project performance risk and CER/ERU transfer risks).
It can be pointed out here that risk of eligibility of CDM projects is reduced as CDM EB has become operational and procedures clearer[49]. Besides, transfer and delivery risk is also reduced for CDM as CDM registry is being set up (first phase terminated)[50].

[46] CER = a unit of GHG reductions that has been generated and certified under the provisions of the Kyoto Protocol for Clean Development Mechanisms (CDM); VER = a unit of GHG reductions that is verified (by third parties) and traded outside of Kyoto compliant mechanisms. ER = a unit of non-verified/certified GHG reductions.
[47] The best way to determine such values is to open discussions with potential buyers and traders who are interested in this market. Initial soundings suggest, for planning purposes, a prospective value of about 6 Euros/tonne of CO_2e for suitable projects. At least two key issues arise in the consideration of what will constitute "*suitable projects*" for this purpose: potential buyers and traders will be seeking projects that are (a) **large** - generating more than, say, 50,000 CER/year; and (b) **secure** – their counter-parties will have to achieve high levels of credit-rating.
[48] Point Carbon (2005), CDM Market Comment, CDM & JI Monitor, 14 June 2005 (p.2). www.pointcarbon.com.
[49] On the contrary, JI Supervisory Committe is to be elected by COP/MOP 1 (The Conference of the Parties serving as the Meeting of the Parties), to be held in November/December 2005, together with COP 11.
[50] On the contrary, for ERU, host country transfer risk is increased due to commitment period reserve (90% of AAUs or latest 100% of latest inventory).

How to trade ERUs, CERs, EUAs

Emission reductions certificates (ERUs, CERs, EUAs) can be traded by direct or indirect contracting.

Direct contracting can be done in two manners: a) Bilateral, i.e. two companies dealing directly (so that they have to be experienced counterparties) and b) through Broker, i.e. over the counter. In the latter case, key factors are: ability to achieve best price, access to large pool of buyers, expert advice on how to structure transaction, tailored transactions, assistance with technical, financial due-diligence, possibility to ensure anonymity, important if large volumes need to be traded. Exchanges do not yet exist, as there is still the necessity to develop clearing system and standardised contracts.

Indirect contracting is based on funds and financial institutions. This option is particularly good for inexperienced buyers, but it is characterised by inflexibility, as the client locks into a specific price for larger volumes. Besides, the client has to check out capabilities, capital, creditworthiness and track record of fund managers.

5.5 Use of CDM projects for compliance with EU ETS Directive – the Linking Directive

The EU emissions trading scheme (ETS) is based on a recognition that creating a price for carbon through the establishment of a liquid market for emission reductions offers the most cost-effective way for EU Member States to meet their Kyoto obligations (**ANNEX D**) and move towards the low-carbon economy of the future.
The scheme is based on six fundamental principles:

- It is a 'cap-and-trade' system
- Its initial focus is on CO2 from big industrial emitters
- Implementation is taking place in phases, with periodic reviews and opportunities for expansion to other gases and sectors;
- Allocation plans for emission allowances are decided periodically
- It includes a strong compliance framework
- The market is EU-wide but taps emission reduction opportunities in the rest of the world through the use of CDM and JI, and provides for links with compatible schemes in third countries.

As soon as a compromise on the ETS directive (2003/87/EC) was found, the European Commission proposed an amending Directive, which will allow operators in the ETS to use credits from the Kyoto Protocol project mechanisms - Joint Implementation (JI) and the Clean Development Mechanism (CDM) - to meet their targets in place of emission cuts within the EU.
The EU scheme is the first in the world that recognises most of these credits as equivalent to emission allowances (1 EUA = 1 CER = 1ERU) and allows them to be traded under the scheme[51].

Nonetheless, the text of the Linking Directive finally adopted (2004/101/EC), introduces some qualitative limitations: 1) credits from land-use change and forestry (sinks) project are excluded for the period 2005-7 and their subsequent introduction will be determined by a Commission review. 2) Hydroelectricity projects are allowed, but it is required to take into account international criteria such as those elaborated by the World Commission on DAMs, especially for projects with a generation capacity of over 20 MW. 3) Credits from nuclear power projects are excluded, which reiterates the language under the Kyoto Protocol, which does not allow such projects to be counted as generating emission reduction credits.
A quantitative limitation is also defined for the period 2008-2012: Member States will have to specify (taking into account supplementarity requirement of the Protocol) a limit up to which individual installations will be able to use external credits to comply with the ETS, expressed in x% of initially allocated allowances for that installation.

[51] Import of CERs is permitted from 2005, ERUs from 2008

Companies are not the only ones looking for emission reduction credits through JI and CDM. Member States intend to use such credits themselves to help meet their emission target under the Protocol. As of October 2004, Member States had provisionally indicated in their national allocation plans that they intend to procure 500–600 million tonnes of CO2 credits for the period 2008–12. Since the majority of JI and CDM projects tend to generate emission reductions averaging between 500.000 and one million tonnes of CO2, EU countries' demand for emission credits can only be satisfied through a great number of such projects. As 2008 draws nearer, EU Member States are actively seeking JI and CDM projects and a number of project contracts have already been signed (see, e.g., **5.5.1**).
With this strong demand for emission credits building up rapidly, major European banks are becoming active in providing finance for prospective emission reduction projects. At the end of 2003, the European Investment Bank created a dedicated financing facility of € 500 million. Likewise, Germany's European banks are considering similar initiatives.
It is likely that strong driver for CER, ERU prices will be the demand from governments and from EU, Canadian and Japanese companies.

In order to promote development of CDM projects, countries in Annex I are signing Memoranda of Understanding (MoUs) with non-Annex I countries.
A MoU is a bilateral (non-binding) agreement between two countries, which is intended to facilitate the processing of JI/CDM projects.
Agreements established by European Countries for CDM projects are reported in **ANNEX D**.

In the next paragraphs, the CDM policies of countries that are possible buyers of credits from Sri Lankan projects (i.e. The Netherlands and Italy) are presented.

5.5.1 The case of The Netherlands and CDM

The Netherlands are one of the first countries which have earmarked public funding for buying CO_2 reductions by CDM. The Ministry of Housing, Spatial Planning and the Environment (VROM) is responsible for the implementation of CDM schemes.

The Dutch government has a substantial budget available for the implementation of CDM. In April 2001, the Ministry of VROM set up a CDM Division as part of the International Environmental Affairs Directorate of the Ministry. The responsibility of the division is to use the funds allocated by the Dutch government to purchase Certified Emission Reductions (CERs) from sustainable projects in developing countries in a cost-effective manner.

The Ministry of VROM intents to purchase CERs through the following four tracks:

1. Multilateral international financial institutions;
2. SENTER International, a Dutch agency acting on behalf of several Dutch Ministries;
3. Private financial institutions;
4. Bilateral purchase-agreements with Host Countries.

Via the above ways VROM is contracting various organizations to act as intermediaries for the purchase of CERs. Under the guidance of VROM, these intermediaries select sustainable projects in developing countries and purchase the resulting CERs for the benefit of the Ministry. Investors from all countries may submit CDM-project proposals to these intermediaries that will judge these projects, including the compliance with the requirements.

Agreements with these intermediaries are described hereafter.

The World Bank[52] announced an agreement with the Netherlands in May 2002, establishing a facility to purchase greenhouse gas emission reduction credits. The Facility supports projects in

[52] International Bank for Reconstruction and Development (IBRD).

developing countries in exchange for such credits under the Clean Development Mechanism (CDM) established by the Kyoto Protocol to the UN Framework Convention on Climate Change (See **ANNEX C**)[53].
Another new fund managed by the International Finance Corporation of the World Bank Group on behalf of the Dutch Government is the IFC-Netherlands Carbon Facility (InCAF). According to the IFC website InCAF is an arrangement under which the IFC will purchase CERs for the benefit of the Government of The Netherlands[54]. The Netherlands will use these emission reductions to help meet its commitments under the Kyoto Protocol. It has allocated € 44 million for InCAF to be used over the next three years[55].

Finally, within the context of establishing GHG opportunities on the buy and sell side, Latin American Carbon Program, (PLAC in Spanish) is engaged in diversifying the buyer pool of emission reductions which benefit CDM projects in Latin America and the Caribbean. An example of these activities is the current CAF-Netherlands CDM Facility or CNCF. The CAF-Netherlands CDM Facility focuses on public and private sector transactions, located in countries in Latin America and the Caribbean.

The Netherlands have already signed many contracts to buy emission credits from CDM and JI projects. The CDM projects are reported in **Table 14**.

Table 14: Dutch CDM Projects

PROJECT	CATEGORY	INVESTOR	LOCATION
Columbo Bagasse cogeneration project	Energy Efficiency		Brazil
Fortuna hydroelectric project	Large Hydro	CERUPT	Panama
Huitengxile wind project	Renewables	CERUPT	China
Onyx landfill gas project	Gas Capture or destruction	CERUPT	Brazil
Kalpataru biomass plant project	Renewables	CERUPT	India
Rio Azul landfill gas capture project	Gas Capture or destruction	CERUPT	Costa Rica

[53] The Facility's initial target was to purchase 16 million tons of carbon dioxide equivalent (mtCO2e) in the first two years of the agreement. The agreement has now been extended, with a firm commitment to purchase an additional five mtCO2e by mid-2005. The agreement also allows for a further purchase of up to approximately 11 million tons of carbon dioxide equivalent.

[54] InCAF is looking for projects with the following characteristics:
- Location: projects can be located in most developing countries. Projects in newly industrializing countries in Central and Eastern Europe are not eligible. A list of eligible countries is available on request.
- Likely project closing: projects must be likely to reach financial closing within the short term.
- IFC and non-IFC investments: InCAF prefers to work with projects in which IFC is an investor but will also consider non-IFC financed projects. For non-IFC projects, the InCAF will look for well-established sponsors with access to confirmed sources of conventional financing. Non-IFC projects will require additional due diligence on project fundamentals.
- Environmental and social impact: all projects, including non-IFC financed projects, must comply with IFC's environmental and social policies and guidelines. Projects that have large-scale adverse environmental or social impacts will not be considered.
- Host country approval: the government of the host country will have to approve the project. IFC can support the application of the project company to the government for such approval. The host country will also need to have ratified, or initiated domestic procedures to ratify, the Kyoto Protocol.
- Independent Verifications: the initial design of the project will need to be validated by an Operational Entity, as required under the Kyoto Protocol. Once a project is operational, the emission reductions produced by a project must be verified and certified periodically by auditors.

[55] InCAF will provide additional revenues to eligible projects that generate emission reductions in developing countries. InCAF will make future payments to the project over a period of 7-14 years upon annual certification of actual greenhouse gas emission reductions. In return for these payments, The Netherlands will receive the CERs. It is possible that InCAF will consider advance payments under certain conditions. A contract between InCAF and the project will specify the volume of emissions that are expected to be reduced, the price agreed per ton of CO_2 equivalent, and the crediting period.

PROJECT	CATEGORY	INVESTOR	LOCATION
V&M do avoided fuel switch project	Fuel Switching, Gas Capture or destruction	IFC-Netherlands Carbon Facility (INCaF)	Brazil
NovaGerar landfill gas project	Gas Capture or destruction	Netherlands CDM Facility	Brazil
Gujarat HFC23 decomposition project	Gas Capture or destruction	RaboBank	India
Haidergarh bagasse co-generation project	Renewables	IFC-Netherlands Carbon Facility (INCaF)	India
TransMilenio urban transport project	Transport	CAF-Netherlands CDM Facility	Colombia
Vinasse anerobic treament project	Gas Capture or destruction, Renewables	CAF-Netherlands CDM Facility	Nicaragua
Poechos hydroelectric project	Large Hydro	Netherlands CDM Facility	Peru
Matuail landfill gas project	Gas Capture or destruction, Renewables	World Wide Recycling (Netherlands)	Bangladesh
Villa Dominico landfill gas project	Gas Capture or destruction	Van der Wiel Stortgas	Argentina
Santa Cruz landfill gas project	Gas Capture or destruction	Grontmij Climate & Energy	Bolivia
Anding landfill gas project	Gas Capture or destruction	Energy Systems International BV	China
Matuail landfill organic waste composting project	Gas Capture or destruction, Renewables	World Wide Recycling (Netherlands)	Bangladesh
Shri Bajrang waste heat recovery project	Energy Efficiency	BHP Billiton International Metals BV	India

5.5.2 The case of Italy and CDM

In Italy, project-based carbon credits are expected to offset national emissions reduction of the first CP between 10% and 50%. So, flexible mechanisms will complement Italian internal policies, on account of their greater convenience in terms of the unit cost for reducing emissions.
Flexible mechanisms will contribute to the overall foreseen reduction through activities sponsored by public institutions and activities carried out by private companies.
The exact extent, to which flexible mechanisms will contribute, will depend on the evolution of both the carbon market as well as national abatement costs.

Table 15: Emissions scenarios and reduction target for period 2008-2012 (Mt di CO_2).

"Business as usual" scenario	*"Reference" scenario (measures already approved or established)*	*Emissions target (Kyoto protocol)*	*Further reduction necessary to reach emissions target*
579,9	528,1	487,1	41,1

⇓

FROM ENERGY SOURCES	**444.5**	
Energy industries, of which:	144.4	**-26**
- thermoelectric	*124.1*	
- refinery (direct consumptions)	*19.2*	
- others	*1.1*	
Manufacturing and construction industries	80.2	
Transportation	134.7	**-7,5**
Residential and tertiary	68	**-6,3**
Agriculture	9.6	
Others (fugitives, military, distribution)	7.6	
FROM OTHER SOURCES	**95.6**	
Industrial processes (mineral and chemical industries)	30.4	
Agriculture	41	
Waste	7.5	
Others (solvents,fluorinated)	16.7	
CARBON CREDITS FROM JI AND CDM	**-12**	**-12**
TOTAL	**528.1**	**-51,8**

Considering that target for Italy for period 2008-2012 is 487,1 Mt of CO_2 emissions, it is necessary to identify policies and measures for a further reduction of 41 Mt CO_2 (**Table 15**). To achieve this result, Italian Plan specifies two broad options of additional measures: national reduction measures and international flexible mechanisms, as reported in **Table 16**[56].

Table 16: Options for the adoption of additional emission reduction measures.

	Potential reduction (Mt CO2 eq /year)
A) ADOPTION OF ADDITIONAL NATIONAL REDUCTION MEASURES	**30,4-44,2**
Use of energy sources	**22,3-35,4**
Industrial sector	5,1-9,6
Renewable sources	1,8-3,4
Residential and tertiary sector	3,8-6,5
Agricultural sector	0,28-0,34
Transport sector	11,3-15,6
From other sources	**8,15-8,80**
B) USE OF THE JI AND CDM MECHANISMS	**20,5-48**
Carbon removal	**5-10**
JI projects	2-5
CDM projects	3-5
Projects in the energy sector	**15,5-38**
JI Project to improve the efficiency of electricity generation and industrial activities	3-10
CDM projects for the production of energy from renewable sources	1-5
CDM projects to improve the efficiency of electricity generation and industrial activities	1.5-3
JI and CDM gas-flaring and gas-venting projects in oil wells	10-20

It can be noticed that the entire gap to reach the final target could be covered by means of flexible mechanisms.

Italy has so far signed Memoranda of Understanding with several countries (see **ANNEX D**). Furthermore, Italy enhanced international cooperation programmes with the Balkans and Southern Mediterranean countries through the MEDREP initiative[57].
In order to explore the potentials of investment in credit generating mechanisms Italy has a) signed an agreement to contribute US$7.7 million to the World Bank's Community Development Carbon Fund (CDCF). The Fund supports small-scale projects in the least developed countries (LDC) and poor communities in developing countries which generate GHG emissions reductions; b) signed an agreement to contribute US$2.5 million to the World Bank's BioCarbon Fund. The Fund supports afforestation and reforestation projects; c) set up the Italian Carbon Fund with the World Bank for GHG emissions reductions.

The BioCarbon Fund will provide carbon finance for projects that sequester or conserve greenhouse gases in forests, agro- and other ecosystems. It is designed to ensure that developing countries, including some of the poorest countries, have an opportunity to benefit from carbon finance in

[56] Among the detailed measures, a selection will be made by Inter-ministerial Committee for GHG reduction. Priority criterion will be the cost-effectiveness of the various options.
[57] The Mediterranean Renewable Energy Programme (MEDREP) was launched as a Type II Initiative at the World Summit on Sustainable Development in Johannesburg, following the recommendations of the G8 Renewable Energy Task Force. MEDREP projects are being developed under the framework of bilateral agreements between Italian Ministry of Environment and Territory (IMET), Algeria, Egypt, Morocco and Tunisia. The pilot projects will represent best practices to be replicated. IMET has allocated 8 million € to support the start-up of the projects. Where possible, MEDREP projects will be structured as carbon finance or green certificate transactions under the auspices of the Clean Development Mechanism or Green Certificate Trading regimes

forestry, agriculture and land management. The Fund will help reduce poverty while reducing greenhouse gases in the atmosphere[58].

Italian Carbon Fund (created in agreement by the World Bank and the Ministry for the Environment and Territory of Italy) is a fund to purchase greenhouse gas emission reductions from projects in developing countries and countries with economies in transition that may be recognized under such mechanisms as the Kyoto Protocol's CDM and JI[59].

5.6 CDM projects in Sri Lanka[60]

Sri Lankan project developers are currently proposing 19 CDM projects, which are in different states of the design/validation process. These projects are mainly based on the introduction of renewable/alternative energies (hydro, biomass and landfill gas) and of forestry initiatives.

Table 17: Sri Lanka CDM Projects

PROJECT	CATEGORY	Investor for Carbon Credits	STATE
Projects for which carbon credits have already been sold			
PV panels (how many planned?)	Solar photovoltaic	GEF/World Bank [1]	10.000 Panels installed Credits sold
Minihydro, 15 grid-connected projects?		GEF/World Bank	Some built Credits sold
8 MW biomass		GEF/World Bank	Not built
Projects for which carbon credits buyers are being sought (if buyers are not found World Bank will buy carbon credits at minimum price?)			
1 MW Biomass Power Plant, Walapane	Biomass		PDD
Delta, Halgran Oya, Sanquhar power project	Hydro		PIN
1 MW Biomass Power Plant of Informatics Agrotech	Biomass		PDD

[58] The types of projects may include small, community-promoted plantations for timber, biofuel and other forest products. Though, these plantations have to fit within a broader landscape design. In this sense, the BioCarbon Fund does not exclude commercial scale plantations per se. However, in most cases such plantations will not meet the CDM additionality requirement, i.e. the plantation project could proceed without the incentives provided by the CDM.

[59] Main features of Italian Carbon Fund are:

- The fund supports projects eligible under the Kyoto Protocol's CDM and JI mechanisms through the purchase of credits;
- The fund is a public-private partnership currently endowed with US$ 15 million, but with a target size of US$ 80 million;
- The fund will buy emissions reductions credits, but at the same time will assist host countries in achieving sustainable development by leveraging substantial investments in modern energy services and technologies, including investments from the private sector;
- The fund is operational since January 28th, 2004;
- The income from payments received from the participants in the fund will be held in a separate trust and used for capacity-building and research—thus leading to the creation of supportive project approval systems in host countries;
- The Fund's project portfolio is proposed to include support for a wide range of technologies and regions, including China, the Mediterranean Region, as well as the Balkans and the Middle Eastern countries.

[60] Sri Lanka has recently (beginning of year 2005) signed a CDM MoU (Memorandum of Understanding) with Canada. Moreover, the British Government conducted a study on CDM projects titled "Initial evaluation of CDM type projects in developing countries". Sri Lanka was one of the countries studied. The reports can be found at http://www.surrey.ac.uk/eng/ces/research/ji/cdm-dfid.htm. The UK Department for International Development (DfID) funded a project coordinated by Ecosecurities to examine the developmental potential of the CDM; to investigate strategies to encourage CDM investment flows in small to medium developing countries; and to suggest ways that donors could get involved in capacity building to facilitate the participation of these developing countries in the CDM. The project had four developing country partners - Bangladesh, Colombia, Ghana and Sri Lanka - for which country papers are available.

PROJECT	CATEGORY	Investor for Carbon Credits	STATE
Aqua Power (Pvt) Ltd – Labuwawa Mini Hydropower project	Hydro		PIN
Tokyo Cement Biomass Power Project, Trincomalee	Biomass		PIN
SJL Holdings (Pvt) Ltd	Hydro		PIN
Coconut shell carbonising gas based power generation	Biomass	Japanese Fund ?	PIN
Rubber cultivation for Sustainable Development Forestry	Forestry		PIN
Assupiniella Small Hydro Power Project	Hydro		PIN
Vanasaviya Biodiesel Production	Biomass/Biofuels		PIN
Biomass Power Project at Amapara	Biomass	Dutch Fund – PREGA [2] ?	PIN
SJL Minihydro (Pvt) Ltd	Hydro		PIN
Adavikanda Small Hydro Power Project	Hydro		N.A.
Barcaple Small Hydro Power Project	Hydro		N.A.
Erathna Small Hydro Power Project	Hydro		N.A.
Way Ganga Small Hydro Power Project	Hydro		N.A.
Landfill Gas Energy Project	Gas capture for energy recovery		N.A.
Sri Lanka Tsunami affected Mangrove forest rehabilitation project	Forestry	BioCarbon Fund?	PIN

[1]GEF is a partnership among UNDP, UNEP and the World Bank. It operates as a mechanism for providing new and additional grant and concessional funding to meet the agreed incremental costs of measures to achieve agreed global environmental benefits in the four focal areas - Climate change; Biological diversity; International waters; and Ozone layer depletion (in 2001, Persistent Organic Pollutants (POPs) program was also added in the GEF).

[2] The Asian Development Bank (ADB) is administering the Dutch funded Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement - PREGA - program which will help will carry out pre-feasibility studies of investment projects for financing consideration through commercial, multilateral, and bilateral sources, including specialized treaty-linked mechanisms such as the Global Environment Facility and the Clean Development Mechanism. It is being implemented in the following developing countries: Bangladesh, Cambodia, China, India, Indonesia, Kazakhstan, Kyrgyz Republic, Mongolia, Nepal, Pakistan, Philippines, Samoa, Sri Lanka, Uzbekistan, Vietnam.

Biomass potential for CDM projects

Figures of biomass availability for year 1997, obtained from the Sri Lanka Energy Balance, are presented in **Table 18**.

Table 18: Biomass availability in Sri Lanka (year 1997).

Type	Metric Tons / Year	%
Rice Husk available from commercial mills	179,149	6.2
Biomass from Coconut (plantations available for industrial use)	1,062,385	37
Sugar Bagasse	283,604	8.3
Bio degradable garbage	786,840	27.4
Saw Dust	52,298	1.8
Off cuts from Timber Mills	47,938	1.7
Biomass from Home Gardens such as Gliricidia	505,880	17.6
Total	**2,873,880**	**100**

However, according to Biomass Energy Association of Sri Lanka (BEASL), there is a potential for using scrub lands all over Sri Lanka to support the growing of fuel wood species (**Figure 8**).

Land Type	Extent – Ha	%
Natural forest	1,678,000	26
Forest Plantations	81,000	1
Industrial Plantations	769,000	12
Paddy Lands	799,000	12
Sparsely used crop lands	1,263,000	20
Range scrub lands	502,000	8
Other	1,408,000	21
Total	**6,500,000**	**100**

Figure 8: Land availability for dendro plantations in Sri Lanka.

Recent estimates show that available scrub lands add up to more than 1.6 million hectares. These energy plantations would lead to about 48 million tons per year of fuel wood[61]. Accordingly, theoretic potential for installed power fuelled from short rotation coppicing could reach 4.000 electric MW.

Short term potential is, however, estimated in 50-80 MWe, which correspond to about 250-450,000 tons of CO_2 emissions avoided.

Besides, in the long term, at least 10 clusters of biomass power plants of 100 MWe each are estimated as feasible. In this sense a possible figure for biomass-generated carbon credits over the next ten years is 7 millions of tons of CO_2, consisting of:
- 5 million tons for power generation;
- 1 million tons for industry;
- 1 million tons for forestry sequestration.

According to first pre-feasibility studies[62], economic incremental abatement cost of CO_2 for biomass projects could be around 3-4 $ / ton, while financial (incremental abatement) cost could reach values of 25-30 $ / ton.

6 CONCLUSIONS AND RECOMMENDATIONS

As underlined in previous paragraphs, European policy for biomass energy utilisation is primarily based on economic incentives to support different types of initiatives, i.e. fiscal incentives for thermal application and feed-in tariffs / green certificates for power production. In addition CDM mechanisms can be applied to increase financial viability of projects. Nonetheless, also other complementary policies (research on crops, research and demonstration of conversion technologies, standardisation of biofuels/waste, agriculture/forestry plans and regulations, plants authorisation procedures) are extremely important to create the conditions for a real growth of biomass sector. Therefore, these arguments should be considered in detail also when analysing problems and opportunities for the development of biomass energy in Sri Lanka and SE Asia. Particularly, the issue of tariffs to be established for biomass electricity is extremely relevant and needs to be studied thoroughly.
Accordingly, most important key issues to be considered are:

[61] Yield of, e.g., gliricidia is considered to be about 30 tons/ha.
[62] *Pre-feasibility Study for 1 MW Biomass Power Plant & CDM Project – Sri Lanka*, P.G.Joseph, Team Leader National Technical Expert - PREGA Project.

- Necessity to study different pricing mechanisms for biomass electricity
  - avoided cost of fuels and capacity charge are two components of electricity tariff that have to be correctly valued and applied to biomass power plants, considering plant scale but also grid-specific situations. For example a capacity charge for small power plants (< 5 MWe) could be applied in particular cases and an avoided cost of electricity transport could be applied if the plant is feeding a distribution network without connecting to transport network

- Necessity to study legislation and regulations that can favour a correct utilisation of biomass
  - classification of land available for short rotation coppicing
  - utilisation of agricultural residues (e.g. rice husks, coconut shells, etc.) for energy production

- Necessity to increase average installed power per unit (e.g. ≥ 10 MWe) for biomass power plants, to exploit higher efficiencies
  - necessity to promote regular, contract-based supply of wood between farmers and power plants
  - necessity to foster investments and to, possibly, allow investments from abroad (that might be connected to highly-efficient technology supply) by defining clear investment and taxation rules

- Necessity to better understand feasibility and benefits of specific interventions, like industrial co-generation, off-grid village schemes based on biomass power generation, replacement of conventional low-efficiency domestic stoves
  - as underlined by CEB (Ceylon Electricity Board)[63], initiatives that are, without any economic assistance, economically convenient can right away foster the development of biomass sector and put the premises for future better conditions for power generation, especially in the industrial sector whereas a relevant demand of energy (e.g. steam) is required and then a significant demand/supply of biomass can be generated. Besides, these initiatives can reduce energy costs for industries.
  - other initiatives could avoid the development of problematic and costly grid connections towards some not easily reachable villages and could reduce wood consumption and pollution at domestic level. These opportunities are to be studied thoroughly, also in view of potential support by CDM credits and by means of:
    - analysis of centralised/connected vs. distributed generation, in terms of cost/efficiency, availability of skilled workers, creation of jobs in rural areas, availability of biomass and logistics problems for supply.
    - analysis of environmental improvement and of avoided costs in domestic cooking (also for wood procurement). Development of a widespread and relevant biomass demand (for industries/power generation) would result in a significant opportunity cost[64] of biomass used for cooking that might make it convenient to invest in more efficient stoves.

- Necessity to better understand possibilities for biomass CDM projects
  - Necessity to thoroughly understand CDM rules on additionality and on possible replications of projects

[63] During a private meeting with BEASL and CTI representatives.
[64] Opportunity cost is a term used in economics, to mean *the cost of something in terms of an opportunity foregone* (and the benefits that could be received from that opportunity), or *the most valuable foregone alternative.*

- Necessity to appreciate costs of different reduction options (renewables, and in particular biomass; energy efficiency; waste recovery, etc.)
- Necessity to enhance links with European countries and with EU carbon credits market and correspondingly identify CDM projects interesting for EU actors

In view of all the above-mentioned issues that need to be addressed, it is deemed essential to form working groups that, by means of a correct balance of technical, political and academic competences and experiences, may, starting from the conference, study and analyse all these substantial themes in order to provide guidelines and manuals for a proper bioenergy exploitation in Sri Lanka and SE Asia.
Working groups should be working on the two following general themes:

- Policy measures for biomass-based electricity production in Sri Lanka, to draft proposals regarding biomass electricity pricing and other complementary measures (organisation and support of biomass supply, regulations to correctly produce and utilise biomass, rules to encourage investments) that could also foster other important biomass energy uses (industrial & domestic)
- Analysis of different CDM project-types (renewable energies like biomass, biogas; waste recovery; forestation), to identify concrete cases that might be adequate to set up bilateral EU-Sri Lanka agreements.

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Abbreviations.

The subject of this report is derived from newly implemented legal processes that have introduced new terms that are constructed from ordinary words, but which have special meanings. These terms are often referred to by the following abbreviations (which are used herein for both the singular and plural forms of the terms):

CCL - the UK's Climate Change Levy.

CCPO = the UK Government's Climate Change Projects Office.

CDM = the Clean Development Mechanism – a means within the **KM** to include those developing countries that are listed in Annex 2 of the Kyoto Protocol in the drive to reduce emissions of **GHG**.

CER = Certified Emission Reductions - verified credits granted to validated projects that can be sold on the carbon-market that can provide an extra income-stream for eligible projects in developing countries.

CO_2e = Carbon Dioxide Equivalent – the effect of six **GHG** on global warming expressed in terms of their equivalence in this respect to carbon dioxide..

DOE = Designated Operational Entity – a body that has been approved by **UNFCCC** to validate a **PDD**, and/or to verify **CER**. For any particular project, separate DOE are required for these two functions.

EB = Executive Board – the arm of **UNFCCC** that deals with **CDM**.

EU-ETS = the European Union's Emissions Trading Scheme.

GHG = the so-called "*Greenhouse gases*", which are a cause of global warming. The **UNFCCC**'s systems cover six GHG, which are measured, for the purposes of the **CDM**, in units of **CO_2e**.

IET = International Emissions Trading - a system to give market-value to **CER**, etc.

JI = Joint Implementation – a **KM** similar to **CDM**, but applicable to countries listed in Annex 1 of the Kyoto Protocol.

KM = Kyoto Mechanisms.

PDD = Project Design Document – a description of the proposed project that starts the legally secure process towards gaining **CER**.

UNFCCC - the United Nations' Framework Convention on Climate Change.

WBPCF – the World Bank's Prototype Carbon Fund.

8 ANNEXES

8.1 ANNEX A: Methodologies approved by CDM Executive Board (EB)

Approved methodologies can be found at UNFCCC/CDM site: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html. The methodologies are continuously revised and updated.
Approved methodologies for small-scale projects can be found at: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html
The additionality of the project activity shall be demonstrated and assessed using the Tool for the demonstration and assessment of additionality.
Graphic overview of procedures for submission and consideration of proposed new methodologies can be found at: http://cdm.unfccc.int/Projects/pac/howto/CDMProjectActivity/NewMethodology/graphmeth.pdf

8.2 ANNEX B: Examples of projects

Example 1. Using landfill-gas at a large landfill site.

Consider a landfill that contains about 1 million tonnes of mixed wastes that have been deposited within the past ten years, and is emitting substantial amounts of landfill gas (LFG) which, in the baseline case, is not controlled in any way. As a rule of thumb (which has to be checked by on-site pumping trials, etc.), there might be enough gas - say 600 Nm^3/hour of LFG consisting of 50 per cent by volume of each of CH_4 and CO_2 – to run a generating set rated at 1 MWe. If that set is run for 8,000 hours/year, it will destroy 300 x 8,000 = 2.4 million Nm^3/year of CH_4.
The density of methane at 0 ^oC and 1 bar is 0.717 kg/m^3, so the annual mass of 2.4 million Nm^3/year of CH_4 is about 1,720 tonnes which (in terms of effects on climate-change) is taken to be (using the factor of 21 – see above) equivalent to about 36,000 tonnes of CO_2.

In practice, the amount of CH_4 destroyed is likely to be larger because, to secure sufficient LFG for the generator(s), and over-sized gas-collection system would be installed because the output of LFG varies for several reasons. It is good practice to flare the excess LFG from such a system. It may be necessary to collect all of the LFG from the site for safety reasons, in which case even more LFG will have to be flared.

The treatment of this example will vary depending on the location of the site. Within the EU, the Landfill Directive requires the proper treatment of LFG, including drainage and high-grade flaring as necessary, and so, as that is a legal requirement anyway, a developer installing the necessary equipment could not expect attract credits under the JI. But that developer could expect credits in a JI from the displacement of electricity made from fossil fuels with electricity generated from LFG.

In contrast, in a developing country, there may be no such regulations, in which case, the develop would seek to receive credits under the CDM for both (a) the drainage and destruction of all of the treated methane (including that burnt in the generation of power), and (b) the displacement of electricity made from fossil fuels with electricity generated from LFG.

The exact basis for calculating CER has to take account of the particular circumstances offered by the project. For example, a typical power station burning hard coal emits about 0.80 tonnes of CO_2 for each MW_eh it generates, whereas the use of brown coal increases this to about 1.0 tonne of CO_2/MW_eh. And a generator running on diesel-oil also emits about 1.0 tonne of CO_2/MW_eh, while a power station fired with natural gas and using a combined-cycle gas-turbine emits only about 0.45 to 0.50 tonnes of CO_2/MW_eh, because of the better properties of the fuel and the more efficient process.

Example 2. Replacing coal with biomass at a power-station.

Consider as a baseline case a power station fuelled with coal that has a rated output of 30 MW_e, which operates at a conversion-efficiency of 33 per cent, and is run for 7,000 hours/year.

The properties of coal vary greatly. A medium-grade coal might have a gross energy-content of about 22 GJ/tonne (or about 6 MWh), and burning 1 tonne of that coal will produce about 2 tonnes of CO_2. If that coal is burned in a power station having a conversion-efficiency of 38 per cent, there will be about 0.9 tonnes of CO_2 emitted for each 1 MW_eh generated.

A developer might look at replacing the coal-burning power station completely with one that burns biomass of various kinds, or alternatively consider keeping the existing station but replacing some of the coal with wood in a so-called "*co-firing*" project, interest in which has grown rapidly within the UK over the past three years. The potential for producing CER is easy to visualise in both of these options.

8.3 ANNEX C: Netherlands CDM Facility – Project Selection Criteria

Projects shall be selected in accordance with the following Project Selection Criteria:
(a) **Consistency with United Nations Framework Convention on Climate Change (UNFCCC) and/or the Kyoto Protocol**. Projects should comply with all current decisions on modalities and procedures adopted by the Parties to the UNFCCC and/or the Kyoto Protocol, as well as all future decisions on modalities and procedures, when adopted, in particular those pertaining to sustainable development and additionality.
(b) **Consistency with Relevant National Criteria**. Project designs should be compatible with and supportive of the national environment and development priorities of the Host Countries. In addition, the projects, the transfer of Emission Reductions (ERs) and the issuance of Certified Emission Reductions (CERs) should be consistent with the rules and criteria adopted by Host Countries regarding Clean Development Mechanism (CDM) projects.
(c) **Consistency with the General Guidance Provided by VROM** . Projects should comply with the VROM requirements and the general guidance provided by VROM at their regular meetings. (VROM is the State of the Netherlands, acting through the Ministry of Housing, Spatial Planning and the Environment.)
(d) **Location of Projects**. Projects should be located in Non-Annex I Countries which have (i) signed and ratified, accepted, approved or acceded to the Kyoto Protocol, or (ii) signed the Kyoto Protocol and demonstrated a clear interest in becoming a party thereto in due time, for example those that have already started or are on the verge of starting their national ratification, acceptance or approval process or (iii) already started or are at the verge of starting the national accession process.
(e) **No Nuclear Energy**. Nuclear energy projects are not eligible.

(f) **LULUCF (Land-Use, Land_Use Change and Forestry)**. Projects involving land-use or land-use change (afforestation, reforestation) are only eligible after the COP/MOP has decided on the relevant modalities and guidelines and VROM has agreed to accept such projects.
(g) **Environmental and Social Impacts**. Projects that are expected to have large scale adverse social or environmental effects are not eligible.
(h) **Advance Payments**. Projects that will require Advance Payments from the NCDMF, shall not be eligible, unless at least 50% (fifty percent) of the total financing needs of such Project will be provided by other entities which are at least A+ rated by S&P or A1 rated by Moody's (bank rating or debt paper rating).
(i) **Purchase Price**. Projects that involve a purchase price of more than € 5.5 (five and a half Euros) per metric tonne of CO2 equivalent, calculated on the basis of ER Unit Price and the Kyoto Protocol Related Project Costs, shall not be eligible, unless they are expected, in VROM's opinion, to make a very significant contribution to sustainable development in the Host Country, preferably in Least Developed Countries.
(j) **Proportion of Payments**. The present value of the total payments (calculated at a discount rate of no more than 4% (four percent) to be made by the NCDMF for the purchase of ERs, shall not exceed 30% (thirty percent) of total financing needs of the project at commissioning, unless otherwise agreed by VROM.
(k) **Financing of Projects**. Of the total financing needs of each individual project at least 30% (thirty percent) shall be covered by co-investing entities meeting at least a rating of A+ by S&P or A1 by Moody's (bank rating or debt paper entities). If such is not the case, an extensive due diligence performed by the NCDMF may determine the project's eligibility.
(l) **Complementarity with GEF(Global Environment Facility)**. Projects should be complementary to the GEF and not compete with the GEF's long-term operational program nor with their short-term response measures. In furtherance of this criterion, potential projects will be reviewed by the Secretariat of the GEF to determine their GEF eligibility. Only if it is determined that a potential project will not receive GEF financing will it be considered for inclusion as a NCDMF project.
(m) **Complementarity with the PCF (Prototype Carbon Fund)**. The PCF shall have the right of first refusal of a Project.
(n) **Cost-effectiveness and Sustainability**. Cost-effectiveness and sustainability will play a major role in selection and approval of projects. Projects may be drawn from a broad range of technologies and processes in energy, industry, and transport, which provide various vehicles for generating ERs, which contribute to sustainable development and achieve transfer of cleaner and more efficient technology to Host Countries. VROM ranks technologies in the following descending order: (i) renewable energy technology, such as geothermal, wind, solar, and small-scale hydro-power; (ii) clean, sustainably grown biomass (no waste); (iii) energy efficiency improvement; (iv) fossil fuel switch and methane recovery; (v) sequestration. VROM expects this ranking to be reflected in the ER Unit Price.
(p) **Additional Characteristics of Projects**. Projects should generally entail manageable technological risk. The technology to be used in a project should be commercially available, have been demonstrated in a commercial context, and be subject to customary commercial performance guarantees. The technical competence in the Host Country to manage this technology should be established in the course of Project appraisal. Projected Emission Reductions over the life of the Project should be predictable and should involve an acceptable level of uncertainty.

8.4 ANNEX D: EU CO_2 emissions reduction targets and CDM programmes

Emission allocations and number of installations covered by the EU emissions trading scheme per Member State (indicative table based on national allocation plans approved) and their Kyoto emission targets.

Member State	CO_2 allowances in million tonnes	Installations covered	Kyoto target
Austria	99.01	205	–13 %(*)
Belgium	188.8	363	–7.5 %(*)
Czech Republic	292.8	436	–8 %
Cyprus	16.98	13	-
Denmark	100.5	362	–21 %(*)
Estonia	56.85	43	–8 %
Finland	136.5	535	0 %(*)
France	469.53	1172	0 %(*)
Germany	1497.0	2419	–21 %(*)
Greece	223.3	141	+25 %(*)
Hungary	93.8	261	–6 %
Ireland	67.0	143	+13 %(*)
Italy	697.5	1240	–6.5 %(*)
Latvia	13.7	95	–8 %
Lithuania	36.8	93	–8 %
Luxembourg	10.07	19	–28 %(*)
Malta	8.83	2	-
Netherlands	285.9	333	–6 %(*)
Poland	717.3	1166	–6 %
Portugal	114.5	239	+27 %(*)
Slovak Republic	91.5	209	–8 %
Slovenia	26.3	98	–8 %
Spain (**)	523.7	927	+15 %
Sweden	68.7	499	+4 %(*)
United Kingdom (***)	736.0	1078	–12.5 %(*)
Total so far	**4 641.97(**)**	**9089(**)**	
Approximate percentage of estimated overall total	**ca. 70 %**	**ca. 70 %**	

(*) Under the Kyoto Protocol, the EU-15 (until 30 April 2004 the EU had 15 Member States) has to reduce its greenhouse gas emissions by 8 % below 1990 levels during 2008–12. This target is shared among the 15 Member States under a legally binding burden-sharing agreement (Council Decision 2002/358/EC of 25 April 2002). The 10 Member States that joined the EU on 1 May 2004 have individual targets under the Kyoto Protocol with the exception of Cyprus and Malta, which as yet have no targets.
(**) Figures do not include some Spanish installations for which allocations are in preparation.
(***) Latter revised plan, which had an increase of emission allocations, has been rejected.

Agreements established by EU 25 Member States for CDM/JI projects are presented hereafter.

MEMBER STATE	AGREEMENTS FOR CDM PROJECTS
Austria	Information on the Austrian CDM/JI program is available at http://www.ji-cdm-austria.at/en/downloads.php MOUs with China, Morocco and Argentina, Austria is an investor in the World Bank's Community Development Carbon Fund (CDCF)
Belgium	Belgium-Wallonia and the Brussels Region are investors in the World Bank's Community Development Carbon Fund (CDCF)
Czech Republic*	
Cyprus**	Cyprus has a CDM MoU with Italy

MEMBER STATE	AGREEMENTS FOR CDM PROJECTS
Denmark	EcoSecurities and Standard Bank London Ltd are managing the Denmark Carbon Facility for the Danish Government Denmark is helping to develop projects in Thailand Denmark has CDM MoUs with Malaysia, Thailand, Argentina, South Africa and Chile In January 2005 Energi E2, Elsam and the Danish ministries of foreign affairs and environment established a carbon fund that will be administered by the World Bank. It aims to purchase 5-6 million carbon credits through JI and CDM projects by 2012. It is an investor in the World Bank's Community Development Carbon Fund (CDCF). CDCF projects can be viewed on the CDCF page
Estonia*	
Finland	Finland has a CDM MoU with Costa Rica, El Salvador and Nicaragua, and CDM co-operation is included in general agreements with India and China Finland is developing a number of small-scale CDM projects. Project Idea Notes are available at: http://global.finland.fi/english/projects/cdm/projects. Finland is an investor in the PCF.
France	France has CDM MoUs with Colombia, Morocco, Argentina and Chile France is an investor in the PCF through Gaz de France which is a state-owned entity
Germany	Germany has funded a study assessing the feasibility of a project to improve energy efficiency in industrial boilers in Peru Germany has funded programs and studies in China, India, Morocco and the Philippines on the CDM The UK and European Commission are jointly funding the CDM Susac program which aims to promote the CDM in Africa, the Carribean and Pacific countries. It is coordinated by the IER University of Stuttgart (Germany) and has partners in Senegal, Uganda, UK and Zambia The World Bank, German, Swiss and Australian Governments jointly funded National Strategy Studies (NSS) on climate change for Indonesia, Zimbabwe, Columbia, Argentina and Bolivia. Included in the studies were identification of potential CDM projects. The reports are available on the World Bank website Germany is jointly funding a study on implementing CDM projects in the Chinese power sector with the World Bank and Swiss Government Government-owned KfW Bankengruppe has set up a CDM/JI fund. For more details see their website Government-owned KfW and the Hessian Ministry for Environment have set up a carbon fund for CDM and JI projects. Read the press release
Greece	
Hungary*	
Ireland	
Italy	Italy has signed MoUs with China, Serbia, Moldova, Croatia, Bulgaria, Poland, Slovenia, Morocco, Argentina, Egypt, Algeria, Cyprus, Israel, Cuba, El Salvador. Letters of Intent exist with Brazil and Romania The World Bank is managing the Italian Carbon Fund Italy is an investor in the World Bank's Community Development Carbon Fund (CDCF) and BioCarbon Fund (BCF)
Latvia*	
Lithuania*	
Luxembourg	Luxembourg is an investor in the World Bank's BioCarbon Fund (BCF) and Community Development Carbon Fund (CDCF)
Malta	
Netherlands Netherlands (continued)	Rabobank Rabobank is an internationally operating private bank focusing on the food and the agribusiness. CDM project proposals may be submitted to the Rabobank at all times. For more information about the CDM funds, please contact Engel Koolhaas at Engel.ejr.Koolhaas@utc.rabobank.com. International Finance Corporation **(IFC)** IFC is also known as the IFC-Netherlands Carbon Facility (INCaF). CDM project proposals may be submitted to the IFC at all times. For more information about the CDM funds, please contact Contact Vikram Widge at vwidge@ifc.org International Bank for Reconstruction and Development **(IBRD)** CDM project proposals may be submitted to the IBRD at all times. For more information, please contact Chandra Shekhar Sinha at csinha@worldbank.org. La Corporación Andina de Fomento **(CAF)** The CAF-Netherlands CDM Facility focuses on public and private sector transactions, located in countries in Latin America and the Caribbean. CDM project proposals may be submitted to CAF at all times. For more information, please contact Jorge Barrigh at JBarrigh@caf.com. SENTER Internationaal SENTER Internationaal has organized a CDM tender called CERUPT for investment projects in developing countries. This tender closed on 31 January 2002; for the time being no new projects will be considered. For more information on CERUPT, please contact Mr. Adriaan Korthuis at a.korthuis@senter.nl.

MEMBER STATE	AGREEMENTS FOR CDM PROJECTS
Poland*	
Portugal	
Slovak Republic*	
Slovenia*	
Spain	Spain has invested Euro 200 million in a range of World Bank carbon funds. Euro170 million will finance a Bank-managed Spanish Carbon Fund; Euro20 million will be invested in the CDCF; Euro10 million will be invested in the BCF; Euro5 million will be invested in the Bank's CF Assist program Spain has a CDM MoU with Panama, Argentina and Brazil
Sweden	Survey of CDM initiatives and potential technology collaboration between China and Sweden - the case of biomass energy technology The Stockholm Environment Institute has recently carried out a study commissioned by the Swedish Energy Agency with the objective of identifying and assessing possible Clean Development Mechanism (CDM) projects that could be carried out in Africa with Swedish financing Sweden is an investor in the PCF.
United Kingdom	A study on the CDM in Kenya with a particular focus on opportunities for UK business EcoSecurities will soon be carrying out an activity in India focussing on industrial CDM potential. The project is being supported by the UK's Foreign and Commonwealth Office and British High Commission, India The UK and European Commission are jointly funding the CDM Susac program which aims to promote the CDM in Africa, the Carribean and Pacific countries. It is coordinated by the IER University of Stuttgart (Germany) and has partners in Senegal, Uganda, UK and Zambia The British Government conducted a study on CDM projects titled "Initial evaluation of CDM type projects in developing countries". The reports can be found at http://www.surrey.ac.uk/eng/ces/research/ji/cdm-dfid.htm The UK Department for International Development (DfID) funded a project coordinated by Ecosecurities to examine the developmental potential of the CDM; to investigate strategies to encourage CDM investment flows in small to medium developing countries; and to suggest ways that donors could get involved in capacity building to facilitate the participation of these developing countries in the CDM. The project had four developing country partners - Bangladesh, Colombia, Ghana and Sri Lanka - for which country papers are available
Canada	The Canadian Department of Foreign Affairs and Trade (DFAIT) and the Canadian International Development Agency (CIDA) with the Pembina Institute for Appropriate Development (PIAD) established the Canadian Clean Development Mechanism Small Projects Facility (CDM SPF) in 2002. A summary of projects in India is available here Canada has CDM MoUs with Costa Rica, Argentina, Colombia, Chile, Nicaragua, Tunisia, Sri Lanka, Bolivia and South Korea Canada is an investor in the World Bank's Community Development Carbon Fund (CDCF), BioCarbon Fund (BCF) and Prototype Carbon Fund (PCF). The Asian Development Bank (AD) is administering the US$5M Canadian Cooperation Fund on Climate Change The Pembina Institute in Canada and Tata Energy Research Institute (TERI) in India are exploring the application of the Clean Development Mechanism (CDM) in Asia, funded by the Canadian International Development Agency. For more information and to download reports go to www.pembina.org/international_eco3a.asp or www.teriin.org
Japan	The Institute for Sustainable Energy Policies, Japan, has written an overview of Japanese CDM activities The Japanese Government has conducted a number of feasibility studies for CDM and JI projects The New Energy Development Organisation (NEDO) of METI is conducting a range of feasibility studies. Brief summaries are on their website Japan is an investor in the PCF

* EIT (Economy in transition): countries that are undergoing the process of transition to a market economy.
** Non-ANNEX I Party: countries classified as least developed countries (LDCs) by the United Nations.