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Renewable Energies for North and Central Asian Countries: Bioeconomics, Environment and Social Impact

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Abstract: Decentralised cooperation at the level of Cities[1] is important: local administrations are responsible for implementation of programmes and their real (positive or negative) impact on local communities. These are inclusive of adaptation and mitigation of global warming and climate change due to Greenhouse Gas (GHG) emissions. At the local level the benefits created by efficacious implementing of sustainable investments at Energy Agencies or Energy Service especially for investors can really be recognised. This strict connection with local investors also suggests different financial instruments that can define and record the evidence and relevance of environmental and social implication rather than financial results. Defined as the "Kyoto Bond"[2] double parallel accountings will show the real value of non financial performance that, summed to fixed earning, is higher than market medium performance.

Keywords: Renewable energy; Asia; bioeconomy; society.

Introduction

The World Summit on Sustainable Development (WSSD)[3] strongly reaffirmed the commitment to the Rio principles, the full implementation of Agenda 21[4] and its programme for implementation thus committing nations to achieving internationally agreed development goals inclusive of the United Nations Millennium Declaration *(UN "Millennium Declaration", 2000 – New York)* through the "Plan of implementation" *(UN "WSSD Ministerial Declaration", 2002, Johannesburg; UN "Johannesburg Plan of Implementation" (2002),*

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Johannesburg). The three components of sustainable development as interdependent and mutually reinforcing are:

- economic development;
- social development; and
- environmental protection.

After WSSD, Public-Private-Partnership[5] was one of the main results targeting concrete implementation of policies and measure especially related to relevant themes such as energy, Energy Efficiency (EE), and Renewable Energy (RE). In providing a basis for economic development and basic services like health care, education and communication people need to access reliable and affordable energy supplies that can meet the gap even in countries where there is a serious lack of energy infrastructure (electricity grid).

Renewable Energy (RE) and Bioeconomic Considerations

RE can play a significant role in counteracting global warming, diminishing air pollution, diminishing dependency on energy imports, providing energy functions to poor rural and isolated areas without energy services and ensuring security of supply in a cost effective way in remote or non-grid connected areas with no energy services nor local sustainable energy sources.

RE comes in many forms, maturities and prices. It can be the cheapest of energy technologies because it is mature; as in the case of wind power (where the energy supply costs – capital and operational - are comparable with fossil fuel costs), the market rules are reasonably favourable, and the resources are strong. In many cases such as Photovoltaic (PV) Concentrating Solar Power (CSP), RE can be very expensive since the technology is less mature in terms of costs for investments, difficulties to find raw material such as the mono or poly silicon, and the market rules are not so favourable.[6]

New market mechanisms like the trading of emission reductions or the Trading of Renewable Energy Certificates (TRECs) offer some attractive advantages (Hamrin and Wingate, 2003; International Conference for Renewable Energies, Bonn, 2004). With the use of tradable certificates, RE investments can be made where resources are most favourable and costs are lowest such as in the North and Central Asian Countries[7] where available space, public acceptance, and accessibility to consumers clearly contribute to development, socio-economic improvements and energy security.[8] International markets

provide economies of scale, causing even lower costs, faster development and faster market uptake of RE technologies.

RE has a wide range of technologies to generate electricity with renewable sources such as biomass, agriculture by-product and waste, landfill gas amongst several others such as hydro and geothermal resources; another emerging sector is that of bio-fuels, i.e. bio-diesel from oil seeds and bio-ethanol from agriculture residues; and sustainable heating systems that use heat generated from combustion of biomass, from biomass fuelled CHP, from solar heating of form geothermal sources. In unlocking their RE potentials developing countries make use of additional income streams from industrialised countries through several mechanisms such as the carbon finance which does not exist at present as do the global markets for oil.

A global market for renewable energy does not exist at present like the global markets for oil and that of Carbon Emission Reductions (CERs) created by the mandatory target of the legal binding Kyoto Protocol.[9] The main reasons for this absence of a global RE market results from home markets for the RE industry development policy, a large geographical spread of optimal RE resources, lack of an infrastructure for transport and trade of RE and also because some RE technologies are still out of the market with high costs.[10]

RE technology can reduce significantly costs resulting from market experience and that may over time overcome the cost barriers and lead to profitable investments. Individual companies and governments may, however, have incentives to free ride and wait for other stakeholders to bring the technological development further. Private companies cannot appropriate all the benefits of their innovation, product and process improvement.[11]

Private returns on R&D across various sectors are between 20-30 per cent, while social rates of return are around 50 per cent. This shows that private investors only appropriate a fraction of social returns because technology 'spill over' in the energy sector is large. Investors also face difficulties in evaluating intangible research and development output and therefore under-invest in research and development.[12]

As a result, research and development intensive companies are systematically under-priced by the market and likely to reduce the incentive to perform basic research. Furthermore, energy technologies are usually sold to markets that are closely regulated. A path-breaking research success is likely to induce a change in the market design or

regulation, so that the public appropriates the profits and not the private innovator. Therefore, it is generally accepted that public support is required to achieve an optimal R&D level.

The importance of R&D also supported by macro-economic analysis which has show that increasing research and development expenditures in carbon-free technologies could crowd out R&D in the rest of the economy and reduce overall growth rates.[13]

Industry-funded R&D focuses on the areas of existing activity of a company. The market volume of renewable energy technologies is still small, and therefore industry R&D is likely to be small. Furthermore, even forward-looking companies do not plan for more than a decade and are therefore likely to focus on improvements that can be leveraged short term in about 5 years. That is reasonable for an economy but not for energy.[14]

Climatic Change and related Aspects

The Fourth Assessment Report of the IPCC[15] in 2007 reports that emission growth will accelerate the increase of CO_2 concentration in the atmosphere, which is a source of a danger for the climate system as dramatically shown by Katrina and other extreme weather events during 2005. Since the industrial revolution, CO_2 concentrations in the atmosphere have increased by more than 30 per cent, reaching a level of about 380 part per million in volume (ppmv).[16] This increase is, at least, partially responsible for the climate variability of the last decades.

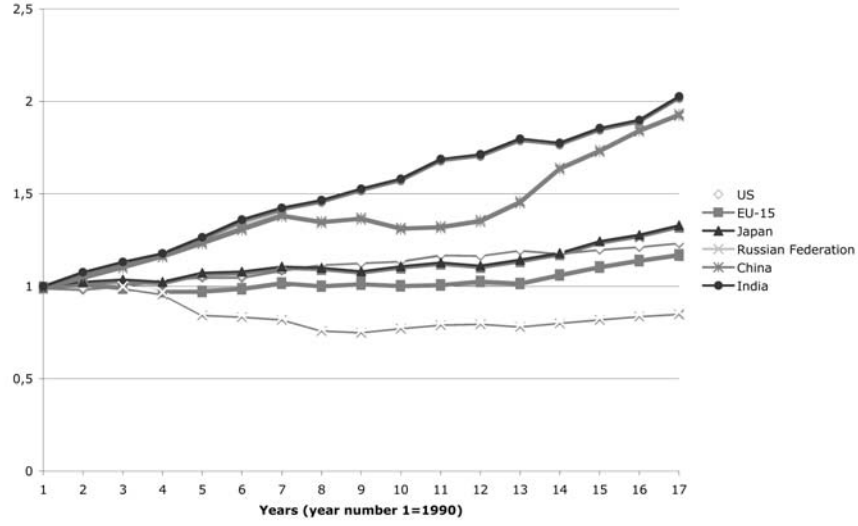
In order not to drastically modify the natural systems and the mountain, glacier and coastal areas, as per IPCC indications, stabilization of CO_2 emissions should not increase the average temperature and sea-levels. By the year 2100, a concentration of CO_2 at 550-650 ppm is considered as the achievable target to contain an increase of the average temperature below 2°C and the rise of sea level below 20 cm.

The "stabilization scenarios" of IPCC predict, at least until 2030, an increase in emissions due to growing fossil fuel consumption in the short-medium term.

The reduction of 5.2 per cent of GHG levels of 1990, expressed in CO_2 equivalent, from developed countries required by the Kyoto Protocol is an important starting point to prevent the climate change and to start new sustainable energy policies for a sustainable economy. IPCC foresees a global emission reduction by 50-60 per cent, compared

to 1990 levels, to be reached in the timeframe 2020-2050, so to ensure the stabilization of CO_2 concentrations within a safe range by the end of the century (Figure 1 shown as the emissions in developing countries will rise tremendously and strong policies and innovative financial arrangements are needed).

Figure 1: Emission of principal emitters of the world compare with the 1990 levels



Source: Author elaboration from UNFCCC, Eurostat, and IEA data, 2006.

It is clear that from 2020 the supply of energy will also need to be provided by a wider use of renewable energies, hydrogen technologies and fuel cells, highly efficient "clean" technologies with an "exit strategy to oil". Policy makers are now seriously considering the issues of implementation of renewable targets to meet 'Kyoto compliance' and a level of independence from fossil fuels that will increase in the future the price in the international markets.

At the local level concerning Region to Cities lower cost/risk portfolios can be developed by adjusting the conventional mix through inclusion of greater amounts of fixed-cost renewable and that coming from the "carbon finance". It is well-known that adding fixed-cost generating technologies to a fossil generating portfolio serves to lower overall generating cost and risk.[17]

Policy makers consider the additional income economical and environmental benefits from the TRECs or CERs or other "energy commodity" as a certificate to avoid pollution from GHG for implementation at the city level. However, in the context of a global energy and "energy commodity market an energy source mix of an Energy Efficiency (EE)) and a Tradable Renewable Energy Certificates system can be implemented locally in harmonization with existing trading systems.

Fostering the Use of Renewable Energies

Governmental support schemes for RE at the national level are not new in the EU. Leaving aside the vast field of state investment grants for RE production mostly for wind or solar power the first wide-ranging support schemes have a long tradition as well. After the first schemes in Portugal (1988), the Netherlands (1989), and Germany (1990), all member countries have followed the lead and implemented support mechanisms (EU Commission, 2005). Perhaps, the Central and Eastern European countries will adopt the use of renewable energies.

At the European level, the regulatory framework established in 2003 with the second package of Directives for the single energy market is now nearing completion (EU Commission 2003). The Italian legislation is oriented to increase the share of renewable energies (RES) in the internal market of energy assuming that the Kyoto Protocol and the European Directives are the bases for the Italian goals. These goals are not easily obtainable on account of the structure of the Italian industrial sector which is less energy intensive than other European countries. Moreover, the high price of electricity generation is partly explained by the market that has still to feel the full effects of liberalisation and competition. This means that the industrial sector will discount the enormous costs concerning the Kyoto target and the energy supply that will be too strong an effort for the entire economic system. On the other hand, the Kyoto commitments should be reached in an economic manner. So, the most appealing question to the Italian Government and others for the next six years is: *who does pay for Kyoto?*

If the roles are not yet clearly identified, the actual scenario finds several economic tools that can support the increasing of REs and energy efficiency that could comply with the Kyoto Protocol. However, many of these actions are not oriented to small-medium enterprises and

households needs and thus cannot be used to reach an improved "energy lifestyle". One of the main features of the Italian economy is the ability to build complex systems of integrated small and medium enterprises — a "production district", able to concentrate, in a portion of territory many enterprises linked to each other and specialised in one kind of production in consonance with the life cycle assessment and in a position to contend in the global market. In the environmental economy, the benchmark represents a serious added value to learn from some other experiences already implemented at the ground level. Therefore, the quoted experiences at the EU level such as the TRECs experience[18] could be a benchmark to stimulate something similar but with the peculiarity needed in Central Asian countries. The experience of small and medium enterprises in Italy is a good practice of an acceptable sustainable approach to the environment.

Under the SAVE programme[19] — a programme to promote among EU Member States the rational use of energy and energy efficiency in industry and the building sector, the European Commission has financed the setting up of regional and local energy management agencies and in the few years many agencies have been established all over Europe inclusive of countries in Central and Eastern Europe. The roles of these agencies consist in informing about and supporting the strengthening of the renewable energy markets but which until now are not able to compete with traditional sources of energy. In addition, many of them are short of funds to implement programmes in an effective manner.

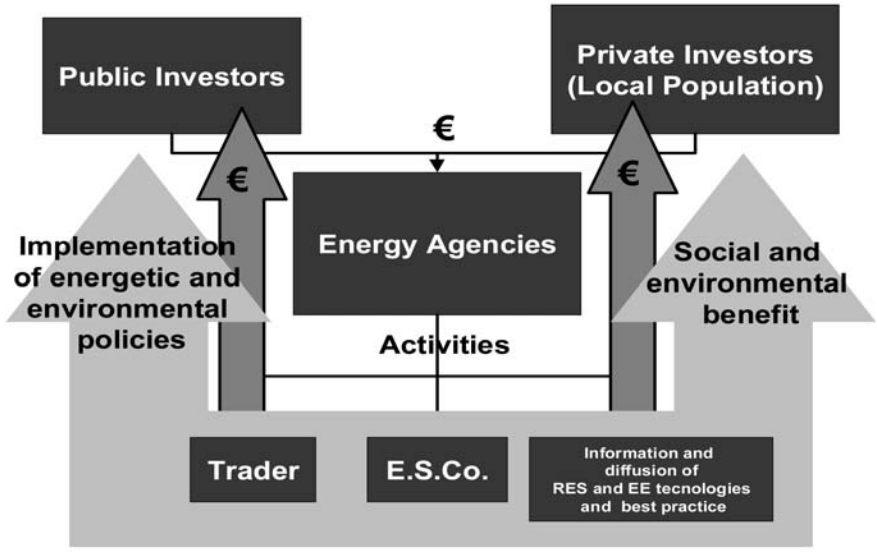
The need of capital for Energy Agencies is primary; implementing programmes and policies requires high financial supply and the investments require a long term to create profits. In addition, citizens often don't realise how these agencies are the means to reach a greater level of benefits when the programmes are well implemented and efficaciously executed. The agencies structured like the SAVE programme are not able to reach the entire population and or the Kyoto targets because they do not have enough financial and technical supports to generate adequate benefits and projects.

However, the energy agencies, that can be implemented also in North and Central Asia as Energy Service Company (ESCO), could have a more important role if they could collect both public and private capitals and operate as a public company with a wide shareholder base: in this way they could operate at a local level supported by the local

population that would became shareholders and, at the same time, be beneficiaries of energetic programmes.

Moreover, public involvement is able to link the implementing activities with policies and programmes at the regional and national level, while private participation would ensure capital requirements for the takeover of the activities. In Figure 2, the possible structure is explained to implement RE at a local level with a Public-Private partnership driven by energy agencies or a energy service company that can play a relevant role at the local level in promoting sustainable energy and implementing the "Kyoto bond" as a energy commodity for RE or Energy Efficiency to replace fossil fuel sources affecting the climate and increasing global warming. A structure like the one represented in Figure 2 can also developed in Northern and Central European countries, and Eurasian countries, where the concept of public company is already well known.

Figure 2: Energy Agencies proposed structure and the sustainable energy project that can be implemented at local level (e.g. energy commodity trading, energy services (as ESCO - Energy Service Companies), information and EE and RE technology deployment and best practice) with global benefits on GHG



A company organized like this would permit the obtaining of social and environmental targets as well as monetary profits. At the same time, investments could be oriented to particular interventions that will spawn benefits and revenues in a long lapse of time. The strict connection with territory and local population is an important incentive to produce greater results in a more efficient manner: the investors reach two different results at the same time: economic, deriving from the return on investments; and social, coming from the increase of wellness connected to the results of activities implemented.

With greater financial support, and with the necessity of making profits, energy agencies must acquire a more important role in an energetic market with an operating role as a trader for all market based incentive mechanisms adopted to support REs and Energy Efficiency white and green certificates.[20, 21]

Bioenergy: An Option for North and Central Asia Countries

The potential role of bio-energy has been addressed more seriously in the last decade when global concerns related to energy prices, environmental degradation, privatization of the energy sector and the sustainability of current energy systems started to arise. An assessment to determine biomass potential production and cost supplies has been undertaken concerning huge land resources in Central and Eastern European countries. Opportunities for the Ukraine have also been considered.[22] Moreover, the state of sustainable wood management in Central and Eastern European countries has been assessed in 2005.[23] This year the Eastern Biofuels Conference reviewed the latest technological developments, feedstocks, export markets, carbon trading, policies, and financing of biofuel and biomass projects.[24]

Bio-energy in general and wood energy in particular are the dominant sources of energy for about half of the world's population who are the poorest, and who use this energy mainly for cooking, heating or lighting with bad and low efficiency. The population of rural and isolated areas of North and Central Asia have also a very limited or very expensive access to electricity and liquid fossil fuels for transport.

Increasingly, different kinds of energy crops and plantations are expected to provide the bulk of biomass for energy production and can offer benefits to agriculture.

The Kyoto Protocol and its mechanisms such as Joint Implementation (JI) (for Annex I countries) and Clean Development Mechanism (for non Annex I countries) does give credit for afforestation and reforestation projects and can stimulate a sustainable land use even in areas such as Russian Federation (e.g. Siberia Region and Kamchacta Peninsula), Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan and Western China (Tibet), where the past use of agriculture was not so sustainable (Table 1).

Biofuels will be seen as a part solution for transport fuels but this may be limited by competing requirements for land use and water resources that can be preserved.

Biofuels are liquid and gaseous fuels produced from various forms of biomass and used to substitute conventional petroleum fuels. Bioethanol, biodiesel, biogas, dimethyl esters and synthetic fuels are included. This is particularly the case with first generation agricultural systems. Second generation technologies, not based on traditional crops grown for food, can help to develop systems using crop and forest residues and non-food crops with good potential in terms of scale economy and cost reductions. Additional support can come from policies that will include the Kyoto JI and CDM mechanisms and International Emission Trading to account for carbon benefits that can generate an additional income from producers and users of bio-fuels to shift from the usage of oil that has been predicted to end soon. This depends on future oil prices (not less than 70 US$ per barrel) and availability that is governed by geopolitics and which force Central and Eastern European countries to adopt a switch towards new liquid fuels like bio-diesel, bio-ethanol or an hydrogen-based economy.

In the EC's 1997 White Paper on Renewable Energy Sources, biomass represented 68 per cent of the EU's indicative target of doubling its share of renewable energy sources from 6 per cent of gross domestic energy consumption in 1998 to 12 per cent in 2010.[25]

However, in its more recent Biomass Action Plan, the EC highlighted that despite the existence of mature, straightforward and commercially viable technologies for renewable heating for residential and industrial purposes, the consumption of biomass is growing slowest in the heating sector.[26]

Many of the Central Asian countries can develop bioenergy and biofuels production for heating systems that represent a high part of energy consumption. Agriculture in Central Asia constitutes at least 20

Table 1: Bioenergy Initiatives in Former North and Central European Countries *

Year	Country	Goal	Activity
Biogas			
2000	Turkmenistan	Promotion ofbiofuel initiatives.	Ministry of Health and Medical Industry in a survey found that most rural households use biogasto meet their domestic energyneeds.
2002	Kyrgystan	Establishment of biogas units and a microhydro plant in the Kizil-Charba village, Talas region.	Power supplied to 22 households biogas units heated in the winter by electricity comingfrom the micro hydro plant that enable gas units to meet domestic energy needs and yieldfertilizer as by-product.
2003		Introduction of bio-gas plant in Nurmanbet village, Issyk-Kul region.	Provides local communitywith autonomous biosource of cheaper non-polluting energy.
2004	Kazakhstan	Establishment of Education Biogas Centre.	The biogas centre known as *AzureFlame* in Karaganda disseminates educational material concerning biogas technology in improving the economical, environmental and social situation of rural communities.
	Mongolia	Development of abiogas plant by a local enterprise through the Experimental Animal Research Centre of The Inner Mongolia University and Inner Mongolia Livestock Improvement Centre as a showcase model that can be replicated elsewhere in ruralareas of Mongolia.	Establishment of a breeding base of several million dairy cows in the Liangcheng County in the zone that includes: Hohhot and Jining -in Inner Mongolia, Ulaan Chab, and Daton in the Shanxi Province of China to control the spread of diseases; enhance rural electrification and enhance income -generating activities such as marketing of digester residue as soil conditioners and biofertilzers
2005	Uzbekistan	Establishment of a pilot biogas plant in Zangi-Ata Rural District, Tashkent Province.	Local farmers encouraged touse biogas as an environment-friendly technology and a clean low-cost biofuel which is linked to some 9340 farms that have cattle, sheep, pigs and chicken.
2006	Tajikistan	Promote the use of biogas as a fuel substitute for *Tapak* cakes made fromdried straw and cattle dung and which emitstoxic fumes harmful to human health of the inhabitants in Sharak village in the Muminabad district.	The aim of introducing biogas technology and allied process benefits is to improve the economical, environmental and social situation of rural communities.

* Data Contributed by Edgar DaSilva

per cent of the GDP of every Central Asian country with the lone exception of Kazakhstan. Despite this, in all of the Central Asian countries, at least 20 per cent of the labour force is employed in agriculture.

The two most significant crops in Central Asia are cotton and wheat. The emphasis on intensive cotton cultivation in the Amu Darya watershed countries of Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan has played a major role in the drying and polluting of the Aral Sea because of the large amounts of water and fertilizer used in cotton cultivation. The energy cultivation could avoid this mistake in future so as to reconstruct the wetland ecosystems.

Aside from these two primary crops, the region produces a wide variety of products which include barley, corn, flax, grapes, potatoes, rice, sugarbeets, sunflowers, tobacco, apricots, pears, plums, apples, cherries, pomegranates, melons, dates, figs, sesame, pistachios and nuts.

The key point for all these remote areas of North, Central and East Asia is to find new financial arrangements and economic tools to stimulate the RE and bioenergy deployment as a sustainable solution to heating, electricity generation and transport needs. The focus must be on the local and small community of citizens since the central governmental authorities can often forecast properly and promptly the local solutions, and provide the financial instruments that are needed.

Kyoto Bond: Economic Rent, Environmental Benefits and Citizens' Wellness

The author supports the importance of a wide shareholder base company to develop policies and programmes at the local level particularly in the Central and Eastern European countries. Energy Agencies could operate in the energetic markets and reach tangible results with environmental and social implications. The relevance of this solution is that the involvement of private funding would be limited to investors at the local level who can really recognise the benefits created by the efficacious implementing of sustainable investments.

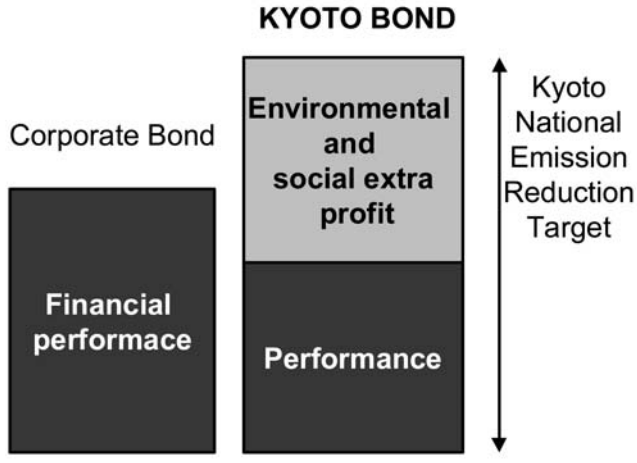
This strict connection with investors' wellness also implies the creation of different financial instruments that can influence the relevance of environmental and social aspects of development. Labelled as the "Kyoto Bond" they would have the following objectives: capital collected would be invested in local projects that target the fulfilment

of local energetic policies and give investors the opportunity to invest their savings for tangible and controlled operations. The performance of these instruments (as shown in Figure 3) has two different characteristics:

- Financial performance: fixed coupon bond with a lower percentage performance than other over the counter instruments;
- Non financial performance: the increase of social and environmental benefits deriving from National Energy Agencies activities.

Double parallel accounting would show the real value of non-financial performance that in relation to fixed earning is higher than market medium performance. Non-economic performance would be benchmarked with European targets of emission reduction derived by Kyoto approval.

Figure 3: The Proposed "Kyoto Bond



Conclusion

Local governments often meet with difficulties in implementing successfully European and national energetic policies and programmes which situation is often due to insufficient budgets assigned for local governance and the inadequacy of efficiency in public administration.

In this paper, the author suggests a different point of view that would increase efficiency of programmes that would enhance environmental and social benefits which results could be reached

through:

- Involvement of public local investors
- Concrete programmes and efficient actuation
- Environmental and social benefits easily valued by local populations.

The proposed innovative financial scheme could be used for all remote areas of North, Central and East Asia to start up new energy tools to stimulate EE, RE and specifically bioenergy deployment as a sustainable solution to heating, electricity generation and transport needs.

Endnotes

1 Cities are urban areas differing in size, population density, importance, or legal status from a town, village, or hamlet. !non financial performance which is the increase of social and environmental benefits derived from Energy Agencies activities.

2 An original approach as conceptualized by the author in the *Kyoto Bond* would have the following characteristics:

- Capital collected would be invested in local projects that permit reaching the target of local energetic policies, and giving investors opportunities to invest their savings in tangible and controlled operations.
- The performance of these instruments is of the following types:
  - → financial performance: fixed coupon bonded with a lower percentage performance than other over the counter instruments;
  - → non financial performance which is the increase of social and environmental benefits derived from Energy Agencies activities.

3 The World Summit on Sustainable Development, (WSSD) or Earth Summit 2002 was convened in Johannesburg, South Africa, from 26 August to 4 September 2002 to discuss with several leaders from national governments, business and non-governmental organizations sustainable development by the United Nations. WSSD was held 10 years after the first Earth Summit in Rio de Janeiro and was also informally known as "Rio+10"

4 Agenda 21 a programme run by the United Nations (UN) concerns sustainable development; and is the blueprint of action to be taken globally, nationally and locally by organisations of the UN, governments, and major groups in every area in which humans impact on the environment. The number 21 refers to the 21st century.

5 Public-private partnership (PPP), often referred to as PPP or P3, is a system in which a government service using tax revenue to provide capital for investment or private business venture is funded and operated through a partnership of government and one or more private sector companies through an established binding contract.

6 IEA (2003 ; IEA (2006).

7 Central and Eastern Europe is a strategic region for energy transit, linking Eurasian supplies with large consumers in Western Europe. The Central/Eastern Europe region is also a significant energy consumer, accounting for 35% of total European energy demand and is constituted of the following countries: Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Estonia, Latvia, Lithuania, The Former Yugoslav Republic of Macedonia, Moldova, Poland, Romania, Serbia and

Montenegro, the Slovak Republic, Slovenia and the Ukraine. The region of Central Eurasia is constituted of the following: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Mongolia and Tajikistan.

8 IEA (2003).

9 The Kyoto Protocol!The 1997 Kyoto Protocol shares the Convention's objective, principles and institutions, but significantly strengthens the Convention by committing Annex I Parties to individual, legally-binding targets to limit or reduce their greenhouse gas emissions. Only Parties to the Convention that have also become Parties to the Protocol (i.e. by ratifying, accepting, approving, or acceding to it) will be bound by the Protocol's commitments. To date 173 Parties have ratified the Protocol. Of these, 35 countries and the EEC are required to reduce greenhouse gas emissions below levels specified for each of them in the treaty. The individual targets for Annex I Parties are listed in the Kyoto Protocol's Annex B. These add up to a total cut in greenhouse-gas emissions of at least 5.2 per cent from 1990 levels in the commitment period 2008-2012. The Kyoto Protocol entered into force on 16 February 2005.

10 IEA/GB (2003).

11 Kilman (2001).

12 IEA/RETD (2006).

13 Goulder and Schneider (1999).

14 Anderson and Bird (1992); Kilman, M. (2001).

15 The Intergovernmental Panel on Climate Change (IPCC) has been established by WMO and UNEP in 1988 to assess scientific, technical and socio- economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. The IPCC does not carry out research nor does it monitor climate related data or other relevant parameters.

16 Part per million in volume (ppmv) indicate one particle of a given substance (e.g. CO2) for every 999,999 other particles, therefore one part in 106.

17 Hamrin and Wingate, (2006).

18 Hamrin and Wingate (2003).

19 The SAVE Programme was the principal focus of the Community's non-technological action on energy efficiency and the only Union-wide programme dedicated exclusively to promoting energy efficiency and encouraging energy-saving behaviour in industry, commerce and the domestic and transport sectors through policy measures, information, studies and pilot actions and the creation of local and regional energy management agencies. The first SAVE programme was adopted by the Council in October 1991 lasted until 1995. SAVE II was adopted by the Council in December 1996 (96/737/EC) for the period 1996-2000. In February 2000 (647/2000/EC) SAVE was integrated into the Energy Framework Programme which outlined the Community's strategy for the five years period 1998-2002 (99/21/EC, EURATOM.

20 White certificate represents the separable bundle of non-energy attributes (environmental, economic and social) associated with energy efficiency performance of final user or a supplier of primary energy or electricity. Green certificate represents the separable bundle of non-energy attributes (environmental, economic and social) associated with the generation of renewable power, and are sometimes also referred to as green tags, green tickets, renewable certificates, and renewable electricity certificates or credits (RECs). Both (green and white certificate) are used in many different contexts for different purposes. This fact sometimes creates confusion for those unfamiliar with the full range of their use. They are generally sold separately from their associated energy in wholesale markets. In retail markets they may be sold separately as an independent «product» or may be combined with electrical energy at the point of sale to create a renewable electricity offering. In several U.S. States, Europe (Italy, UK, Belgium, Sweden the

Netherlands) and Australia, those energy commodity are used as an accounting tool to measure and track renewable generation and energy efficiency achievement.

21 Holt and Bird (2005).

22 Faaij et al, (2004).

23 Sustainable Wood Biomass Management in Central and Eastern European countries; (meeting organized November 9 – 11, 2005 in Bled, Slovenia with support from the Slovenian Ministry of Agriculture, Forestry and Food and FAO(http/www.zgs.gov.si/fileadmin/zgs/main/img/CE/biomasa/BIOMASA_ANG_PROJEKTI/Conclusions).

24 Third Annual Eastern Biofuels Conference & Expo, Prague, Czech Republic, May 29 – 31, 2007-06-07 (http:www.biomatnet.org/secure/Fair/S831.htm

25 EU Commission (2005).

26 EU Commission (2005).

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