CDM-JI potential and energy efficiency: an application to Italy

Enzo Di Giulio
Eni Corporate University - Scuola Mattei
Via S. Salvo, 1 – 20097 San Donato Milanese (MI), Italy
enzo.digiulio@enicorporateuniversity.eni.it

Stefania Migliavacca
Eni Corporate University - Scuola Mattei
Via S. Salvo, 1 – 20097 San Donato Milanese (MI), Italy
stefania.migliavacca@enicorporateuniversity.eni.it

Alessandro Vaglio
University of Bergamo
Dept. of Economics
Via dei Caniana, 2 – Bergamo
alessandro.vaglio@unibg.it

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Abstract

CDM and JI are going to play a key role in the attainment of the Kyoto target by many countries. Some studies evaluate the market for the only CDM around 25-85 billion US$, for the first commitment period. It is not clear how much of the huge amount of CO_2 reduction via CDM and JI will translate in simple fuel mix changes or carbon sink projects, instead of energy efficiency improvements. Since CDM and JI are a form of FDI (Foreign Direct Investment), the aim of the paper is two-fold: 1. study whether the current trend of international FDI is coherent with a target of energy efficiency improvement; 2. analyze the Italian CDM and JI opportunities in the context of its FDI structure. With reference to 1, a first piece of information that is considered by the study is the history of a country FDI. This element gives information about the country's financial and economic strength, and is the basis for deriving to what extent the current FDI trend should be changed, in order to attain an energy efficiency improvement target. Given this element, the research evaluates which shifts in the distribution of FDI, among different areas and countries, should occur so that it fully exploits the energy efficiency improvement opportunities. As far as 2 is concerned, its aim is to study the history of Italy's FDI, evaluate its coherence with an energy efficiency improvement target, describe and comment the new Government guidelines for the reduction of GHGs emissions.

Will CDM and JI improve energy efficiency?

The Clean Development Mechanism (CDM) and Joint Implementation (JI) are two tools introduced by the Kyoto Protocol that the countries subject to mitigation constraints can use for attaining their GHGs emissions target. CDM and JI should lower the GHGs abatement costs and export development, at the same time. Some studies estimate their market around 25-85 billion US$. Moreover, after the COP 6 bis, held in Bonn in July 2001, it is claimed that the role played by CDM is greatly reinforced due to the possibility given to Less Developed Countries (LDCs) of registering their own projects in the CDM register and, thus, generating Certified Emissions Reductions (CERs) by themselves. This implies that the supply of CERs, and thus the role of CDM, should increase substantially. Given such a key role that CDM and JI will play in the next future, a very important question in the context of energy efficiency is the impact that they will have on it: how much big will the volume of CDM and JI be? To what extent CDM-JI projects will translate in energy efficiency improvements? Not yet widely investigated by energy and environment scholars, such last issue is a crucial one. Given a certain volume of CDM-JI projects, on the one hand there is a scenario in which all of them translate in energy efficiency improvement; on the other hand, there exists an opposite scenario in which the impact of CDM-JI on energy efficiency is null. This can occur because alternative projects crowd out investments in energy efficiency. Basically, these antagonist projects can belong to three classes:

projects that act on the fuel mix (e.g. renewables replacing coal), projects that exploit natural carbon sinks (e.g. reforestation), and projects of carbon storage into land. Certainly, projects that act on the fuel mix often influence energy efficiency, but the potential for energy efficiency improvement is generally more exploited by actions explicitly addressed to energy efficiency. It must considered that, in the context of the Kyoto policies, CDM-JI represents a substitute for domestic measures, that is for actions that can bring about a better organization of the countries' energy systems, and thus improvements in energy efficiency. This means that, if domestic policies and measures are widely replaced by CDM-JI, and within CDM-JI energy efficiency projects are crowded out, the impact of the Kyoto Protocol on energy efficiency will be very weak or null.

Generally, the dimension of the CDM-JI market is studied through models which investigate the comparison between GHGs abatement costs in different regions and with different technologies. This paper proposes an alternative approach that, recognizing that CDM-JI is nothing but a form of Foreign Direct Investment (FDI), starts just from data concerning FDI and elaborates quantitative reflections on the relationship between FDI, CDM-JI and energy efficiency. In other words, we believe that CDM-JI projects do not occur in an empty context, rather they are crucially linked to the past and actual structure of FDI: that is our starting point.

General overview on Foreign Direct Investment

FDI strongly increased in the last years. In 2000, FDI was around 1.2 trillion US dollars, more than five times the level of four years earlier. More than 90% of such a huge amount of money comes from Developed Countries (DCs), while more than 80% flows to DCs. In other words, to a large extent, FDI occurs within industrialized countries, and the importance of such a feature increased in the years, in 1995 the DCs being responsible for 86% of the FDI outflows and 68% of FDI inflows. Nevertheless, the FDI stock represents a significant share of LDCs' GDP (about 28% in 2000): for Asia, such a share is more than 30%, while for Latin America and Africa is about 26% and 21%. In DCs, it falls to about 14% and, for the world as a whole, it is almost 18%. Among LDCs, the top ten recipients of total inward FDI stock are: China, Brazil, Mexico, Argentina, Republic of Korea, Indonesia, Bermuda, Malaysia, South Africa and Chile. According to a new survey by OECD (OECD 2002a), among the factors driving FDI, the most important are: resource-seeking, i.e. the search for low-priced production factors, such as inexpensive labor or natural resources; market-seeking, i.e. access to host markets, especially whereas direct export is impeded by economic or institutional barriers; strategic asset-seeking, i.e. the search for a competitive edge by acquiring strategic assets such as research and development capabilities. Generally, the level of FDI inflows is positively related to the quality of institutional governance: "countries where the rule of law prevails and is enforceable, the judicial system is efficient, corruption is low and ownership is less concentrated, receive more investment" (OECD 2002 a, p. 179). On the other hand, the main obstacles to FDI are: political and economic instability; significant risk of capital losses (e.g. due to non-enforceability of contracts); high taxes. Such obstacles, which create a non benign investment environment, explain the low performance of Africa in attracting FDI. In fact, if we exclude South Africa, in 2000 the whole Africa received FDI inflows for about 8.5 billion US$, i.e. about 0.6% of the total world FDI inflows.

As far as the relationship between FDI and environment is concerned, two opposite views face each other. On the one hand, there is the "race to the bottom" thesis, according to which environment in the developing world can be heavily damaged by FDI, due to the relocation of pollution to "pollution havens". Keller and Levinson (2002), in a recent study on FDI within the US, found robust evidence that abatement costs related to environmental regulation have moderate effects on foreign investment. On the other hand, there are scholars that argue that FDI can provide LDCs with environmental benefits (Warhurst 1999, Wheleer 2000). A recent study by OECD (OECD 2000a), which investigates the relationship between FDI and CO_2 emissions for capita in 14 DCs (Algeria, Chile, Colombia, India, Indonesia, Ivory Coast, Kenya, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Thailand, Venezuela), does not produce unambiguous evidence.

With reference to CDM-JI, since it is a form of FDI, we start by considering the amount of FDI inflows in different regions. It can provide a first idea about the volume of future CDM-JI investments (see Table 1).

Some clear messages emerge from Table 1:

- The amount of FDI towards DCs is much larger (about 5 times in the year 2000) than the amount towards LDCs.
- In particular, FDI towards Western Europe is about 96 times FDI towards Africa, about 9 times FDI towards Latin America and 6 times FDI towards Asia.
- FDI is characterized by an increasing trend. In four years, since 1996 to 2000, FDI at world level increased by around four times.
- FDI towards DCs increased (5.5 times) more than FDI towards LDCs (0.6 times).
- Within DCs, the largest increase was in the EU (7.3 times). In North America, the increase was by around 4 times.
- Within LDCs, North Africa was characterized by the main increase (2 times), while the lowest increase was in West Asia (+ 24%).

In other words, wide differences exist between FDI to DCs and LDCs (Fig. 1) and such differences increase in years. This means that if CDM-JI must become a tool for attaining CO_2 abatements and energy efficiency improvements at low cost, by exploiting the differences within energy systems around the world, the current trend of FDI has to be changed by flowing more to LDCs.

Other useful information is provided by the flows of FDI towards sectors. If FDI has to influence energy efficiency and CO_2 emissions, it should preferably be directed towards energy intensive sectors. Unfortunately, with reference to destination sectors, the statistics do not offer a high level of detail. For such a reason, here we will focus on the EU,

Table 1. FDI inflows by host region (millions of US $) (source UNCTAD 2001).

Host Region	1990-1995 (average)	1996	1997	1998	1999	2000	2001
DCs	145 019	219 908	267 947	484 239	837 761	1 227 476	503 144
Western Europe	87 383	115 863	137 890	274 739	507 222	832 067	336 210
EU	84 165	110 376	127 919	262 216	487 898	808 519	322 954
Other Western Europe	3 218	5 487	9 971	12 523	19 324	23 549	13 256
North America	47 058	94 089	114 925	197 243	307 811	367 529	151 900
Other DC	10 578	9 955	15 132	12 257	22 728	27 880	15 034
LDCs	74 288	152 685	191 022	187 611	225 140	237 894	204 801
Africa	4 320	5 835	10 744	9 021	12 821	8 694	17 165
North Africa	1 543	1 479	2 607	2 788	4 896	2 904	5 323
Other Africa	2 777	4 356	8 137	6 233	7 925	5 790	11 841
Latin America & the Carib.	22 259	52 856	74 299	8 223	109 311	95 405	85 373
South America	10 357	32 232	48 166	51 886	70 880	56 837	40 111
Other Latin America & Carib.	11 901	20 624	26 133	30 318	38 431	38 568	45 261
Asia & the Pacific	47 710	93 994	105 978	96 386	103 008	133 795	102 264
Asia	47 321	93 331	105 828	96 109	102 779	133 707	102 066
West Asia	2 096	2 898	5 645	6 705	324	688	4 133
Central Asia	662	2 590	3 844	3 152	2 466	1 895	3 569
South, East and South-E. Asia	44 564	87 843	96 338	86 252	99 990	131 123	94 365
The Pacific	388	663	150	277	229	88	198
Central & Eastern Europe	6 014	13 547	19 113	22 608	25 363	26 563	27 200

whose data are detailed enough. In Table 2 its investments in specific areas and sectors are provided.

One can see that at world level, a large share (40%) of the EU FDI flows towards manufacturing. On the other hand, electricity and gas do not absorb much FDI (7%), while services (financial intermediation, telecommunication, real estate and business activities, trade and repairs) absorb almost half (48%) of the EU FDI. If we consider LDCs, i.e. the area which represents the arena of CDM, we notice that the services share is around 44%. Such information is confirmed if we look at a longer period (1994-1999). At world level, if we exclude the year 1994, the share of FDI flowing towards services is always higher than that of the year 1999 (maximum: 63% in 1995). In the LDCs area, we find similar results, the FDI flowing to services reaching its maximum value in 1998 (90%). With reference to FDI flowing to the energy sector, at world level the 1999 data are the highest of the period under consideration, the average value being

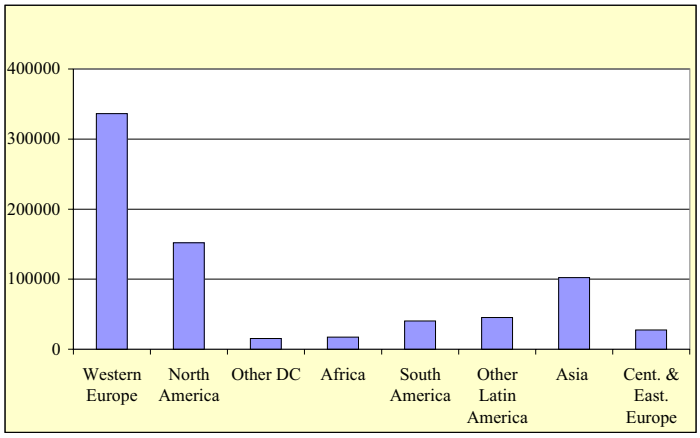

Figure 1. *FDI inflows by host region (mil. US$) (Source: UNCTAD 2002).*

Table 2. FDI from EU in 1999 (mil. Euro) (Source: Eurostat 2001).

	World	EU	Non EU	USA	Japan	Canada	EFTA	LDCs
Agriculture & Fishing	-855	-951	101	75	1	0	-12	32
Mining & Quarrying	21 393	2 307	19 179	2 420	99	-19	74	16 512
Manufacturing	196 568	139 207	47 532	33 521	5 850	974	1 529	15 487
Electricity, Gas & Water	32 290	2 894	29 519	20 940	337	-85	385	7 819
Construction	2 155	1 102	614	-45	-32	2	-13	1 141
Trade & Repairs	13 744	9 378	4 347	1 538	-103	-184	-1 065	4 180
Hotels & Restaurants	1 774	446	1 319	-220	448	-47	33	1 114
Total Transport	1 758	-627	2 362	2 415	9	20	-418	359
Telecommunications	101 677	14 566	87 433	72 920	1 296	-111	1 004	12 002
Financial Intermediation	74 527	38 695	35 830	27 427	122	636	1 494	6 153
Real Estate & Business Act	46 170	23 960	22 209	12 234	423	706	254	8 593
Other Services	1 924	1 053	-	498	-5	39	167	172

around 3%. In LDCs, the maximum value is 7%, in 1997. These data just confirm the high importance of services among sectors. Nevertheless, they show the existence of a problem: both with reference to destination areas and destination sectors, the historical and current trends of FDI are far from an ideal pattern.

FDI and energy efficiency

We improved the above analysis by considering FDI jointly with the real economic dimension of a country. We considered 110 countries and computed an index of FDI concentration for each country, as follows:

$$I_c = \frac{\frac{FDI_i}{FDI}}{\frac{GDP_i}{GDP}}$$

where FDI_i and FDI are respectively the average inflow of FDI towards the i-th county over the 1996-2001 period and the same magnitude referred to the overall sample of countries, while GDP_i, GDP are respectively the i-th country 1999 GDP and the total 1999 GDP for all countries in the sample (data are from: UNCTAD 2002; IEA 2002a, 2002b, 2002c; World Bank 2001). If, for a country, such an index is larger than 1, it means that it has a good performance in attracting FDI; viceversa, if the concentration index is lower than 1. Where the index is negative, we face a disinvestment trend. From Table 3 we can see that wide differences exist among countries, the concentration index ranging from -0.97 (Yemen) to 12.57 (Belgium and Luxemburg). It is interesting to notice that when we look at FDI taking into account also GDP, the uneven distribution among DCs and LDCs is not confirmed. Even if the DCs' concentration index is usually larger than 1, we do not find hints that DCs are generally characterized by concentration indexes larger than the LDCs' ones. A part from the two extreme cases, countries which perform well are: Azerbaijan (5.88), Angola (4.72), Ireland (4.56), Kazakhstan (4.33), Trinidad & Tobago (4.02), Singapore (3.96), Chile (3.18). On the contrary, Gabon (-0.54), United Arab Emirates (-0.01), Indonesia (0.00), Iran (0.01), Japan (0.05), Nepal, Haiti and Kuwait (0.10), Bangladesh (0.12), El Salvador (0.13) perform badly.

Table 3. Energy intensity and FDI Concentration Index by country.

Country	Energy Intensity	FDI Conc. Index	Country	Energy Intensity	FDI Conc. Index	Country	Energy Intensity	FDI Conc. Index
Albania	0.14	0.97	Georgia	0.22	2.21	Panama	0.16	3.26
Algeria	0.19	0.43	Germany	0.18	1.00	Paraguay	0.17	0.86
Angola	0.25	4.72	Ghana	0.22	0.44	Perù	0.11	1.36
Argentina	0.14	1.42	Giordan	0.27	0.85	Philippines	0.15	0.69
Armenia	0.22	2.49	Greece	0.18	0.28	Poland	0.26	1.73
Australia	0.23	0.67	Guatemale	0.18	0.60	Portugal	0.15	1.20
Austria	0.15	0.92	Haiti	0.19	0.10	Romania	0.27	1.29
Azerbaijan	0.56	5.88	Honduras	0.20	1.25	Russia	0.55	0.31
Bangladesh	0.10	0.12	Hungary	0.22	1.68	Saudi Arabia	0.49	0.17
Belarus	0.34	0.33	India	0.22	0.24	Senegal	0.23	0.83
Belgium & Lux	0.23	12.57	Indonesia	0.25	0.00	Singapore	0.27	3.96
Benin	0.40	1.03	Iran	0.32	0.01	Slovakia	0.31	1.69
Bolivia	0.26	3.59	Ireland	0.14	4.56	Slovenia	0.20	0.53
Bosnia & Herz	0.20	0.74	Italy	0.14	0.25	South Africa	0.29	0.71
Brazil	0.15	1.24	Jamaica	0.43	2.34	Spain	0.17	1.11
Bulgaria	0.43	1.93	Japan	0.17	0.05	Srilanka	0.13	0.54
Camerun	0.27	0.20	Kazakhstan	0.51	4.33	Sudan	0.32	1.21
Canada	0.31	1.67	Kenya	0.52	0.19	Sweden	0.23	3.62
Czech Rep.	0.30	2.79	Kuwait	0.71	0.10	Tajikystan	0.43	0.44
Chile	0.18	3.18	Kyrgyzstan	0.20	1.67	Tanzania	0.92	0.80
China	0.24	1.69	Latvia	0.23	2.31	Thailand	0.20	1.11
Colombia	0.12	1.31	Lebanon	0.29	0.46	Togo	0.25	1.33
Congo	0.34	0.72	Lithuania	0.29	1.68	Trinidad & Tob.	0.79	4.02
Congo Dem Rep	0.47	0.13	Malaisya	0.26	2.03	Tunisia	0.14	0.94
Costa Rica	0.11	0.95	Mexico	0.19	1.19	Turkey	0.18	0.26
Cote d'Ivore	0.28	1.20	Moldova	0.32	2.82	Turkmenistan	0.75	1.32
Croatia	0.24	2.01	Morocco	0.11	1.02	United Kingdom	0.18	1.77
Denmark	0.14	2.49	Mozambique	0.50	1.90	Ukraine	0.80	0.63
Ecuador	0.23	2.51	Namibia	0.10	1.39	United Arab Em.	0.56	-0.01
Egypt	0.21	2.49	Nepal	0.27	0.10	Uruguay	0.11	1.29
El Salvador	0.16	0.13	Netherlands	0.19	3.46	Uzbekistan	0.91	0.24
Eritrea	0.23	2.16	New Zealand	0.26	1.48	Venezuela	0.44	1.49
Estonia	0.38	2.78	Nicaragua	0.22	3.31	Vietnam	0.25	2.31
Ethiopia	0.46	0.81	Nigeria	0.87	1.34	Yemen	0.27	-0.97
Finland	0.27	1.63	Norway	0.22	1.03	Zambia	0.82	1.45
France	0.19	1.00	Oman	0.23	0.14	Zimbabwe	0.32	0.87
Gabon	0.22	-0.54	Pakistan	0.26	0.38			

However, in the context of the CDM-JI issue, such information about FDI distribution represents only a piece of answer. In order to understand whether FDI actually flows towards countries where the potential for energy efficiency improvements is higher, we focused on the relationship between FDI and energy intensity, here used as a proxy of energy efficiency. An ideal pattern of FDI would be one in which FDI towards countries increases as energy intensity increases. To a certain extent, this would mean that FDI flows towards countries in which the potential for energy efficiency improvements is higher. In Fig. 2, in which we plotted the FDI concentration index versus energy intensity, we find that no positive relationship exists between the two variables. Such a result is also confirmed by the low value of the correlation coefficient (0.019). Further investigations performed about the relationship between the FDI concentration index and energy intensity concern the different areas. We can see that all the areas are characterized by a very low degree of correlation between the two variables. In particular, the correlation coefficients are as follows: Formerly Planned Economies, 0.016; Africa, -0.037; Asia, -0.165; Developed Countries, 0.167. An exception to such results is Central and South America, whose correlation coefficient is equal to 0.519.

In order to deepen our investigation, at world level we distinguished between the industrial sector and other sectors, and again plotted the industry energy intensity versus the FDI concentration index. We repeated the same exercise for the other sectors. In both cases (see Fig. 3) we had a confirmation of no significant positive relationship, the correlation coefficient being -0.048 (industry) and -0.029 (other sectors). In other words, at world level, both for the industrial sector and the other sector, there is no evidence that FDI flows towards countries in which there is a high potential for energy efficiency.

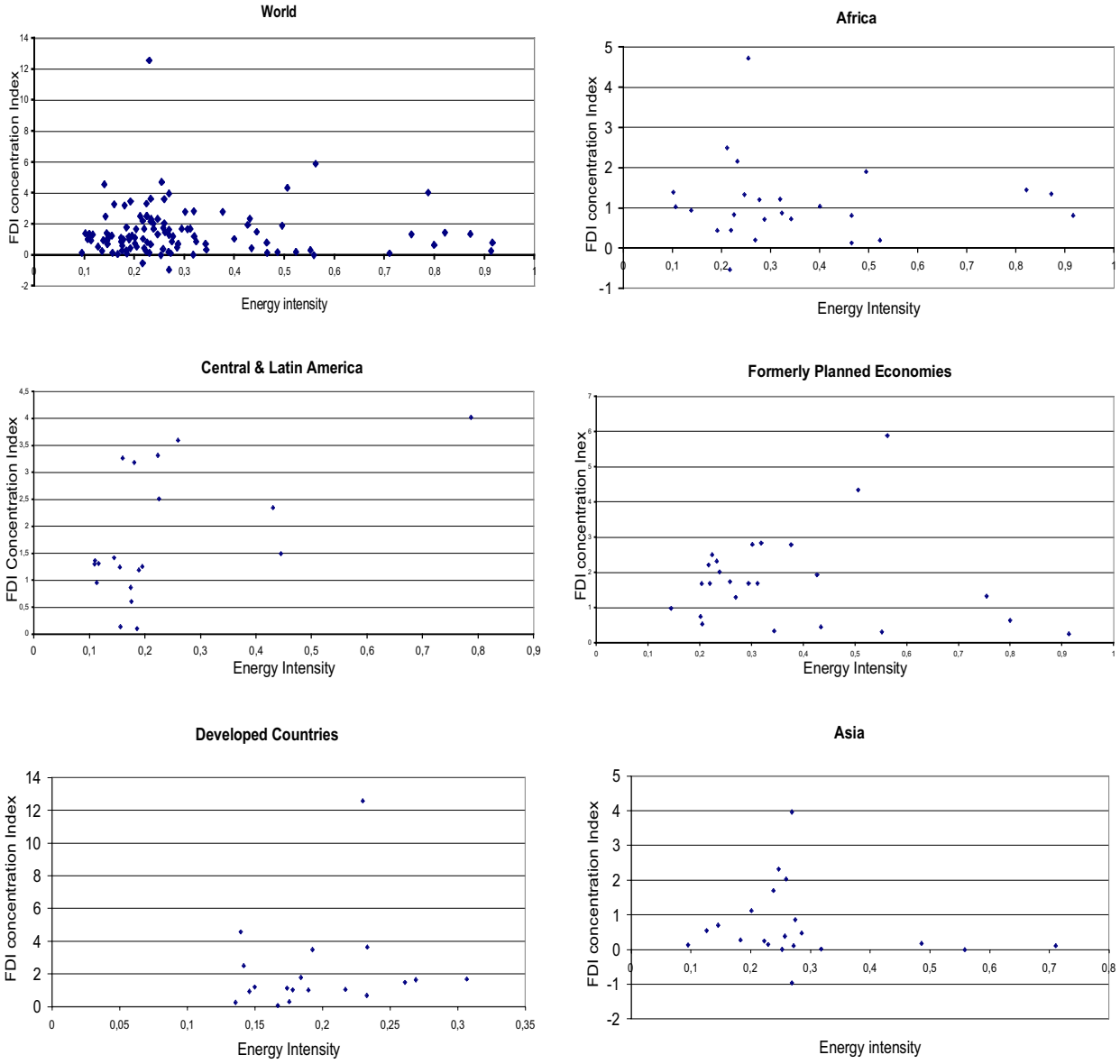

Figure 2 . *FDI Concentration Index vs. Energy Intensity in different regions.*

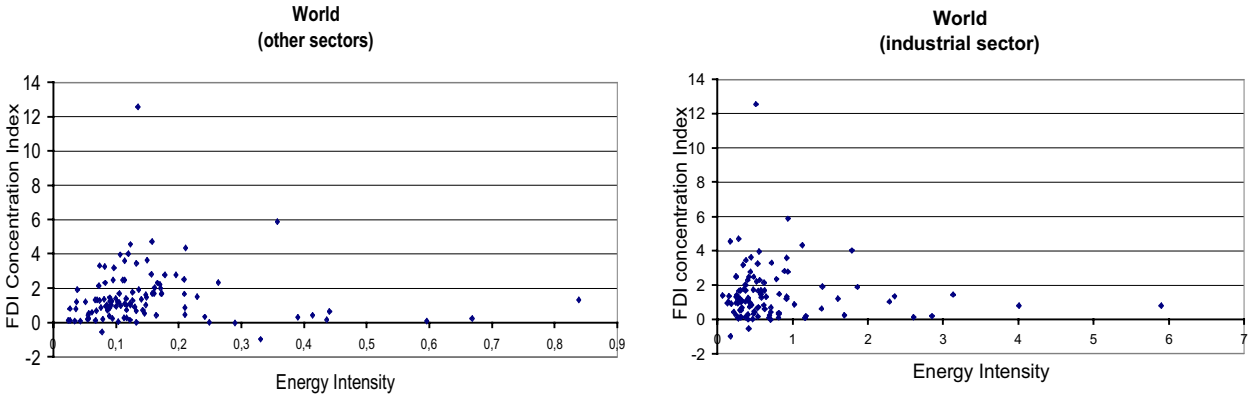

Figure 3. *FDI Concentration Index vs. Energy Intensity at world level.*

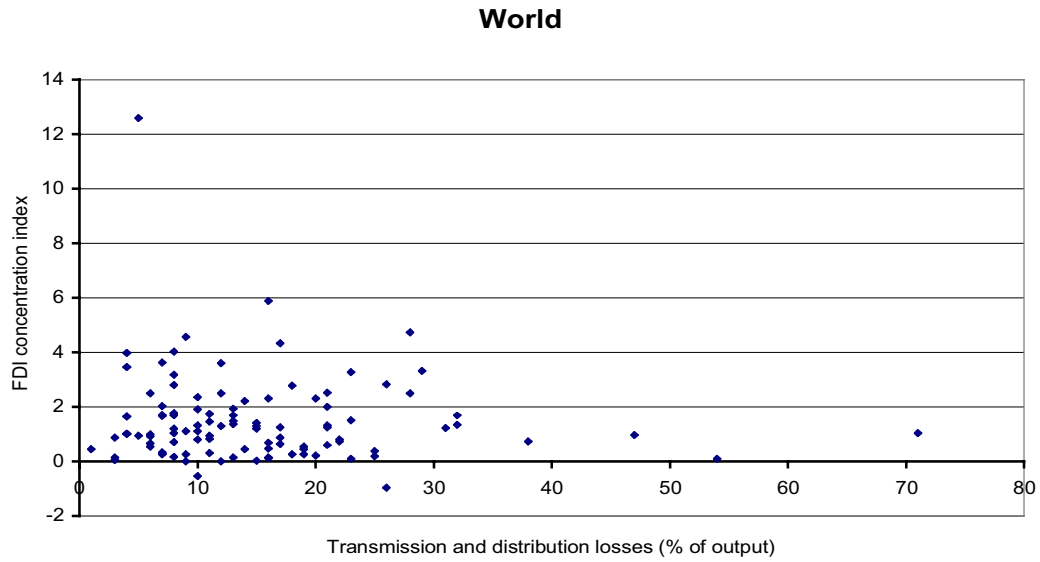

Figure 4. *FDI Concentration Index vs. Transmission and distribution losses at world level.*

The last exercise we performed was to explore the relationship between the FDI concentration index and an index of energy inefficiency, such as transmission and distribution losses (Fig. 4). Again, we obtained no significant correlation between the two variables.

Readjusting FDI: an exercise

Data, as we expected, confirm that there is no apparent relationship between FDI inflows to a country and the country's level of energy intensity. The next point to be discussed is then: how large is the difference between the current structure of FDI flows and a notional structure where flows are directed to countries where the scope for energy efficiency improvement is largest? In order to do so, we considered the actual ranking of countries according to energy intensities and computed the relative energy intensity ratio as

$$REI^i = \frac{EI^i}{E}$$

where EI^i and E are respectively the energy intensity of the i-th county over the 1996-2001 period and the same magnitude referred to the overall sample of countries. Building on REI^i, we built the index EMF^i:

$$EMF^i = REI^i \cdot \frac{GDP^i}{GDP} \cdot FDI$$

EMF^i stands for Energy Motivated Flows and represents the inflow of foreign direct investments to country *i*, which would be observed if the FDI concentration index equaled the relative efficiency index. As a matter of facts, this procedure is equivalent to compute

$$EMF^i = \frac{TPES^i}{TPES} FDI$$

i.e. one country's share of foreign direct investments is assumed to equal the country's share in world's *TPES* (Total Primary Energy Supply). We can then compare EMF^i with

the actual FDI^i and assess the amount of readjustment which should be required if investments were to be motivated by energy efficiency purposes. Table 4 shows the results for large geo-economic areas.

As it can be easily seen from column 1, the adjustment required consists in a redistribution of flows of 262 615 Millions Euro, with dramatic changes with respect to the actual inflows to specific areas. From column 2, one can see the adjustment of FDI with reference to areas' FDI, while from columns 3 and 4 one can see the negative and positive adjustments in percentage of total adjustment. For instance, European countries should contribute to adjustment with a decrease in inflows amounting to 0.7 of current actual inflows to Europe and to 91% of the total adjustment required at the world level. Another 8% of the total readjustment falls on Latin American countries and 1% on North America. The corresponding increase in inflows to other countries benefits mainly South East Asian countries (+ 40%) and the Formerly Planned Economies (+26%). Northern African Countries should receive more than 3 times than the amount of FDI they receive today, i.e. + 8% of total FDI. North America should contribute to readjustment to a very low extent (1%).

Table 5 provides a country-level summary account of the readjustment process. At this level, the process is rather concentrated. Eight European countries should contribute (by a reduction of their inflows) to the 80% of world readjustment. In particular, Belgium and Luxemburg, an area in which many multinational enterprises are located, should contribute to the total adjustment by 26.2%, UK by 16.3%, Netherlands by 10.1% and Germany by 9.5%. On the other hand, three countries (China, Russia and India) would receive around 47% of the additional investments. These results are reasonable, and confirm the need for a relocation of FDI towards less energy efficient countries, if an energy efficiency improvement target has to be met.

Italian policies

As far as Italy is concerned, first of all we consider the amount of FDI outflows, i.e. towards which countries and sectors they are addressed. In particular, we investigate if they flow to developing countries with a significant CDM-JI potential (in our case represented by high energy intensity). The trend of the Italian FDI outflows since 1993 to 1999 is showed in Fig. 5: in 1998, the year with the highest figure, the Italian share of world FDI was about 4%.

If we consider the destination of these flows, we can notice that Italy invests mainly in the European Community (Table 6 and Fig. 6), even though the share of the other European countries grew in recent year. In particular, within this area, Poland and Hungary are the preferred destination.

Breaking up this FDI by economic sector (Fig. 7), we see that 63% goes to the financial sector while only 14% goes to the energy sector (mining, electricity, gas and water).

The picture does not change if we consider only non-EU countries: the sectorial composition of outflows remains still the same, only the share of manufacturing doubles but causing a strong decrease in the share of mining, electricity, gas & water.

Table 4. Changes in FDI inflows reflecting the energy intensity ranking.

	EMF-FDI (Mil. Euro)	(EMF-FDI) /FDI	Share of total negative adjustment	Share of total positive adjustment
European Countries	-238 884	-0.7	91	
North America	-2 155	0.0	1	
Other developed countries	37 453	2.6		14
Southern and Central America	-21 576	-0.3	8	
Formerly Planned Economies	68 231	2.7	-	26
Northern African Countries	5 306	1.5	-	2
Other African Countries	19 731	3.2	-	8
Near East	27 222	12.3	-	10
South-East Asia	10 4672	1.6	-	40

Table 5. Adjustment as share of total adjustment: first 10 countries.

	Largest negative adjustments as shares of total adjustment		Largest positive adjustments as shares of total adjustment
Belgium & Lux.	26.2	China	17.5
UK	16.3	Russia	16.0
Netherlands	10.1	India	13.0
Germany	9.5	Japan	12.7
Sweden	6.4	Indonesia	4.1
France	5.6	Ukraine	3.7
Ireland	3.4	Iran	3.1
Denmark	3.3	Saudi Arabia	2.7
Brazil	3.2	South Africa	2.2
Canada	2.5	Italy	2.2
Total	**86.5**	Total	**77.2**

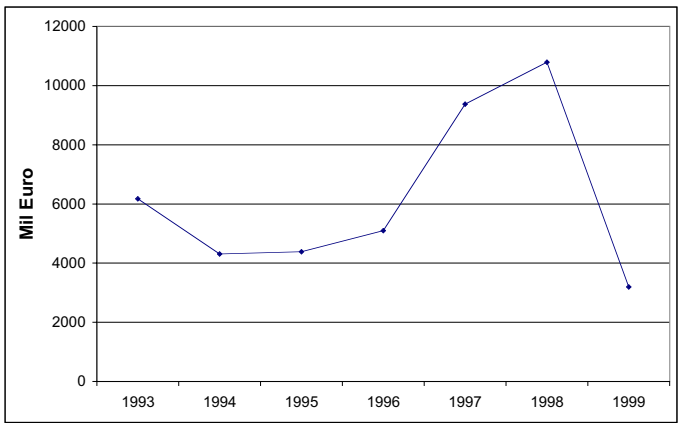

Figure 5. *Total FDI outflows from Italy (mil. Euro) (Source: Eurostat 2001).*

Table 6. FDI outflows from Italy by destination 1993-1999 (mil. Euro) ***(Source: Eurostat 2001).***

	1993	1994	1995	1996	1997	1998	1999
Europe	5 695	3 347	3 743	3 592	6 046	5 913	2 330
Other Eu. Countries	371	120	114	88	168	661	1 000
Africa	33	19	48	68	329	125	94
North America	-194	413	357	669	1048	1894	266
South America	-24	31	98	132	252	1 507	632
Asia	35	270	48	159	695	222	132
Oceania	-5	-33	-2	3	58	16	-21
TOTAL	6 174	4 302	4 384	5 092	9 373	10 787	3 194

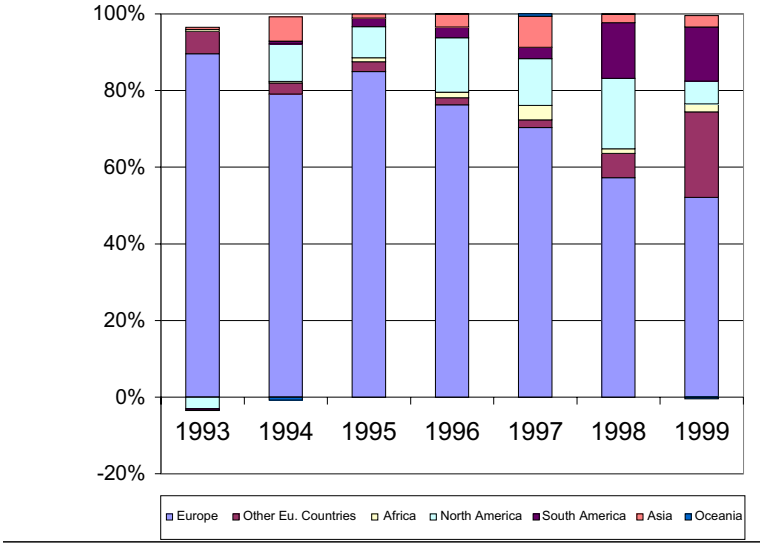

Figure 6. *Italy: % FDI outflows by area 1993-1999 (Source: Eurostat 2001).*

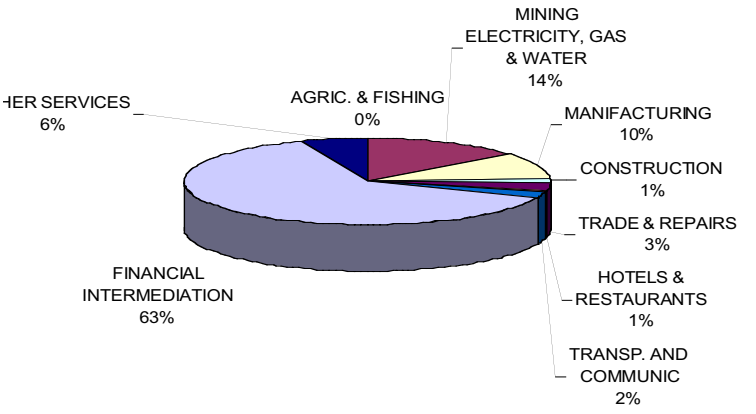

Figure 7. *Italy: FDI outflows composition by sector (average 1993-1999) (Source: Eurostat 2001).*

Another interesting information for our study is the FDI stocks. The sectorial composition worldwide in 1998 is shown in the next graph.

It is interesting to underline that, among manufacturing activities, the share of metal and mechanical products is very high (37.5%). This sector is one of the most energy intensive, so it could be a good opportunity for the implementation of CDM and JI projects.

To sum up, Italian FDI outflows are mainly directed towards developed countries (especially inside the EU) and in the service sector (financial intermediation firstly). In other words, till now the FDI strategy followed by the Italian industry did not consider the wide and promising CDM and JI opportunities available in appropriate sectors and areas. So, the question which arises is: what has to be done to redesign this strategy? Which policies and measures could awake investors to CDM and JI projects?

In order to answer such a question, we will consider the 2002 resolution by CIPE (Joint Government Committee for Economic Planning), containing the new guidelines for GHGs emissions reductions. The document contains a detailed analysis of the current Italian emissions, a forecast to 2010, and outlines which policies and measures must be undertaken to meet the Kyoto target. According to the CIPE document, an important part of GHGs emissions reductions should be realized through external measures, because of the lower cost of these options. In particular, "industry and forestry sector, through CDM and JI, could generate carbon credits between 20.5 and 43 Mton CO_2 eq.", i.e. a significant share of the estimated total surplus in emissions to 2010 (92.6 Mton. CO_2 eq.). Since there is no previous experience in flexible mechanisms, their implementation by the private sector needs solid support by the Government. That is why the CIPE resolution states specific assistance programs, coordinated by a national JI and CDM Office, to help and inform firms. This Office should assess all the current Italian initiatives that could be classified as CDM or JI and promote further projects (for example, by informing firms about the World Bank's Carbon Fund and similar). The CIPE philosophy focuses on the Italian firms with international assets, especially in the transport and energy sector, where the abatement potential is higher. A large part of the projects concerns ENI, the Italian oil company, whose activities would have a great CDM potential (about 20 Mton CO_2) through gas flaring and gas venting projects in developing countries. In the only ENI's oil fields in Nigeria, re-injection, combined cycles and LNG technologies could abate

Table 7. Estimated reductions potential of LNG and NGCC projects by ENI *(Source: CIPE 2002).*

Project	Start up	CO_2 abatement (Mton/y)	Investment cost (Mil.$)
Nigerian LNG 1st step	2000	1,4	441
2nd step	2003	0,95	171
3rd step	2006	1,9	411
Nigeria Kwale Power Plant – NGCC	2004	0,27	82
Congo Djeno Power Plant – NGCC	2002-2003	0,11	23
Total		**4,6**	**1 128**
Other probable CO_2 abatement		**7-13**	

Table 8. Estimated reductions potential for the Italian electric sector abroad *(Source: CIPE 2002).*

Project	CO_2 reduction (Mton)	Investment cost (M Euro)	Net cost (M Euro/M ton CO2)
JI coal plant – increasing efficiency or NGCC conversion	3-5	350-580	1,5
CDM coal plant – increasing efficiency or NGCC conversion	1,5-3	175-350	1,5
CDM – renewable energy (wind)	1-5	316-1 600	<0/1

Source: CIPE 2002

about 7-13 Mton/y CO_2 eq. According to the CIPE document, the cost range of these projects is slightly larger than zero (considering 5% discount rate and oil price around 21 $/barrel) (Table 7).

ENI is also involved in R&D activities on CO_2 sequestration projects, and this could create further CDM opportunities. The CIPE resolution focuses also on the power generation sector, which is fast growing in developing countries and is one of the major responsible of CO_2 emissions. CDM and JI initiatives could include wind energy plants, NGCC conversion and the updating of coal plants (see Table 8).

In synthesis, the CIPE resolution implicitly designs a structure of FDI outflows which strongly exploits the opportunities of improving energy efficiency through appropriate investments in specific area and countries. Nevertheless, the history of Italian FDI tells us that Italy, like the majority of the other countries, addressed its investments according to principles which disregard the energy efficiency aspect.

In general, with reference to its impact on energy efficiency, either in Italy or abroad, the CIPE resolution stimulates a number of reflections:

- A large part of the domestic CO_2 abatement incorporated in the so called "reference scenario" to 2010 refers to energy efficiency actions which would have been realized in any case. For instance, the implementation of 3 200 new Combined Cycles MW which should abate around 26 Mton. CO_2/year, and the new decrees on white certificates and energy efficiency in end uses (6.3 Mton. CO_2 in the year 2006);
- the CDM-JI opportunities were suggested by the Italian firms on the basis of considerations about their already planned business. In other words, it is very probable that the CDM-JI measures in the CIPE resolution are nothing but "old wine in new bottles". Maybe, this is not true for all the suggested interventions, but it so for a great number of them;
- there exists a strong eligibility issue, especially regarding the gas flaring projects in Nigeria. It is not sure that they

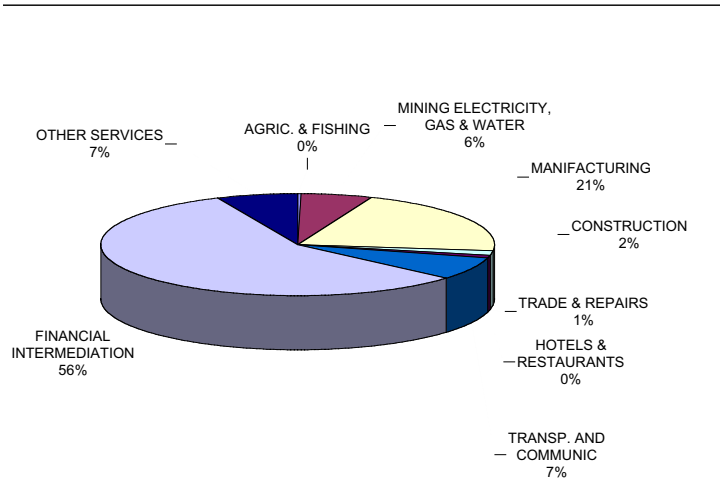

Figure 8. *Italy: FDI outflows composition by sector (non-EU countries, average 1993-1999) (Source: Eurostat 2001).*

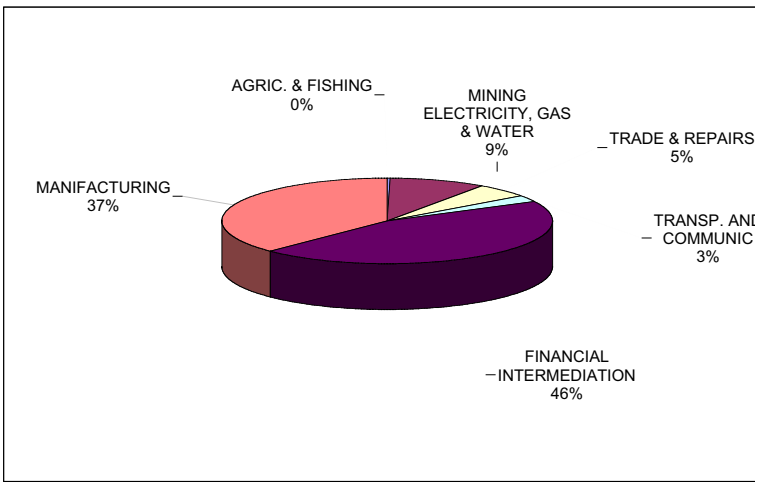

Figure 9. *Italy: FDI stocks by economic activity (1998) (Source: Eurostat 2001).*

will generate additional CO_2 reduction, since the Nigerian authorities are oriented to lower the baseline of the oil fields by the year 2008.

Finally, within the Italian context, there exist hints that a competition between energy efficiency and carbon sinks projects is arising, both in Italy and abroad. As the latter is concerned, the CIPE document refers to further JI and CDM projects in the LULUCF (Land Use, Land Use Change and Forestry) sector, which could generate 5-20 Mton CO_2 eq. reductions per year. Since LULUCF often represents a very cheap opportunity, it is probable that it could crowd out energy efficiency projects. At the domestic level, the CIPE resolution, facing a very strong growth in the transport sector CO_2 emissions (+ 14% in 10 years), plans to compensate it by afforestation, reforestation, forest and land management actions. The national potential for them, estimated in the CIPE resolution, is equal to 10.2 Mton CO_2 eq./year. Such intervention should be financed by a new carbon tax in the transport sector, whose amount, starting from 2004, will be 1 cent/Euro per fuel litre.

Conclusions

We can summarize the main points of our analysis as follows:

- FDI strongly increased in the last years (about 500% since 1996 to 2000). To a very large extent (80%-90%), this increase occurred within industrialized countries.
- If we compute an FDI concentration index that takes into account the economic dimension of a country (GDP), we notice that the FDI distribution among DCs and LDCs is not as uneven as the one that emerges by the simple consideration of the FDI absolute value.
- If we study the relationship between FDI and energy intensity, we see that until today FDI did flow neither towards countries nor towards sectors with high energy efficiency improvement potential.
- A readjustment of FDI which fully exploits the CDM-JI potential would be one in which investments are shifted from European Countries (-91%) to South-East Asia (+40%) and Formerly Planned Economies (+26%).
- FDI should be reduced mainly in Belgium and Luxemburg, UK and the Netherlands. On the contrary, a strong increase of FDI would be necessary in China, India and Russia.
- Like many other countries, Italy's FDI did not grasp the numerous opportunities for energy efficiency improvement. Certainly, the new policies by the Government introduce big changes. Nevertheless, there is no guarantee that the Italian companies will behave as hoped by the Italian policy makers, their past behavior being very far from an energy efficiency improvement target.

International data show a movement of FDI originated mainly by the search for high returns and financial efficiency. The majority of FDI remains within LDCs and in sectors (e.g. telecommunication and financial intermediation) characterized by very low energy intensities. A small shift of FDI towards LDCs, especially to energy intensive sectors, could give rise to relevant improvements in energy efficiency. This is the big challenge set by the Kyoto Protocol, one in which different patterns of FDI arise, bringing development in LDCs and, at the same time, generating GHGs abatement and energy efficiency. The probability of being successful in such a challenge is crucially linked to the price of CO_2 credits (ERUs and CERs) emerging in the JI and the CDM markets. The higher the price of the CO_2 credits, the higher the incentive for the firms to start CDM-JI initiatives. Certainly, the CO_2 market is not yet entirely ready. Nevertheless, with reference to the CO_2 price, we have to admit that it is very lower than the first estimates in 1998, just some months after the signature of the Kyoto Protocol. As it happened in the US experience with the SO_2 credits market, CO_2 price fell a lot. While in 1998 there were estimates around 200 US$/ton. CO_2, today we face prices which are often lower than 20 US$. A reference point for the CDM market is the Prototype Carbon Fund (http://prototypecarbonfund.org), a World Bank initiative that undertakes carbon reduction programs, verifies credits and 'credits' them to subscribers in proportion to subscriptions to fund. This experience gave rise to CO_2 prices in the range 3-4 US$/ton. According to some estimates by experts, the CO_2 price should increase as the first commitment period is approached and countries buy more credits in order to meet their targets. Nevertheless, the price should remain under 20 US$/ton CO_2. This result is also affected by the exit of the US from the Kyoto agreement, which lowered a lot the demand for CO_2 credits. Moreover, even if the CO_2 price will rise in the future years, it is not probable that firms will start CDM-JI projects for exploiting uncertain high prices. Firms usually decide their strategies on the basis of quite likely cash flows rather than uncertain price predictions. Finally, it must be recognized that a strong competitor for energy efficiency projects is represented by LULUCF, an arena of very cheap opportunities of CO_2 reduction. Due to very low CO_2 abatement costs, carbon sequestration (e.g. plantation, afforestation, reforestation) and carbon conservation (e.g. prevented deforestation, land degradation prevention) projects can crowd out energy efficiency projects. Some experiences of carbon sinks in Central and South America gave rise to abatement costs in the range 0.07-0.39 US$/ton. CO_2. For instance, in Paraguay AES, one of the world biggest independent power producers, along with The Nature Conservancy, realized a tropical forest reserve with an abatement cost equal to about 0.07 US$/ton. CO_2. Similarly, in Bolivia, American Electric Power, PacifiCorp, BP America and The Nature Conservancy preserved 640 000 hectares of forest at 0.17 US$/ton. CO_2. Competing with such projects is very difficult, and maybe impossible. The future years will show whether or not energy efficiency projects will be successful in the struggle with its many enemies: low cost projects, profit logic, transaction costs.

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Glossary

CDM	Clean Development Mechanism
CER	Certificated Emission Reduction
CIPE	Interministry Committee for Economic Planning
DC	Developed Country
ERU	Emissions Reduction Unit
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Greenhouse Gas
JI	Joint Implementation
LDC	Less Developed Country
LNG	Liquid Natural Gas
LULUCF	Land Use, Land Use Change, Forestry
NGCC	Natural Gas Combined Cycle
TPES	Total Primary Energy Supply