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Unlocking private investments in energy efficiency through carbon finance

According to the latest IEA World Energy Outlook, energy efficiency is a "key option" in transition to a low-carbon economy. A decade of experience with the CDM and JI demonstrates that carbon finance can be used as an effective tool to unlock private investments in energy efficiency. Capital investments in offset projects may significantly exceed the expected carbon revenues resulting in an average weighted leverage ratio of 4:1 and 9:1 for the CDM and JI respectively, which is comparable to other international financial instruments. So far carbon finance has been used mostly for large-scale industrial energy efficiency projects in advanced developing countries and economies in transition, although it is increasingly suited to tap into scattered household energy efficiency projects.

Background: untapped opportunities for energy efficiency

Unlocking energy efficiency requires different policies

According to the latest World Energy Outlook (IEA, 2012a), investments in energy efficiency should amount to US$158 billion per year, which would enable two thirds of greenhouse gas (GHG) emission reductions envisaged by 2035 under the New Policies Scenario[1]. The payback periods for energy efficiency measures included in the New Policies Scenario range from 2 years for electric equipment to 8 years for air and water heating. Nevertheless, despite the economic attractiveness of these measures, different barriers prevent tapping into these opportunities and need to be addressed through public policies. According to the report of the United Nations Industrial Development Organization (UNIDO, 2011), the main obstacles are high technical and financial risk, imperfect information, hidden costs, access to capital, split incentives and bounded rationality. The height of these barriers may differ depending on the sector as well as on the specific countries' circumstances and therefore may require different policies.

The International Partnership for Energy Efficiency Cooperation (IPEEC, 2012) has identified that the implementation of energy efficiency policies depends on the market maturity – i.e. availability of financial infrastructure – of sectors or countries concerned:

- In premature markets, of least-developed countries, which are plagued by the lack of liquidity and high transaction costs, energy efficiency improvements are mostly supported through simple and direct public finance mechanisms such as grants and subsidies. These policies are however associated with higher "free rider" risk as their additionality is difficult to evaluate.
- Markets in transition, such as those of emerging economies, are likely to benefit from more sophisticated instruments, e.g. performance contracting or carbon finance.
- Finally, mature markets, usually to be found in developed countries, are ready to use complex tools such as energy saving certificates trading.

[1] New Policies Scenario is the main scenario of the World Energy Outlook (IEA 2012a) that takes into account existing commitments and new policies that have been announced.

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Market-based mechanisms are supposed to enable energy efficiency improvements at the lowest cost, but require established financial infrastructure and regulatory framework. Thus, less mature markets usually use direct public finance in energy efficiency while in more mature markets the role of the public sector is shifting towards establishing necessary regulatory frameworks for private finance that is readily available. Premature markets, markets in transition and mature markets can also coexist in one country, depending on the sector.

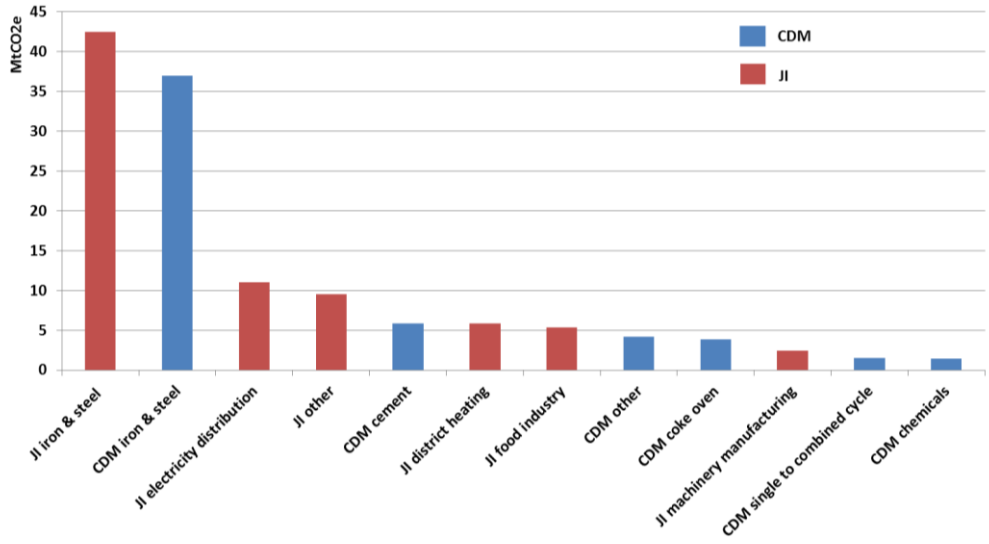
Analysis: the role of carbon finance in energy efficiency

While the international climate conference that took place in Doha in late 2012 marked the continuation of the Kyoto Protocol and its market mechanisms, it is worth reviewing the experience with carbon finance as a tool to encourage energy efficiency improvements. Although its primary goal is to reduce GHG emissions in a cost-effective way, carbon offsetting has also played significant role in financing energy efficiency projects. Indeed, as of December 2012, these projects accounted respectively for 30% and 5% of all verified emissions reductions under Joint Implementation (JI) and the Clean Development Mechanism (CDM) – the two largest carbon offset standards.

Carbon finance for different project types…

At the end of 2012, there were 407 and 135 energy efficiency projects registered under the CDM and JI respectively, with over 40 different sub-types in various sectors. On the one hand, this demonstrates that carbon finance can be applied in virtually all sectors – from large-scale industrial projects to small-scale scattered household-level initiatives. On the other hand, these projects are largely concentrated in the iron and steel industry in both the CDM and JI – accounting for 70% and 50% of verified emissions reductions respectively (Figure 1). This can be explained by the large potential for modernization of this industry in advanced developing countries for the CDM and transition economies for JI.

Figure 1 – Verified emissions reductions by energy efficiency project sub-type ($MtCO_2e$)



Source: CDC Climat Research based on UNEP Risoe's CDM Pipeline and JI Pipeline (December 2012).

…for economies in transition and advanced developing countries

Energy efficiency projects are also largely concentrated geographically – China and India account for 84% of CDM projects, while Russia and Ukraine account for 88% of JI projects. This concentration is in line with the overall distribution of offset projects, which is determined by the countries' absolute GHG emissions and relative emissions intensity, overall investment climate and the level of international cooperation (Shishlov and Bellassen 2012). The geographical concentration of carbon offset projects is much higher than that of other

international financial instruments. For example, more than half of 118 energy efficiency projects financed through grants of the World Bank's Global Environment Facility (GEF) are located outside BRICS and Eastern European countries.

In the case of JI, there is a clear distinction in types of projects implemented in Russia and Ukraine compared to those implemented in the EU. Former Soviet republics mostly host large industrial projects in sectors like iron and steel, cement, chemical industry and electricity distribution, while EU countries focus more on small-scale projects such as district heating, agriculture as well as scattered household energy efficiency Programs of Activities (PoAs)[2]. Indeed, in the presence of the European Union Emissions Trading Scheme (EU ETS), which regulates GHG emissions of large industrial installations, the implementation of industrial energy efficiency JI projects would cause double counting of emissions reductions and is therefore not allowed. Note that carbon finance still likely plays a role within the scope of the ETS, rewarding energy efficiency measures through saving emissions allowances (EUAs). However, tracking energy savings that can be attributed to the ETS is much more difficult than in the case of audited JI and CDM projects.

Conversely, Russia and Ukraine do not have an ETS in place, which, together with a lack of national energy efficiency policies, explains the wide use of carbon finance by industries. Moreover, these countries do not have an economic incentive to be stringent on additionality of projects as they benefit from large surpluses of Assigned Amount Units (AAUs) – countries' emission quotas under the Kyoto Protocol – from which carbon credits for projects are issued. Similarly, virtually all energy efficiency CDM projects in China and India are focused on industrial energy efficiency – mainly waste heat utilization in heavy industries.

Finally, the potential of carbon finance for least-developed countries is rather limited due to lower absolute levels of GHG emissions, low relative carbon intensity of their economies and less favorable investment climate. Besides, low-income countries usually have other development priorities such as water and energy access. Nevertheless, the introduction of the PoA framework can pave the way for the implementation of demand-side energy efficiency projects, e.g. improved lighting or cookstoves, in least-developed countries.

The carbon leverage effect

As of December 2012, 265 CDM and 25 JI energy efficiency projects for which the investment data is available leveraged US$18.9 billion and US$4.7 billion and are expected to reduce 446 and 48 $MtCO_2e$ of GHG emissions over their first crediting periods respectively. Assuming the carbon price of US$10 per ton of CO_2e – roughly the average price for carbon credits generated by the CDM and JI in the past three years – it can be estimated that each dollar of international carbon finance managed to leverage 4 and 9 dollars of investments in energy efficiency through the CDM and JI respectively (Table 1).

Table 1 – Leverage ratio of CDM and JI energy efficiency projects

	CDM	JI
Number of projects with investment data	265	25
Planned GHG reduction (1st crediting period)	446 $MtCO_2e$	48 $MtCO_2e$
Expected carbon revenue (at US$10/$tCO_2e$)	US$ 4.5 billion	US$ 0.5 billion
Total project capital investments	US$18.9 billion	US$4.7 billion
Leverage ratio (investment/carbon revenue)	4:1	9:1

Source: CDC Climat Research based on UNEP Risoe's CDM Pipeline and JI Pipeline (December 2012).

[2] Programme of Activity (PoA) is a framework that allows implementing an unlimited number of programme activities (CPAs) under one registered PoA helping reduce transaction costs. This modality enables the gradual deployment of small-scale technologies which would be too costly under the regular CDM/JI.

The crediting periods for CDM projects are either 7 years (renewable) or 10 years (non-renewable), while the maximum crediting period for a JI project is only 5 years (2008-2012), hence the significant difference in the leverage ratios. Note that this is a simplified definition of the leverage ratio, as it takes into account only capital investments, while neither operational costs nor the discount rate are accounted for.

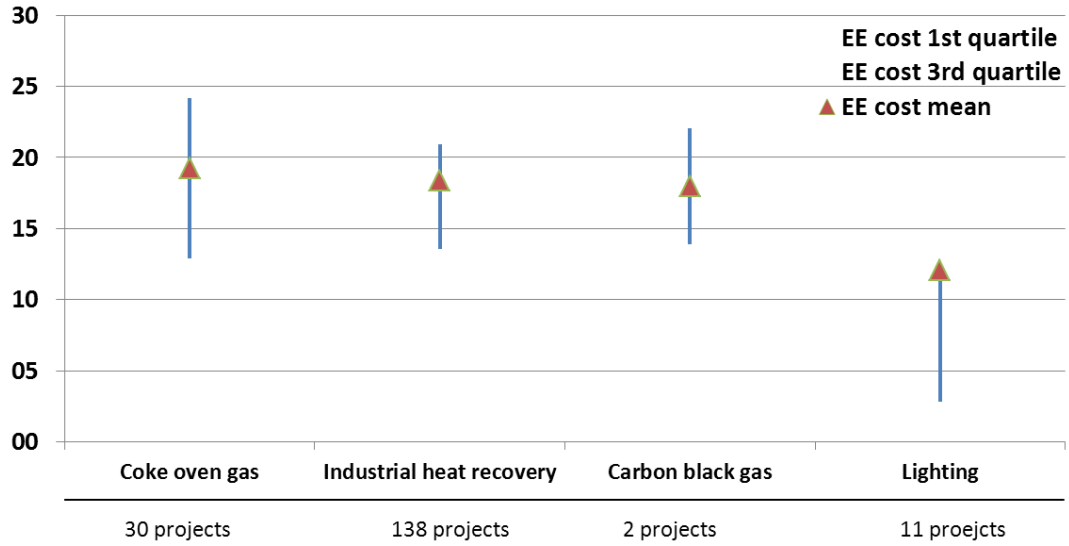
According to project design documentation the average weighted amount of capital investments required to reduce one ton of CO_2e in energy efficiency CDM projects can vary from US$7 in projects focused on improving household lighting to US$120 in projects on more efficient coal power plants. Carbon finance can therefore be considered an effective public policy tool that unlocks private investments in energy efficiency projects across different sectors, provided that additionality of these projects is ensured. Capital costs of improving energy efficiency may significantly exceed the revenues expected from the sale of carbon credits, resulting in a higher leverage ratio of carbon finance. The higher the non-carbon revenues are, the higher the leverage ratio a project developer can afford, as energy savings outweigh the investments not covered by carbon finance.

The leverage offered by carbon offset projects is comparable to that of other international financial instruments. For example, the World Bank (2010) reported the leverage ratios of 6:1, 7:1 and 9:1 of its Global Environment Facility (GEF), the Clean Technology Fund (CTF) and Carbon Partnership Facility (CPF) respectively. Energy Agency (2012b) estimated the leverage ratio of energy efficiency financing by multilateral development banks and bilateral financial institutions between 2:1 and 8:1. Note, however, that the definition of the leverage ratio of public development banks – the amount of co-investments divided by the investment of the public bank – is slightly different to the “carbon leverage” of offset projects. The latter does not require any direct use of public money, other than for setting up the regulatory framework for the carbon market.

The cost of energy efficiency

The analysis of a sample of 181 CDM projects, for which the investment and energy savings data is available, shows that the average capital investments required to save one MWh vary from US$12 for projects focused on household lighting improvement to US$20 in projects aimed at utilization of waste gas in carbon black production (Figure 2).

Figure 2 – Capital investments (US$) per MWh saved *



**Sub-types with at least two registered projects. Projects focused on supply side energy efficiency, such as supercritical coal-fired power plants and switch from single cycle to combined cycle gas-fired power plants, are excluded due to complexity of calculating energy savings. Note that the average cost of lighting projects is in the high range of the third quartile due to two exceptionally expensive projects.*

Source: CDC Climat Research based on UNEP Risoe's CDM Pipeline (December 2012).

When the electricity price exceeds the capital investments required to save one MWh of energy, the additionality of energy efficiency projects may be questioned. One has to note, however, that costs are likely underestimated, as these calculations include neither operational nor transaction costs. Besides, projects may face other barriers: out of 248 registered projects focused on waste heat/gas utilization only 103 used investment analysis to prove additionality, 71 used barrier analysis and 74 used both (IGES 2012).

Conclusion: carbon finance is one of the viable tools to promote energy efficiency

The experience with the CDM and JI demonstrates that carbon finance is a viable tool that helps unlock private investments in energy efficiency – from large-scale industrial projects to small-scale household initiatives – that is particularly well suited for advanced developing countries and economies in transition. Thanks to the average weighted leverage ratio of 4:1 and 9:1 in the CDM and JI respectively, carbon offset projects managed to raise almost US$24 billion of mostly private investments in energy efficiency, which is comparable to other international financial instruments, such as, for example, the GEF that has leveraged around US$6 billion in its energy efficiency projects. Carbon finance therefore deserves some attention from the advocates of energy efficiency, although measures to boost demand for carbon credits are required to save the mechanism.

To find out more…

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