END-USE VERSUS SUPPLY SIDE APPROACH FOR GHG REDUCTION IN SIDS. CASE STUDY: CAPE VERDE ISLANDS

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Abstract The energy sector in many Small Island Developing States (SIDS) is an important constraint for socio-economic development. It also is the cause for major environmental damage, from desertification to GHG emission. In a previous study for Santo Antão Island (Duic et al.), a simulation of wind and solar energy penetration in the power production sector was performed and the possibility of Clean Development Mechanism to act as incentive was analysed. This paper analyses the impact of end-use energy policy measures aiming at reducing CO_2 emissions. The end use approach will be compared with the supply side approach carried out in the previous study.

In 1990 the domestic sector accounted for almost 40% of the energy consumption in Cape Verde. In a rural region as Santo Antão Island this share rises to nearly 80%. Electricity consumption accounts for only 0.7% of the total consumption while wood fuel consumption rises above 60% of the total. Even if the recent rural electrification increased the electrification rate from 13% in 1990 to about 53,5% in 2000, this did not likely affect the demand of wood for cooking. Thus, any action aiming at reducing energy consumption and GHG emissions in Santo Antão should have the domestic sector as main target.

To carry out an end-use analysis the energy sector is disaggregated into sub-sectors (e.g. domestic), end-use (e.g. cooking) and devices (e.g. improved stoves). For cooking the population generally uses a combination of two sources between wood, biomass, kerosene and LPG. Wood fuel is burned in traditional three stone, classic stoves and improved stoves. In this paper we analyse the impact of better efficiency, changes on behaviour and introduction of solar stoves on CO_2 emission. It is assumed that a program to reduce GHG emission starting in 2000 until 2030 will be implemented. A financial analysis is carried out and the possibility of financing trough Clean Development Mechanism is investigated.

It was concluded that for Cape Verde, particularly the Santo Antão Island, a simple program aimed at reducing GHG emission based on behaviour changes, fuel shift and improved efficiency can be implemented with high impact and reduced cost. The application of such measures can, with correct accounting, be included in CDM projects and thus be easily financed by a market mechanism.

Keywords: CDM, domestic sector, energetic behaviour, energy efficiency, GHG emission, SIDS.

1. INTRODUCTION

The UNFCCC – United Nations Framework Convention on Climate Change signed during the United Nation Conference on Environment and Development in Rio (Earth Summit, 1992) was based on a new concept: sustainability. Sustainable development is a broader concept than human development, which itself includes economic development. Afterward, the environment issue (mainly the climate change issue) overlies the development concern.

However, the UNFCCC, whose main objective is "the stabilization of green house gas concentration in the atmosphere" (article 2) made a natural partition of the countries based on the "common but differentiated responsibilities and respective capabilities" (article 3) i.e. a partition based on economic development.

The Annex I countries (the 24 members of the Organization of the Economic co-operation and Development – OCDE plus 12 countries in the process of transition to a market economy) were recognized responsible for the actual concentration levels of Green House Gases (GHG).

The Kyoto Protocol (signed in December 1997 in Kyoto-Japan) resulted from the third Conference of the Parties to the UNFCCC and sets legally binding emission targets for developed countries (Annex I countries). Together, these countries must reduce their emissions of six greenhouse gases by 5.2% below 1990 levels over the commitment period 2008-2012. The countries not listed in Annex I (developing countries) did not commit themselves to any reduction.

Reflecting the guiding principle that "policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost", the Kyoto Protocol incorporates provisions for cooperative implementation mechanisms that allow countries to exploit the differentials in marginal costs of climate change mitigation.

The so-called Kyoto Mechanisms are: Joint Implementation (JI – Article 6), International Emissions Trading (IET – Article 17) and the Clean Development Mechanism (CDM – Article 12).

Essentially, the Kyoto mechanisms allow Annex I countries and respective GHG-emitting companies to meet part of their reduction commitments by financing (directly – CDM and JI, or indirectly – IET) GHG reductions abroad. Since mitigation of global warming is independent from the location of GHG abatement efforts, the overall effectiveness in terms of climate change mitigation is not reduced. JI and IET are possible only among Annex I Parties, CDM being the only mechanism that involves non-Annex I Parties (developing countries). The cooperation between developed and developing nations involves the concept of "leap-frogging" the development of the GHG-generation infrastructure in developing countries should occur in such a way to leap over emission-intensive steps that have been undertaken by industrialized nations.

More than merely the reduction in CO_2 emissions the Kyoto Protocol reinforces the Convention in which it points to sustainable development as the solution: if such development is achieved the reduction in emissions will come naturally. Thus sustainable development should be required for eligibility. However, there is no agreement on how to define sustainability in the operational terms required for specific activities. The Commission for Sustainable Development (CSD) is currently preparing a list of sustainability indicators. In the meantime, the most practical approach would be to allow host countries to define their own criteria for sustainable development.

Among the Kyoto Mechanisms, CDM is clearly a mechanism that addresses both climate and development issues and in this way integrates the essence of the "Earth Summit" environment and development. The international legislation that will regulate the CDM is under ongoing discussion. There is common agreement in some areas, and others, such as project eligibility, additionality, equity, baselines, role of the organisations involved, supplementarity, funding, auditing, verification and certification of emissions reductions achieved, share of the proceeds for adaptation assistance and sinks are still being discussed.

Among these issues this papers intends to highlight the fact that UNFCCC and the Protocol should not exacerbate inequities. Rapidly industrialised countries show the greatest potential for emission reduction. They might receive the bulk of investment resulting from the CDM. In the interest of equity, investments under CDM must be fairly distributed among regions. This could be accomplished by means of a quota-based system. Other solution (Papayotou, 1998) could be giving extra credits to activities undertaken in countries with very low income per capita.

Another issue addresses the kind of project that will be implemented. Small projects with very high social impact can be neglected against projects based on a high level of technology. The developed countries could prefer to support their own industry when selecting CDM projects. In this case the developed country will benefit from CO2 credits as well as from export and maintenance and operation support. For instance, a wind farm would be preferred in opposition to an energy efficiency program.

To illustrate this issue an analysis is made to the way the mechanism will work in a particular type of country: Small Islands Developing States – SIDS, in this case, Santo Antão islands in the archipelago of Cape Verde. The first case is an analysis of a demand side project in the electricity sector, and the second case consists on the evaluation of demand side projects.

2. CASE STUDY: CAPE VERDE, SANTO ANTÃO ISLAND

Cape Verde is an archipelago of 10 islands and several islets lie around 450 kilometres off the coast of West Africa in the Atlantic Ocean. The overall land area is of 4,033 square kilometres and the population is around 440,000 (in 2000). Santo Antão is the second biggest island (779 square kilometres, 44,000 people) characterised by mountainous landscape. The climate of Cape Verde is tropical and arid with erratic rainfall and average temperature of 24ºC.

2.1. Supply Side Project

Supply side projects address the way services and goods are supplied to consumers, either by improving the efficiency of the supply system or, as is the case for some energy sector projects, by changing the primary source of energy (by introducing renewable sources of energy).

One of the best candidates for such CDM projects is the energy sector, particularly electricity production. There is no local production of oil or gas in Santo Antão thus 92% of the electricity comes from diesel engines. This problematic dependence on fossil fuels can only be eliminated through the use of renewable sources of energy. Cape Verde has abundant wind resources and the technology is proven and commercially available. The units already installed are now responsible for a share of approximately 8% of the energy produced (table 1). The potential of the islands is not yet fully exploited. Santo Antão, for example, has on the northeastern side of the island an average yearly wind velocity of more than 11 m/s.

Table 1 - Electricity production (kWh) and losses in the year 2000. (Source: ELECTRA)

Island	Diesel/Fuel	Wind	Total	Losses (%)
Santo Antão	5.866.742	-	5.866.742	22.4
Total ELECTRA	134.399.506	7.927.254	142.326.760	14.6

A recent analysis of the electricity sector in the island of Santiago (Duić *et al*., 2001) simulate the penetration of wind energy in Santo Antão electricity grid. Business as usual scenario based on Diesel capacity is compared to different scenario one of them envisaging 30% of the electricity generated by the wind power. The scenarios were compared from the point of view of electricity generation prices, but also from the point of view of greenhouse gases (GHG) emissions. The possible influence of Clean Development Mechanism as part of satisfying the United Nations Framework Convention on Climate Change objectives were assessed. A certain potential for financing the technology transfer was quantified and its influence on different electricity system planning scenarios estimated. The study covers a period from 2000 to 2030 (figure 1).

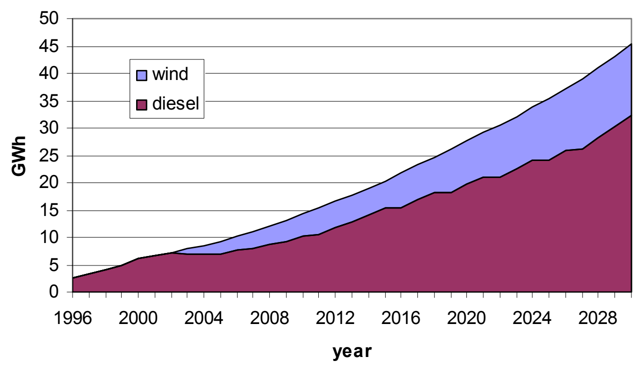

Figure 1 - Electricity production for 30% wind electricity scenario

The major drawback in the use of wind technology is that it does not eliminate the need for conventional power plants. Thus the final price per kWh from a wind-diesel option will be affected. The benefit will be the reduction on fuel consumption and GHG avoided. The first can be accounted in terms of financial benefit (at a macro level, for the whole economy because the fuel is imported and at micro level as it means money saved). If the GHG avoided can be expressed in financial unit thus there might be a financial compensation that can benefit the final price of each kWh produced from wind - diesel.

Figure 2 the shows reduction of CO_2 emissions from the electricity generation due to producing 30% of electricity from wind that can be used as CO2 credit by an Annex I country through CDM to fulfill its own obligation under the Kyoto Protocol.

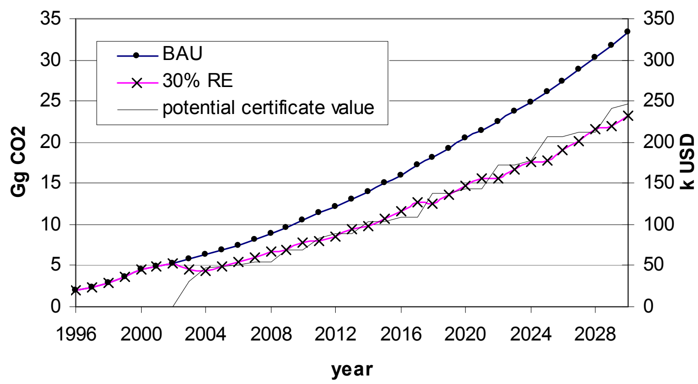

Figure 2 - Reduction of CO2 emission due to 30% of electricity produce from wind and the maximum potential value of emission certificates due to CDM

The study used an estimated price of Diesel electricity in Cape Verde of 8 US¢/kWh for a unit that operates on 45% of load and a price of wind electricity estimated at 7 US¢/kWh. The comparison of electricity prices between the business as usual scenario and wind scenario shows that even if the price of renewable scenario is higher than the Diesel only the influence of CDM certificates is crucial, since it pushes the wind into economic viability (figure 3).

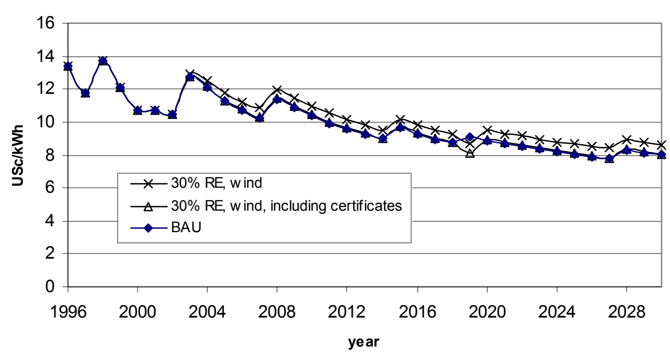

Figure 3. Comparison of electricity price generated in business and usual and wind scenarios, with the influence of the emission certificates

In a scenario with wind technology prices falling by 2 % per year the energy mix will get economically viable when compared with the business as usual scenario only in 2018, while when taking into account the potential value of CDM certificates this would happen in 2014, four years earlier.

3. DEMAND SIDE PROJECTS

In 1990, electricity accounted for less than 5% of the energy use in Cape Verde. The most important source of energy was biomass (31% of the primary energy) and the biggest consumer was the residential sector (44.6% of the final energy use). In Santo Antão islands the share of the domestic sector raised to 80% of the final energy use, and most of that energy was used for cooking. The fuels used were a combination of liquefied petroleum gas (LPG), kerosene, wood and residues (domestic and agricultural).

In 2002 the share of electricity increased due to a recent campaign of rural electrification. However the domestic sector is still the main consumer with cooking at the top of energy uses. Thus any measure to significantly reduce CO_2 emissions should address this sector.

A supply side approach such as the one for wind penetration is not feasible, as the most important fuel, wood, is collected by each family directly from the fields, and all the fuels are used according to the needs of each family and not according to their availability. Besides, cooking is a cultural matter. The fuel, the technology, the dishes and any other behaviour related to cooking hardly depend on social input. Thus, any measure to change the consumption pattern must change the energy behaviour of the population. The following study is largely based on the results of an inquiry on cooking practices conducted by the World Bank in 1988.

3.1. Structure of the model

For the model created, the results to any year are calculated in the following sequence:

1. The population model provides the size and number of families;

2. To each type of family, the useful energy needs are considered only to change with the size of the family, remaining the same than in 1990 (base year). However, if a family reduces from, e.g., 5 to 4 people, it is not reasonable to assume that the new family uses 4/5 of the energy; in reality it uses a little more. This is considered by introducing a “virtual guest” that uses X% (this value is an

input of the model, by default it is set to 20%) of the energy of a normal person. Then the new family uses:

$$E_4 = E_5 - \frac{1}{5}E_5 + X\% \times (E_5 - E_4) \qquad (1)$$

3. The share of each fuel in the energy mix of each family remains the same than in the base year (e.g. a family that uses 30% wood and 70% LPG will always have the same distribution). The change in cooking practices is captured by the changes in the number of families with this energy mix;

4. Using the efficiencies of each device the model calculates the fuel consumption of each family;

5. By using the share of each type of family (the main input of the model: the 10 types identified by the World Bank report plus the four new types introduced with solar ovens, bearing in mind that the total shares must sum 100%), the model calculates the total use of each fuel for cooking for the given year;

$$Fuel(tons/year) = \sum S_i \times FU_i \qquad (2)$$

Where:

S_i – Share of each type of family

FU_i – Fuel Use by year of each type of family

6. The number of devices is calculated on the assumption that each family has a number of devices equal to the different number of fuels used (if a family uses two different fuels it has only one device for each fuel);

7. The emissions resulting are calculated with the CO_2 equivalents per unit of fuel used recommended by the IPCC (table 2);

Table 2 - CO2 emissions by fuel

Fuel	CO_2 emissions ($kgCO_2$/kgfuel)
Biomass	1.6
LPG	3.0
Kerosene	3.1
Residues	0.8

8. Finally, the model calculates the expected revenues from the sale of CO_2 credits (at 15USD/ton$_{CO2}$) and expected investment in devices: these values are inputs of the model, the prices used are considered typical in Cabo Verde (table 3):

Table 3 – Equipment costs (Cabo Verde Escudos)

Device	Price in Cabo Verde Escudos (ECV)
Classic stove	500
Improved stove	2000
Solar oven	4000
LPG stove	2000
Kerosene stove	1500
Solar water heater	100000

The data on fuel consumption was obtained from a thorough survey conducted by the World Bank in 1988. It is assumed that the consumption does not vary significantly from 1988 to 1990. The fuels used in Santo Antão include LPG, kerosene, firewood and residues (agricultural and domestic).

The devices considered in the model are:

- 3 stone open fires – the simplest device, consists of 3 stones arranged in a triangular shape. Fuel (firewood or residues) is fed between the stones;
- Classic stove – type of stove locally hand built from large tin cans;
- Improved stove – metallic wood stove built in local workshops according to the specifications of the World Bank report authors;
- Kerosene stove – several manufacturers;
- LPG stove – Camping Gas manufactures the most common model.

The calculations made in the model require only the efficiency of each one of these devices (table 4):

ε=Useful energy (MJ/kg)/Calorific power of fuel (MJ/kg)

Table 4 – Devices used for cooking - efficiencies (World Bank, 1988)

Device	Efficiency
3 stone fire	15%
Classic stove	30%
Improved stove	45%
LPG stove	55%
Kerosene stove	63%

There is no reliable data about the share of each device but in order to provide some demonstration results, the following shares where considered in 1990: 3 stone–80%, classic–15% and improved–5%. The average efficiency of firewood stoves can be calculated with the following equation:

$$\varepsilon_{FS} = \frac{\varepsilon_{3S}}{S_{3S} + S_C \frac{\varepsilon_{3S}}{\varepsilon_C} + S_I \frac{\varepsilon_{3S}}{\varepsilon_I}} \qquad (3)$$

Where:

ε_{FS} – Overall efficiency of firewood stoves

S_i – share of each device (3 Stone, Classic and Improved)

ε_i – efficiency of each device

According to the assumptions made, the firewood use efficiency in the base year is then 16.8%. The value is recalculated whenever the shares of each firewood stoves change.

3.2. Population model:

An estimate of the total population and the size of the families (both rural and urban) is required to calculate the family energy use and the total energy use. The population is estimated based on the available data from the national census conducted in 1990 and 2000 and some considerations on the growth rate (table 5).

Table 5 – Demographic data from the 1990 and 2000 census

	1990	2000
Population	43845	47223
Urban population	10083	11462
Rural population	33762	35761
Urban family size	4.63	3.92
Rural family size	5.40	4.90
Number of urban families	2180	2921
Number of rural families	6252	7298

For the purpose of this study the population model is divided in three periods: 2000-2010, 2011-2020 and 2021-2030. The annual growth rate of the population and the number of families for the first period is considered to be the same than that of the period 1990-2000 (table 6). That average growth rate is calculated as follows:

$$P_{2000} = P_{1990} \times (1 + Gr)^{(2000-1990)} \Rightarrow Gr = 0.74\% \quad (4)$$

Table 6 - Growth rates considered in the model

	Population	Rural population	Number of families	Number of rural families
2000-2010	0.74%	0.58%	1.94%	1.56%
2011-2020	0.50%	0.20%	1.00%	1.10%
2021-2030	0.20%	-0.05%	0.50%	0.80%

3.3. Base year (1990) data

The data available from the World Bank report was organized in order to give shares of types of families and fuel consumptions for each type.

Table 7 – Base year data

Family type	Share	Wood (Kg/year)	LPG (Kg/year)	Kerosene (L/year)	Residues (Kg/year)	Useful energy use (GJ/year)
RURAL	100%					
Firewood	8.2%	1596.5				4.30
Firewood + LPG	32.8%	1419.2	70.9			5.61
Firewood + kerosene	11.5%	1025.0		236.6		7.97
Firewood + residues	42.6%	1616.3			80.7	4.46
LPG	3.3%		169.5			4.29
Kerosene + LPG	1.6%		88.7	443.5		12.02
URBAN	100%					
Firewood	4.8%	1367.6				3.68
Firewood + LPG	21.0%	1215.7	60.8			4.81
Firewood + kerosene	3.2%	878.0		202.6		6.83
Firewood + residues	3.2%	1384.5			69.1	3.82
LPG	35.5%		145.2			3.67
LPG + firewood	21.0%	523.4	121.6			4.49
LPG + kerosene	6.5%		121.6	109.8		5.50
Kerosene	1.6%			261.7		5.77
Kerosene + firewood	1.6%	1435.1		295.5		10.38

3.4. Scenarios

To build the scenarios 4 new families types were introduced (solar + firewood, solar + kerosene, solar + LPG for the rural families and solar + LPG for the urban families). A solar oven is capable of cooking a meal if given enough time, which is of no problem in rural areas where it is common to leave the meal cooking in slow fire during the whole morning. Since the fuel is required only for cooking, the share of fuel needed is reduced. It is still not possible to completely replace conventional devices with solar ovens, therefore the use of such devices is limited to a share of the total cooking energy needs. This value is an input of the model and is set by default to vary from 50% in the base year to 70% in 2030, meaning that the use of the solar oven reduced the fuel needs by 50% and 70% respectively. The useful energy needs of these families are considered equal to the energy use of the families that use only firewood (4.3 GJ/year), LPG (4.29 GJ/year) or kerosene (12.02 GJ/year).

- Business as usual – BAU: in this scenario the share of each type of family, and therefore the share of each fuel remains constant, providing a baseline for other scenarios

- Introduction of efficient firewood stoves in both rural and urban areas: this scenario calculates the result of replacing 3 stone fires with classic and improved stoves, keeping unchanged all other values. This will result in an improved use of wood fuel without change to the other fuels or devices

- Introduction of solar ovens in rural areas: this scenario simulates the introduction of solar ovens in rural areas as a complement to the use of conventional heating appliances and fuels. Users of firewood, LPG and kerosene will use solar ovens to cover part of their energy needs, maintaining their conventional devices. The introduction of such devices is phased during the simulation period.

- Introduction of LPG in rural areas: this scenario simulates the introduction of LPG in rural areas replacing other fuels (the scenario does not include solar ovens). The main types of families are be pure LPG and LPG + firewood.

- Introduction of LPG in urban areas: although LPG already has a strong presence in urban areas, this scenario simulates almost the entire urban population using LPG, eliminating kerosene and residues. The implications on the overall results are expected to be small due the low share of urban population (20%-25%).

- Introduction of solar water heaters in urban areas: solar water heaters already exist in Santo Antão but due to their cost, only a few units have been installed. The need for hot water in these mild weather islands is reduced. Even though, this situation is simulated. Only the wealthier families could afford to pay for such device, even if it was strongly subsidized and these families are those who consume mostly LPG. This measure slightly reduces the fuel demand.

- Best-case scenario: this scenario simulates the combined use of all the alternatives tested: introduction of efficient firewood stoves, increased use of

LPG and introduction of solar ovens in rural areas. Solar water heaters where excluded due to their high costs and low impacts.

Figure 4 shows the saving potential, which can reach almost 18000 tons of CO_2 in 2030 for the best-case scenario. Figure 5 shows the potential CO2 credit in Cabo Verde Escudos. Figure 6 shows the calculated costs of each scenario simulated. Those costs include only the investment made in devices, and do not include the investment needed to disseminate and distribute the technologies.

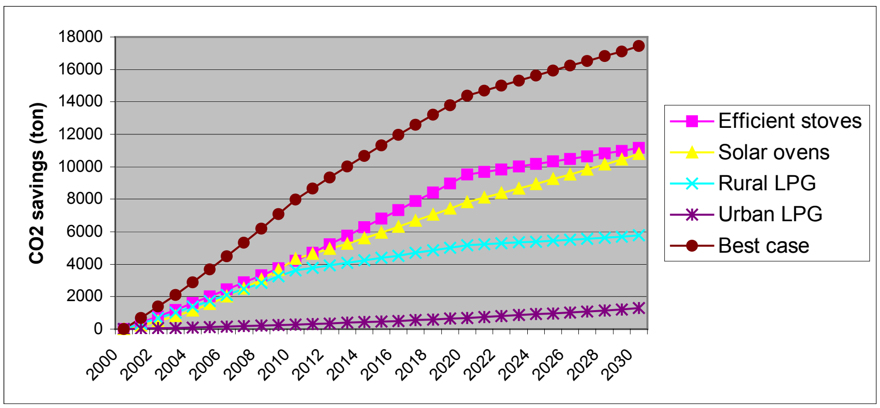

Figure 4 – CO2 saving potential

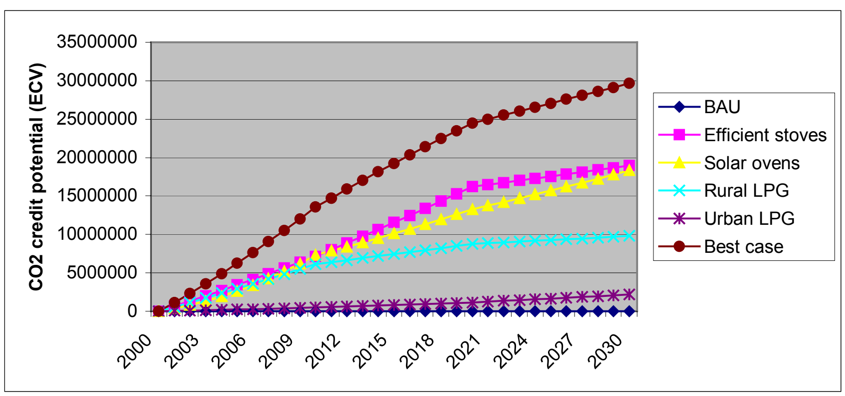

Figure 5 - CO2 credit potential

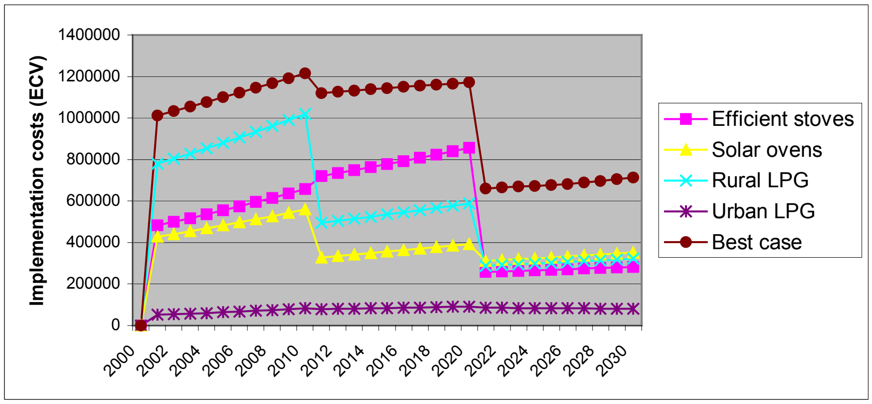

Figure 6 - calculated costs of each scenario simulated

The results show a great potential for reduction in the domestic sector, with the credit potential exceeding the investment by an order of magnitude. But the cost does not reflect the total cost of the action. Particularly since this is an action aiming at changing energetic behaviour, the time and the effort needed to reach the objectives are hard to quantify. For instance, the switch from a three stone cooking device to GPL or the adoption of a solar oven will affect the way people cook, the taste of the meal prepared in this new conditions and even the cultural heritage. For instance, the recent switches from wood to GPL in Cabo Verde, mainly in urban areas changed the base dish from (dried) corn to rice based dish.

The effective result in public health (mainly women and children) is obvious as the smoke inhaled while preparing the meals is the cause of an abnormal occurrence of respiratory diseases. Women are free from the daily task of collecting wood and can develop productive activities and children can dedicate their free time to schoolwork. These are just some examples of indirect benefit from the implementation of the proposed scenarios that have a positive impact on long term development (education, health and economy).

4. CONCLUSION

It is obvious that this two study are not in a straight line comparable due to the differences in the assumed assumption. However they show, in a qualitative way, that there may be is a biggest potential in small projects dealing with rational energy use, fuel switching and change in energy behaviour than in high tech projects. Naturally, the introduction of electricity in rural areas would have a positive benefit in the long term but for the rural population with low income the need for this noble form of energy is low (mainly for lighting).

Some industrialised countries would choose the high tech project, benefiting directly from the CO_2 credit and indirectly from technology exportation. Even the authorities from developing countries would probably have the same choice, as a high tech project is more visible. This study shows, however, that the population would rather benefit from the second project. Even if the discussion about the impact of both projects in the long-term development is still open, it is clear that the end-use approach would profit even in a short-term.

To conclude, this paper shows that an end-use approach associated to distributed production would benefit Renewable Energy penetration and Rational Use of Energy.

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6. LITERATURE

1. Briguglio L., Small Island Developing States and their Economic Vulnerabilities, World Development. 23(9): 1615-1632, 1995
2. Brown P., N. Kete, R. Livernash, Forest and Land Use projects, Issues & Options The Clean Development Mechanism Chapter 13: 163 – 173, UNDP, 1998
3. Dessus B., Equity, Sustainability and Solidarity Concerns, Issues & Options The Clean Development Mechanism Chapter 6: 81 – 89, UNDP, 1998
4. Duić N., L. M. Alves, M. G. Carvalho, Potential of Kyoto Protocol Clean Development Mechanism in Transfer of Energy Technologies to Developing Countries, 2001
5. ELECTRA, Empresa de electricidade e águas de Cabo Verde, http://www.electra.cv/
6. Hamwey R., F. Szekely, Practical Approaches in the Energy Sector, Issues & Options The Clean Development Mechanism Chapter 10: 119 – 136, UNDP, 1998

7. Hassing P., M. S. Mendis, Sustainable Development and Greenhouse Gas Reduction, Issues & Options The Clean Development Mechanism Chapter 12: 147 – 162, UNDP, 1998
8. Sathaye J., End-use energy modeling for developing countries, UNEP, 1995
9. Sokona Y., S. Humphreys, J. Thomas, What Prospects for Africa?, Issues & Options The Clean Development Mechanism Chapter 9: 105 – 118, UNDP, 1998
10. TERI (Tata Energy Research Institute), Clean Development Mechanism Issues and Modalities, 1998
11. World Bank, Cape Verde Household Energy Strategy Study, 1990
12. Yamin F., Operational and Institutional Challenges, Issues & Options The Clean Development Mechanism Chapter 5: 53 – 79, UNDP, 1998
13. Karani P., Constraints for Activities Implemented Jointly (AIJ) Technology Transfer to Africa, World Bank, 1998
14. United Nations Commission for Sustainable Development – CSD, http://www.un.org/esa/sustdev/csd.htm
15. United Nations Framework Convention on Climate Change, United Nations, 1992