

Project Surya: Carbon Credit Pilot Project (C2P2)

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Project Surya is embarking on a major pilot project to explore if rewarding women directly with funds from carbon markets, for using improved stoves and lighting, will significantly enhance adoption.

Improved solid-fuel, biogas, and solar stoves significantly reduce smoke indoors and outdoors. However, these are currently too expensive, with prices typically ranging from US\$50 to US\$90 per stove. Clearly, they are not affordable for the more than 2.5 billion people who live on US\$2 a day or less and are therefore forced to depend on primitive traditional cooking methods. Moreover, the additional costs of maintenance and fuel supply further increase the actual cost of the stoves. This demonstrates the need for a new approach to promote their distribution and use.

The Surya Approach: Project Surya believes that sufficient funds from carbon markets can be channeled to women beneficiaries, in order to subsidize their purchase of improved cooking stoves as well as to familiarize them with the stoves' efficient use and maintenance.

To facilitate this transition, Project Surya is exploring

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ABC Science Team Meeting Review Progress of ABC Programme

The Atmospheric Brown Cloud (ABC) Science Team met in September 2012 to review the implementation of the ABC Programme. The meeting was hosted in Beijing by ABC-China and was attended by a multi-disciplinary team of experts, including ABC team members. The meeting agreed on a five-year plan for further implementation of the ABC Programme.

The ABC Programme was commissioned by United Nations Environment Programme (UNEP) in collaboration with a team of distinguished scientists in 2002, to enhance understanding of Atmospheric Brown Clouds (ABCs) and to improve the capacity to address this issue. For over a decade, the ABC Programme has set up observatories; carried out monitoring, modeling, impact assessment, and demonstration of mitigation measures; and provided information to policy makers. Twelve observation stations across the Asian region provide time series data for sound science. The establishment of observation stations in Africa has been initiated. The ABC Programme has also published important regional impact assessments, explaining the impacts of ABCs on health, agriculture, water, and climate. The preliminary assessment published in 2002 identified ABCs as an emerging atmospheric issue. The 2008 impact assessment report confirmed that the interaction between ABCs and the build-up of greenhouse gases have significant impacts on regional climate systems, including the monsoon and the Himalayan glaciers, water budgets, agricultural production, and human health. To link the

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Editorial: Reduction of Black Carbon Emission from Transport Sector



Achim Steiner, Executive Director, UNEP

Confirmation by the International Agency for Cancer Research (IARC) in June last year that diesel engine exhaust is carcinogenic to humans provides yet another impetus to redouble efforts to tackle air pollution and associated challenges through efforts such as the Climate and Clean Air Coalition (CCAC), launched by the United Nations Environment Programme (UNEP) together with governments from different countries, to reduce short-lived climate pollutants (SLCPs), of which black carbon (BC) accounts for significant amounts. In addition to being carcinogenic, particulate matter (PM) and black carbon emissions by diesel engines also contribute to climate change.

The CCAC places the highest priority on the reduction of PM and BC emissions worldwide, particularly in view of the projected huge increase in these emissions as the global fleet diesel-powered vehicles is predicted to triple from about 800 million at present to some 2.5 billion by 2050.

UNEP and the US Government, the co-conveners of this particular CCAC initiative to reduce emissions from diesel engines, are developing a global programme that involves appropriate policy changes and investments, in order to achieve both health and climate benefits. We basically need to do two things. Firstly, we need to introduce low sulphur diesel fuels in every country worldwide. Vehicles using low sulphur diesel fuels emit less PM/BC. Secondly, having introduced cleaner fuels we can start promoting cleaner diesel vehicles. Cleaner diesel technologies can reduce PM/BC emissions by up to 90%. The technology is available and is now being used as a standard in different countries around the world.

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Cloud Aerosol Radiative Forcing Dynamics Experiment

In March 2012, the ABC Science Team led by Prof. Ramanathan conducted a field campaign, Cloud Aerosol Radiative Forcing Dynamics Experiment (CARDEX), to further develop our understanding of the effects of ABCs on the environment using unmanned aerial vehicles (UAVs) and surface measurements. Drs. Richard Thomas and Praveen Puppala operated the UAVs as flight scientists.



and entrainment, and aerosol-cloud interaction. However, scientists realize that these otherwise valuable aerosol and dynamics measurements do have limitations, since they have not been made simultaneously. This is the motivation for CARDEX.

ABC scientists have developed lightweight UAVs and suits of advanced instrumentation for measuring aerosol, cloud physics, and radiation physics.

The past two decades have witnessed significant progress in our understanding of individual processes occurring in boundary layer cloud systems, due to field experiments, such as ASTEX, INDOEX, DYCOMS, RICO, and VOCALS. Such studies have provided a sound experimental background to explain individual relationships between cloud processes, such as dynamics

Thus, by using a combination of UAV, satellite and surface measurements, the ABC Science Team has conducted simultaneous measurements to explore the linkages between dynamics, aerosol chemistry, optical cloud properties, and cloud albedos.

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carbon credit calculations that cover short-lived climate pollutants (SLCPs), including black and brown carbon, ozone-producing gases (carbon monoxide and VOCs), and methane. Preliminary estimates suggest that the potential for each cooking stove to help mitigate climate change is dramatically larger when the reduced amount of SLCPs is taken into account, instead of basing the calculation on the reduced amount of CO₂ alone. Once these preliminary estimates are verified and confirmed by new Surya data, climate credits that include SLCPs could trade at higher prices, radically changing the carbon market.

What is new about Project Surya's Carbon Credit Pilot Project (C2P2)?

First of all, Project Surya will use real-time field data to develop a scale for climate-financed credits, not only for reduced CO₂ emissions (as is currently done) *but also for emissions of SLCPs, such as black carbon, ozone, and methane.*

One of the main objectives of the C2P2 is to quantify the combined effects of CO₂ and SLCPs. Project Surya is developing methodologies for estimating climate gains from reductions in SLCP and CO₂ emissions resulting from the use of cooking stoves. Innovative wireless technologies involving the use of cell phones will record the operation and performance of the cooking stoves, their fuel consumption, and levels of pollutant emission.

Secondly, Project Surya will distribute funds from climate credits directly to the participants (through local rural banks), instead of through stove distributors and/or manufacturers.

A number of issues will make this new approach possible. First, there is global interest in achieving wide scale adoption of the cooking stoves, as evidenced by such initiatives as the Global Alliance for Clean Cookstoves established by the United Nations Foundation under the leadership of the US Secretary of State Hillary Clinton. Se-

cond, there is a growing body of scientific evidence of the impacts of SLCPs on climate warming, in addition to those of CO₂. The annual emissions of these pollutants from burning solid fuels indoors are major contributors to global warming. These pollutants also have grave human impacts, causing over two million deaths, tens of millions of dollars in crop damages, the melting of glaciers in the Himalaya/Tibetan region, and disruption of rainfalls.

Implementation

Project Surya has completed pilot projects in India and Kenya since 2010 on the scientific and technological aspects of cooking stoves, pollutant emissions, human exposure, and climate forcing. These findings have been documented in open peer-reviewed literature. Initially, the C2P2 will be introduced in about 1000 homes located in the Indo-Gangetic Plains of India. The project has identified a major rural bank that will be used to issue low-interest loans to women participating in the C2P2. Each participant will have a bank account. The Surya team will collect data on air pollution levels (indoor and outdoor), compliance (use of improved cooking stoves), and fuels (types and amounts used). The data will be used to estimate climate credits in two ways: (i) to use the literature values for the climate effects of SLCPs and stove emissions to derive the conventional Reference Climate Credits (RCC), and (ii) to make new estimates that are consistent with Surya data to calculate the Surya Climate Credits (SCC). The credits will be converted to dollars/rupees, using current rates and distributed equally between the bank (to repay loans) and the women (to support increased adoption). The pilot phase is expected to run for about 18 months. The outcome of the C2P2 will be evaluated by independent professionals.

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Cleaner Kiln Technologies Offer Promise of Cleaner Brick Production

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Under a project supported by the Shakti Sustainable Energy Foundation and Climate Works, a first-ever energy, environmental, and financial performance assessment of nine brick kilns in India and Vietnam have been carried out by Greentech Knowledge Solutions Pvt. Ltd. (India), Enzen Global Solutions Pvt Ltd (India), Clean Air Task Force (USA), and the University of Illinois (USA). The assessment covers five main brick firing technologies during 2011, as follows:

- Fixed Chimney Bull's Trench Kiln (FCBTK) - India
- Zig-zag (natural and forced draft) - India
- Vertical Shaft Brick Kiln (VSBK) - India and Vietnam
- Down-Draught Kiln (DDK) - India
- Tunnel Kiln - Vietnam

The objective of the comprehensive assessment of brick making technologies is to gain a deeper understanding of energy utilization and emissions from current technologies as well as technologies that offer the promise of cleaner brick production. Table 1 and Figure 2 show the monitoring of emissions of suspended particulate matter (SPM), fine particulate matter (PM_{2.5}), black carbon (BC), sulphur dioxide (SO₂), oxides of nitrogen (NO_x), carbon monoxide (CO), and carbon dioxide (CO₂). In addition, the kilns' energy performance and financial performance were also studied.



Figure 1: Filter with deposits of Black Carbon

A large variation was observed in the performance of the main brick firing technologies. Zig-zag, VSBK, and tunnel kiln technologies offer a large reduction of 85% to 95% in BC emissions compared to the baseline FCBTK technology. Zig-zag and VSBK technologies also offer significant savings in fuel (15% to 40%) compared to FCBTK. Among the cleaner kiln options, it has been noted that

Table 1: Emission Factors for Particulate Matter and Gaseous Pollutants

Technology	Emission Factors (g/kg of fired brick)				
	SPM	PM _{2.5}	SO ₂	CO	CO ₂
FCBTK	0.86	0.18	0.66	2.25	115
Zig-zag	0.26	0.13	0.32	1.47	103
VSBK	0.11	0.09	0.54	1.84	70
DDK	1.56	0.97	n.d.	5.78	282
Tunnel	0.31	0.18	0.72	2.45	166

Notes: The emission factors for FCBTK, zig-zag, and VSBK are a simple average of the three FCBTKs, two zig-zag kilns and two VSBK kilns, respectively; for all the other kiln types, the data are for a single kiln. n.d. = not detectable (measurement below detection limit)

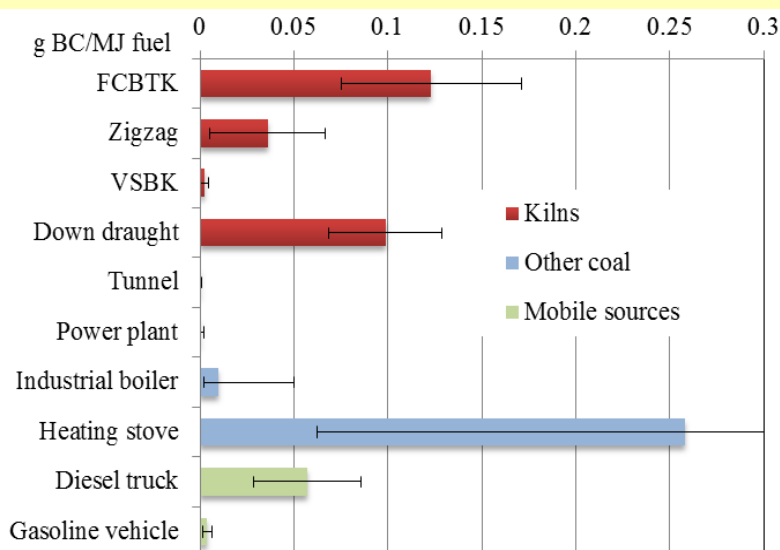


Figure 2: Black Carbon emission factors for brick kiln technologies

- (i) The zig-zag kiln technology requires lower investment and has shorter pay-back periods (sometimes less than one year). Zig-zag technology offers easy integration with the existing production process of FCBTKs, and is the best suited intermediate solution for large scale adoption.
- (ii) The tunnel kiln technology is suitable for large scale production, requires large capital investment (10 to 20 times more compared to zig-zag technology), and has a long pay-back period. It can be an important solution in a medium to long time frame.
- (iii) VSBK, being modular in nature, can be used for small and medium scale production, but works best only with certain types of clays and production practices/processes. The technology may be suitable for "niche" segments.

Apart from cleaner kiln technologies, the production of hollow/perforated bricks (in place of solid bricks) and use of internal fuel (powdered fuel mixed with clay) also reduce emissions as well as energy use in brick making. The study provides valuable information for decision makers in selecting appropriate brick making technologies in the context of emission reduction, fuel savings, and financial feasibility. In 2012 the project initiated work on the dissemination of the zig-zag firing technology through training and capacity building. The first training programme on zig-zag firing technology for brick kiln entrepreneurs received an overwhelming response

1. Greentech Knowledge Solutions, New Delhi

ABC Observatory Established in Multan



A new Atmospheric Brown Cloud (ABC) observatory has been established in Multan, Pakistan, by Ev-K2-CNR in collaboration with the Meteorological Department (PMD) and Bahauddin Zakariya University (BZU). Operational since September 2012, the observatory is carrying out continuous measurement of (i) meteorological parameters, using Vaisala WXT520 and Raingauge Vaisala RG13; (ii) global solar radiation, using K&Z CMP3; (iii) total suspended particulate matter, PM₁₀, and PM_{2.5} using SWAM 5a dual channel monitor FAI sampler; and (iv) surface ozone, using Teledyne, Model 400E. The measurement data are acquired on a 60 minute-basis and are transmitted in near real time.

Initial results indicate high concentrations of PM₁₀, PM_{2.5}, and ground level ozone. Multan is the largest town in central Pakistan with a population of more than 5 million. It is located along the east bank of Chenab River, with two deserts, Thal and Cholistan, at about 200 km on its north and south, respectively. This new ABC observatory will enhance local air quality management in Pakistan as well as create better understanding of the regional and global level effects of air pollution.

CCAC Update

Six new member countries joined the Climate and Clean Air Coalition (CCAC) on 6 December 2012. The CCAC is a voluntary initiative aimed at maximizing the health, agricultural and climate benefits of swift action on short-lived climate pollutants (SLCPs). This brings the number of CCAC partners to around 50. For further information, please visit: www.unep.org/ccac/

Development of Regional Action Plan on Air Pollution in Latin America and the Caribbean

In January 2012, the Forum of Ministers of Latin America and the Caribbean made a decision to continue work on the development of a Regional Action Plan on Air Pollution. The plan, which will provide the orientation for the work being carried out by the Regional Intergovernmental Network and an assessment of potential funding sources, will be presented at the next Forum of Ministers for consideration and approval. Pursuant to this decision, the Regional Intergovernmental Network of Latin America and the Caribbean met in Bogota, Colombia, on 2 November 2012.

To facilitate the debate, the UNEP Secretariat, with support

from Mexico's National Institute on Ecology and Climate Change and the Clean Air Institute, prepared a document entitled, "Elements for a Regional Action Plan on Air Pollution", taking into account the results of the network's discussions. The meeting expressed its gratitude for the document and general agreement that it covers all the required elements, and considered the Regional Action Plan an excellent opportunity for collaboration among Latin American and Caribbean countries. The meeting provided valuable inputs for further development of the Regional Action Plan, which is expected to be revised and submitted to the next Forum of Ministers of Latin America and the Caribbean in 2013.

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science to policy, a series of pilot mitigation projects have been carried out in India and Kenya. With these developments, national, regional, and global level activities have been initiated to reduce the emissions of constituents of ABCs. Lack of implementation is one of

the obstacles faced by developing countries. To address these needs, the five-year plan agreed by the ABC Science Team will focus on supporting emission reduction measures, while continuing its support to developing the science and capacity to address the ABC issue.

Editorial ...

There are encouraging signs that many countries have now started to reduce their diesel sulphur levels and have demonstrated keen interest to introduce cleaner and more efficient vehicles, if only because of the resulting fuel savings. However, we need to support these countries to implement these measures and to quickly make the transition to low sulphur fuels and corresponding vehicle standards.

Studies show that we only have a small window of opportunity before BC emissions rapidly increase in regions such as Africa

and Asia. By putting in place policies and standards that will introduce and promote clean diesel fuels and vehicles, we will not only achieve major reductions of BC emissions globally but will also significantly improve air quality for more than 2 billion people living in urban areas. These are concrete targets that can be achieved within a short time period as the technology is available and the cost-benefit ratio is overwhelmingly favorable. I would like to encourage all governments and their partners to support our goal to introduce strategies that will promote clean diesel fuels and vehicles throughout the world.

For further information:

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