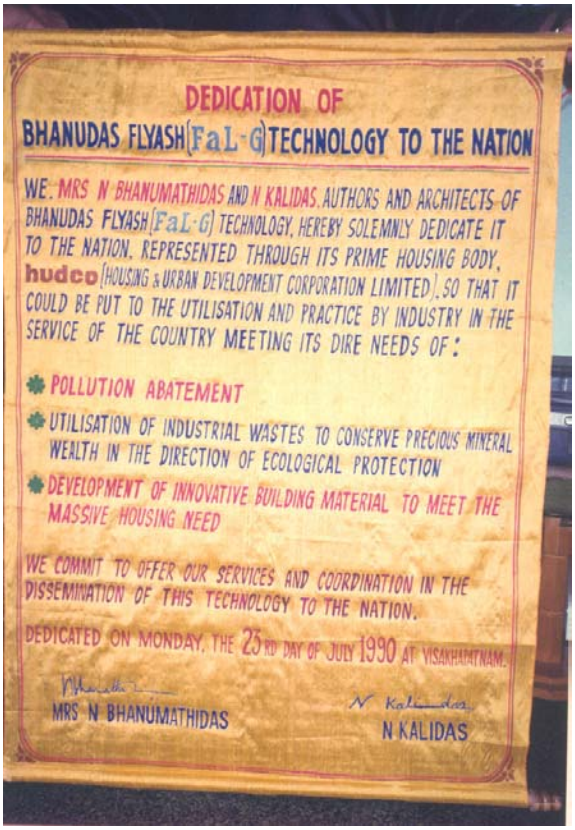
CASE STUDY ON DEVELOPMENT AND DISSEMINATION OF FaL-G TECHNOLOGY

Institute for Solid Waste Research & Ecological Balance (INSWAREB) is the unique techno-scientific research body set up in 1992, as the non-profit and non-government organization (NGO). The founder-directors have specialized in cement-concrete and building material technologies. Hence, though it was envisaged to cover all the solid wastes in the scope of research, the founder-directors have confined the scope to 'Industrial Solid Wastes' which are, almost all, constituted of lime, silica and alumina as independent or collective constituents, qualifying for building materials. The first achievement was development of indigenous process to refine and manufacture calcined gypsum out of chemical gypsum.

In the process of research for scientific solution to impart insolubility to set-gypsum as building materials, cement was identified as the minor input to gypsum and, subsequently through further research cement was replaced by fly ash-lime mix for cost effectiveness. This has basis to the cement theory called 'Crystallo-Mineral Combination of Setting Behaviour', postulated by the Scientists, Dr N Bhanumathidas and N Kalidas, which was unraveled to the scientific community at an International Conference in Miami in 1986.

Innovation of FaL-G

However, the Scientists were not convinced of the commercial mileage in adding a product of major output (fly ash at 60 mn. Tpa) as minor constituent (5-20%) to the target product of minor output (gypsum at 1.5 mn tpa) as major constituent (80-95%). This has encouraged to reverse the input of constituents, leading to the development of FaL-G. After mineralogical studies through x-ray diffraction and stoichiometric optimizations, FaL-G was released for commercialization at a workshop conducted by Scientists in 1990. In view of widespread service to the Nation as visualized by them, they have dedicated this technology to the Nation over the hands of HUDCO (Housing & Urban Development Corporation, New Delhi) at the same event.



FaL-G Mansion, the residence of Scientists at Visakhapatnam.

As the first initiative for confidence build up, the scientists have constructed their own building in 1990, using FaL-G as the cementitious input in concrete, replacing OPC totally, to cast about 200 sq.m of concrete slab together with beams for the ground floor. This is the first RCC structure in the world, christened as 'FaL-G mansion', without using even an iota of OPC in the concrete preparation. There upon two floors were put over FaL-G concrete slab, blending Portland cement and FaL-G (Portland:FaL-G) as cementing material.

Due to sintering process in which the product has to be uniformly exposed to heat, clay brick has limitation in size. Whereas, FaL-G attains strength through hydration chemistry and hence, size of the product is not an issue. In the case of traditional brick, quality of clay decides the engineering properties of brick in addition to quality of sintering to some extent. In the case of fly ash brick, the pozzolanic chemistry can be monitored, altered and augmented to achieve strengths as high as 40 MPa. Thus scope of fly ash brick is enlarged from walling to infrastructure application such as canals, check dams, khadanza pavements etc.

Khadanza pavement with FaL-G high strength Blocks –
INSWAREB Building Centre, Paravada

Structure over a drain at the Gollapudi market yard, Vijayawada
With high strength FaL-G blocks

This means taking into account 200 billions of brick consumption in the walling market, infrastructure would offer at least double the scope ie., 400 billion, which alone require 200-400 million tons of fly ash as against over 160 million tons of generation of the date.

Pursuant to further research in fly ash towards Sustainable Development, the Scientists have developed No-Aggregate Concrete (NAC), as a solution to future generations who may face shortage of sand and stone in the decades to come.

NAC contains no sand and stone as the name indicates, but fly ash plays the role of total aggregate. NAC contains 80% fly ash and 20% OPC together with minor inputs of mineral and chemical admixtures. While reactive portion of fly ash participates in pozzolanic chemistry, the non-reactive fly ash works as micro-aggregate. Through microstructure studies the Scientists project its life at not less than 1000 years, and by virtue of absolute impermeability (27 coulombs), they predict that steel within the concrete could be recovered intact and reused even after 2 to 3 centuries.

Dome with NAC – lawn is grown on the slab
in order to induce hostile conditions of weathering.

It is visualized that, when this product gets commercialized, all the fly ash ponds would be dug to retrieve the fly ash, releasing vast stretches of land otherwise locked up with ash ponds.

Impressed by the field level demonstrations of the Scientists and their ambitious program for dissemination of the technology, visualizing the massive potential of FaL-G in construction sector in the years to come at national level, the then Executive Director of HUDCO, Mr V Suresh has encouraged the Scientists to set up an NGO outfit so that HUDCO would accord 'Building Centre' status to it. The result was the registration of INSWAREB in 1992, which has been used as the platform for dissemination of FaL-G technology throughout the country. It may be recalled that, despite holding a patent on FaL-G technology, the technology has been disseminated and allowed to be practiced without any royalties in order to facilitate rapid proliferation, as a service to Ecology. Realising the scope of FaL-G in 1996, the then Prime Minister has constituted a high power committee with CMD of HUDCO, Mr V Suresh, as its head to evaluate FaL-G technology and recommend necessary strategies for its adoption as National-level program. It was unfortunate that this report could not see the light due to subsequent political changes at the seat of governance. Despite all these efforts penetration of FaL-G was marginal in the clay brick market.

FaL-G for Sustainable Development

INSWAREB has been accredited as the Observer Organisation to COP in 2000. While getting prepared for this status and studying at length the Protocol together with Carbon credit mechanisms, the Institute realized that its FaL-G technology is the most potential tool

for CDM. There upon a technology presentation was conducted to the executives of PCF at the World Bank-head quarters in December 2000. Since India was not a signatory to Protocol in 2000 no deal could be signed with PCF despite eagerness from both sides. India became a signatory to the Protocol in 2002. In the same year The World Bank launched another carbon fund instrument, Community Development Carbon Fund (CDCF). INSWAREB took the earliest opportunity and filed the first project with the World Bank highlighting the following features of FaL-G brick/block activity in serving the community:

- FaL-G bricks replace clay bricks, conserving the precious topsoil, otherwise necessary to protect the fertility of agriculture lands.

- Each FaL-G brick plant in tiny sector can absorb 10-15 workers. Thus over 2500 plants working throughout India have contributed to employment to over 30,000 workers with a further potential for 6 lakhs workers, when the 50,000-unit target could be accomplished.

- Contrary to the seasonal employment in clay brick industry, FaL-G brick plants provide yearlong employment with handsome wages over clay brick units. Such job security would relieve the worker from the status of bonded-labour, which is more prevalent in clay brick industry.

- By not using thermal energy, each million FaL-G bricks conserve over 200 tons of coal or equivalent fuel. Thus carbon emissions are abated.

Award for CDM Project with Holistic Compliance to
Sustainable Development as that of FaL-G

In the process of scanning the project for its qualifying parameters, ECPL observed no other project as holistic as that of FaL-G in complying with the indicators of Sustainable Development. In order to substantiate this uniqueness of the project, ECPL declared an award of Rs. One million to the first pointer of CDM project as good as FaL-G anywhere in the world. So far there are no takers.

FaL-G as CDM Project with CDCF, the World Bank

In view of holistic compliance to the Sustainable Development indicators and Community Development agenda, the World Bank agreed to take up FaL-G as CDM project. Promoting a carbon abatement activity as CDM project is a laborious exercise, involving a lot of intellectual input and record work. Keeping in view the consultancy from high profile experts, the transaction costs are very high that deter small scale and tiny sector units in staking their claims for credits, despite their virtuous activity for achieving emission reductions (ERs).

To overcome this barrier to SSI units, INSWAREB opted to avail the scope of 'Bundling' provided by UNFCCC to small scale activity, by which, over 100-120 micro industrial plants producing FaL-G bricks, each with a potential to generate over 1000 ERs every year, have been targeted into a few bundles and offered as CDM projects.

In view of commercial deals involved in promoting CDM project for which INSWAREB has constraints as NGO outfit, the Scientists have promoted a corporate body, Eco Carbon Pvt. Ltd. (ECPL), in 2003, who have assumed the role of Project Entity and signed MOU with CDCF in 2004. This is followed by signing ERPA in June 2006, offering to transfer 600,000 ERs as contractual commitment and 200,000 under call option.


Certificate of Appreciation

On the occasion of the Signing of

Emission Reductions Purchase Agreement

600,000 tons of CO_2e

from the Bundling of Micro Industrial Plants Manufacturing FaL-G Bricks and Blocks

Presented to

Mr. N. Kalidas

Executive Director

Eco Carbon Private Ltd.

Rachid Benmessaoud

International Bank for Reconstruction and Development

as Trustee of the Community Development Carbon Fund

THE WORLD BANK

Working for a World Free of Poverty

This is a typical VER contract for effecting payment promptly every year and at the same time CER contract as far as commitment of coordination by Project Entity. In view of typical acceptance to VERs, date of receipt of Host Country Approval is marked as the Project Commencement Date for computing the VERs. But for this clause, the project would have bogged down right at the beginning had it been linked to CERs, because the SPEs have no patience to understand the reasons of delay in Registration of ERs and absorb the delay in receiving carbon revenue.

Encapsulating the obligations and commitment under ERPA as well as EMCB plan, ECPL designed the back to back agreement, Emission Reduction Transfer Agreement (ERTA), and signed with each FaL-G brick plant, identified as Sub-Project Entity (SPE). To make the SPE-deals transparent, regional CDM workshops were conducted at Kakinada, Bhimavaram, Vijayawada, Hyderabad, Visakhapatnam, Chennai, Coimbatore, Delhi, Tatanagar, Korba, Raipur and Pune where entrepreneurs got educated about the privileges and accountabilities before opting to join the bundles or signing ERTA.

Ms Gayathri Ramachandran, Special Chief Secretary to Govt. of AP
& Director General-EPTRI, presenting the Participation Certificate to SPE.

In order to highlight the participation in CDM as a privileged status for SPEs, Certificate of Participation was conferred to all the SPEs at the Project Launching Ceremony conducted on March 27, 2007. During this ceremony ECPL placed on record and declared publicly the Charter of FaL-G:CDM Project (attached as Annex I) emphasizing the sanctity of the program and diligence of commitments attached with it.

Registration of FaL-G as CDM Project

As a qualifying parameter to comply with Additionality, those units came into existence on or after 1st January 2004 only were accepted as eligible for inclusion into bundles. Diligent production practices in maintaining quality and adhering to statutory compliances were cited as additional mandate to get qualified for this project.

After identifying the stake holders and defining their roles, the task was to register the CDM project with suitable Methodology. But as there was no approved methodology specific to total energy avoidance, it was opined that a new methodology would be needed and papers were filed with CDM-EB in April 2005. But the latter negated the need of new methodology and suggested in February 2006 to register the project under an approved methodology in vogue ie., **ASM *II-D. Energy Efficiency and Fuel Switching measures for Industrial facilities.*** Bundle I got Host Country Approval in June 2006 and the project was registered on 16th February 2007.

Meanwhile Bundle II got ready in 2006 and Registration Process was set into course by June 2006, having received the Host Country Approval by June 2007. But the Registration process got into a whirlpool with the identification of leakages by DOE for using cement as one of the raw material inputs, which was ignored in Bundle I due to its minor constituent at not more than 4%. After being pushed back and forth between Meth Panel and SSC Working group on the issue of Deviation and Revision for over one year (Feb '08-March '09), EB suggested in March 2009 that the Project be registered with new methodology, ***ASM III.Z. Fuel Switch, process improvement and energy efficiency in brick manufacture,*** exclusively drawn for bricks and blocks. But, since the methodology has been inconsistent to the small scale operations, ECPL sought a revision in June 2009, to which EB provided in September '09 its clarification as a response rather than accepting the revision. Ultimately Bundle II with ASM III.Z Version 2, was submitted for Validation and web-hosted in November 2009. After having gone through various filtering processes, Bundle II passed through the Technical Review in March and put for completeness check by April 2011. Simultaneously Bundle III & IV are also going through Validation, and expected to be registered within the next couple of months.

Monitoring Plan – VER – CER Generation

It is common that Methodology and tools seek strict monitoring systems, refining them for more and more stringency in the target of diligent computation and avoidance of counter factual claims. A comprehensive Monitoring Plan was drawn to inspect these units periodically by the Carbon Inspectors of ECPL, specially trained for this purpose. Generally they visit all the units at least twice a year.

The Monitoring Plan drawn by ECPL volunteered to bring in this stringency right from beginning. The following are some of the salient features of Monitoring Plan drawn for the Bundle I registered with ASM II-D:

- It is the sales which practically effect the replacement of clay bricks in comparison to production. Hence Sales is counterchecked against production though latter is the basis for computation of ERs.

- Instead of simply accepting the production data from the stock books, production is tallied by the consumption of fly ash, cement and power/fuel. If there is a grave mismatch among the data, the least tallied data would be taken as 'acceptable production'.

With advent of ASM III-Z ERs are computed against production only. However ECPL is going to monitor in their conservative approach tallying production against consumption of fly ash, cement/lime and power/fuel.

The SPEs are expected submit statements of their monthly performance within 15 days. The carbon Inspectors of ECPL conduct periodical visits to the units of entrepreneurs to monitor the operations and check the diligence of records by tallying with monthly statements.

This contract with CDCF is typical in offering payment against VERs, which are computed by ECPL upon the completion of every financial year. The credits are reported to CDCF vide 'Annual Emission Reduction Report' along with EMCB compliance plan. CDCF gets the VERs verified within two months of receipt of Report or else waive of the same and releases payment. However, such waiver is not permanent; ECPL should substantiate the claim at any time of Verification by DOE subsequently and, discrepancies if any, would be adjusted against subsequent bills. ECPL ensures the commitment of SPEs to make available their records for Verification at any subsequent time in order to facilitate the Registration of VERs as CERs. So far one Verification was accomplished to Bundle I for the period 2004-07 by which 27,433 CERs were issued.

Thanks to CDCF, ever since the project commenced submitting the VER claims, the payment is received promptly by July and disbursement to SPEs is effected by August-September. For this purpose, ECPL conducts CDM-awareness program every year and gets the cheques distributed to all the SPEs over the hands of invited dignitaries in order to propagate the achievement of micro and small entrepreneurs in achieving carbon revenue. Press gives good importance to these events, as evidenced vide Annex 2 attached rendering awareness mileage.

Cheque given away by Mr V Suresh, former CMD of HUDCO, Govt. of India, to Ms Y Sita Mahalakshmi, Chandra Fly ash Bricks, Hyderabad (AP/NGD/III/2) at the Workshop on 9.8.2009

Co-Benefits of the Project

The participants in this project are almost micro and small scale entrepreneurs. Many of them are not tuned to book-keeping and maintenance of records. It was a challenge to rope in such entrepreneurs and ensure their diligence. Though considerable resistance was faced initially, many of them acknowledged that they have better tracking of their business in view of records for all their transactions. Some of them acknowledged that they are more confident in facing tax officers having equipped with records on hand. Thus, SPEs have been cultured into diligent tax payers. In a way CDM has paved way for the transformation into orderly entrepreneurs.

The challenge faced by ECPL was not in pooling FaL-G units and generating ERs, but in making them to commit for maintaining records amenable for Verification. The second challenge was in motivating the units to accept Environment Monitoring and Community Benefit (EMCB) plan and conducting them to adhere to the compliance. In the process of rigorous implementation of program, so far two units opted to withdraw, nine units have been dropped by ECPL on disciplinary grounds even at the stake of losing credits, and one unit has gone into dormancy due to operational exigencies.

Notwithstanding the income to SPEs out of carbon revenue, it was focused to confer certain privileges to the workers under Community Benefit Program, for their effective role in this emission-abatement activity. For this purpose about 12% of ER revenue is getting credited to ESCROW account with an overall budget of over Rs. 2.80 crores during the project period. Salient features of the benefits are:

- Providing self-protection gadgets such as gumboots, helmets, nose masks and gloves to the workers. After some progress issuance of one mosquito net to each worker annually has been included, which is very well received by workers.

- Water purifying systems at each FaL-G plant for serving drinking water to the workers.

- Construction of bathroom cum toilet for workers.

- Health and life insurance to workers every year.

- Health check up once in a year.

- Aids-awareness program by which workers are exposed to causes of Aids and taught with the preventive and curative measures.

- To inculcate the habit of savings to the workers by contributing Rs. 500 per each worker per year to their individual savings account; wherever individual accounts do not exist distribution of linen for the same value.

Future Program for FaL-G

Despite of over 12,000 operating plants throughout the country producing over 24-36 billion bricks or equivalent volume of blocks, the penetration is mere 12-18% against 200 billion national brick market. This demand is likely to cross over 300 billion in the coming decade with rapid increase in urbanization and relevant housing stocks. This is notwithstanding the potential scope of FaL-G brick/block in infrastructure segment which may be over 400 billion.

On supply side, against the generation of over 160 million tons of fly ash, approx. 18 million tons are used towards brick, leaving a huze hiatus. Moreover, 40-60 million tons of generation is expected to be added in the coming decade (2010-20). Hence any amount of efforts to work for proliferation of FaL-G units is desirable.

The global efforts to work for 'food security' summons for protecting fertile soils from denudation and putting them to alternate use in order to ensure their deployment for cultivation. This agenda would be served unasked for when FaL-G bricks pervade on walling market and prevent the production clay bricks. Hence INSWAREB owns the target of 100,000 FaL-G brick units, producing over 300 billion bricks that can abate over 93 million tons of GHG emissions.

India's voluntary commitment stands at 20% reduction in GHG emissions by 2020. Against total emissions of 1,612 million tons, the country has to abate the emissions of 322 million tons in order to live up to its commitment. FaL-G bricks alone could abate 93 mn. tons contributing to 28% of its commitment.

In this back ground, in order to buttress the efforts of proliferation to the whopping target of 100,000 units with due incentive mechanism, ECPL envisages to register large number of bundles under Program of Activities (PoA), taking the support of fly ash generators in private sector and also some State Governments. In the case of latter, it may be envisaged to conceive PoA projects. Undoubtedly FaL-G activity offers multilateral benefits to all the stake holders, be it government, entrepreneurs, consumers or community.

Annex I

CHARTER OF
FaL-G : CDM PROJECT LAUNCHING

I, N Kalidas, Executive Director of Eco Carbon Pvt. Ltd., do hereby declare that the FaL-G : CDM Project, signed with the International Bank for Reconstruction and Development, Washington, as Trustee of the Community Development Carbon Fund, on June 28, 2006, is hereby launched for due compliance.

On behalf of Eco Carbon Pvt. Ltd., we do hereby commit that the Emission Reduction Transfer Agreements signed with various Sub-Project Entities, ie., the FaL-G brick & block plants, would be diligently implemented with regard to Environment Monitoring and Community Benefit parameters.

We, Eco Carbon Pvt. Ltd., do hereby commit that this FaL-G : CDM project would adhere to all monitoring parameters, as approved by the CDM Executive Board constituted by UNFCCC, in computing Emission Reductions earned by each Sub-Project Entity with due diligence.

We, Eco Carbon Pvt. Ltd., do hereby reiterate our commitment in accumulating Emission Reductions out of FaL-G Brick & Block activity and transferring them to The World Bank with due diligence in quantity and quality; as well as in getting the revenue distributed to all Sub-Project Entities as enshrined in Emission Reduction Transfer Agreements.

For & on behalf of
Eco Carbon Pvt. Ltd.,

Visakhapatnam
March 27, 2007

N Kalidas
Executive Director

Annex 2

* The New Indian Express Saturday, August 8, 2009 | Visakhapatnam

● ECO-FRIENDLY STEP

World Bank incentive for Fal-G brick producers

Express News Service
Visakhapatnam, August 7

SIXTY Fal-G brick manufacturers of the state will get cash benefit of Rs one crore for their role in reducing carbon level in the environment. Institute for Solid Waste Research and Ecological Balance (INSWAREB), a techno-scientific organisation in NGO sector, will pay the amount at the third national workshop on Clean Development Mechanism (CDM) at Gateway hotel, here on August nine.

Speaking to reporters here today, INSWAREB Director N Kalidas said 60 proprietors of Fal-G brick manufacturing units in the state including around 40 from Visakhapatnam, Vizianagaram and Srikakulam districts would get the amount depending upon their production. Maximum amount goes to Rs five lakh.

During the last financial year, these manufacturing units produced 10.5 crore Fal-G bricks and reduced 32,701 carbon credit tons which is a great support to maintain a healthy environment. In a bid to encourage the proprietors, the World Bank announced the Rs one crore incentive to them.

Explaining the manufacturing process of Fal-G bricks and the bricks' role in reducing carbon level, Kalidas said it does not use any thermal energy and thereby conserves coal that amounts to 380 tons of CO2 abatement. However, for the use of power and small quantities of cement or lime, FaL-G loses certain credits and gets over 240 tons of net credits per every million standard bricks.

FaL-G mix can be tailor-made depending on the quality of fly ash. The input cost of fly ash can be rationalised with reference to the logistical distance of source to the production unit. Thus, each brick can be manufactured containing fly ash from 0.5 kg to 2 kg in each brick. Even at an average of 1 kg per brick, FaL-G activity alone can find the way for total fly ash generation that has the potential to register a demand of 214 million tons against the projected generation of over 150 million tons by 2010.

VISAKHAPATNAM
THE HINDU • SATURDAY, AUGUST 8, 2009

Growth potential high in fly ash brick industry

'Fal-G tech has helped develop over 9,000 entrepreneurs and create employment to over 1.08 lakh workforce in India'

Special Correspondent

- The technology has made a dent into clay brick sector that monopolised the industry for years
- Third national workshop on clean development mechanism tomorrow

VISAKHAPATNAM: There is potential for growth by at least 11 times in the fly ash brick industry which is now contributing to a turnover of about Rs.3,600 crores to Rs.5,400 crores.

Making this observation at a media conference here on Friday, founder-director of Institute for Solid Waste Research and Ecological Balance (INSWAREB) N. Kalidas said INSWAREB's Fal-G technology which is used to manufacture fly ash bricks had made a dent on the clay brick industry which had monopolised the walling market for centuries in the absence of tangible alternative.

"Our technology helped develop over 9,000 entrepreneurs and created direct employment to over 1.08 lakh workforce in India.

There is scope to develop one lakh entrepreneurs with employment potential to over 12 lakhs. We have patented the technology, but we are providing it very liberally," he said.

Mr. Kalidas said that in view of its potential for blemish less emission abatement and taking into account its multiple contributions to ecology and community Fal-G technology caught the attention of the World Bank which sought to buy the emission reduction credits out of this activity. For this purpose, Eco Carbon Pvt. Ltd. (EPCL) was incorporated as special purpose vehicle to handle the contracts on both the sides - with the World Bank on one side and Fal-G entrepreneurs on the other.

EPCL had signed a contract with World Bank committing to transfer six lakh tonnes of carbon credits by 2015, beginning in the year 2004.

This contract was worth $6 million (about Rs.24 crores) and it was envisaged to enrol 108 entrepreneurs under different bundles.

Already three bundles consisting 66 entrepreneurs had come on stream and the last one consisting of over 50 units was due for submission this month, he disclosed.

He also said so far 76,430 tonnes of credits were delivered and about Rs.1.3 crores disbursed.

Another Rs.1 crore would be disbursed in the city on Sunday at the third national workshop on clean development mechanism (CDM), he stated.

The entrepreneur draws the carbon revenue of Rs.80,000 per each million bricks of specified size. However, to reap this benefit, one should maintain records, quality standards and also implement welfare programmes, he explained.