

LOW-SMOKE FUEL PROGRAMME: PRELIMINARY RESULTS OF THE MACRO-SCALE EXPERIMENT

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1. INTRODUCTION

The Macro-Scale Experiment was the in situ testing of Low-Smoke Fuels in an isolated Township of Qalabotjha, situated about 100km from Johannesburg on the motorway to Durban. The experiment started on 1 July 1997 and was scheduled to end on 10 July 1997. The experiment marked the culmination of the research work done on the Low-Smoke Fuel Programme which commenced in June 1994. However unforeseen circumstances, including weather and delivery (see below), caused it to be extended until 20 July 1997.

2. PRELIMINARY RESULTS

The experiment has only recently been completed. The current stage is to analyse the data and determine results. Preliminary items of interest are:

2.1 LOW-SMOKE FUEL DISTRIBUTION AND HANDLING (LLOYD)

2.1.1 Fuels

Some of the fuels supplied showed problems which were not encountered in preliminary work:

PROBLEM	SOLUTION
a) Some of the devolatilised coal contained fines which did not allow free flow of air through the stoves, thereby lowering the ease of combustion.	A mechanical mesh was inserted in the fire-place to assist airflow. Screening of this fuel (at 25mm) and re-bagging was also undertaken.
b) Some households used excessive amounts of the paper-based fuel, thereby causing their combustion equipment to glow red hot (The paper based fuel has a very high CV.) This caused a scare.	Word was sent around to warn the residents to use moderate amounts of this fuel at any given time.
c) For about three days the wind direction was in opposition to the placement of the monitoring equipment	The experimental period was extended by ten days.
d) About 250t of LSF remain in the warehouse.	It is planned to utilise them in a brick making project.

2.1.2 Fuel Distribution

From the outset it was apparent that the work would be done in conjunction with the existing coal supply infrastructure if the experiment were to succeed. This meant using essentially the same truckers to move the low-smoke fuel to Qalabotjha as normal household coal, and the same distribution system within the town. To identify the truckers, work started with the merchant distributors.

With the help of the local officials, four coal merchants in the town were identified. A series of meetings were held, but the merchants were extremely suspicious of the intent of the experiment, and how it might affect their existing business. They even went as far as to warn the truckers that we might be approaching them. When the truckers were finally identified, they refused point blank to have any dealings with the experiment team.

Finally the merchants' co-operation was won when a meeting was held with representatives of the Department of Minerals and Energy, officials from the Free State government, the mayor and other local officials. At that meeting it was agreed that:

- (a) The merchants would organise an initial free distribution of one bag of fuel to every household in Qalabotjha, for which they would be paid the equivalent of their margin on an equivalent bag of coal R7/bag). The idea of the initial free bag of fuel was mooted by the coal merchants,
- (b) Thereafter they would receive low-smoke fuel on a consignment basis, paying R7/bag and selling at R14/bag for 40 kg vs R18/bag for a 50 kg bag of coal.

Each 40 kg bag of low-smoke fuel contained a voucher worth R0,50 towards the purchase of the next bag of fuel, and the merchants agreed to redeem these vouchers.

The first step in this process went well, and about 96% of the households received a free bag of fuel. However, soon there was some negative feedback:

- (a) None of the fuel supplied was suitable for burning in an open brazier. These appliances needed a large-size coal, are lit outdoors and only taken inside once smoke generation has ceased and ash formation on the outside of the lumps has slowed the rate of combustion. We had not anticipated that

the volume of sales into this market would be as high as it proved.

- (b) The devolatilised coal low-smoke fuel was too fine, which slowed the rate of combustion in some kinds of stoves.

It is interesting to note that so far as the Township was concerned, there were two main identifiable interested parties viz. the end-users and the coal merchants.

Three of the merchants seized upon these factors to revert to coal sales, and in spite of their earlier agreement to support the experiment, now moved into active competition. The merchants in trying to protect their trade tried to influence the end-users about the efficacy of the low-smoke fuels. There were reports of rumours being spread that the *government fuel* would poison people, and suchlike. However, the strongest weapon they used was a threat to withdraw credit if people bought *government fuel*. We had been unaware of this aspect of the market, that the merchants granted their customers credit, until pension day. We were not able to estimate precisely what volume of sales was on credit, but it appeared to be at least 30%.

The fourth merchant, however, honoured the agreement, and sold the low-smoke fuel successfully into an appreciative market. To maximise the use of low-smoke fuel, we also marketed directly. As a result, overall we were able to distribute a total of 160 t of low-smoke fuel between 1 to 18 July, versus a similar amount of coal sold between 3 to 18 July 1997.

2.2 SOCIOLOGICAL FACTORS

2.2.1 Awareness of and Attitude to Experiment

Prior to the commencement of the experiment, a contractor was hired to undertake marketing and user education in the community. In addition to this, a local office for the dissemination of information on the experiment was set up. A survey revealed that about 93% of the Township residents were aware of the experiment. Some of the views expressed about the experiment are listed below:

- * "We were happy to participate in this study."
- * "We benefitted a lot because our people got money out of it and we were given coal for free"
- * "We feel happy that our community was chosen and at least now Qalabotjha is being recognised as a location"

Asked specifically how much coal smoke worried them, 83% said it worried them a lot, 7% a little and 10% not at all, confirming previous perceptions.

2.2.2 The Test Fuels Comparison with "Usual" Coal

2.2.2.1 Flame Africa (compressed paper with binder)

The results suggest that Flame Africa is the only fuel that emerged as better than domestic coal. However, it doesn't

perform well in terms of heat retention — a critical characteristic for any fuel that is to substitute for coal in winter where space heating is the most important reason for the use of coal. As in 1996 the results indicate that Flame Africa would provide a good substitute for paraffin (a fuel that is generally not liked) as it would enable people to prepare meals and boil water quickly (in the mornings before school / work). It would also be used as a starter / "firelighter" to speed up the lighting of domestic coal. The smell could also be a problem.

2.2.2.2 AFC (devolatilised coal)

AFC was acceptable in terms of smoke, smell and but did not really perform satisfactorily elsewhere. If anything, the sifting of AFC appears to have decreased its acceptability in terms of critical factors such as heat produced and heat retention.

2.2.2.3 Chartec (devolatilised coal)

Chartec was acceptable in terms of ease of lighting (when sifted), amount of ash, amount of smoke and smell. However, it was not acceptable in terms of the most critical factors in a devolatilised coal: heat produced, heat retained and speed of cooking.

A summary of key results follows.

COMPARISON OF TEST FUELS WITH CONVENTIONAL COAL					
	AFC		Chartec		Flame
	Original	Sifted	Original	Sifted	
Sample of households	108 %	35 %	223 %	56 %	269 %
EASE OF LIGHTING					
Better	49	54	46	71	91
Same	21	23	24	14	6
Worse	30	23	30	14	2
HEAT PRODUCED					
Better	37	29	26	38	80
Same	19	37	24	29	11
Worse	44	34	50	32	8
HEAT RETENTION					
Better	30	23	25	34	52
Same	21	29	21	32	12
Worse	48	49	51	34	38
SPEED OF COOKING					
Better	32	37	26	39	81
Same	21	17	23	36	10
Worse	43	46	50	25	5

	AFC		Chartec		Flame
	Original	Sifted	Original	Sifted	
AMOUNT OF ASH					
Better	69	66	61	79	84
Same	8	23	24	18	13
Worse	23	11	13	4	2
AMOUNT OF SMOKE					
Better	76	77	78	82	84
Same	7	17	13	7	6
Worse	18	3	9	11	9
SMELL					
Better	69	74	68	68	55
Same	7	20	15	11	11
Worse	24	6	17	20	33
OVERALL					
Much better	32 (54)	49 (58)	18 (38)	27 (57)	62 (89)
A little better	22	9	20	30	17
Same	12	6	10	11	9
A little worse	14	9	23	21	8
Much worse	19 (33)	29 (38)	29 (52)	11 (32)	3 (11)
Balance = Don't know () total better and worse					

2.2.3 Overall Preferences

Overall, the preferences were not particularly conclusive. When asked to rank the test fuels they had used in order of preference, 66% of consumers had no particular preference; 31% chose Flame, 18% chose Chartec Original and 14% AFC Original. Only 35 households used AFC sifted and 56 used Chartec sifted.

Note: two of the devolatilised coals tested in 1996 were rated as being satisfactory, compared with coal in terms of heat retention.

2.2.4 Coal Merchants

The coal merchants said that they were generally *satisfied* with the manner in which they were contacted and invited to participate in the project. However, the history of the negotiations with the merchants and their final somewhat reluctant agreement to participate suggests that this may not be an accurate reflection of their spirit of co-operation in the project.

Two of the three fuels supplied to Qalabotjha did not meet requirements. Both the devolatilised fuels (Chartec and AFC) were delivered with a high percentage of undersized pieces. Since the majority of coal stoves in Qalabotjha are old, these smaller pieces fell through the stoves. Despite Prof. Lloyd providing grates for stoves, people who were delivered these

two fuels reacted negatively to them. Even though they had been provided with them at no charge, they complained to the coal merchants:

- * "After I delivered the coal people stopped me on the way to tell me how unsatisfied they were with the coals I have just provided them"
- * "The coal was not popular with the people, they did not buy them, even though the price was still R7.00"

The reaction of most of the merchants was to withdraw from the project and revert to selling standard coal:

- * "If the business is not good it is the owner who suffers the most. I loaded equal bags of normal and test coal and went out but only the normal coal would be bought. Even when I loaded the test coal on top of the normal coal, the normal coal was still bought rather than the test coal. Imagine now if I was only selling the test coal, what would have happened to my business. If I had followed the request that we only sell this test coal, what could I have done with the people I have employed to help me?"
- * "I think their attitude was to succeed at any cost. Whoever gets hurt in the process it does not matter to them. For an example, they asked us to only sell this coal but they did not consider what disadvantages they might have on us as dealers. They must look on both sides and not only on succeeding."

On the basis of their experiences with the merchants, various project team members have commented that it will not be possible to retail low-smoke fuels through the coal merchant network and that alternative retail mechanisms have to be sought.

The survey team's opinion is that it was not possible to sell AFC and Chartec through the merchants in Qalabotjha *because these fuels were inferior* and were not a viable alternative to D grade coal (the minimum standard). Despite sieving the devolatilised fuels and reducing the price to R7 per bag (compared with R14.40 (per equivalent bag of coal), consumers were not particularly enthusiastic about the test fuels and initially rejected them. The coal merchants, like retailers of any product, know better than to try to force customers to buy products. The following comment indicates that the merchants have an excellent grasp on the principles of marketing:

- * "I think that the project did not succeed because the coal was of poor quality. For the project to have succeeded it needed a high quality of coal, better than the market already has. For example — for Pepsi to have beaten Coke it should have come up with a very good and better product than Coke for the reason that Coke is a very well established product."

Even though Flame proved to be popular in the longer term there was considerable confusion about it initially. People thought it was kindling and consistently referred to it as the "wood logs". Many thought they should wait for their test coal deliveries before starting to use the product.

Education in the use of the fuels was also identified as a problem. Several households packed their stoves with Flame Africa which resulted in a dangerously hot fire. One reported they thought there was a rocket outside, until their neighbours notified them about the "fire roaring out of their chimney". This could have had serious repercussions if any shacks had caught fire. Similarly, Chartec and AFC were difficult to light and keep alight and consumers learned how to use them through trial and error (and persistence).

The first reaction of consumers to a new product is critical. Consumers, who had received no education or instructions in the use of the products, reacted negatively and conveyed these reactions to the merchants. It was this reaction which caused the merchants, many of whom were already reluctant participants in the project, to withdraw from the project and revert to selling coal.

In corroboration of the merchants' concerns, the survey team experienced considerable difficulty in obtaining the recall interview at households in Qalabotjha. Householders who had been quite happy to be interviewed for the benchmark study (before the fuels were placed) had to be persuaded to undertake the recall interview. Generally, the fuels had not lived up to their expectations and their goodwill and enthusiasm had been undermined.

The community wished to take part in a project that had been launched with such a fanfare. As the fuels were marketed independently of the merchants, sales of the test fuels did pick up. Consumers were able to buy sifted devolatillised fuels; they were able to buy the fuels at a hugely discounted rate and they learned how to use them.

* "We enjoyed participating in this study. Although the coal did not burn OK in my stove and some of us had problems using it, it is not a big problem"

In a real market situation no product would get this many chances and the real lesson to be learned from this experiment is that when low smoke fuels are finally launched *they have to provide* a viable alternative to D grade coal.

Given that coal substitutes are heavy and bulky, they will have to be distributed through the existing coal merchant network if they are to penetrate the market. If the fuels had performed, as they should have, the majority of consumers would have responded favourably to the fuels from the start and the merchants would not have refused to deliver the fuels.

2.3 THE WAY FORWARD

A workshop was organised in mid-November in order to subject the results of the Macro-Scale Experiment to a critique. The results from the workshop and a Decision Support Model which is currently being developed would be used as engines for developing inputs to a future policy on the use of clean and safe fuels in the Townships. The findings garnered by the experiment with other studies may necessitate a form on intervention by the government. Interventionist scenarios may include a combination of financial assistance to low-smoke fuel manufacturers, subsidy, zero rating of value added tax and an imposition of a form of carbon tax on D-grade coal. In the long term, areas that use D-grade coal may be proclaimed as smoke free zones.

A basket of other measures like tarring of roads, the use of the right energy mix, housing insulation, prohibition and or abating of refuse burning and others are possible measures that may be adopted to reduce the incidence of air pollution. In the worst case scenario, should the low-smoke fuel route, which is only one of several options in an integrated approach, be found unsatisfactory, one may revisit the drawing boards.

2.4 CONCLUSION

Although some of the above could be viewed as negative aspects, the emergence of these factors was the reason for undertaking the experiment. Further results will be forthcoming. Of special importance are further sociological aspects and the physical measurements of pollution levels.

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