STRATEGY TO COMBAT THE NEGATIVE IMPACTS OF DOMESTIC COAL COMBUSTION: BASA NJENGO MAGOGO

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1. INTRODUCTION

Notwithstanding access to electricity, coal still remains the fuel of preference for cooking and space heating for most low-income households in the central Highveld region. The main reasons are that coal has the desired characteristics of extended heat release, required for space heating. Approximately 1 million households consume just over 1 million tonnes of coal per annum, most of which is burnt during winter. This leads to excessive concentrations of air pollution that have measurable negative impacts on health. Increased morbidity and mortality have been attributed to these high levels of coal-based air pollution in residential areas. Studies in the Vaal Triangle have shown that children exposed to coal smoke have an approximately ten fold higher incidence of respiratory tract disease than children living nearby and not exposed to smoke. It has been calculated that the costs to state-funded health care programmes could be of the order of approximately R1.2 billion per year. This amount is only the state's cost and does not represent the total of health and environmental cost to society, which is believed to be much larger. The poor who can least afford it carry most of this ill-health burden.

The Department of Minerals and Energy's Low-Smoke Fuels Programme was initiated as an outcome of a stakeholder workshop held in Soweto during 1994. Comprehensive literature studies were followed by laboratory scale technical investigations, mainly on the impact of coal on the environment, the potential of low-smoke fuels and community socio-economic studies. These were followed by a large scale experiment in the town of Qalabotjha where the residents used approximately 200 tonnes of low-smoke fuels over a 20-day period during the winter of 1997. The main outcome of that investigation was that low-smoke fuels, inter alia, have a role to play reducing air pollution to acceptable levels. This led to the formulation of an Intergrated Household Clean Energy Strategy, which incorporates, inter alia, measures such as the low-smoke generating top-down ignition of coal fires (Basa Njengo Magogo-method), low-smoke fuels manufacture and distribution, and housing insulation and design, as well as also in the longer term measures such as cleaner fuels (liquids & gases) and stoves.

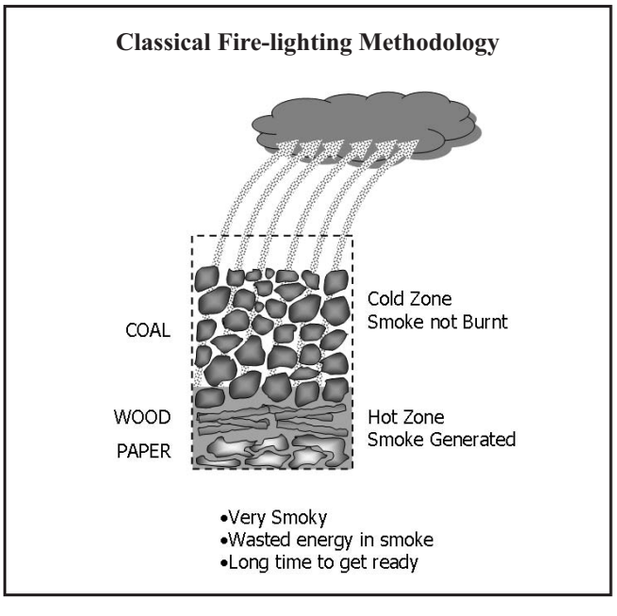
2. BASA NJENGO MAGOGO

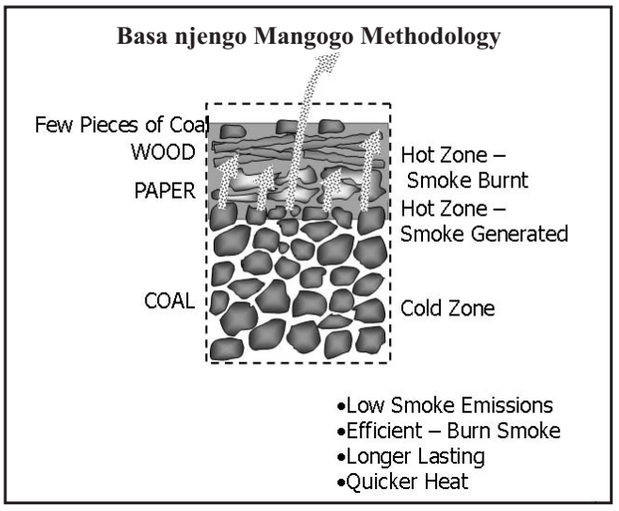
The top-down ignition of household coal fires is the least-cost option for decreasing smoke emissions.

2.1 Description of Method

In the classical bottom-up fire ignition approach, the order of laying the fire is paper, wood then coal. In the "Basa Njengo Magogo" or top-down ignition approach, the order of laying the fire is coal, paper then wood, and few lumps of coal on top at an appropriate time after the fire has been lit.

The principle is as follows: smoke is generated at the hot/cold boundary. In the normal bottom-up coal fire ignition process, the smoke rises through the cold coals and thus escapes. In the top-down ignition process, the smoke rises through the hot zone and is consequently burnt.





The basis of the "Basa njengo Magogo" has a long history. "A new method of lightning a fire is sometimes practised with advantage, the fire lighting from top to bottom down, in place of being lighted and burning up from below. This is arranged by laying the coals at the bottom, mixed with a few good-sized cinders, and the wood at the top with another layer of coals and some paper over it; the paper is lighted in the usual way, and soon burns down to a good fire, within some economy of fuel as is said."

The top-down ignition methodology, under the name of "Scots fire", was promoted by the National Association for Clean Air during 1980's.

The methodology was perfected by Mrs Mashinini of Embalenhle during her participation in a clean energy project undertaken by Nova with Sasol support. By placing a few lumps of coal on the top of the fire at the right time, she found an improved ignition of the underlying coals. The project is named "Basa njengo Magogo" in her honour, meaning "make your fire like the old lady".

2.2 Laboratory Tests of "Basa njengo Magogo"

Controlled laboratory Tests of the "Basa Njengo Magogo" methodology were undertaken by the CSIR during 2004. These tests showed an 80-90% reduction in the smoke emissions, a shorter time to cooking and less coal burnt, confirming the field observations. These latter two properties are the principle 'selling' points. That is, the time to cooking was lowered from an average of 55 minutes to 11 minutes (compared with the within 20 minutes observed in the Orange Farm pilot project). Also, the "Basa njengo Magogo" methodology uses approximately 1 kg less coal to reach cooking temperature when compared with the classical method. At a cost of approximately R1/kg for coal this could translate into a cost saving of approximately R30/month during winter (compared with the R26/month observed in the Orange Farm pilot project). It would also save carbon dioxide emissions.

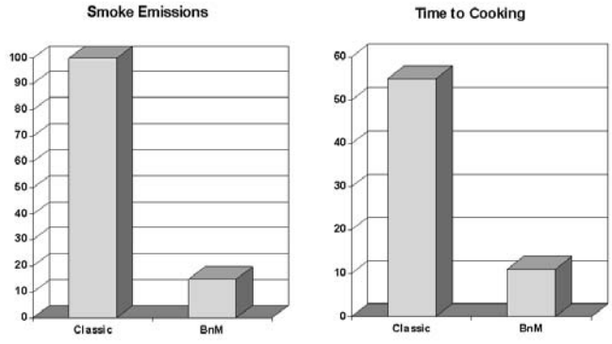
[1]Mrs Isabella Beeton The Book of Household Management, 1861-an encyclopedia of cooking and household management for the middle class.

Sulphur dioxide emissions were approximately the same for the traditional and the "Basa njengo Magogo" methods. The "Basa njengo Magogo" methodology was also effective for igniting low volatile coals (low-smoke fuels) such as anthracite.

2.3 Demonstrations of "Basa njengo Magogo"

There have been four projects to disseminate the top-down ignition technique; by PDC (funded by the Department of Minerals and Energy), and Nova (funded by Sasol). Two other such projects are scheduled for winter 2005, funded by the Department of Minerals and Energy.

During 2003, the Department of Minerals and Energy commissioned PDC to undertake a pilot scale "Basa Njengo Magogo" project as a first step in implementing the Strategy. The purpose of this pilot was to ascertain what processes are required for the success in
promoting this coal fire-lighting technology, and what to avoid. The pilot took place in the area of Orange Farm and environs during the winter of 2003. A total of 307 demonstrations were held reaching 19 425 households directly and indirectly. The acceptability of the project and the up-take of the methodology exceeded expectations.



The primary purpose of the programme is to reduce levels of air pollution and consequently the associated negative impacts. Although no pollution measurements were made during this project, approximately 76% of residents stated that they subjectively noticed less smoke after one month of use. Moreover, approximately 67% of households noticed less smoke in the street. It was observed that the "Basa Njengo Magogo" technology resulted in savings of coal. This is brought about mainly as the smoke (unburnt coal) is now burnt. Approximately 88% of households reported savings. Most households reported saving half a 25 kg bag of coal per week. About 92% of households used to make fire twice a day, but now needed to make a fire only once per day. The above translated into a saving of approximately R26 per household per month.

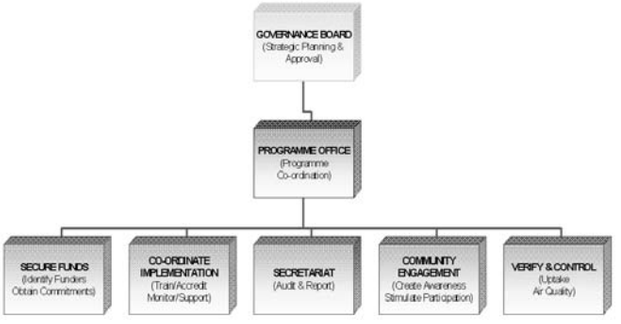
Moreover, because of the nature of the "Basa Njengo Magogo" technology, the fire was usually ready for cooking within 20 minutes, a considerable advantage over the approximately 45 minutes over the more common methodology.

3. GOVERNANCE

Other groups have also shown an interest to become involved in disseminating the technology. With so many parties pursuing the same end, it is foreseen that the dissemination of the technology could become disorganised, the target audience confused and incorrect or inferior information propagated. Hence, there is a requirement to manage this activity on a national basis and co-ordinate the various role players.

Department of Minerals and Energy is establishing a governance system to co-ordinate a national roll-out in those areas that burn coal. The Department has registered the name and logo that interllectual property. The governance system is intended to address, inter alia:

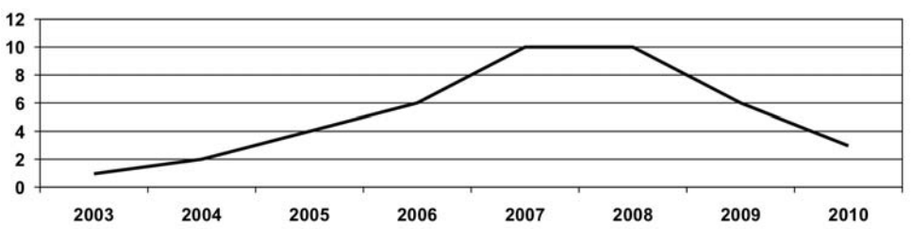
- Co-ordinate the national roll-out
- Make available name logo and promotional material to approve projects.
- Standards and quality control
- Training material
- Draft project plans.



The Programme will co-ordinated by a "Governing Body" that will approve specific projects and will provide access to training, standards and logos etc and oversee quality management.

It is estimated that it may take 8 years to reach 1 million households. Such a programme is envisaged to ramp up to about ten demonstration projects per year. At this stage it is uncertain the extent that 'word of mouth' will precipitate households to convert to the "Basa njengo Magogo" technology, thereby eliminating the need to demonstrate to all 1 million households. Therefore, the programme will be reappraised at regular intervals and revised appropriate.

Demonstrations per Year



4. BASA NJENGO MAGOGO SUPPORT

It is intended to seek the assistance of donor agencies and industries in rolling-out the "Basa Njengo Magogo" ignition Technology. It is the goal of the Department of Minerals and Energy to achieve a complete national roll-out and as such, the Department will encourage and co-operate with all established institutions wishing to undertake the roll-out in different parts of the country.

5. CONCLUSION

Although the purpose of the Programme is to reduce smoke, the "Basa Njengo Magogo" technology is appealing to the householder because:

- It costs nothing (in contrast to projects that endeavour to sell products to households on a 'good-for-you' basis)
- It makes use of existing appliances
- Less coal was burnt and thereby monetary savings were obtained
- Fire was ready for cooking earlier
- Air pollution was lower
- The "Basa Njengo Magogo" process works in all coal burning appliances, including stoves, umbawulas and even in a heap on the ground.

The programme is to be rolled-out on a national basis to those areas that burn coal; as a domestic fuel under a co-ordinated governance system.