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Scaling Up Biomass Gasifier Use in India; Barriers Interventions & Remedies: A Review

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ABSTRACT
In India, work on gasifiers for energy applications started in the early 1980s. These efforts received a boost with the Department of Non-conventional Energy Sources' (DNES, latter MNES, now a ministry, MNRE) dissemination program that was initiated in 1987. While this subsidy-based program was successful in placing about 1200 gasifier systems for irrigation pumping in the field, most of these units were non-operational soon after for lots of reasons. Despite all this, large-scale gasifier deployment has still not taken off in India. The fact that scale -up did not take place automatically even in cases where gasifiers are economically clearly feasible indicates that there are a number of issues to be considered and barriers to be overcome for successful large-scale deployment. To facilitate gasifier deployment among poorer and nonskilled users (i.e., unorganized, small-scale firms, rural areas); and lack of systematic programs targeted towards scale-up. Especially important is the fact that the particulars of implementing gasifier-based energy systems depend on the kind of application and context; therefore the approach has to be tailored to the specific application – this impedes the potential success of any single approach to scale-up.

Keywords-Biomass, Gasifier, Gasifiication, renewableenergy, scaling-up

I. INTRODUCTION

As a consequence, over the last two decades, there have been efforts in many countries to explore the implementation of gasifiers in a number of applications and contexts. There has been considerable research on, and evolution, in gasifier designs with a concomitant increase in the ability to utilize a greater range of biomass feed stocks. There have been a number of demonstration and implementation efforts that have begun to yield a wealth of experience that in turn are leading to a refinement of the thinking on how to make further progress on this front.

Ultimately, though perhaps the most important aspect of any contemplation of efforts to realize the potential role of biomass gasifiers in contributing to development in any meaningful manner is the "scale" issue. To put it simply, this technology will make any significant contribution to the enormous energy problem in developing countries only through large-scale deployment. Only if the dissemination and use of gasifiers can be scaled up, can they be considered to be successful contributors to economic and social development in developing countries.

This paper aims to highlight the various applications and contexts in which biomass gasification may be successfully utilized at a large scale. It also discusses the various dimensions that need to be considered in scaling up deployment in any of these categories, and suggests possible approaches that might be particularly promising. The analysis in this report builds on the experience and lessons from the substantial efforts in India on biomass gasifier development and dissemination over the last two decades. It also explicitly takes a systems perspective in analyzing the Indian case as well as possible ways forward in order to mainstream gasifier use in developing countries.

II. DEVELOPMENT AND DISSEMINATION OF BIOMASS GASIFIERS IN INDIA

The development and dissemination of modern biomass gasifiers in India began in the early 1980s. During this period, a number of research institutions commenced efforts to examine different aspects of biomass gasifier use as well as to develop indigenous gasifiers and gasifier based energy systems (GESs).

The earliest of these efforts began with some work by a French couple, Vincent and Marie -Sabine D'Amour at the Jyoti Solar Energy Research Institute (JSERI) in Gujarat. JSERI had been established by Jyoti Ltd., an industrial house, to develop renewable energy technologies. After some experimentation, JSERI researchers developed a **5**-horsepower (hp) gasifier that was suitable for coupling to a diesel engine that in turn could power irrigation pump sets. The design and drawings for this design belonged to Jyoti Ltd., and the firm, through its energy division, started manufacturing these gasifiers. (In 1984, JSERI became an autonomous, not-for-profit

organization that was funded in part by the government. It also changed its name to the Sardar Patel Renewable Energy Research Institute (SPRERI).) Dr. B.C. Jain who headed the energy division at Jyoti left in 1986 to start his own firm, Ankur Scientific Energy Technologies, Ltd., to focus on the development, manufacture, and popularization of biomass gasifiers and solar hot water systems. SPRERI is still in continuous effort in the research area of non conventional energy.

The institutional landscape has also evolved somewhat over the years. While the major R&D Institutions that had begun work on gasifiers in the early 1980s continue to be active in the area, only a few other R&D actors have emerged subsequently, and only with the help of government support. There are, though, now a large number of gasifier manufacturers in the country. The Ministry of non-Conventional Energy Sources (MNRE, the successor to MNES, DNES) remains the main funder of gasifier R&D in the country and deployment through its subsidy program. Until recently, it also supported activities at the various institutions designated as the gasifier action research programs (GARPs). But a number of other actors have also started playing a role in funding and catalyzing gasifier-related activities in the country. On the public -sector side, these include state nodal agencies such as the Renewable Energy Development Agencies of West Bengal (WBREDA), Gujarat (GEDA) and Orissa (OREDA). Some donor agencies have also supported specific gasifier development and dissemination activities – for example, the Swiss Agency for Development and Cooperation (SDC) has provided support for the development of gasifiers for silk reeling and cardamom drying enterprises. DESI Power has been supported,

While the government has been instrumental in the development and dissemination of gasifier technology in the country, it does not have policies specifically designed to promote large-scale deployment. While its programs have been successful at adding to the installed gasifier capacity in the country, this has happened by simple replication of demonstration or small-scale activities rather than by the emergence of different modes of industrial organization (for example, mass production by a few manufacturers instead of craft production by many small manufacturers) required to move from small-scale to large-scale deployment. The lack of efforts to experiment with, and promote, innovative institutional models to overcome existing barriers to deployment in particular applications has also constrained the uptake of gasifiers.

III. BARRIERS FOR SCALING-UP

It should be noted that this is not a comprehensive list but rather one that touches upon particularly important issues. Many of these barriers will also be relevant in other developing countries.

3.1 Technology/product development and production

(a)Downscaling of gasifiers sizes:

While there has been a major effort over the past two decades to develop large gasifier sizes that can take advantage of economies of scale in energy service delivery, there remains a need for small gasifiers that can be utilized in applications where the loads are smaller, particularly in rural areas and in informal enterprises.

(b) System automation

Process control and automation in gasifier systems (with respect to feedstock processing and feed charging, change over from diesel only to dual-fuel mode, etc.) has not been adequately developed. While there are cost barriers to the development of such technologies, they would be extremely useful in applications where the personnel costs contribute significantly to the operating expenses. Such systems would be more appropriate in industrial applications where skilled personnel are available rather than in rural/remote area applications.

3.2 Information and awareness

(a)Technology/product selection

In the present Indian situation, information on product specifications (technical specifications, performance parameters, O&M procedures) as well as prices offered by different technology suppliers is not available in public domain – this impedes competitive and fair selection of technology suppliers by users. May actors also express a concern for technology selection often being driven not by technology competitiveness but rather by informal alliances between manufacturers and project promoters.

3.3 Economic and financing issues

High system costs are driven by high capital costs and high costs of transportation in supplying the technology from manufacturing to user site. Difficulties in capital access for users hinder adoption.

3.4 Policy issues

(a)Bureaucracy

The procedures for government subsidy approval and disbursement are lengthy and cumbersome that deters potential beneficiaries (although to be fair, this is not a particular problem for the renewable areas only). A bottom-up structure exists related to project development and implementation that leads to high cost and time overruns due to factors such as

procedural bottlenecks and approval needs from multiple agencies.

IV. MAINSTREAMING BIOMASS GASIFIERS

The Indian experience has shown the tremendous potential of biomass gasifiers in providing thermal and electrical energy services for a variety of applications in a developing country. But the experience has also revealed the various hurdles on the path to widespread deployment of this technology. Hence efforts to scale up and mainstream the use of biomass gasifiers for providing energy services in developing countries will need to employ a systematic approach to build on past lessons and avoid potential pitfalls. This should include an examination of specific aspects of the technology development and deployment process as it relates to gasifiers. It should also focus on selected applications that seem to show the greatest potential for large-scale gasifier deployment in terms of technical, economic, and financial feasibility as well as social, economic, and environmental benefits.

V. REMEDIES

a) A proper awareness program should be developed by MNRE.
b) NGO's should be encouraged for helping in understanding the use of renewable energy and its advantages.
c) Marketing should be done for the related to renewable energy

VI. CONCLUSION

There is an enormous potential to utilize GESs for the provision of energy services for a range of applications in developing countries. Based on our analysis of the substantial Indian experience with this technology, a number of applications appear particularly amenable to the scaled-up application of GESs. Most fruitful scale -up strategy would be one that initially focuses on pure thermal productive applications. These could be taken up in the short-term, given their economic and financial feasibility and only minor needs for technology development. At the same time, a sequenced approach could be followed for power generation applications

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