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SUMMARY OF THE WORKSHOP ON NONUTILITY POWER GENERATION IN INDIA

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SUMMARY OF THE WORKSHOP ON NONUTILITY POWER GENERATION IN INDIA

In 1986, a study was conducted to explore the prospects for nonutility power generation in Gujarat and Maharashtra focusing on the role of the private sector.[1]

The results of this study indicated that nonutility power generation from large-scale domestic fossil fuel plants, industrial and commercial cogeneration systems, and renewable energy sources for sale to the grid presents a viable option for improving power supply in Gujarat and Maharashtra. The study demonstrated that the power generation potential from these options is large enough to eliminate power shortages in these states and reduce the expansion needs of government utilities. According to the study, the private-sector generation of electricity from large-scale combined cycle power plants running on domestic natural gas, for example, could bring over 1,500 MW of additional capacity into the grid. Industrial cogeneration represents an additional power generation potential of over 2,000 MW, while power generation from sugar cane waste represents a potential of over 400 MW. The potential from other domestic fuels is comparable to the generation expansion needs of the state electricity boards (SEBs) in these two states.

[1] The study was sponsored by the Department of Non-Conventional Energy Sources in collaboration with the United States Agency for International Development, and conducted by Hagler, Bailly & Company, a U.S. consulting firm, in collaboration with the National Productivity Council (NPC) of India during August and September 1986. The executive summary of this study is presented in Appendix A.

The study indicated that the development of this potential is currently hampered by: (i) lack of a clear policy framework for establishing nonutility power generation and selling electricity to the grid, (ii) difficulty in financing such power projects, (iii) uncertainty about price, quality, and availability of fuels, (iv) uncertainty about quality and timely availability of equipment, and (v) uncertainty about terms of interconnection with the grid.

To overcome these impediments, the study recommended a number of measures, including:

(i) Defining a clear policy on nonutility power generation covering procedures for licensing such power plants, terms of interactions between SEBs and nonutility generators, and the purchase price for electricity

(ii) Reevaluating the current policy on limiting the use of natural gas for power generation

(iii) Reevaluating the current policy on limiting the rate of return on power investments

(iv) Examining the prospects for private-sector leasing and third-party financing of power generation facilities in government industries

(v) Encouraging international competitive bidding for nonutility power systems

(vi) Encouraging technology transfer and manufacturing capability of selected power generation equipment

(vii) Supporting and publicizing demonstration projects

(viii) Undertaking similar studies for other states.

WORKSHOP BACKGROUND

Since the completion of this study, the electricity supply situation in India has further deteriorated. The ongoing drought in the country has reduced hydroelectric generation by over 30 percent, resulting in growing load shedding and worsening reliability of electricity supply. Therefore, an increasing number of industrial and commercial consumers are purchasing small diesel generators to supply their power needs during grid curtailments. There are indications that the government will not be able to increase its funding of power supply expansion projects, and that power cuts and supply unreliability will continue for the foreseeable future. In addition, the government convened a panel that addressed the possible role of private-sector investments in the power sector.

As a follow-up activity to the nonutility power study, two workshops were held, one in New Delhi on September 28, and one in Ahmedabad on October 1, 1987. The objectives of these workshops were to: (i) present the study results to a broad audience, including key representatives of central and state governments, utilities, industry, financial institutions, and the private sector; (ii) elicit the views of workshop participants on the role of the private sector in power generation; and (iii) confirm or amend the conclusions and recommendations of the study, or both.

Each workshop began with a presentation of study findings by Hagler, Bailly & Company, followed by two panel discussions on policy and financing issues related to nonutility power generation. Members of the policy panel were from government electric power and energy organizations, while the panel members discussing financing were primarily from industry, financial institutions, and the private sector. Each panel discussion was followed by a question and answer session. Each workshop ended with a wrap-up session summarizing the findings and recommendations of the workshop. The workshop in New Delhi also included a technical session on the second day that addressed (i) the analytical methodology used in the study to estimate the market for industrial cogeneration, and (ii) various approaches used to determine the purchase price for nonutility generated electricity.

The detailed workshop agenda is presented in Appendix B. The list of panel members and workshop participants is presented in Appendix C.

SUMMARY OF WORKSHOP FINDINGS

The workshop participants generally acknowledged the critical power situation in India and the need for infusion of additional resources into power supply activities. In the words of one participant: "If the Advisory Board on Energy's projected electricity demand is to be satisfied by the year 2004, 40 percent of the government's public outlay would have to be directed for energy programs. Such a large allocation of government resources to the energy sector is clearly unrealistic and would have a negative impact on the development of other services badly needed in the country, such as health, education, and transportation."

The workshop participants were asked to express their views on the impediments to the development of private power in India that were identified in the study. These views are summarized below.

Policy on Private Power Generation

Before discussing the policy issues raised in the workshops, it is important to distinguish between nonutility power generation and captive power generation. Captive power generation is the generation of electricity by a nonutility entity -- often an industrial or commercial consumer -- for its own uses with no sale to the grid. Because of India's power shortages, this mode of generation is relatively common and has led to growing reliance by industry and other consumers on small, inefficient diesel generators that increase the country's dependence on imported fuels. Nonutility power generation is the generation of electricity -- by such means as large-scale power plants, industrial cogeneration, and renewable energy facilities such as wind mills -- for sale to the grid or other customers.

The workshop participants agreed that there is a large potential for nonutility power generation in the country. However, there was a dichotomy of views on the need for the development of a clear government policy on nonutility power generation. Some government representatives asserted that there are enough guidelines in the current power supply policy to allow the development of nonutility power generation activities, while many other workshop participants disagreed with this statement and cited numerous shortcomings of the current policy framework.

Some government representatives focused primarily on captive power generation and acknowledged that there is a large potential for such power generation in the industrial sector. They also said that the power supply in the country is not going to improve dramatically over the next decade, and emphasized that the industry getting "the least priority of supply must fend for itself" by generating its own power and providing enough redundant capacity -- and a standby arrangement -- to be independent of the grid. Some participants also said that since adequate power supply is so important to the well-being of industry, it should be willing to accept lower returns on its power investments compared with returns on production investments.

Regarding the need for policy reforms, most government representatives said that as far as captive power generation is concerned, the Industry Policy Resolution Act of 1956 is very clear in permitting special industries to install captive power plants to meet their own needs. In fact, they said, by the end of the Eighth Development Plan (1995), energy-intensive industries such as aluminum, steel, and fertilizers are expected to generate about 40 percent of the power they use by captive arrangement.

On the need for policy reform to allow nonutility power generation for sale, some government representatives said that the Electricity Supply Act allows private entities to generate and distribute power in certain areas. They cited the three private power companies in Bombay, Calcutta, and Ahmedabad as examples of the effectiveness of existing policy in allowing private power generation. They also said that there are general policy guidelines available to SEBs for the purchase of power from private sources. In addition, some government representatives said that there are already many bilateral

arrangements regarding the sale of electricity between SEBs, regional electricity boards, and central undertakings. These arrangements have been developed to the satisfaction of all parties, based on the technoeconomics of power generation. Similar approaches, they said, can be and are being followed in dealing with private-sector generators. Therefore, according to some government representatives, there are no insurmountable problems to the development of nonutility power generation projects. In practice, they admitted, there may be some delay by electricity boards in processing nonutility power generation proposals, or there may be differences in pricing methodologies adopted. But, these problems, they said, can be easily resolved.

Concern was expressed about the viability of interconnection with small non-conventional power plants that, according to some participants, would pose technical problems for the grid. Some participants said that such power options, e.g., small (30 kW) windmills, are suitable for remote areas but not for supplying power to the grid over high voltage transmission lines.

Many workshop participants had a different opinion from some government representatives on the need for clear policy on private power generation. One participant said: "The effectiveness of the existing policy framework [with regard to nonutility power generation] can be determined by the results. As the results have not been forthcoming, there is something basically wrong with the policy."

The general view expressed by private-sector and industry representatives was that -- in contrast to the some government representatives' assertions -- the nonutility power policy framework is not clear. They also believed that there is ambiguity in buying and selling power or exchanging surplus power

with the grid and that SEBs generally are not able or willing to resolve these problems.

Some representatives of Indian industry, in particular, disagreed that the policy on captive power supply is adequate. They expressed their concern about lack of policy on the sale of power by captive power plants, as the SEBs generally do not accept such power or give permission for its sale to adjoining industries. One participant cited an example of the impact of no clear national policy:

> "A process industry with 9 MW of power generation potential based on waste heat generated in the process is able to tap only 3 MW in the state of West Bangal, where the electricity board does not permit paralleling with the grid, while a similar project in the state of Gujarat has higher profitability as it is able to tap the full 9 MW potential and operate in parallel with the grid."

In the sugar industry, another industry representative indicated, there is the potential for generating 2,000 MW of additional power which could be supplied to the grid or sold to nearby rural areas. But to do this, a policy framework similar to the PURPA regulations in the United States is needed.

Other industry representatives said that there is a large, idle captive generation capacity in the country that could be used to generate power for sale to the grid if the necessary arrangements were in place.

In particular, many representatives suggested that the Electricity Act of 1948 should be closely examined and possibly amended to overcome the basic obstacles to nonutility power generation.

The discussions at the Ahmedabad workshop indicated a higher level of agreement between government representatives and the private-sector than did those at the New Delhi workshop. The representative of the Gujarat government said that the public power sector is facing a severe financial crunch and "all industries, whether public, private, or cooperative sector, should be encouraged to produce power and sell it to the grid". The state of Gujarat, he said, welcomes private-sector participation in power supply and has taken steps to encourage it. For example, he said that the Gujarat Electricity Board allows captive plants to operate in parallel with the grid, and is purchasing power from a number of captive units as well as a private wind power plant. In addition, he continued, the state has introduced exemption of excise duty for new captive generation plants and is going to extend this exemption to existing industries. He also said that every effort should be made to ensure that private-sector resources are efficiently used in power generation. However, he pointed out that the current captive supply strategy has not led to efficient utilization of resources. For example, he explained, many industries are installing small diesel generators that produce only 2.8 kWh of electricity per liter of diesel oil. If they were to install a large diesel set and share the electricity output, they could generate over 4 kWh of electricity per liter of fuel.

He also said that the private-sector will only invest in power projects if the returns on investment are attractive (in contrast, SEBs do not necessarily focus on the rate of return on their investment). Therefore, it is extremely important, he continued, that the nonutility power supply policies provide attractive financial incentives for the private-sector to invest in power projects.

He also noted the need for a review of other states' policies and activities on nonutility power generation.

Difficulty in Financing Power Projects

On the issue of financing power projects, some central government representatives said that industry should not look at captive power projects as a money-making proposition. Electricity, they said, is so important to industry that it should be willing to bear the costs and build its own captive plants.

Some government representatives said that power shortages in India are essentially the result of a financial crunch. If funding were available, the country would have planned for an additional 10,000 MW of generating capacity. Therefore, they commented, if the nonutility power generation programs have to compete for financial resources from public-sector financial institutions, there is a contradiction in the premise on which nonutility power is based.

Some government representatives also expressed their doubts about foreign supplier credit, which may look attractive compared with global tenders in the open market. They said that detailed financial evaluation of various foreign financial offers by the present worth method often indicates that such propositions are not attractive compared with more traditional financing mechanisms. They also expressed their concern about bilateral assistance, as debt servicing may involve a big drain on the country's resources in the future.

The representatives of financial institutions indicated that their organizations were willing to finance power projects and provided examples of past involvement in such projects. In their view, the major financing bottleneck is the fact that industry is not prepared to allocate a sizable borrowing capacity [to power projects] when the capital is needed for production expansion purposes. They said that the current terms of financing -- 14 percent interest rate with deferred payments -- should be attractive to industry, and that industry should look at power projects in terms of supplementing the efforts of electricity boards in meeting the country's power needs (rather than as a business venture).

Representatives of the private-sector, on the other hand, pointed to the large equity-to-debt requirement of financial institutions. In addition, they said that if power supply is so important to the country, the government should reassess the adequacy of a 2 percent rate of return above central bank rates for power projects.

Finally, private-sector industry representatives expressed their concern about heavy duties on imported power equipment (100 percent), which push generation costs up and make investments in power projects unattractive.

The Gujarat government representative agreed with the private-sector participants and acknowledged that if a viable nonutility power supply option involving the private-sector is to be developed in India, the issue of acceptable and allowable rate of return on power projects must be carefully reexamined. The government of Gujarat has introduced some tax exemptions for power generation projects as an incentive to bring additional capital into power projects.

Finally, the last issue raised on the subject of financing power projects was the suitability of leasing arrangements, which could be applicable to SEBs as well as private, industrial, and cooperative power projects. However, for successful implementation of leasing arrangements, the workshop participants concluded, the policy on purchase price by electricity boards needs to be clarified.

Availability, Quality, and Price of Fuels

Almost everyone in the workshop agreed that there is a lack of clarity on the policy addressing the availability and price of natural gas. Many participants agreed that the availability of natural gas provides an important opportunity to private and government sector to install power generation facilities in a short period of up to 2 years compared to 4 to 5 years required for coal-fired plants. Some participants said that ONGC estimates of natural gas resources in the country are very conservative and unofficial estimates seem to indicate a much larger natural gas availability. There were numerous suggestions about the need for a review of the country's fuel policy in light of the new discoveries of natural gas.

Private-sector and industry representatives also expressed concern that the priority given to electricity boards for the supply of coal is not given to industrial captive power facilities, although they produce electricity too.

Availability, Quality and Price of Equipment

The issue of the problem of availability, quality, and price of power generation equipment included discussions on domestic manufacturing of power equipment and the demand for imported equipment.

Some participants from the government said there is domestic manufacturing capability for all types of captive power plants, including gas turbines. For equipment that is not manufactured in the country, or where domestic suppliers are unable to supply the requested equipment, the government has no objection to permitting import licenses.

The industry representatives indicated concern about (i) the long time required to obtain import licenses, (ii) the high import duties on power equipment, (iii) unreliable and costly domestic equipment, and (iv) the unavailability of spare parts from domestic suppliers. Some participants expressed the need for higher quality domestic equipment and improved inventory through better forecasting of power equipment requirements to minimize the long delays in obtaining equipment. In response, representatives of domestic suppliers explained their difficulty in maintaining a large inventory of critical components. They said that foreign suppliers have a larger market and therefore an edge in maintaining a large inventory of critical components, resulting in shorter delivery times to customers.

Interconnection with the Grid

The workshop participants recognized that one of the main issues associated with the development of nonutility power in India is how power can be fed

into the grid. The interconnection issues were discussed in detail by the representatives of government, financial institutions, utilities, industry, and the private-sector. The conclusion was that there is no clear policy on interconnection with the grid.

Some participants proposed that SEBs should be mandated to buy electricity from nonconventional generation plants, cogeneration facilities, and captive generators. Some government representatives responded that most SEBs are suffering losses for each unit of electricity sold to users, as they often have to subsidize the electricity supplied to agricultural and residential consumers. Therefore, the more electricity they purchase or generate -- as long as average electricity prices are below average supply costs -- the higher their financial losses will be. In addition, during off-peak periods, some utilities do not need additional supply and they should not be required to purchase from nonutility suppliers.

Some participants said that the requirements for defining terms of interconnection with the grid, as is done in the United States, are very complicated and the SEBs and consulting industry are unable to provide assistance in these matters. Many factors -- such as large variations in daily and seasonal load, different types of power plants in SEBs with varying marginal costs of production, and the inadequate accounting and metering procedures of SEBs -- make estimating the purchase price very complicated. Studies to identify of a more straightforward procedure for defining purchase price, in particular one that will share the savings from nonutility supply between SEBs and independent generators, should be undertaken.

In addition, participants recommended that the Electricity Supply Act be critically examined to see if transactions such as those permitted by PURPA in the United States can be undertaken in India in the current policy framework. If not, necessary modifications should be identified. Another major issue raised was parallel operation with the grid, which is not currently allowed or encouraged by most SEBs. One suggestion was that a committee at the central level should be formed to provide consultancy and mediation between SEBs and nonutility generators.

WORKSHOP RECOMMENDATIONS

In light of the views expressed during the workshops in New Delhi and Ahmedabad, the following measures are recommended as means of reducing the impediments to and encouraging the development of nonutility power generation in India.

Policy Measures

- Examination of the Electricity Act of 1948

  There is an urgent need for a careful examination of the Electricity Act of 1948 to identify what modifications, if any, are needed to accelerate the development of nonutility power generation in India. The focus of this examination should be the Act's provisions with regard to

production of electricity, particularly by the private-sector, for sale to the grid or wheeled to other customers, rate of return on private power investments, and excise taxes on "self-generated" electricity.

- Development of Nonutility Power Generation Policy

  It has been largely recognized by parties interested in investing or promoting nonutility power generation that a dedicated policy on this subject should be defined and publicized. Such a policy should be designed to remove impediments to the flow of greater private-sector resources into power generation for sale to the grid. The policy should take into account the impact of power shortages on the country's economic growth, especially in the industrial and agricultural sectors, the public-sector capital constraints, the inability of the SEBs to satisfy the growing demand for electricity, and the demonstrated interest of private entities in investing in power projects.

The policy should clarify the respective roles of the central government, the states, and other relevant authorities, particularly with regard to:

(i) Permission for independent generators to operate in parallel with, and sell electricity to, the grid

(ii) The establishment of a straightforward procedure for licensing nonutility generation systems. This procedure should cover construction and operation permits, import licenses, and fuel supply

(iii) Definition of the terms of interconnection between the SEBs and nonutility generators. These terms should spell out the technical requirements for interconnection and parallel operation

(iv) Definition of methodologies for determining the price that the SEBs will pay to nonutility generators for electricity

(v) Definition of the back-up power charges that SEBs will charge cogenerators and private power plants that require backup power from the grid

(vi) Definition of the terms, both technical and financial, for "wheeling" and "banking" of electricity.

- Since the "avoided cost" pricing of nonutility electricity has proven to be an effective incentive for development of such electricity generation options in the United States, its applicability to the Indian power sector should be fully examined. In particular, the examination should consider:

  - The impact of avoided cost pricing of electricity on the mobilization of private-sector resources for power projects

  - The financial impact of avoided cost pricing on the SEBs

  - The practicality of such pricing schemes in light of the level of sophistication in the SEBs' accounting procedure.

- In parallel with the above measure, an extensive review should be undertaken of existing technical and financial interconnection arrangements between the SEBs and independent generators. This review should also include interactions between NTPC, the SEBs, and private utilities such as AEC and Tata. Gujarat provides a good first case study, since there are some six captive generators in parallel operation with the grid. In addition, GEB is purchasing power from at least five suppliers.

- To provide an independent forum to resolve differences between SEBs and nonutility generators (in particular with respect to pricing, interconnection requirements, and backup procedures), alternative options should be identified and analyzed.

- To maximize nonutility power generation opportunities, a comparative analysis of the merits of private-sector and joint sector power project development should be undertaken.

Natural Gas Availability and Price

Large-scale combined cycle gas turbine systems provide an efficient, cost-effective and short-term response to power generation needs. Consideration should be given to encouraging mobilization of private-sector resources to develop these systems for the sale of electricity to the grid or for supply to industrial customers.

Given the importance to industry of an adequate supply of electricity, the large gas-based industrial cogeneration potential, and the high efficiency of cogeneration systems, the policy on use of natural gas in industry and for power generation must be clarified and publicized, especially with respect to availability at given locations, prices, and other contractual terms. Gas-fired cogeneration has a large potential in India in general and in Gujarat and Maharashtra in particular. In addition, these systems are the least-cost power generation option in economic terms and are very easy to operate.

An additional advantage of natural gas-fired power generation is its impact on the environment. Considering the impurities in Indian coal and the petroleum fuel used for power generation (LSHS), the use of natural gas can substantially reduce the pollution currently associated with power generation.

Financing

In light of the inability of the government to allocate sufficient funds for adequate expansion of generation capacity in India, there is a need to:

1. Analyze the need for effective incentives to attract private capital in power generation for both independent power production and cogeneration in industrial plants. Such incentives could include:

    - A relaxation of the existing rate of return ceiling (2% above the Bank of India's interest rates) on power generation investments.

    - Special incentives for leasing and third-party financing of power generation opportunities in industry.

2. Prepare a series of case studies on the reasons for success or failure of previous nonutility power projects.

Technology

Maximizing the efficient use of electricity generation resources in India will require use of the most appropriate and efficient technologies. A number of technologies -- such as gas turbines and fluidized bed combustion -- have the ability to dramatically improve the power supply situation. In light of this need, the recommendations of the workshop are:

1. Encourage and pursue the development and full commercialization of selected power generation technologies most suitable for Indian needs. A good example is the development of small, efficient steam turbines suitable for power generation in sugar plants.

2. Encourage international competitive bidding for nonutility generation plants to ensure the most efficient allocation of resources for power equipment.

3. Facilitate the import of selected power generation equipment. In particular, import of gas turbines should be facilitated, at least until a domestic supply is available.

Training

Training should be provided for SEBs and energy planning organizations in planning and technical issues of nonutility power generation programs including the determination of the purchase price for electricity. In addition, technical

assistance should be provided to SEBs, industrial cogenerators, and independent power plant operators on interconnection technologies and requirements and on parallel operation with the grid.

In light of the extensive experience of U.S. utilities and cogenerators in such activities, opportunities should be explored for transferring this technical knowhow to India.

Project Demonstration

There are still many questions and issues unresolved in the area of nonutility power generation, especially where interactions with the existing SEB grid are involved, such as purchasing, wheeling, or banking arrangements. To reduce the barriers associated with lack of experience or precedent with such arrangements, a number of full scale demonstration projects should be carried out. To address the range of issues and conditions, such demonstrations might include:

(i) A large-scale private power plant selling electricity to the grid or wheeling power to industrial customers

(ii) Industrial cogeneration facility selling surplus power to the grid, including leasing arrangements

(iii) Renewable energy based systems such as bagasse-based generation or wind farms.

APPENDIX A: EXECUTIVE SUMMARY OF THE NON-UTILITY POWER GENERATION STUDY IN GUJARAT AND MAHARASHTRA

EXECUTIVE SUMMARY

Background

India's power generation capacity has increased significantly over the past few decades, rising from 1,712 MW in 1950 to over 42,000 MW in 1986, for an annual growth rate of about 9 percent, significantly higher than the rate of growth of GNP. At the same time, however, several factors -- population growth, agricultural expansion, industrial growth, and rising energy use -- have boosted the demand for electricity. As a result, the country is facing a power shortage that averages over 10 percent and ranges between 15 percent and 40 percent in some states, such as Karnataka and Haryana.

The power shortage has many insidious effects on the Indian economy. One of the most crippling ones is the loss of productivity that an insufficient and unreliable supply of power causes in industry. For example, a study by the Federation of Indian Chambers of Commerce and Industry estimates the loss of production to the Indian industry because of a 10 percent power shortage at Rs. 70 billion ($6 billion), or about 12 percent of the total industrial production in India.[1]

Since India's power sector is dominated by the central and state governments, financing the necessary supply expansion has become a major burden on both state and central government resources. In the Seventh Plan, for example, energy investments absorb well over 30 percent of the total budget with power the largest component. Further expansion is unlikely and would have a negative impact on other critical sectors such as agriculture and health. Despite this level of spending for capacity expansion, the power supply is falling further behind demand. For example, electricity demand during the Seventh Plan is projected to increase by about 30,000 MW, but only 22,000 MW of new capacity will be added because of insufficient funds.

A number of technical, financial, and managerial difficulties in the power sector of India make the prospects for an adequate supply in the near future very unlikely. Most state electricity boards (SEBs) have suffered from financial losses year after year. Current losses stand at over $1 billion per year. This financial difficulty is in part due to the existing tariff structure, which is not based on economic pricing of electricity. The principle of economic pricing of power generally gives way to social and agricultural

[1] As quoted in K.P. Srinivasa Setty, R. Natarajan, "India's Power Scenario - A Case for Captive Power Generation", National Seminar on Captive Power Generation, March 1986.

objectives. In addition, many SEBs are hampered by the poor condition of their plant and equipment. Inadequate maintenance, deficiencies in manufacture, unavailability of spare parts, and the poor quality of coal contribute to the poor state of thermal power plants. As a result, the plant load factor of some SEB units is below 50 percent. Furthermore, transmission and distribution systems have suffered from inadequate maintenance and overloading, resulting in T&D losses of over 20 percent. Finally, the management practices of some SEBs are outmoded and inadequate and the pace of improvements has been slow. The combination of these factors will continue to constrain efforts to improve the power supply in India despite anticipated rehabilitation and expansion efforts.

In light of the financial difficulties of the government and the state electricity boards that prevent greater expansion of the country's generation capacity, growing consideration is being given to opportunities for electricity generation outside the existing power sector for sale to the grid. There are many power generation options that can be most efficiently developed by non-utility entities. For example, industries with substantial steam demand can install cogeneration systems and supply their own power needs while producing steam. Some industries may have access to low-cost fuels, such as rice husks, bagasse, and low grade petroleum, which could be efficiently used on-site to generate power. In addition, non-utility entities, in particular the private sector, can get involved in developing large scale power plants to reduce the financial and managerial burden on the government and the electric utilities.

If non-utility power generation activities are expanded, the financial and technical pressure on existing power utilities would be reduced, enabling them to devote more of their resources to improving operations and the quality of the country's power supply.

There have been a number of recent initiatives in India in non-utility power generation. For instance, a number of industries in Gujarat are cooperating to build a 120 MW power generation facility for their own use, using the existing power network for distributing their power. A similar private project is underway in Faridabad, Haryana, where a group of industries is planning to install and operate a 120 MW diesel power plant in order to cope with the severe power shortage in the state. These non-utility entities, however, are planning to build these plants primarily to satisfy their own power requirements. This study will examine the possibilities for going one step further by exploring the potential for and impediments to power generation not only for on-site use but also for sale to the grid or other customers. Such power generation options are being pursued in a number of developing countries. In Turkey, for example, a private consortium is planning to build and operate a 960 MW imported coal-fired power plant with electricty sold to grid. This is very similar to activities contemplated in

Tamil vadu, where private-sector development of two 210 MW coal-fired power plants are under consideration.

The focus of this study will be on Gujarat and Maharashtra, two of the most industrialized states in the country. These states represent over 25 percent of the demand for electricity in the country and contain over 25 percent of the generation capacity. They are both experiencing power shortages, although to a limited extent in Maharashtra. In the Western region of India, containing the states of Gujarat and Maharashtra, the power generation capacity deficit is projected to grow from 1,605 MW in 1986 to over 7,560 MW in 1995. The state electricity boards respond to these shortages by direct load shedding to rural and industrial customers. They have been unable to expand capacity fast enough to meet demand because of several factors, the primary one being their poor financial situation. In both states, the SEBs have been operating at a financial loss in the past few years, amounting to Rs.-2.8 crore in Gujarat and Rs.-29.4 crore in Maharashtra as of 1984.

More importantly for this study is the fact that there are a number of private utilities in Gujarat and Maharashtra so there is a precedent for the generation and sale of power by facilities outside the existing SEBs. Finally, the Gujarat Electricity Board has been very receptive to the idea of non-utility power generation and has encouraged the development of some private power systems.

STUDY OBJECTIVES

The objectives of this study are:

(1) Preliminary identification of the technical, economic, and financial potential for non-utility power generation including industrial cogeneration and systems using renewable and indigenous energy resources in Gujarat and Maharashtra.

(2) Identification of the technical, economic, financial, and institutional impediments to the development of non-utility power generation in Gujarat and Maharashtra.

(3) Development of recommendations and an action plan for addressing the impediments to non-utility power generation.

The analysis was carried out in India by a team of consultants from Hagler, Bailly & Company during July 26 - August 23, 1986. The team was assisted by the staff of the National Productivity Council (NPC) in New Delhi, Gujarat, and Maharashtra.

STUDY FINDINGS

The study findings are organized in two categories: power generation potential and major impediments.

Power Generation Potential

The preliminary analyses conducted in this study reveal that the financially attractive non-utility power generation potential in Gujarat and Maharashtra could exceed 2,600 MW during the 1986-1996 period. The private sector could potentially finance, build, own, and operate enough capacity to significantly reduce the current and projected power shortages in Gujarat and Maharashtra.

Industrial cogeneration accounts for the vast majority of this potential, perhaps exceeding 2,000 MW by itself (see Exhibit 1). The estimate of the potential could be lower or higher depending on the availability and cost of natural gas, the purchase price for power, regulations governing interconnection with the utility, and the cost for backup power, among other things. This estimate may be on the conservative side since no calculation of the cost of load shedding is included in the analysis. The financial and managerial problems caused by load shedding are one of the major incentives for cogeneration investment in India.

The industries with the highest potential are the fertilizer, basic chemicals, refinery, and pharmaceutical industries. About one-third of the cogeneration potential lies in existing plants (retrofit or replacement of existing steam generating equipment), and almost all the potential comes from topping cycle cogeneration systems, where steam is used first for power generation and then for industrial processes. Over two-thirds of this potential lies in government-owned industries. In the analysis of cogeneration potential it is assumed that natural gas is available only to fertilizer and petrochemical industries. However, if natural gas is made available to all industries, the analysis indicates that the cogeneration potential could be over 3,000 MW over the 1986-1996 period. The potential for bottoming cogeneration is estimated at only 50 MW, mainly in refineries and in fertilizer and petrochemical plants.

The study team also looked into the cogeneration potential in commercial buildings in Bombay. It found that cogeneration systems are only suitable for large hotels and hospitals that have a continuous demand for hot water for domestic needs and steam for air conditioning. However, only large hotels were found to be a financially attractive application. In Bombay, the estimated potential for commercial cogeneration in large hotels over the next 10 years is about 50 MW.

The potential for power generation from bagasse and cane residue over the next 10 years is estimated at about 425 MW -- 75 MW in Gujarat and 350 MW in Maharashtra. This resource represents the least expensive power option of those studied. Power can be generated from sugar cane wastes during the dry season, from November to April. Since this is the period of peak agricultural electricity demand and minimum hydroelectric power availability, developing power systems using bagasse and cane waste could reduce the peak generation expansion requirements of utilities substantially, at the same time reducing the use of oil for peaking units.

The potential from other agrowastes is very limited. It is estimated to be only 30 MW, solely in Gujarat.

Small-scale power generation from domestic fossil fuels, i.e., natural gas and coal, is estimated to be only marginally competitive with power from utilities. The cost of power from small-scale (under 50 MW) coal-fired systems, in particular, is expected to be considerably higher than the utilities' generation cost. Natural gas-fired systems, however, could generate power at financially attractive rates in sizes over 20 MW if gas is made available to non-utility generators and priced at concessionary rates. The actual size of the potential for these options depends on the government's policy on the supply and price of fossil fuels for power generation.

Dendrothermal and other renewable power systems do not represent any considerable financial generation potential as their costs are considerably higher than the cost of electricity from the grid.

Finally, large scale conventional power systems fueled by domestic fossil fuels, e.g. coal, natural gas, and fuel oil, have generation costs that are competitive with those of the electric utilities. They not only can reduce the cost of power to industry but also present a valuable addition to state-owned power plants by bringing new private capital and management into the power sector. Based on the existing private utility performance in India, it is likely that private sector large-scale power plants will be operated more efficiently and reliably, thus increasing the efficiency of the nation's electricity supply.

Major Impediments

The potential for non-utility power generation in India is substantial and is just beginning to be realized. The study team found that the prime motivation for non-utility entities to venture into power generation activities has been their concern about the unreliability of the power supply from the grid. The

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Exhibit 1

Electricity Generation Costs and Potential for Non-utility Power Options (1986-1996)

Technology	Economic		Financial	
	Generation Costs[1] (Ps/kWh)	Potential (MW)	Generation Costs[2] (Ps/kWh)	Potential (MW)
A. Small Scale				
Cogeneration				
Industrial Topping Systems	Under 80	2,550	Under 130	2,150
Industrial Bottoming Systems	55-77	50	70-120	50
Commercial Systems[3]	Under 80	30	Under 160	30
Power Only				
Sugar Cane Residue-Fired Systems	40-49	425	49-66	425
Other Agrowaste-Fired Systems	40-49	nil	49-66	nil
Coal Fired Systems	60-99	(4)	92-169	(4)
Gas Fired Systems	78-117	(4)	120-189	(4)
Municipal Waste-Fired Systems[1]	148	--	195	--
Hydroelectric Systems	N.A.	N.A.	N.A.	N.A.
Dendrothermal Systems	1.54	--	2.83	--
B. Large Scale				
Coal-Fired Systems	76-103	(4)	95-145	(4)
Diesel Generators	88	(2)	93-94	(2)
Combined Cycle	64-97	(4)	67-114	(4)

1 Systems with electricity costs of under Ps. 80/kWh are considered economically attractive. This figure reflects the avoided cost to utilities from power supplied by non-utility generators and is estimated based on the long-run marginal cost of electricity generation to GEB and MSEB.

2 Systems with electricity costs of under Ps.130/kWh are considered financially attractive. This figure reflects the current price of electricity to industry in Gujarat and Maharashtra.

3 Analysis was done only for Bombay.

4 There is no resource limitation for these systems. Therefore the total potential could, in theory, replace a major portion of expansion needs in Gujarat and Maharashtra during 1986 - 1996.

Source: Hagler, Bailly & Company

team found that there are 5 major impediments keeping non-utility entities from investing in power projects.

Lack of Clear Government Policy

The primary barrier to the development of non-utility power systems in India is the lack of concrete national and state policies permitting private power generation and establishing a framework for selling power to the grid or other customers. Although some government policies are designed to facilitate licensing of captive power projects, in practice almost all facilities must go through the extensive permitting process. Specifically, the licensing process for private power plants of 25 MW or less is greatly simplified, but so many exceptions exist that most plants, regardless of their size, must follow the more time-consuming licensing process. The central government's position as expressed to the study team is that policies defining the terms of interaction between private generators and the SEBs should be developed by the state governments. Policies in state governments are not well formulated and there is little precedent and few established procedures for selling power to the grid. This situation creates uncertainty in the market that inhibits the development of private power generation. Industry and private investors are hesitant to commit resources to private generation not knowing if the central government and state electricity boards will look favorably on their efforts.

Difficulty in Financing Power Projects

Financing problems also inhibit the private sector from investing in power generation systems. Obtaining funds to finance power projects can be very difficult. In the first place, these projects face competition for the limited investment funds from private-sector non-power projects. In the second place, even where funds are available from development banks, it can take a long time and great effort to obtain such funds, which limits their usefulness and desirability.

Industries and private investors often hesitate to invest in private power projects since they can often earn higher rates of return on other projects for several reasons. Government regulations limit profits on power projects to 2 percentage points above the prevailing interest rate. Investors typically expect a return of 20 to 25 percent on equity, but since prevailing interest rates are around 12 percent, power projects will yield a much lower rate of return. In addition, import duties, restrictions on the importation of power equipment, and foreign exchange restrictions add further limitations that reduce the expected rate of return on many power projects. Import duties are 40 percent on equipment for power projects in new facilities and they can be over 100 percent on equipment for retrofit projects. Finally, investments in plant equipment to increase production often appear to be the most

productive use of funds in many Indian industries and decision-makers would rather invest their limited funds in expanding output than in installing power systems.

However, these financing difficulties appear to be surmountable. In at least one case of private power development in India -- the Faridabad project -- developers have had very little difficulty arranging a mixture of private and public financing.

Uncertainty of Fuel Supplies and Availability

The private sector also hesitates to invest in power projects fearing that they will not be able to obtain reliable supplies of good-quality fuel. The current government policy limits access to natural gas, complicated licensing procedures hamper access to coal, and the expense of using oil add together to create a significant disincentive to private power generation. The supply of natural gas is essentially limited by the government to fertilizer and petrochemical plants. A few gas-turbine power plants have been given access to natural gas recently, but under current policy industry cannot expect to receive supplies for power generation. Coal is distributed by the government and supply priority is given to the SEBs and large industries. Coal supplies are available to potential power generators, but obtaining good quality coal at a reasonable price requires a major effort to track supplies and push the required paperwork through the extensive bureaucracy. Few industries can afford to devote such resources to their fuel supply. The problem of railway wagon shortages and the substantial cost difference between coal transport by rail and by road add to the supply uncertainty of this fuel.

Uncertainty of Equipment Availability and Quality

The private sector also hesitates to invest in power generation because government regulations intended to protect domestic manufacturers of power equipment often require the use of equipment that in some cases is more expensive and of lower quality than imported equipment. This can eliminate any financial and energy-efficiency benefits that power projects offer. In addition, it often takes longer to obtain domestic equipment than imported equipment. A typical lead time for obtaining domestic power equipment is over 3 years, while foreign equipment can be delivered in less than 18 months.

Uncertainty About the Terms of Interconnection to the Grid

A final reason that the potential for private power is not being met is that the ill-defined state of the terms of interconnection to the grid gives the

private sector no assurance that it will be treated fairly when it installs power generation equipment. Independent electricity generators will, in most cases, need to rely on existing electric utilities or the SEBs to sell their power, either directly to the utilities or indirectly to other customers through the utilities' distribution network. Cogeneration systems will also need to rely on utilities for backup power during system failure or maintenance. Many of the issues that need to be defined to govern this interaction have not been spelled out in regulations and policies. Standards on metering requirements, protective and control devises, performance requirements, and other technical factors vital to successfully interconnecting power systems need to be clearly defined. In the absence of well-defined terms of interconnection, industry will face high technical risks as it installs generation equipment.

Financial interconnection issues are also not clearly defined in India. Procedures for determining the cost of back-up power and the buy-back rate -- the price a utility pays for independently generated power -- need to be established. In their absence, utilities often charge unreasonably high rates for backup power and pay low rates to purchase power. The existing uncertainty is discouraging industry from supplying power to the grid.

RECOMMENDATIONS

Based on the findings of this study, several measures are recommended to increase the participation of non-utility entities in power generation in India in general, and in Gujarat and Maharashtra in particular. The recommendations are divided into two categories: general and specific.

General

1. It is necessary to define and publicize a clear policy on non-utility power generation, covering cogeneration and power-only systems. The primary policy issues are:

(i) Permission for independent generators to operate in parallel with, and sell electricity to, the grid.

(ii) The establishment of a straightforward procedure for licensing independent generation systems. This procedure should cover construction and operation permits, import licenses, financing, and fuel supplies.

(iii) Definition of the terms of interaction between the SEBs and non-utility generators. These terms should spell out the technical requirements for interconnection and parallel operation.

(iv) Definition of a price that utilities will pay to independent power generators for electricity and the cost of backup power.

In defining this policy, the following should be taken into account:

(i) The impact of power shortages on the country's economic growth and prosperity, especially in the industrial sector

(ii) The inability of the SEBs to satisfy the growing demand for electricity

(iii) The positive impact of some non-utility power options on the efficiency of fuel use and the nation's reliance on domestic fuels.

2. An important issue for non-utility power generators is the purchase price that the SEBs pay for power. Guidelines should be established for defining this price. A price policy based on the avoided costs of the SEBs offers a fair value for non-utility-generated power and has proven to be an effective incentive for the development of non-utility power generation in other countries, e.g., the United States. This policy will lead to the efficient allocation of resources and expanded generation capacity. In defining a fair purchase price, the following issues should be taken into account:

(i) The SEB's relatively high generation costs that will result from future plants

(ii) The high transmission and distribution losses of the grid

(iii) The increased value of private power to utilities based on the season, time of day, and region

(iv) The cost of providing power to remote areas and associated premiums that might be considered for power generated in these areas

(v) Special incentives for private businesses that are the first to invest in power generation systems.

Specific

In addition to the general recommendations presented above, a number of more specific measures could be taken to speed up the development of non-utility power development.

1. In light of the importance to industry of an adequate supply of electricity, the large industrial cogeneration potential, and the high efficiency of

cogeneration systems, the policy on limiting the natural gas supply to industry should be revisited. Gas-fired cogeneration systems are relatively simple to operate and have low operation and maintenance costs compared to coal-fired systems. Allowing the industry to use natural gas could greatly expand the cogeneration capacity in the country and result in a highly efficient use of the valuable natural gas resource. Similarly, access to natural gas could draw investors into the development of large scale simple or combined cycle power systems to generate electricity for sale to the grid.

2. Similarly, in light of the inadequate supply of power in the country, the policy of limiting the rate of return on power investments to 2 percent above the interest rate should be reevaluated as an incentive to bring more capital into power activities.

3. Leasing and third-party financing of power plants could alleviate some of the financing difficulties associated with non-utility power options. In light of the cogeneration potential in government-owned industries, the government should consider implementing such financing schemes in its facilities.

4. Since industrialists in India are very concerned about the quality and cost of domestic power equipment, international competitive bids for private power systems should be encouraged.

5. Since there is a considerable potential for power generation in the sugar industry that is constrained by the unavailability of proper equipment (small but efficient steam turbines), avenues for developing the capability for manufacturing such power systems should be identified and pursued. Joint venture efforts with foreign manufacturers should be considered to develop and locally manufacture proper power systems based on waste fuels for the sugar industry.

6. Training should be provided for utility and energy planning personnel in defining the purchase price for electricity (according to SEBs' avoided costs). In addition, technical assistance should be provided to industrial cogenerators and independent power generators on interconnection technologies and requirements and on operating in parallel with the grid. In light of the extensive experience of U.S. utilities and cogenerators in such activities, opportunities should be explored for transferring this technical know-how to India.

7. Publicizing local non-utility power generation activities and proposals should be supported, in particular those projects that involve the interaction between SEBs and non-utility generators.

8. Additional demonstration projects should be undertaken to reduce uncertainty about interconnecting with the grid.

9. Studies should be undertaken in other parts of India by local consultants to verify the potential for non-utility power generation to provide a solution to the country's power shortage. Other industrial states with chronic power shortages, in particular, should be early targets of such studies.

10. The feasibility of private power generation dedicated to large industrial complexes or industrial parks should be assessed.

11. If not already available, a detailed analysis of the cost of load shedding should be done so that a more accurate estimate of the economic value of the incremental non-utility power generation can be developed.

APPENDIX B: WORKSHOP AGENDA

WORKSHOP

ON

NON-UTILITY POWER GENERATION

September 28, 1987 - New Delhi
October 1, 1987 - Ahmedabad

IN COLLABORATION WITH
United States Agency for International Development

CO-SPONSORED BY
Department of Non Conventional Energy Sources
Ministry of Energy

NATIONAL PRODUCTIVITY COUNCIL
LODI ROAD, NEW DELHI-110 003

INTRODUCTION

The AID Bureau for Asia and near East initiated studies on Non-Utility Power Generation in July, 1986 with the approval of Govt. of India and support from National Productivity Council by engaging a leading international consultancy organisation Hagler Bailly & Company (HB), Washington, USA. The objective of the study was to assess the potential, impediments and policy issues of non utility power generation in India focussing on Gujarat and Maharashtra states. The study findings indicate that non-utility power generation can make a significant impact on the power supply position in these states and reduce the need for additional government investment in the power expansion programmes. Keeping in view the perennial power shortages thoughout the country and the dearth of financial resources to augment future power development programmes, it would be advantageous to tap the opportunities lying outside the traditional scope of electric utility, e.g., industrial cogeneration, power generation facilities based on non conventional resources such as agro wastes, etc.

OBJECTIVE

It is felt that an opportunity to discuss the findings of HB study team would assist Government, State Electricity Boards, Indian industry and Power Specialists to integrate such power options in their planning efforts. With the above objective, two workshops are being organised at Delhi and Ahmedabad in order to :

i) Present the major findings of the study to key government policy makers, utilities, industries--private and public, financial institutions, energy analysis, etc.

ii) Elicit view point of the professionals concerned with the energy sector and confirm/amend the conclusions and recommendations of the HB analysis.

PARTICIPATION

Participants would be from the concerned Ministries and Departments of Government of India, Utilities, Public and Private Sector Industries, Financial Institutions, Energy Research Organisations, etc.

DATES

September 28, 1987-New Delhi
October 1, 1987-Ahmedabad

VENUES

New Delhi—Hotel Taj Palace,
Diplomatic Enclave,
Sardar Patel Marg,
New Delhi.

Ahmedabad—Hotel Cama
Khanpur
Ahmedabad.

REGISTRATION

For registration, the names of the participants may be sent to NPC at the following address indicating the venue where they would like to participate. Maximum of two nominations may be sent from one organisation. No nomination fee is being charged for participation in the above workshop. Last date for registration is 24th September, 1987. For Further details, please contact :

Mr. V. Raghuraman,
Director (Fuel Efficiency),
National Productivity Council,
Lodi Road, New Delhi-110 003.
Telephone : 611780, 690331,690332, 690333
Telex : 031-66059 Gram : Productivity

AGENDA

8.30— 9.00 A.M.	Registration
9.00—10.00 A.M.	Presentation of study findings*
10.00—10.30 A.M.	Tea Break
10.30—11.45 A.M.	Panel discussion by public policy makers. Panelists will present views on the issues and implications of the analysis.
11.45—12.45 P.M.	Panel discussion by industries/financial institutions. Panelists will present views on the issues and implications from an investor or financial institution's view point.
12.45— 2.00 P.M.	Lunch
2.00— 3.30 P.M.	Presentation of Indian case studies
3.30— 3.45 P.M.	Tea Break
3.45— 4.30 P.M.	Summing up and conclusion.

* The presentation would be by a team consisting of M/s Alain Streicher, John Stafurik, Pirooz Sharafi from Hagler and Bailly Company, Washington, USA a leading international consultancy organisation in the field of energy and their areas of work include public policy analysis and development, institutional development and feasibility studies. They have recently conducted studies on the prospects of private sector power generation in various developing countries at the request from USAID.

APPENDIX C: LIST OF PANEL MEMBERS AND WORKSHOP PARTICIPANTS

WORKSHOP ON NON-UTILITY POWER GENERATION

NEW DELHI

SEPTEMBER 28, 1987

10:30 A.M. - 11:40 A.M.

A. GOVERNMENT ORGANIZATIONS/POLICY MAKERS

Name & Designation	Organization
Mr. L. R. Suri Secretary General	National Council of Power Utilities, New Delhi
Mr. M. L. Shishoo Chairman	National Thermal Power Corporation, New Delhi
Mr. T. T. Joseph Joint Secretary	Department of Power New Delhi
Mr. J. K. Bhasin Member Planning	Central Electricity Authority, New Delhi
Dr. J. Gururaja Adviser	Department of Non-Conventional Energy Sources, New Delhi
Mr. S. C. Nagpal Development Officer	DGTD New Delhi
Mr. V. Raghuraman Director	National Productivity Council, New Delhi

WORKSHOP ON NON-UTILITY POWER GENERATION

NEW DELHI

SEPTEMBER 28, 1987

11:45 A.M. - 12:45 P.M.

B. INDUSTRIES/FINANCIAL INSTITUTIONS

Name & Designation	Organization
Mr. R. W. Bakley Mission Director	USAID New Delhi
Mr. S. S. Betrabet Chief General Manager	ICICI Bombay
Mr. M. Ramaswamy General Manager	IDBI New Delhi
Dr. R. K. Pachauri Director	Tata Energy Research Institute, New Delhi
Mr. R. K. Rajgarhia Chairman (Energy Committee)	PHD Chambers of Commerce and Industries, New Delhi
Mr. M. Balasundram Director	Faridabad Captive Power System, Faridabad
Mr. A. K. Chakrabarti General Manager (CEC) (CEI Nominee)	Bharat Heavy Electrical Limited, New Delhi
Mr. Y. K. Sethi AGM (Engineering)	Shriram Foods & Fertilizer Company, New Delhi
Mr. P. J. Manohar Rao Managing Director	National Federation of Co- operative Sugar Factories, New Delhi

WORKSHOP ON NON-UTILITY POWER GENERATION

NEW DELHI

SEPTEMBER 28, 1987

LIST OF PARTICIPANTS

Name & Designation	Organization
Mrs. Jayashree Deputy Secretary	Ministry of Industry, New Delhi
Mr. Prem Nath Deputy Secretary	Department of Power, Ministry of Energy, New Delhi
Mr. K. R. Bhagwan Deputy Secretary	Department of Power, Ministry of Energy, New Delhi
Mr. K. P. Gupta Director	Bureau of Industrial Cost and Prices, New Delhi
Mr. A. Soni Deputy General Manager	Engineers India Limited, New Delhi
Mr. E. V. R. Sastry Principal Scientific Officer	Department of Non-Conventional Energy Sources, New Delhi
Dr. J. Henry	Indian Institute of Technology, New Delhi
Prof. J. Nanda	Indian Institute of Technology, New Delhi
Mr. P. K. Goel Chief General Manager	Petroleum Conservation Research Association, New Delhi
Mr. Roberto Bentjerodt, Sr. Oprns. Officer	The World Bank, New Delhi
Mr. O. P. Chopra Deputy Secretary (Power)	Planning Commission, New Delhi
Mr. Rajiv Budhiraja Secretary (Energy Committee)	PHD Chambers of Commerce, New Delhi

Mr. H. H. Jethanandani Vice President	Ballarpur Industries Ltd., New Delhi
Mr. Arun Barar Executive Director	Nuchem Plastics, Faridabad
Mr. R. C. Barar Managing Director	Nuchem Plastics, Faridabad
Mr. N. Pratap	APE Bliss Morcom, New Delhi
Mr. Rajiv Khatri	APE Bliss Morcom, New Delhi
Mr. Atul Dingra	APE Bliss Morcom, New Delhi
Mr. Mohan Murti Assistant Director	Confederation of Engineering Industry, New Delhi
Mr. Dalip Chenoy, Executive Officer	Confederation of Engineering Industry, New Delhi
Mr. Sanjay K. Rastogi Research Associate	Tata Energy Research Institute, New Delhi
Mr. Dipak Chaudhuri Editor	URJA, New Delhi
Mr. Devraj	Central Electricity Authority, New Delhi
Mr. N. R. Srinivasan	Advisory Board on Energy, New Delhi
Mr. H. L. Bhala	Kelvinator of India Ltd. Faridabad
Mr. S. S. Grewal	The Sinmbaoli Sugar Mills Ltd.
Mr. V. S. Date	ICICI, New Delhi
Mr. K. C. Jerath Chief Engineering	Haryana State Electricity Board, Chandigarh

Mr. C. Bhattacharya Dy. Chief Engineer	Central Electricity Authority, New Delhi
Mr. Prabir Sengupta	Advisory Board on Energy, New Delhi
Mr. J. R. Meena Principal Scientific Officer	Department of Non-Conventional Energy Sources, New Delhi
Mr. G. S. Bindra	Bharat Heavy Electricals Limited, New Delhi
Mr. Varinder Pandhi	Bharat Heavy Electricals Limited, New Delhi
Mr. I. J. Raju Consultant	Free Lance Consultant, New Delhi
Mr. A. K. Dua	Simbhaoli Sugar Mills Simbharoli
Mr. K. C. Mahajan Deputy Director	National Productivity Council, New Delhi
Mr. N. V. Seshadri Deputy Director	National Productivity Council, New Delhi
Mr. R. K. Kapoor Deputy Director	National Productivity Council, New Delhi
Dr. N. V. C. Rao Project Adviser	National Productivity Council, New Delhi

USAID DELEGATES

Name & Designation	Organization
Mr. Bob Archer	AID, Washington
Mr. Alberto J. Sabadell	AID, Washington
Mr. S. Padmanabhan	USAID, New Delhi
Mr. Alain Streicher	Hagler, Bailly & Company, Washington, D.C.

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Dr. Pirooz Sharafi	Hagler, Bailly & Company, Washington, D.C.
Mr. John F. Stafurik	Hagler, Bailly & Company, Washington, D.C.

WORKSHOP ON NON-UTILITY POWER GENERATION

AHMEDABAD

OCTOBER 1, 1987

10:30 A.M. - 11:40 A.M.

A. GOVERNMENT ORGANIZATIONS/POLICY MAKERS

Name & Designation	Organization
Mr. J. C. Shah Director	J. C. Shah Associates, New Delhi
Mr. M. Ratnaprabhu Deputy Director	Ahmedabad Textile Industries Research Association, Ahmedabad
Mr. M. A. Shah Superintendent Engineer	Gujarat Electricity Board Baroda
Mr. P. J. Damany Director	Bhatt & Dhamany Associates Baroda
Mr. V. Raghuraman Director	National Productivity Council, New Delhi

WORKSHOP ON NON-UTILITY POWER GENERATION

AHMEDABAD

OCTOBER 1, 1987

11:45 A.M. - 12:45 P.M.

B. INDUSTRIES/FINANCIAL INSTITUTIONS

Name & Designation	Organization
Mr. Bob Archer	AID, Washington
Dr. Anil Kane General Manager (Engineering)	Gujarat Industrial Investment Corporation, Ahmedabad
Mr. Arun Patel Managing Director	Prudential Industrial Captive Power Leasing Co., Baroda
Mr. M. S. Pangaal	Industrial Development Bank of India, Bombay
Mr. V. S. Date Deputy General Manager	Industrial Credit Investment Corporation of India, Bombay
Mr. S. J. Coelho Chief Executive	Ahmedabad Electric Company, Ahmedabad

WORKSHOP ON NON-UTILITY POWER GENERATION

AHMEDABAD

OCTOBER 1, 1987

LIST OF PARTICIPANTS

Name & Designation	Organization
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Mr. C. A. Nagadia Dy. Chief Engineer	Maize Products, Ahmedabad
Mr. N. R. Dhruva Senior Manager	Alembic Chemicals Works Co., Ltd., Baroda
Mr. N. B. Jariwala Senior Manager	Alembic Chemicals Works Co., Ltd., Baroda
Mr. A. Vaitheeswaran Works Manager	The Mahendra Mills Ltd., Kalol, Gujarat
Mr. N. C. Choksi Senior Manager	Sarabhai Common Services, Baroda
Mr. U. B. Parmar	Bharat Vijay Mills, Kalol, Gujarat
Mr. V. Charandas Executive Director	Gujarat State Fertilizer Corporation, Baroda
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Mr. A. T. Patadia Manager	Gujarat Narmada Valley Fertilizers Company Limited, Gujarat
Mr. R. S. Sheth Manager (Production Engineering)	Sabarkantha District Co-Operative Milk Producers Union Ltd., Himatnagar
Mr. J. R. Patel Manager (Maintenance)	Sabarkantha District Co-Operative Milk Producers Union Ltd., Himatnagar
Mr. V. S. Dave	Shir Ambica Mills Ahmedabad
Mr. V. M. Despande	Maharashtra Energy Development Agency, Bombay
Mr. Mahesh Shukla	Ahmedabad Productivity Council, Ahmedabad
Mr. Nikesh Shah	Ahmedabad Productivity Council, Ahmedabad
Mr. R. L. Gosain Deputy General Manager	Gujarat Industrial Investment Corporation Ltd., Ahmedabad
Mr. V. O. Bhalodia	Gujarat Industrial Investment Corporation Ltd., Ahmedabad
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Mr. S. W. Patwardhan	Industrial Development Bank of India, Ahmedabad
Mr. J. A. Hirani	The Arvind Mills, Ahmedabad

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Mr. K. N. Venketramu Regional Director	National Productivity Council, Ahmedabad
Mr. D. Pawan Kumar Deputy Director	National Productivity Council, Ahmedabad
Mr. Y. Sachidananada Assistant Director	National Productivity Council, Ahmedabad
Mr. K. C. Mahajan Deputy Director	National Productivity Council, New Delhi

USAID DELEGATES

Name & Designation	Organization
Mr. Bob Archer	AID, Washington
Mr. Alberto J. Sabadell	AID, Washington
Mr. S. Padmanabhan	USAID, New Delhi
Mr. Alain Streicher	Hagler, Bailly & Company, Washington, D.C.
Dr. Pirooz Sharafi	Hagler, Bailly & Company, Washington, D.C.