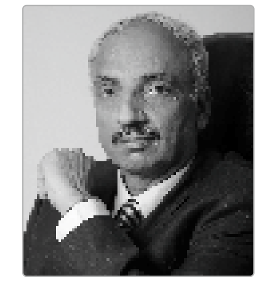
53rd AGM 2017 SPECIAL ISSUE

PPMAI speak

Process Plant and Machinery Association of India

Performance that never stops...



Dear Friends,

As this will be my last message as the Chairman of PPMAI, I wish to begin by thanking you for entrusting me with the responsibility as the Chairman for the past 2 years and would like to extend my heartfelt gratitude to all of you for your support and co-operation.

In the past 2 years, we supported the industry to understand various new policies of the Government, specially related to **"Make in India, Zero Defect- Zero Effect"** and the advantages of the same to the Indian industry.

We have experienced the policy developments, new avenues opening on the FDI front, new tax regimes and digital revolution. India is indeed an investor friendly destination. Capacity expansions and new projects are taking place in the refinery sector. The onus lies on us to further leverage the opportunities arising out of reviving sector and recovering economy.

Smart manufacturing maturity is at an introductory level in India, amidst global digital transformations. The need lies in creating flexible production cycles, shorter innovation cycles and developing designs adapting to Industry 4.0 architecture, by either integrating newer models or changing existing systems.

We do have enormous expertise working towards utilizing every possible opportunity to make possibilities a reality.

Let us move ahead with the changing technology and incorporate methodologies by way of training, skill upgradation, technical integration and process enhancements.

Anil Rairikar
Chairman

edited printed & published by:
V.P. Ramachandran, Secretary General

PPMAI
PROCESS PLANT & MACHINERY ASSOCIATION OF INDIA

002 Loha Bhavan, 91/ 93, P D'Mello Road,
Masjid (E), Mumbai - 400 009, India

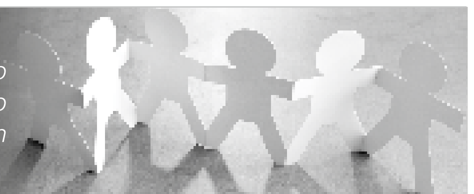
Tel : 91 22 2348 0965, 2348 0405
Fax : 91 22 2348 0426

ppmai@vsnl.net | www.ppmai.org

TECHNICAL TALK

Welcome
NEW MEMBER

PPMAI welcome the following member/s who newly joined the Association and look forward to their prolonged association and active participation in all our programmes.



Sr. No.	Name of the company	Name of the company	Activity
1.	EM ELECTRO MECHANICALS PVT. LTD. 31, E Sector Industrial Area, Govindpura, Bhopal – 462023. Madhya Pradesh Tel : 0755 – 4022100 Fax : 0755 – 2581041 Email : atul@emtanks.com; WEb : www.emtanks.com	Mr. Atul Gupta Director Mob: 9820785022 Mr. Harish Saxena BDM Mob: 09827250522	manufacturer Parts of Transformer, Yoke Clamp, Core Building Platform, Oil Chamber, Chasis & Vibratory Frame, MS Tank, Parts of Textile Machine, Underframe, Boogie etc.

Forthcoming
PROGRAMS 2017

- Pressure Vessel Design / Heat Exchanger
- Metallurgy for Non-Metallurgists
- Stainless Steel Welding
- Tower Internals

Organization Development

Organization development (OD) is the study of successful organizational change and performance. OD emerged from human relations studies in the 1930s, during which psychologists realized that organizational structures and processes influence worker behavior and motivation. More recently, work on OD has expanded to focus on aligning organizations with their rapidly changing and complex environments through organizational learning, knowledge management and transformation of organizational norms and values. Key concepts of OD theory include: organizational climate (the mood or unique "personality" of an organization, which includes attitudes and beliefs that influence members' collective behavior), organizational culture (the deeply-seated norms, values and behaviors that members share) and organizational strategies (how an organization identifies problems, plans action, negotiates change and evaluates progress).

Overview

Organization development as a practice involves an ongoing, systematic process of implementing effective organizational change. OD is known both as a field of applied science focused on understanding and managing organizational change and as a field of scientific study and inquiry. It is interdisciplinary in nature and draws on sociology, psychology, particularly industrial and organizational psychology, and theories of motivation, learning, and personality. Although behavioral science has provided the basic foundation for the study and practice of OD, new and emerging fields of study have made their presence felt. Experts in systems thinking, in organizational learning, in the structure of intuition in decision-making, and in coaching (to name a few) whose perspective is not steeped in just the behavioral sciences, but in a much more multi-disciplinary and inter-disciplinary approach, have emerged as OD catalysts or tools.

Organization development, as a growing field, is responsive to many new approaches.

History

Kurt Lewin (1898–1947) is widely recognized as the founding father of OD, although he died before the concept became current in the mid-1950s. From Lewin came the ideas of group dynamics and action research which underpin the basic OD process as well as providing its collaborative consultant/client ethos. Institutionally, Lewin founded the "Research Center for Group Dynamics" (RCGD) at MIT, which moved to Michigan after his death. RCGD colleagues were among those who founded the National Training Laboratories (NTL), from which the T-groups and group-based OD emerged.

Kurt Lewin played a key role in the evolution of organization development as it is known today. As early as World War II (1939-1945), Lewin experimented with a collaborative change-process (involving himself as consultant and a client group) based on a three-step process of planning, taking action, and measuring results. This was the forerunner of action research, an important element of OD, which will be discussed later. Lewin then participated in the beginnings of laboratory training, or T-groups. After Lewin's death in 1947, his close associates helped to develop survey-research methods at the University of Michigan. These procedures became important parts of OD as developments in this field continued at the National Training Laboratories and in growing numbers of universities and private consulting-firms across the country]. Leading universities offering doctoral-level[3] degrees in OD include Benedictine University and the Fielding Graduate University.

Douglas and Richard Beckhard, while "consulting together at General Mills in the 1950s [...] coined the term organization development (OD) to describe an innovative bottom-up change effort that fit no traditional consulting categories" (Weisbord, 1987, p. 112).

The failure of off-site laboratory training to live up to its early promise was one of the important forces stimulating the development of OD. Laboratory training is learning from a person's "here and now" experience as a member of an ongoing training group. Such groups usually meet without a specific agenda. Their purpose is for the members to learn about themselves from their spontaneous "here and now" responses to an ambiguous hypothetical situation. Problems of leadership, structure, status, communication, and self-serving behavior typically arise in such a group. The members have an opportunity to learn something about themselves and to practice such skills as listening, observing others, and functioning as effective group members. Herbert A. Shepard conducted the first large-scale experiments in Organization Development in the late fifties.

As formerly practiced (and occasionally still practiced for special purposes), laboratory training was conducted in "stranger groups" - groups composed of individuals from different organizations, situations, and backgrounds. A major difficulty developed, however, in transferring knowledge gained from these "stranger labs" to the actual situation "back home". This required a transfer between two different cultures, the relatively safe and protected environment of the T-group (or training group) and the give-and-take of the organizational environment with its traditional values. This led the early pioneers in this type of learning to begin to apply it to "family groups" — that is, groups located within an organization. From this shift in the locale of the training site and the realization that culture was an important factor in influencing group members (along with some other developments in the behavioral sciences) emerged the concept of organization development.

Core values

Underlying Organization Development are humanistic values. Margulies and Raia (1972) articulated the humanistic values of OD as follows:

1. providing opportunities for people to function as human beings rather than as resources in the productive process
2. providing opportunities for each organization member, as well as for the organization itself, to develop to their full potential
3. seeking to increase the effectiveness of the organization in terms of all of its goals
4. attempting to create an environment in which it is possible to find exciting and challenging work
5. providing opportunities for people in organizations to influence the way in which they relate to work, the organization, and the environment
6. treating each human being as a person with a complex set of needs, all of which are important to their work and their life

Differentiating OD from other change efforts such as- 1. Operation management 2. Training and Development 3. Technological innovations....etc.

Objectives

The objectives of OD are:

1. to increase the level of inter-personal trust among employees
2. to increase employees' level of satisfaction and commitment
3. to confront problems instead of neglecting them
4. to effectively manage conflict
5. to increase cooperation and collaboration among employees
6. to increase organizational problem-solving
7. to put in place processes that will help improve the ongoing operation of an organization on a continuous basis

As objectives of organizational development are framed] keeping in view specific situations, they vary from one situation to another. In other words, these programs] are tailored to meet the requirements of a particular situation. But broadly speaking, all organizational development programs try to achieve the following objectives:

1. making individuals in the organization aware of the vision of the organization. Organizational development helps in making employees align with the vision of the organization
2. encouraging employees to solve problems instead of avoiding them
3. strengthening inter-personal trust, cooperation, and communication for the successful achievement of organizational goals
4. encouraging every individual to participate in the process of planning, thus making them feel responsible for the implementation of the plan
5. creating a work atmosphere in which employees are encouraged] to work and participate enthusiastically
6. replacing formal lines of authority with personal knowledge and skill
7. preparing members to align with changes and to break stereotypes
8. creating an environment of trust so that employees willingly accept change

According to organizational-development thinking, organization development provides managers with a vehicle for introducing change systematically by applying a broad selection of management techniques. This, in turn, leads to greater personal, group, and organizational effectiveness.

Change agent

A change agent in the sense used here is not a technical expert skilled in such functional areas as accounting, production, or finance. The change agent is a behavioral scientist who knows how to get people in an organization involved in solving their own problems. A change agent's main strength is a comprehensive knowledge of human behavior, supported by a number of intervention techniques (to be discussed later). The change agent can be either external or internal to the organization. An internal change agent is usually a staff person who has expertise in the behavioral sciences and in the intervention technology of OD. Beckhard reports several cases in which line people have been trained in OD and have returned to their organizations to engage in successful change-assignments. In the natural evolution of change mechanisms in organizations, this would seem to approach the ideal arrangement.

Researchers at the University of Oxford found that leaders can be effective change-agents within their own organizations if they are strongly committed to "knowledge leadership targeted towards organizational development. In their three-year study of UK healthcare organizations, the researchers identified three different mechanisms through which knowledge leaders actively "transposed", "appropriated" or "contended" change concepts, effectively translating and embedding these in organizational practice.

The change agent may be a staff or line member of the organization who is schooled in OD theory and technique. In such a case, the "contractual relationship" is an in-house agreement that should probably be explicit with respect to all of the conditions involved except the fee.

Sponsoring organization

The initiative for OD programs often comes from an organization that has a problem or anticipates facing a problem. This means that top management or someone authorized by top management is aware that a problem exists and has decided to seek help in solving it. There is a direct analogy here to the practice of psychotherapy: The client or patient must actively seek help in finding a solution to his problems. This indicates a willingness on the part of the client organization to accept help and assures the organization that management is actively concerned.

Applied behavioral science

One of the outstanding characteristics of OD that distinguishes it from most other improvement programs is that it is based on a "helping relationship". Some believe that the change agent is not a physician to the organization's ills; that s/he does not examine the "patient", make a diagnosis, and write a prescription. Nor does s/he try to teach organizational members a new inventory of knowledge which they then transfer to the job situation. Using theory and methods drawn from such behavioral sciences as industrial/organizational psychology, industrial sociology, sociology, communication, cultural anthropology, administrative theory, organizational behavior, economics, and political science, the change agent's main function is to help the organization define and solve its own problems. The basic method used is known as action research. This approach, which is described in detail later, consists of a preliminary diagnosis, collecting data, feedback of the data to the client, data exploration by the client group, action planning based on the data, and taking action.

Systems context
The holistic and futuristic view of organization

OD deals with a total system — the organization as a whole, including its relevant environment — or with a subsystem or systems — departments or work groups — in the context of the total system. Parts of systems — for example, individuals, cliques, structures, norms, values, and products — are not considered in isolation; the principle of interdependency — that change in one part of a system affects the other parts — is fully recognized. Thus OD interventions focus on the total cultures and cultural processes of organizations. The focus is also on groups, since the relevant behavior of individuals in organizations and groups is generally a product of the influences of groups rather than of personalities.

Improved organizational performance

The objective of OD is to improve the organization's capacity to handle its internal and external functioning and relationships. This includes improved interpersonal and group processes, more effective communication, and enhanced ability to cope with organizational problems of all kinds. It also involves more effective decision processes, more appropriate leadership styles, improved skill in dealing with destructive conflict, as well as developing improved levels of trust and cooperation among organizational members. These objectives stem from a value system based on an optimistic view of the nature of man — that man in a supportive environment is capable of achieving higher levels of development and accomplishment. Essential to organization development and effectiveness is the scientific method — inquiry, a rigorous search for causes, experimental testing of hypotheses, and review of results.

Self-managing work groups allows the members of a work team to manage, control, and monitor all facets of their work, from recruiting, hiring, and new employees to deciding when to take rest breaks. An early analysis of the first-self-managing work groups yielded the following behavioral characteristics (Hackman, 1986):

- Employees assume personal responsibility and accountability for outcomes of their work.
- Employees monitor their own performance and seek feedback on how well they are accomplishing their goals.
- Employees manage their performance and take corrective action when necessary to improve their and the performance of other group members.
- Employees seek guidance, assistance, and resources from the organization when they do not have what they need to do the job.
- Employees help members of their work group and employees in other groups to improve job performance and raise productivity for the organization as a whole.

Organizational self-renewal

The ultimate aim of OD practitioners is to "work themselves out of a job" by leaving the client organization with a set of tools, behaviors, attitudes, and an action plan with which to monitor its own state of health and to take corrective steps toward its own renewal and development. This is consistent with the systems concept of feedback as a regulatory and corrective mechanism.

Understanding organizations

Weisbord presents a six-box model for understanding organizations:

1. Purposes: The organization members are clear about the organization's mission and purpose and goal agreements, whether people support the organization's purpose.
2. Structure: How is the organization's work divided up? The question is whether there is an adequate fit between the purpose and the internal structure.
3. Relationship: Between individuals, between units or departments that perform different tasks, and between the people and requirements of their jobs.
4. Rewards: The consultant should diagnose the similarities between what the organization formally rewarded or punished members for.
5. Leadership: Is to watch for blips among the other boxes and maintain balance among them.

6. Helpful mechanism: What must the organization attend to in order to survive and thrive - procedures such as planning, control, budgeting, and other information systems.

Modern development

In recent years, serious questioning has emerged about the relevance of OD to managing change in modern organizations. The need for "reinventing" the field has become a topic that even some of its "founding fathers" are discussing critically.

With this call for reinvention and change, scholars have begun to examine organization development from an emotion-based standpoint. For example, deKlerk (2007) writes about how emotional trauma can negatively affect performance. Due to downsizing, outsourcing, mergers, restructuring, continual changes, invasions of privacy, harassment, and abuses of power, many employees experience the emotions of aggression, anxiety, apprehension, cynicism, and fear, which can lead to performance decreases. deKlerk (2007) suggests that in order to heal the trauma and increase performance, O.D. practitioners must acknowledge the existence of the trauma, provide a safe place for employees to discuss their feelings, symbolize the trauma and put it into perspective, and then allow for and deal with the emotional responses. One method of achieving this is by having employees draw pictures of what they feel about the situation, and then having them explain their drawings with each other. Drawing pictures is beneficial because it allows employees to express emotions they normally would not be able to put into words. Also, drawings often prompt active participation in the activity, as everyone is required to draw a picture and then discuss its meaning..

The use of new technologies combined with globalization has also shifted the field of organization development. Roland Sullivan (2005) defined Organization Development with participants at the 1st Organization Development Conference for Asia in Dubai-2005 as "Organization Development is a transformative leap to a desired vision where strategies and systems align, in the light of local culture with an innovative and authentic leadership style using the support of high tech tools. Bob Aubrey (2015) introduced KDIs (Key Development Indicators) to help organisations go beyond performance and align strategy, organisations and individuals and argued that fundamental challenges such as robotics, artificial intelligence and genetics prefigure a regeneration of the field.

Action research

Wendell L French and Cecil Bell defined organization development (OD) at one point as "organization improvement through action research". If one idea can be said to summarize OD's underlying philosophy, it would be action research as it was conceptualized by Kurt Lewin and later elaborated and expanded on by other behavioral scientists. Concerned with social change and, more particularly, with effective, permanent social change, Lewin believed that the motivation to change was strongly related to action: If people are active in decisions affecting them, they are more likely to adopt new ways. "Rational social management", he said, "proceeds in a spiral of steps, each of which is composed of a circle of planning, action, and fact-finding about the result of action".

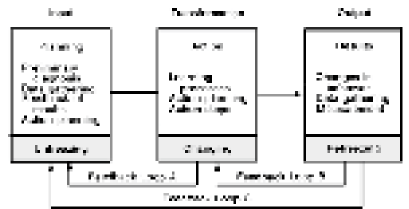


Figure 1: Systems Model of Action-Research Process

Lewin's description of the process of change involves three steps:

"Unfreezing": Faced with a dilemma or disconfirmation, the individual or group becomes aware of a need to change.

"Changing": The situation is diagnosed and new models of behavior are explored and tested.

"Refreezing": Application of new behavior is evaluated, and if reinforced, adopted.

Figure 1 summarizes the steps and processes involved in planned change through action research. Action research is depicted as a cyclical process of change. The cycle begins with a series of planning actions initiated by the client and the change agent working together. The principal elements of this stage include a preliminary diagnosis, data gathering, feedback of results, and joint action planning. In the language of systems theory, this is the input phase, in which the client system becomes aware of problems as yet unidentified, realizes it may need outside help to effect changes, and shares with the consultant the process of problem diagnosis.

The second stage of action research is the action, or transformation, phase. This stage includes actions relating to learning processes (perhaps in the form of role analysis) and to planning and executing behavioral changes in the client organization. As shown in Figure 1, feedback at this stage would move via Feedback Loop A and would have the effect of altering previous planning to bring the learning activities of the client system into better alignment with change objectives. Included in this stage is action-planning activity carried out jointly by the consultant and members of the client system. Following the workshop or learning sessions, these action steps are carried out on the job as part of the transformation stage.

The third stage of action research is the output, or results, phase. This stage includes actual changes in behavior (if any) resulting from corrective action steps taken following the second stage. Data are again gathered from the client system so that progress can be determined and necessary adjustments in learning activities can be made. Minor adjustments of this nature can be made in learning activities via Feedback Loop B (see Figure 1). Major adjustments and reevaluations would return the OD project to the first, or planning, stage for basic changes in the program. The action-research model shown in Figure 1 closely follows Lewin's repetitive cycle of planning, action, and measuring results. It also illustrates other aspects of Lewin's general model of change. As indicated in the diagram, the planning stage is a period of unfreezing, or problem awareness. The action stage is a period of changing, that is, trying out new forms of behavior in an effort to understand and cope with the system's problems. (There is inevitable overlap between the stages, since the boundaries are not clear-cut and cannot be in a continuous process). The results stage is a period of refreezing, in which new behaviors are tried out on the job and, if successful and reinforcing, become a part of the system's repertoire of problem-solving behavior.

Action research is problem centered, client centered, and action oriented. It involves the client system in a diagnostic, active-learning, problem-finding, and problem-solving process. Data are not simply returned in the form of a written report but instead are fed back in open joint sessions, and the client and the change agent collaborate in identifying and ranking specific problems, in devising methods for finding their real causes, and in developing plans for coping with them realistically and practically. Scientific method in the form of data gathering, forming hypotheses, testing hypotheses, and measuring results, although not pursued as rigorously as in the laboratory, is nevertheless an integral part of the process. Action research also sets in motion a long-range, cyclical, self-correcting mechanism for maintaining and enhancing the effectiveness of the client's system by leaving the system with practical and useful tools for self-analysis and self-renewal.

OD interventions

"Interventions" are principal learning processes in the "action" stage (see Figure 1) of organization development. Interventions are structured activities used individually or in combination by the members of a client system to improve their social or task performance. They may be introduced by a change agent as part of an improvement program, or they may be used by the client following a program to check on the state of the organization's health, or to effect necessary changes in its own behavior. "Structured activities" mean such diverse procedures as experiential exercises, questionnaires, attitude surveys, interviews, relevant group discussions, and even lunchtime meetings between the change agent and a member of the client organization. Every action that influences an organization's improvement program in a change agent-client system relationship can be said to be an intervention.

There are many possible intervention strategies from which to choose. Several assumptions about the nature and functioning of organizations are made in the choice of a particular strategy. Beckhard lists six such assumptions:

1. The basic building blocks of an organization are groups (teams). Therefore, the basic units of change are groups, not individuals.

2. An always relevant change goal is the reduction of inappropriate competition between parts of the organization and the development of a more collaborative condition.

3. Decision making in a healthy organization is located where the information sources are, rather than in a particular role or level of hierarchy.

4. Organizations, subunits of organizations, and individuals continuously manage their affairs against goals. Controls are interim measurements, not the basis of managerial strategy.

5. One goal of a healthy organization is to develop generally open communication, mutual trust, and confidence between and across levels.

6. People support what they help create. People affected by a change must be allowed active participation and a sense of ownership in the planning and conduct of the change.

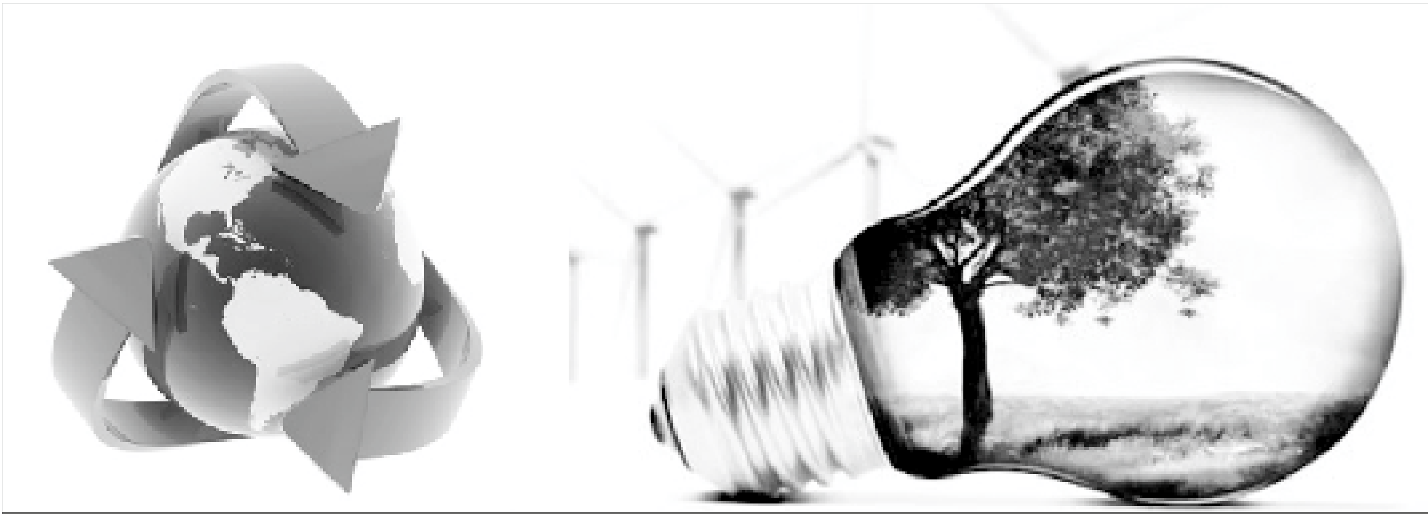
Interventions range from those designed to improve the effectiveness of individuals through those designed to deal with teams and groups, intergroup relations, and the total organization. There are interventions that focus on task issues (what people do), and those that focus on process issues (how people go about doing it). Finally, interventions may be roughly classified according to which change mechanism they tend to emphasize: for example, feedback, awareness of changing cultural norms, interaction and communication, conflict, and education through either new knowledge or skill practice.

One of the most difficult tasks confronting the change agent is to help create in the client system a safe climate for learning and change. In a favorable climate, human learning builds on itself and continues indefinitely during man's lifetime. Out of new behavior, new dilemmas and problems emerge as the spiral continues upward to new levels. In an unfavorable climate, in contrast, learning is far less certain, and in an atmosphere of psychological threat, it often stops altogether. Unfreezing old ways can be inhibited in organizations because the climate makes employees feel that it is inappropriate to reveal true feelings, even though such revelations could be constructive. In an inhibited atmosphere, therefore, necessary feedback is not available. Also, trying out new ways may be viewed as risky because it violates established norms. Such an organization may also be constrained because of the law of systems: If one part changes, other parts will become involved. Hence, it is easier to maintain the status quo. Hierarchical authority, specialization, span of control, and other characteristics of formal systems also discourage experimentation.

The change agent must address himself to all of these hazards and obstacles. Some of the things which will help him are:

1. A real need in the client system to change
2. Genuine support from management
3. Setting a personal example: listening, supporting behavior
4. A sound background in the behavioral sciences
5. A working knowledge of systems theory
6. A belief in man as a rational, self-educating being fully capable of learning better ways to do things.

A few examples of interventions include team building, coaching, Large Group Interventions, mentoring, performance appraisal, downsizing, TQM, and leadership development.



Energy Recycling

Energy recycling is the energy recovery process of utilizing energy that would normally be wasted, usually by converting it into electricity or thermal energy. Undertaken at manufacturing facilities, power plants, and large institutions such as hospitals and universities, it significantly increases efficiency, thereby reducing energy costs and greenhouse gas pollution simultaneously. The process is noted for its potential to mitigate global warming profitably. This work is usually done in the form of combined heat and power (also called cogeneration) or waste heat recovery.

Forms of energy recycling

Waste heat recovery is a process that captures excess heat that would normally be discharged at manufacturing facilities and converts it into electricity and steam, or returns energy to the manufacturing process in the form of heated air, water, glycol, or oil. A "waste heat recovery boiler" contains a series of water-filled tubes placed throughout the area where heat is released. When high-temperature heat meets the boiler, steam is produced, which in turn powers a turbine that creates electricity. This process is similar to that of other fired boilers, but in this case, waste heat replaces a traditional flame. No fossil fuels are used in this process. Metals, glass, pulp and paper, silicon and other production plants are typical locations where waste heat recovery can be effective.

Waste heat recovery from air conditioning is also used as an alternative to wasting heat to the atmosphere from chiller plants. Heat recovered in summer from chiller plants is stored in Thermalbanks in the ground and recycled back to the same building in winter via a heat pump to provide heating without burning fossil fuels. This elegant approach saves energy - and carbon - in both seasons by recycling summer heat for winter use.

Combined heat and power (CHP), also called cogeneration, is, according to the U.S. Environmental Protection Agency, "an efficient, clean, and reliable approach to generating electricity and heat energy from a single fuel source. By installing a CHP system designed to meet the thermal and electrical base loads of a facility, CHP can greatly increase the facility's operational efficiency and decrease energy costs. At the same time, CHP reduces the emission of greenhouse gases, which contribute to global climate change." When electricity is produced on-site with a CHP plant, excess heat is recycled to produce both processed heat and additional power.

Enabling technologies: Heat pumps and thermal energy storage are classes of technologies that can enable the recycling of energy that would otherwise be inaccessible due to a temperature that is too low for utilization or a time lag between when the energy is available and when it is needed. While enhancing the temperature of available renewable thermal energy, heat pumps have the additional property of leveraging electrical power (or in some cases mechanical or thermal power) by using it to extract additional energy from a low quality source (such as seawater, lake water, the ground, the air, or waste heat from a process).

Thermal storage technologies allow heat or cold to be stored for periods of time ranging from hours or overnight to interseasonal, and can involve storage of sensible energy (i.e. by changing the temperature of a medium) or latent energy (i.e. through phase changes of a medium, such between water and slush or ice). Short-term thermal storages can be used for peak-shaving in district heating or electrical distribution systems. Kinds of renewable or alternative energy sources that can be enabled include natural energy (e.g. collected via solar-thermal collectors, or dry cooling towers used to collect winter's cold), waste energy (e.g. from HVAC equipment, industrial processes or power plants), or surplus energy (e.g. as seasonally from hydropower projects or intermittently from wind farms). The Drake Landing Solar Community (Alberta, Canada) is illustrative. borehole thermal energy storage allows the community to get 97% of its year-round heat from solar collectors on the garage roofs, which most of the heat collected in summer. Types of storages for sensible energy include insulated tanks, borehole clusters in substrates ranging from gravel to bedrock, deep aquifers, or shallow lined pits that are insulated on top. Some types of storage are capable of storing heat or cold between opposing seasons (particularly if very large), and some storage applications require inclusion of a heat pump. Latent heat is typically stored in ice tanks or what are called phase-change materials (PCMs).

TUV India Pvt. Ltd.

Founded in the 19th Century (1869 AD) during the industrial revolution, the **TÜV NORD GROUP** was established as an industrial self-control organization for providing independent, neutral, third party services. With a current workforce of over 12,000 employees across 70 countries globally, the TÜV NORD GROUP is one of the world's largest Inspection, Certification and Testing organizations.

TUV India Pvt. Ltd. was established in 1989, as part of TÜV NORD GROUP's Indian operations. With over 600 employees in more than 25 locations across India and laboratories in Pune and Bengaluru, TUV India is never far from its customers.

State-of-the-art Laboratory, Pune

TUV India Pvt. Ltd. provides diverse services in:

- **Industrial Services** - Third Party Inspections, European Approvals, Onshore and Off Shore Services, ASME and Nuclear Services, IBR, Site Inspections and other services
- **Management System Certification** - Quality, Environment, Health, Safety, Social Accountability, Aerospace, Oil and Gas
- **Food Certification and Inspection** : Food Certifications, Supplier Audits, Compliance Audits, Hygiene Audits, Schedule IV Inspections as per FSSAI
- **IT Services** - Information Security, IT Service Management, CMMI, Risk Management and Business Continuity Management
- **Product Certification** - CE Marking, ATEX, GS Mark, Safety Certification, Bauart Approval
- **Laboratory Services** - Processed Foods, Agricultural Produce, Chemicals, Herbals, Pharmaceuticals, REACH, RoHS, Rubber and Polymers, Toys and Stationery, Food Packaging, Home and Personal Care Products
- **Electrical and Electronic Testing** - EMC / EMI, Electronics/IT Products Testing, CE Compliance, Electrical Safety Testing
- **Training** - Programs related to Management System Standards including International Accredited Auditor Courses, VDA 6.3 Programs in association with VDA licensed partner UBF.B, Functional Safety, Soft Skills, Technical Training and Allied Courses
- **Infrastructure** - Civil/Construction Quality Assurance, Railway Engineering, Power Plants and other services
- **Sustainability** - Energy, Water Assessment, CFP/CSR Assurance
- **Renewable Energy (Wind and Solar)** - Certification and Type Approval, Site Assessments, Inspection, Performance Measurement and Monitoring
- **Petroleum, Chemicals and Gas Services** - Cargo Quality and Quantity Control, Laboratory Testing, Tank Calibration
- **Automotive Services** - Supplier Audits, Homologation, Testing, Approval and Management System Certification

TÜV NORD GROUP

TÜV INDIA
TÜV NORD GROUP

TUV India Training Academy

TUV India Training Academy provides the right forward-looking skills and expertise to meet the challenges of the future. Training being an integral part of TUV India's service offerings, we conduct more than 1200 training programs in a year in India and neighbouring countries.

Our training programs have been designed with up-to-date content for various industry sectors in line with requirements by national and international accreditations.

- Management Systems related IRCA Accredited Lead Auditor, Internal Auditor, Awareness, Implementation Courses
- Occupational Health & Safety
- Functional Safety
- Food Safety
- Information Technology
- Aerospace
- Manufacturing and/or Service Excellence
- Six Sigma
- Technical Training
- Social Accountability
- Soft Skills
- Supply Chain Management
- VDA 6.3 Programs in association with VDA licensed partner UBF.B
- Lean Manufacturing

Registered & Head Office: 801, Raheja Plaza I, LBS Marg, Ghatkopar (W), Mumbai - 400 086
Email: infoindia@tuv-nord.com **Tel:** +91-22-66477000
Website: www.tuv-nord.com/in
Toll Free Number: 1800-209-0902

TÜV®

Current system

Both waste heat recovery and CHP constitute "decentralized" energy production, which is in contrast to traditional "centralized" power generated at large power plants run by regional utilities. The "centralized" system has an average efficiency of 34 percent, requiring about three units of fuel to produce one unit of power. By capturing both heat and power, CHP and waste heat recovery projects have higher efficiencies.

A 2007 Department of Energy study found the potential for 135,000 megawatts of CHP in the U.S., and a Lawrence Berkley National Laboratory study identified about 64,000 megawatts that could be obtained from industrial waste energy, not counting CHP. These studies suggest about 200,000 megawatts—or 20% -- of total power capacity that could come from energy recycling in the U.S. Widespread use of energy recycling could therefore reduce global warming emissions by an estimated 20 percent. Indeed, as of 2005, about 42 percent of U.S. greenhouse gas pollution came from the production of electricity and 27 percent from the production of heat.

Advocates contend that recycled energy costs less and has lower emissions than most other energy options in current use.

Currently Recycling Energy Int. Corp. takes advantage of recycling energy in heat recovery ventilation and latent heat pump and CHCP.

History

Perhaps the first modern use of energy recycling was done by Thomas Edison. His 1882 Pearl Street Station, the world's first commercial power plant, was a CHP plant, producing both electricity and thermal energy while using waste heat to warm neighboring buildings. Recycling allowed Edison's plant to achieve approximately 50 percent efficiency.

By the early 1900s, regulations emerged to promote rural electrification through the construction of centralized plants managed by regional utilities. These regulations not only promoted electrification throughout the countryside, but they also discouraged decentralized power generation, such as CHP. They even went so far as to make it illegal for non-utilities to sell power.

By 1978, Congress recognized that efficiency at central power plants had stagnated and sought to encourage improved efficiency with the Public Utility Regulatory Policies Act (PURPA), which encouraged utilities to buy power from other energy producers. CHP plants proliferated, soon producing about 8 percent of all energy in the U.S. However, the bill left implementation and enforcement up to individual states, resulting in little or nothing being done in many parts of the country.

In 2008 Tom Casten, chairman of Recycled Energy Development, said that "We think we could make about 19 to 20 percent of U.S. electricity with heat that is currently thrown away by industry.

Outside the U.S., energy recycling is more common. Denmark is probably the most active energy recycler, obtaining about 55% of its energy from CHP and waste heat recovery. Other large countries, including Germany, Russia, and India, also obtain a much higher share of their energy from decentralized sources.

Integrated gasification combined cycle

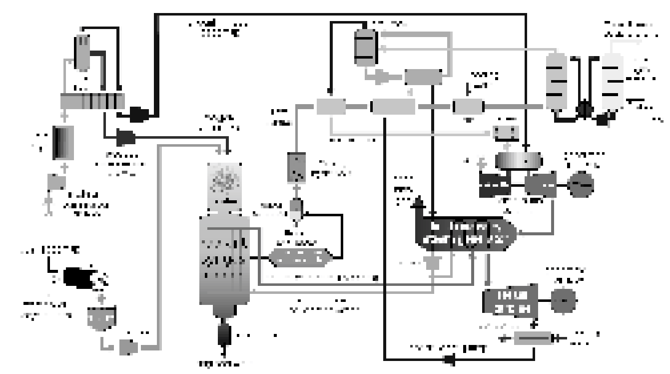
An integrated gasification combined cycle (IGCC) is a technology that uses a high pressure gasifier to turn coal and other carbon based fuels into pressurized gas—synthesis gas (syngas). It can then remove impurities from the syngas prior to the power generation cycle. Some of these pollutants, such as sulfur, can be turned into re-usable byproducts through the Claus process. This results in lower emissions of sulfur dioxide, particulates, mercury, and in some cases carbon dioxide. With additional process equipment, a water-gas shift reaction can increase gasification efficiency and reduce carbon monoxide emissions by converting it to carbon dioxide. The resulting carbon dioxide from the shift reaction can be separated, compressed, and stored through sequestration. Excess heat from the primary combustion and syngas fired generation is then passed to a steam cycle, similar to a combined cycle gas turbine. This process results in improved thermodynamic efficiency compared to conventional pulverized coal combustion.

Significance

Coal can be found in abundance in the USA and many other countries and its price has remained relatively constant in recent years. Of the traditional fossil fuels - oil, coal, and natural gas - coal is used as a feedstock for 40% of global electricity generation. Fossil fuel consumption and its contribution to large-scale, detrimental environmental changes is becoming a pressing issue, especially in light of the Paris Agreement. In particular, coal contains more CO2 per BTU than oil or natural gas and is responsible for 43% of CO2 emissions from fuel combustion. Thus, the lower emissions that IGCC technology allows through gasification and pre-combustion carbon capture is crucial to addressing aforementioned concerns.

Operations

Below is a schematic flow diagram of an IGCC plant:



Block diagram of IGCC power plant, which utilizes the HRSG

The gasification process can produce syngas from a wide variety of carbon-containing feedstocks, such as high-sulfur coal, heavy petroleum residues, and biomass.

The plant is called integrated because (1) the syngas produced in the gasification section is used as fuel for the gas turbine in the combined cycle and (2) the steam produced by the syngas coolers in the gasification section is used by the steam turbine in the combined cycle. In this example the syngas produced is used as fuel in a gas turbine which produces electrical power. In a normal combined cycle, so-called "waste heat" from the gas turbine exhaust is used in a Heat Recovery Steam Generator (HRSG) to make steam for the steam turbine cycle. An IGCC plant improves the overall process efficiency by adding the higher-temperature steam produced by the gasification process to the steam turbine cycle. This steam is then used in steam turbines to produce additional electrical power.

IGCC plants are advantageous in comparison to conventional coal power plants due to their high thermal efficiency, low non-carbon greenhouse gas emissions, and capability to process low grade coal. The disadvantages include higher capital and maintenance costs, and the amount of CO2 released without pre-combustion capture.

Process overview

- The solid coal is gasified to produce syngas, or synthetic gas. Syngas is synthesized by gasifying coal in a closed pressurized reactor with a shortage of oxygen. The shortage of oxygen ensures that coal is broken down by the heat and pressure as opposed to burning completely. The chemical reaction between coal and oxygen produces a product that is a mixture of carbon and hydrogen, or syngas. $C_xH_y + (x/2)O_2$ $(x)CO_2 + (y/2)H_2$
- The heat from the production of syngas is used to produce steam from cooling water which is then used for steam turbine electricity production.
- The syngas must go through a pre-combustion separation process to remove CO_2 and other impurities to produce a more purified fuel. Three steps are necessary for the separation of impurities:
  1. Water-gas-shift reaction. The reaction that occurs in a water-gas-shift reactor is $CO + H_2O$ $CO_2 + H_2$. This produces a syngas with a higher composition of hydrogen fuel which is more efficient for burning later in combustion.
  2. Physical separation process. This can be done through various mechanisms such as absorption, adsorption or membrane separation.
  3. Drying, compression and storage/shipping.
- The resulting syngas fuels a combustion turbine that produces electricity. At this stage the syngas is fairly pure H_2.

Benefits and drawbacks

A major drawback of using coal as a fuel source is the emission of carbon dioxide and other pollutants, including sulfur dioxide, nitrogen oxide, mercury, and particulates. Almost all coal-fired power plants use pulverized coal combustion, which grinds the coal to increase the surface area, burns it to make steam, and runs the steam through a turbine to generate electricity. Pulverized coal plants can only capture carbon dioxide after combustion when it is diluted and harder to separate. In comparison, gasification in IGCC allows for separation and capture of the concentrated and pressurized carbon dioxide before combustion. Syngas cleanup includes filters to remove bulk particulates, scrubbing to remove fine particulates, and solid adsorbents for mercury removal. Additionally, hydrogen gas is used as fuel, which produces no pollutants under combustion.

IGCC also consumes less water than traditional pulverized coal plants. In a pulverized coal plant, coal is burned to produce steam, which is then used to create electricity using a steam turbine. Then steam exhaust must then be condensed with cooling water, and water is lost by evaporation. In IGCC, water consumption is reduced by combustion in a gas turbine, which uses the generated heat to expand air and drive the turbine. Steam is only used to capture the heat from the combustion turbine exhaust for use in a secondary steam turbine. Currently, the major drawback is the high capital cost compared to other forms of power production. To become an economically viable source of energy, gasification-based plants must become comparable to pulverized coal and natural gas plants in terms of capital costs.

Installations

The DOE Clean Coal Demonstration Project[5] helped construct 3 IGCC plants: Edwarsport Power Station in Edwardsport, Indiana, Polk Power Station in Tampa, Florida (online 1996), and Pinon Pine in Reno, Nevada. In the Reno demonstration project, researchers found that then-current IGCC technology would not work more than 300 feet (100m) above sea level. The DOE report in reference 3 however makes no mention of any altitude effect, and most of the problems were associated with the solid waste extraction system. The Wabash River and Polk Power stations are currently operating, following resolution of demonstration start-up problems, but the Piñon Pine project encountered significant problems and was abandoned.

The US DOE's Clean Coal Power Initiative (CCPI Phase 2) selected the Kemper Project as one of two projects to demonstrate the feasibility of low emission coal-fired power plants. Mississippi Power began construction on the Kemper Project in Kemper County, Mississippi, in 2010 and is poised to begin operation in 2016, though there have been many delays.[7] In March, the projected date was further pushed back from early 2016 to August 31, 2016, adding $110 million to the total and putting the project 3 years behind schedule. The electrical plant is a flagship Carbon Capture and Storage (CCS) project that burns lignite coal and utilizes pre-combustion IGCC technology with a projected 65% emission capture rate.

The first generation of IGCC plants polluted less than contemporary coal-based technology, but also polluted water; for example, the Wabash River Plant was out of compliance with its water permit during 1998–2001[9] because it emitted arsenic, selenium and cyanide. The Wabash River Generating Station is now wholly owned and operated by the Wabash River Power Association.

IGCC is now touted as capture ready and could potentially be used to capture and store carbon dioxide. (See Future Gen) Poland's Kdzierzyn will soon host a Zero-Emission Power & Chemical Plant that combines coal gasification technology with Carbon Capture & Storage (CCS). This installation had been planned, but there has been no information about it since 2009. Other operating IGCC plants in existence around the world are the Alexander (formerly Buggenum) in the Netherlands, Puertollano in Spain, and JGC in Japan.

The Texas Clean Energy project plans to build a 400 MW IGCC facility that will incorporate carbon capture, utilization and storage (CCUS) technology. The project will be the first coal power plant in the United States to combine IGCC and 90% carbon capture and storage. Commercial operation is due to start in 2018.

There are several advantages and disadvantages when compared to conventional post combustion carbon capture and various variations

Cost and reliability

A key issue in implementing IGCC is its high capital cost, which prevents it from competing with other power plant technologies. Currently, ordinary pulverized coal plants are the lowest cost power plant option. The advantage of IGCC comes from the ease of retrofitting existing power plants that could offset the high capital cost. In a 2007 model, IGCC with CCS is the lowest-cost system in all cases. This model compared estimations of levelized cost of electricity, showing IGCC with CCS to cost 71.9 $US2005/MWh, pulverized coal with CCS to cost 88 $US2005/MWh, and natural gas combined cycle with CCS to cost 80.6 $US2005/MWh. The levelized cost of electricity was noticeably sensitive to the price of natural gas and the inclusion of carbon storage and transport costs.

The potential benefit of retrofitting has so far, not offset the cost of IGCC with carbon capture technology. A 2013 report by the U.S. Energy Information Administration demonstrates that the overnight cost of IGCC with CCS has increased 19% since 2010. Amongst the three power plant types, pulverized coal with CCS has an overnight capital cost of $5,227 (2012 dollars)/kW, IGCC with CCS has an overnight capital cost of $6,599 (2012 dollars)/kW, and natural gas combined cycle with CCS has an overnight capital cost of $2,095 (2012 dollars)/kW. Pulverized coal and NGCC costs did not change significantly since 2010. The report further relates that the 19% increase in IGCC cost is due to recent information from IGCC projects that have gone over budget and cost more than expected.

Recent testimony in regulatory proceedings show the cost of IGCC to be twice that predicted by Goddell, from $96 to 104/MWhr. That's before addition of carbon capture and sequestration (sequestration has been a mature technology at both Weyburn in Canada (for enhanced oil recovery) and Sleipner in the North Sea at a commercial scale for the past ten years)—capture at a 90% rate is expected to have a $30/MWh additional cost.

Wabash River was down repeatedly for long stretches due to gasifier problems. The gasifier problems have not been remedied—subsequent projects, such as Excelsior's Mesaba Project, have a third gasifier and train built in. However, the past year has seen Wabash River running reliably, with availability comparable to or better than other technologies.

The Polk County IGCC has design problems. First, the project was initially shut down because of corrosion in the slurry pipeline that fed slurried coal from the rail cars into the gasifier. A new coating for the pipe was developed. Second, the thermocoupler was replaced in less than two years; an indication that the gasifier had problems with a variety of feedstocks; from bituminous to sub-bituminous coal. The gasifier was designed to also handle lower rank lignites. Third, unplanned down time on the gasifier because of refractory liner problems, and those problems were expensive to repair. The gasifier was originally designed in Italy to be half the size of what was built at Polk. Newer ceramic materials may assist in improving gasifier performance and longevity. Understanding the operating problems of the current IGCC plant is necessary to improve the design for the IGCC plant of the future. (Polk IGCC Power Plant, http://www.clean- energy.us/projects/polk_florida.html.) Keim, K., 2009, IGCC A Project on Sustainability Management Systems for Plant Re-Design and Re-Image. This is an unpublished paper from Harvard University)

General Electric is currently designing an IGCC model plant that should introduce greater reliability. GE's model features advanced turbines optimized for the coal syngas. Eastman's industrial gasification plant in Kingsport, TN uses a GE Energy solid-fed gasifier. Eastman, a fortune 500 company, built the facility in 1983 without any state or federal subsidies and turns a profit.

There are several refinery-based IGCC plants in Europe that have demonstrated good availability (90-95%) after initial shakedown periods. Several factors help this performance:

1. None of these facilities use advanced technology (F type) gas turbines.
2. All refinery-based plants use refinery residues, rather than coal, as the feedstock. This eliminates coal handling and coal preparation equipment and its problems. Also, there is a much lower level of ash produced in the gasifier, which reduces cleanup and downtime in its gas cooling and cleaning stages.
3. These non-utility plants have recognized the need to treat the gasification system as an up-front chemical processing plant, and have reorganized their operating staff accordingly.

Another IGCC success story has been the 250 MW Buggenum plant in The Netherlands. It also has good availability. This coal-based IGCC plant currently uses about 30% biomass as a supplemental feedstock. The owner, NUON, is paid an incentive fee by the government to use the biomass. NUON has constructed a 1,311 MW IGCC plant in the Netherlands, comprising three 437 MW STEG units. The Nuon Magnum IGCC power plant was commissioned in 2011, and was officially opened in June 2013. Mitsubishi Heavy Industries has been awarded to construct the power plant. Following a deal with environmental organizations, NUON has been prohibited from using the Magnum plant to burn coal and biomass, until 2020. Because of high gas prices in the Netherlands, two of the three units are currently offline, whilst the third unit sees only low usage levels. The relatively low 59% efficiency of the Magnum plant means that more efficient CCGT plants (such as the Hemweg 9 plant) are preferred to provide (backup) power.

A new generation of IGCC-based coal-fired power plants has been proposed, although none is yet under construction. Projects are being developed by AEP, Duke Energy, and Southern Company in the US, and in Europe by ZAK/PKE, Centrica (UK), E.ON and RWE (both Germany) and NUON (Netherlands). In Minnesota, the state's Dept. of Commerce analysis found IGCC to have the highest cost, with an emissions profile not significantly better than pulverized coal. In Delaware, the Delmarva and state consultant analysis had essentially the same results.

The high cost of IGCC is the biggest obstacle to its integration in the power market; however, most energy executives recognize that carbon regulation is coming soon. Bills requiring carbon reduction are being proposed again both the House and the Senate, and with the Democratic majority it seems likely that with the next President there will be a greater push for carbon regulation. The Supreme Court decision requiring the EPA to regulate carbon (Commonwealth of Massachusetts et al. v. Environmental Protection Agency et al.)[20] also speaks to the likelihood of future carbon regulations coming sooner, rather than later. With carbon capture, the cost of electricity from an IGCC plant would increase approximately 33%. For a natural gas CC, the increase is approximately 46%. For a pulverized coal plant, the increase is approximately 57%. This potential for less expensive carbon capture makes IGCC an attractive choice for keeping low cost coal an available fuel source in a carbon constrained world. However, the industry needs a lot more experience to reduce the risk premium. IGCC with CCS requires some sort of mandate, higher carbon market price, or regulatory framework to properly incentivize the industry.

In Japan, electric power companies, in conjunction with Mitsubishi Heavy Industries has been operating a 200 t/d IGCC pilot plant since the early '90s. In September 2007, they started up a 250 MW demo plant in Nakoso. It runs on air-blown (not oxygen) dry feed coal only. It burns PRB coal with an unburned carbon content ratio of <0.1% and no detected leaching of trace elements. It employs not only F type turbines but G type as well. (see gasification.org link below)

Next generation IGCC plants with CO_2 capture technology will be expected to have higher thermal efficiency and to hold the cost down because of simplified systems compared to conventional IGCC. The main feature is that instead of using oxygen and nitrogen to gasify coal, they use oxygen and CO_2. The main advantage is that it is possible to improve the performance of cold gas efficiency and to reduce the unburned carbon (char).

As a reference for power plant efficiency:

- With Frame E gas turbine, 30bar quench gas cooling, Cold Temperature Gas Cleaning and 2 level HRSC it is possible to achieve around 38% energy efficiency.
- With Frame F gas turbine, 60 bar quench gasifier, Cold Temperature Gas Cleaning and 3 level+RH HRSC it is possible to achieve around 45% energy efficiency.
- Latest development of Frame G gas turbines, ASU air integration, High temperature desulfurization may shift up performance even further.

The CO_2 extracted from gas turbine exhaust gas is utilized in this system. Using a closed gas turbine system capable of capturing the CO_2 by direct compression and liquefication obviates the need for a separation and capture system.

CO2 capture in IGCC

Pre-combustion CO_2 removal is much easier than CO_2 removal from flue gas in post-combustion capture due to the high concentration of CO_2 after the water-gas-shift reaction and the high pressure of the syngas. During pre-combustion in IGCC, the partial pressure of CO_2 is nearly 1000 times higher than in post-combustion flue gas. Due to the high concentration of CO_2 pre-combustion, physical solvents, such as Selexol and Rectisol, are preferred for the removal of CO_2 vs that of chemical solvents. Physical solvents work by absorbing the acid gases without the need of a chemical reaction as in traditional amine based solvents. The solvent can then be regenerated, and the CO_2 desorbed, by reducing the pressure. The biggest obstacle with physical solvents is the need for the syngas to be cooled before separation and reheated afterwards for combustion. This requires energy and decreases overall plant efficiency.

Testing

National and international test codes are used to standardize the procedures and definitions used to test IGCC Power Plants. Selection of the test code to be used is an agreement between the purchaser and the manufacturer, and has some significance to the design of the plant and associated systems. In the United States, The American Society of Mechanical Engineers published the Performance Test Code for IGCC Power Generation Plants (PTC 47) in 2006 which provides procedures for the determination of quantity and quality of fuel gas by its flow rate, temperature, pressure, composition, heating valve, and its content of contaminants.

IGCC emission controversy

In 2007, the New York State Attorney General's office demanded full disclosure of "financial risks from greenhouse gases" to the shareholders of electric power companies proposing the development of IGCC coal-fired power plants. "Any one of the several new or likely regulatory initiatives for CO_2 emissions from power plants - including state carbon controls, EPA's regulations under the Clean Air Act, or the enactment of federal global warming legislation - would add a significant cost to carbon-intensive coal generation"; U.S. Senator Hillary Clinton from New York has proposed that this full risk disclosure be required of all publicly traded power companies nationwide. This honest disclosure has begun to reduce investor interest in all types of existing-technology coal-fired power plant development, including IGCC.

Senator Harry Reid (Majority Leader of the 2007/2008 U.S. Senate) told the 2007 Clean Energy Summit that he will do everything he can to stop construction of proposed new IGCC coal-fired electric power plants in Nevada. Reid wants Nevada utility companies to invest in solar energy, wind energy and energy instead of coal technologies. Reid stated that global warming is a reality, and just one proposed coal-fired plant would contribute to it by burning seven million tons of coal a year. The long-term healthcare costs would be far too high, he claimed (no source attributed). "I'm going to do everything I can to stop these plants.", he said. "There is no clean coal technology. There is cleaner coal technology, but there is no clean coal technology."

One of the most efficient ways to treat the H_2S gas from an IGCC plant is by converting it into sulphuric acid in a wet gas sulphuric acid process wsa process. However, the majority of the H_2S treating plants utilize the modified Claus process, as the sulphur market infrastructure and the transportation costs of sulphuric acid versus sulphur are in favour of sulphur production.

ADVERTISEMENT **TARIFF**

PPMAI Speak Bi-Monthly Bulletin

Full Page Colour	Amount
Back Cover Outside / Inside	₹ 25,000.00
Inside Front Cover	₹ 25,000.00
Inside Full Page	₹ 20,000.00

Specification of our publication is as follows:

Period	:	Bi-monthly
Print Size	:	A-4
Print Process	:	Offset 4 colour
Paper used for cover	:	170 gsm Sinarmass Coated Art Paper with matte lamination
Paper used for inside	:	130 gsm Sinarmass Coated Art Paper

Advt. Size Artwork should be A/4 size for full page advt. (210 mm width x 297 mm height). All advertisement will be in 4+4 cmyk Colours.

Payment:

- Payment for banner advertisement should be made in advance by Cheque / DD in the favour of, "Process Plant and Machinery Association of India" payable at Mumbai along with release order

PPMAI Website

Internet today has made the world small place and easily reachable nay it is the best and fastest medium to reach and access global markets. Airing advertisements on website is definitely an economical way to propagate your company and publicize your products world-over. Keeping this in mind, we have earmarked seven strips for advertisements on our website.

www.ppmai.org
gives you an opportunity to advertise worldwide

We are pleased to inform you that PPMAI website www.ppmai.org is now fully revamped with new look and features.

₹ 10,000/- per annum

Advertisers may modify their advertisement matter every quarter.

- The rate includes free link to your existing website
- The banner will be designed and provided by the advertiser as per specified size
- The banner will be in the form of JPEG or GIF file and its size will not exceed 20kB

Payment:

- Payment for banner advertisement should be made in advance by Cheque / DD in the favour of, "Process Plant and Machinery Association of India" payable at Mumbai along with release order

PPMAI eSpeak Journal | soft copy (Published twice in a month)

₹ 10,000/- per annum
(Rupees : Ten Thousand per annum)

- Advertisers may change their advertisement matter every quarter
- The rates quoted are exclusive of service tax
- The size of the ad should be around 40 kb max. Logos or Images will not be entertained
- A format will be provided by PPMAI wherein the advertiser can furnish the advertisement matter

Payment:

- Payment for banner advertisement should be made in advance by Cheque / DD in the favour of, "Process Plant and Machinery Association of India" payable at Mumbai along with release order

PPMAI Newsletter | soft copy (Published twice in a month)

₹ 10,000/- per annum
(Rupees : Ten Thousand per annum)

- Advertisers may change their advertisement matter every quarter
- The rates quoted are exclusive of service tax.
- The size of the ad should be around 40 kb max. Logos or Images will not be entertained.
- A format will be provided by PPMAI wherein the advertiser can furnish the advertisement matter.

Payment:

- Payment for banner advertisement should be made in advance by Cheque / DD in the favour of, "Process Plant and Machinery Association of India" payable at Mumbai along with release order

For enquiries and queries contact :

Mr. V.P. Ramachandran, Secretary General
PROCESS PLANT AND MACHINERY ASSOCIATION OF INDIA
002 Loha Bhavan, 91/93, P.D'Mello Road, Masjid (E), Mumbai 400 009.
Tel. 022-23480405 / 965 Fax: 022-23480426. Email: ppmai@vsnl.net * Cell: +91 98192 07269