



Industrial Vision

Vision For Industrial Empowerment | Vol:2 | 2015





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Advisors

Prof. Dr. Govind Raj Pokharel, Vice-Chairman, Govt. of Nepal, National Planning Commission
Dr. Hari Ram Parajuli, Campus Chief, IOE Thapathali campus
Er. Shailendra Raj Khanal, HOD, Department of Industrial Engineering
Er. Sudan Neupane, DHOD, Department of Industrial Engineering
Prakash JamarKattel, Dipesh Nepal

Co-ordinator

Pitambar Chaulagain

Editor-in-Chief

Santosh Ghimire

Chief-Designer

Bikram Dahal

Financial Co-ordinator

Geeta Bhatta

Editors

Dinesh Aryal
Smaran Khanal

Designers

Rajan Sharma
Sandeep Bashyal

Financial Controllers

Yogesh Dahal
Amrit Dahal
Binod Rijal
Ramesh Acharya
Anita Rijal
Pradip Bista
Asutosh Bhattarai

Supportive Team

Milan Babu Shrestha
Dipendra Sunari Magar
Prabesh Raj Devkota
Narayan Maharjan
Rishta Karki
Dison Maharjan
Bhanu Shrestha
Bikash Poudel
Riti Newa
Paritosh Koirala
Sujan Neupane

Special Thanks To

Er. Shambhu Yadav, Former HOD, DOIE
Er. Krishna Prasad Pandey, Faculty Member, DOIE
Er. Bishow Ram Parajuli, Faculty Member, DOIE
Er. Sushant Raj Giri
Er. Subodh Kumar Ghimire
Purna Bhadra Khanal, Office Helper, DOIE



Prof. Dr. Govind Raj Pokharel
Vice-Chairman

Government of Nepal
National Planning Commission
Singha Durbar, Kathmandu, Nepal

Date: Magh 18, 2071



I am very pleased to know that Society of Industrial Engineering Students (SOIES Nepal) has continued the good tradition of publication of the annual magazine this year too. I believe, such publications will contribute to the development of Industrial sector by strengthening the knowledge, information, and innovation relevant to the sector.

Government of Nepal is targeting to graduate from Least Development Country (LDC) status to Developing Country by 2022. For this contribution of industrial sector is vital. We need to ramp up private sector engagement in the industrial sector which requires a broad swathe of investment climate reforms, from business regulations to access to finance for private sector especially SMEs. Nepal needs to revive its collapsed manufacturing and merchandise exports. Industrial sector provides a robust base for economic growth.

Industrial Engineering plays a crucial role in the economic development of the country through innovation in management and technology, which will enhance the productive capacity of the sector. Hope, this magazine will create a knowledge-based environment among students, professionals, industrialists, and entrepreneurs to enhance their capacity in different aspects.

I would like to congratulate the "Industrial Vision" team who are involved in bringing out the second issue of the Annual Magazine "Industrial Vision". I hope our industrial engineering graduates will continue with similar constructive endeavors in the near future to create an investment environment in the country.

Let us join hands to develop Nepal

Prof Dr Govind Raj Pokharel

P.O.Box: 1284, Tel: 4211970, Singha Durbar, Kathmandu, Nepal

E-mail: gpokharel@npc.gov.np

Website: www.npc.gov.np



त्रिभुवन विश्वविद्यालय
Tribhuvan University
इन्जिनियरिङ अध्ययन संस्थान
Institute of Engineering

डीनको कार्यालय OFFICE OF THE DEAN

GPO box- 1915, Pulchowk, Lalitpur
Tel: 977-5-521531, Fax: 977-5-525830
dean@ioe.edu.np, www.ioe.edu.np
गोश्वारा पो.ब. नं.- १९१५, पुल्चोक, ललितपुर
फोन- ५५२१५३१, फ्याक्स- ५५२५८३०

Date: February 3, 2015



Message from the Dean

It is my pleasure to write a message to this second edition of annual journal “**Industrial Vision**” published by the Society of Industrial Engineering Students-Nepal (SOIES-Nepal) in collaboration with Department of Industrial Engineering, Thapathali Campus.

The Institute of Engineering (IOE) being the centre of excellence for engineering education in Nepal; it has greater role to achieve its goal and provide excellent manpower to the nation. This can be possible only by setting a mission of quality engineering education in the frontier engineering areas relevant primarily to nation thereby enhancing national development process. I believe this publication will be one of such steps to achieve the national development goal.

I appreciate the effort made by the students for this creative work. I congratulate all the contributors and the editorial board for bringing out such a beautiful journal.

Prof. Dr. Tri Ratna Bajracharya

Dean



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इन्जिनियरिङ अध्ययन संस्थान
Institute of Engineering

थापाथली क्याम्पस THAPATHALI CAMPUS

GPO box- 280, Thapathali, Kathmandu
Tel: 4-246465, 4-246307, Fax: 977-1-4247340
E-mail : tcampus@ioe.edu.np
गोश्वारा पो.ब.नं.- २८०, थापाथली, काठमाडौं
फोन- ४२४६४६५, ४२४६३०७
फ्याक्स- ९७७-१-४२४७३४०

Date: 2071-10-22



Message from the Campus Chief

I feel very delighted to know that the Society of Industrial Engineering Students (SOIES Nepal) is publishing the second issue of their annual magazine “Industrial Vision”. The first issue of the magazine was a fair reflection of Nepalese Industrial Sector. The magazine also served to create a level of awareness among the industrialists regarding the new technological advancements.

I would like to thank the all the members of the team who contributed in such a creative work. I am looking forward to reading the second issue of the magazine and I hope this issue will continue the good work of updating the current scenario of Nepalese Industrial sector and suggests some measures for the betterment.

Lastly, I on the behalf of IOE Thapathali Campus family would like to extend my congratulations to the whole team of SOIES Nepal and Industrial Vision for the publication of second issue of the magazine.

Best wishes for success.

Dr. Hari Ram Parajuli

Campus Chief

TU, IOE Thapathali Campus



Date: February 1, 2015

Message

I am delighted to know that the Society of Industrial Engineering Students (SOIES) Nepal, Institute of Engineering (IOE) Thapathali Campus is publishing the 2nd issue of its annual journal 'Industrial Vision'. I would like to congratulate the publisher for publishing such useful journal which is very instrumental for technological advancement and innovation in the industrial sector, the backbone of the economy.

The areas that the journal covers are timely and noteworthy for the industrial enterprises and government agencies to promote research and development for good exposures in the national as well as international levels. For the least developed countries like Nepal the role of industrial engineers and professionals is vital in the nation building process especially in manufacturing and service sectors. Hope this journal will be value addition to contribute in those sectors.

In the context, Confederation of Nepalese Industries (CNI), the apex body of country's manufacturing and service industries, believes that the journal shall become a good reference to all stakeholders including private companies, students, researchers and government agencies to get insight information about the industrial engineering and its practical issues.

Narendra Kumar Basnyat
President

Talking Business, Talking Change



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Institute of Engineering
थापाथली क्याम्पस
Thapathali Campus

इण्डस्ट्रियल इन्जिनियरिङ्ग विभाग
Department of Industrial Engineering

GPO Box- 280, Thapathali, Kathmandu
Tel: 4-246465, 4-246307, Fax: 977-1-4247340
E-mail: doie.tcampus@ioe.edu.np
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Date:-2071/10/21



Message from the HOD

It's a matter of pride for all the faculties as well as students under the Department of Industrial Engineering that the Society of Industrial Engineering Students (SOIES Nepal) is preparing for the publication of second issue of our annual magazine "Industrial Vision". The first issue published last year was a notable success in spite of limited available resources and circulation.

The first issue of the magazine was beneficial for students, professionals, industrialists and entrepreneurs considering their positive feedback. I look forward to reading the second issue and wish for even greater circulation this time around.

The Department of Industrial Engineering is delighted to have such hardworking and enthusiastic bunch of people among ourselves who contributed to bringing forward yet another issue of our annual magazine. I would like to thank and congratulate all the concerned people who contributed by providing articles, advertisements and the whole Industrial Vision team for this creative work.

With every good wish for continuing success.

Er. Shailendra Raj Khanal

Head of Department

Department of Industrial Engineering

TU, IOE Thapathali Campus





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Date: February, 3 2015



Letter of Appreciation

It gives me immense pleasure to write a few words on the publication of this technical journal. The journal presents all the hard work and effort put by all those involved in this venture. It serves as a pool of various technical papers which are based on the research and development work of different industries, energy sectors and other disciplines.

The present techno-economic scenario of Nepal is marked by increasing competition in every sector. Thus, there is a challenge before the industries to manufacture goods of right quality and quantity, at a right time and at minimum cost possible for their survival and growth. Industrial engineers can play a vital role in this concern.

Industrial engineering is a profession in which a knowledge of mathematics and natural sciences gained by study, experience and practices with judgments to develop the way to utilize economically the materials and other natural resources for the benefit of mankind. So this journal serves for the industrial revolution through techno-managerial skill. What industrial engineering is today and aspires to be in future is determined by the joint effort of all stakeholders of industrial engineering.

I would like to appreciate the efforts of SOIES-Nepal family and congratulate in the successful publication second edition of this journal. I hope for similar innovative idea and effort in future too.

Er. Sudan Neupane
Deputy Head
Department of Industrial Engineering
Thapathali Campus



Words from President

It is hard to change our point of view as we are in a dilemma. Most often it is because we are not nearly interested in resolving the dilemma and possibly creating a new 'Pearl' as we are being right. Creating a new Pearl involves both dreams and destination. We have a common dream and a destination. Dream became veracity as we published the first edition of our annual Magazine "INDUSTRIAL VISION" but destiny is on its way.

Creating a platform and striding on it are two different things. We had a good platform after the successful launch of the inaugural edition and we have left no stone unturned for the publication of the second one. "Industrial Vision" has proven to be a common platform for an interaction between the Industrial Engineers, Government agencies and industries. This will certainly strengthen the values of Industrial Engineering and make Industrial Engineering more familiar in the Nepalese Industrial Sector.

I feel very motivated that SOIES-Nepal has not been confined within the executive committee. The effort and hard work shown by the other members are worth appreciating. I want to express my sincere gratitude to the whole Industrial Vision team without whom this would have remained just a dream. Thank you for making our dream come true.

I would also like to thank all those who supported our work by providing their advertisement. I must thank all the advisors, faculty members of Department, professionals and everyone who has been directly or indirectly involved in bringing this magazine among you all. We are indebted by your support and expect similar co-operation and co-ordination in the near future.

Pitambar Chaulagain
President
SOIES-Nepal



From The Desk of Editor

“Continuity gives us roots; change gives branches; letting us stretch and grow and reach a new height”. The first volume of “**INDUSTRIAL VISION**” sowed the seeds of innovation, optimization and changes and this volume aims to water the seeds sowed a year ago. The support and feedback we received for the first volume has been the driving force for us and that justifies our belief in constant improvement and change.

We have the potential; all we need is a platform for exposure. Industrial Vision is a solid platform for Industrial Engineers to bring forward their innovative ideas and vision to show why we are different. We will have to make our identity by ourselves and Industrial Vision is the first initiative in doing so.

Ask HR managers and they will talk about a serious shortage of talent. Ask students and they will say there are no opportunities for good jobs. This is where things contradict. Some industries still hire Industrial Engineers from India and Nepalese graduates are in search of a good platform to explore their talent. Industrial Vision provides a good platform for collaboration and co-operation between the stakeholders for a better tomorrow.

The articles in this volume of Industrial Vision have encompassed the new dimensions of Industrial Engineering, environment, energy and entrepreneurship. Articles on new technologies and automation will certainly keep the industries updated with the latest technologies.

There are a number of government institutions working independently in this section. But there has been no significant result yet. The dreams of industrial empowerment can only be reached only when we hold our hands and walk together. “Industrial Vision” paves the path forward in doing so.

One day Industrial Engineers, industries, government institutions and all other stakeholders will put their hands together and walk in the long awaited path of Industrial Empowerment. Yes, we dream of this and we believe we can make this happen. I have no doubt that Industrial Vision will drive this dream into a reality.

Santosh Ghimire
Editor-in-Chief

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Creating Differences

SCOPES OF INDUSTRIAL ENGINEERING

Work Design, Human Factors & Ergonomics

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15

As companies and organizations embrace management philosophies of continuous productivity and quality improvement to survive in the increasingly competitive world market, the need for industrial engineers is growing. While most other engineering disciplines apply skills to very specific areas, a career in IE gives you the flexibility and opportunity to work in a wide array of businesses and organizations. Since the focus of IE graduates is to design processes and systems that improve quality and productivity, they work to eliminate, or significantly reduce, the waste of time, money, materials, energy and other commodities.

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On-The-Job Training (OJT)

"An opportunity not burden for the Industries"

Bachelors in Industrial Engineering was started in 2062 B.S. as the first Bachelors program in IOE Thapathali Campus. The Department of Industrial Engineering has gone through various ups and downs. In this course of time, the students under this Department have always co-ordinated with the Department and its faculties. The first batch in 2063 B.S. came up with a novel idea of establishing an umbrella organization which would work in the interest of students and the Department as a whole. As such Society of Industrial Engineering Students (SOIES-Nepal) was established and registered as a NGO. Since its establishment, SOIES-Nepal has worked as an intermediary organization for the sharing of ideas and experience between Industrial Engineering students passed out Graduates and the Industries.

SOIES-Nepal has always emphasized on the all-round development of the students. SOIES-Nepal has acted as a medium of interaction and communication between the senior graduates and the students. In addition to this, SOIES-Nepal has always worked for building positive relations with the Government institutions like IEMP, Department of Industry, Department of Labor and various other industries.

The major activities of 7th Executive Committee are highlighted below:

- A training on "MATLAB and Simulation"
- A Seminar on "Career Development and Challenges"
- A Training on "Solid works and Simulation"
- Launch of Official Website: www.soiesnepal.org.np
- Extra classes on "C-Programming" for first year students

7th Executive Committee:

Pitambar Chaulagain	President
Pratikshya Devkota	Vice-President
Bikesh Suwal	Secretary
Asutosh Bhattarai	Treasurer
Dison Maharjan	Joint-Secretary
Radhika Pokharel	Member
Resham Kumar Shrestha	Member
Anita Rijal	Member
Kushal Sharan Bhatta	Member

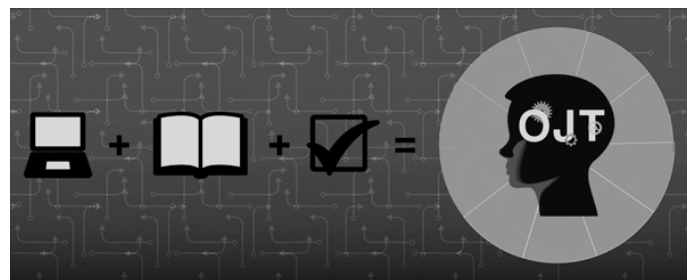
Confucius once said: "If all I do is hear, I will forget. If I hear and see, I will remember. If I hear, see and do, I will understand." These words seem practical in various aspects of life. Mere studying alone can't make you an efficient person. Many people learn better when they start performing the works they will be responsible for in their professional life. Along with education, training is necessary which will expose one with the rigors of work. All industries want their workers with good skills and right attitude. Mostly they expect good employees to walk the way to their door seeking a job. But

most important tools to develop good employees with required skills and attitudes. Effective on-the-job training (OJT) is a measure which will help to eliminate and mostly reduce the work failure and employee turnover.

OJT can be considered for the students, new recruits or existing workers. In Nepal, this term is quite new. The MBBS students perform their OJT in the name of internships and Industrial Engineers (IEs) from IOE,

"The attitudes of managers in Nepali industries towards OJT need a radical change"

Thapathali Campus have their OJT in their final year. Fresh students have



in reality it's very difficult to get such an employee with magic-mix combination of skills and attitudes. Industries should develop good employees needed for them. Proper training can be one of the

right attitude, knowledge and techniques and their skills should be upgraded by means of good training, exposing them to rigours of real job.

OJT is the part of a

college curriculum that is designed to train and orient students about their future work. OJT is very important not only to train students in their chosen career but to show students the reality about working. It is used by many different industries around the world. During the period of OJT, students get chance to be acquainted with practical challenges of the organization.

Providing OJT is beneficial to both parties as current students will be future new hires of the industry. Good employees needed should be developed by the organization and it can be done only through structured OJT. OJT provides pay-back to industries to help compensate for the costs related with skills improvement training and loss of production for newly recruited employees. It is an opportunity to train employees as required by them. For students, OJT is an opportunity to apply previously acquired knowledge and skills to career preparation and work. It helps students to consolidate previously learnt skills and to have the transition from university to work smooth.

IE students have problems getting OJT easily in industries in Nepal. Although some Nepalese industries have recruited pass out IEs, they are rejecting OJT request of new students. As OJT is beneficial to the industries, the management can be called narrow and inefficient. These industries are not realizing their role to offer OJT. One of the largest Fast Moving Consumer Goods (FMCG) industry in Nepal, (name not to be mentioned) which has employed IEs from IOE rejected to provide OJT to students from IOE. The Human Resource Manager denied to meet me and said 'NO' indirectly to my request. This is just a single example. Few other industries, as reported by my friends, have denied the OJT

request. Officer of a wine factory situated in Chobhar, Kathmandu demanded Rs. 2,500 per hour to allow some students to visit their factory. This type of activity shrinks the reliance and innovativeness of students to perform projects, consequently decreasing their confidence level. But the case is not same for all industries as many others have warmly welcomed the students for the OJT, also promising fair stipend during training session. These type of industries will help students to be more practical and efficient, thus augmenting the innovativeness and skills of students. This will certainly lead to improved state of industrial growth in the nation.

Beside students, industries should also provide OJT to existing employees. In Nepal, a big workforce leaves the job for better posts. This type of turnover is a major expense for many industries. When a worker leaves the job, there will be increased cost of vacancies in the media, interview and training cost and time, along with a huge productivity loss associated with time and money. Generally, to replace an employee it costs from one month to one year's salary. Major turnovers in Nepalese industries are because of employee frustration with their own skills and boredom of performing repeatedly the same work every day. Workers should be provided with effective OJT for their skill improvement so that they become able to perform new tasks. This frees them from frustration and boredom mentioned above. By providing new opportunities and support through effective OJT, workers can



remain keen in the job and at the same time they become more valuable for the industry.

Inadequate training is the cause behind major mistakes which are taken as human error and often ignored. OJT is a major tool and technique to avoid such mistakes. Mistakes should be taken as learnable moments so that future occurrence can be avoided.

In Nepal, OJT is yet to be prioritized. The attitudes of managers in Nepali industries towards OJT need a radical change. Also the government should enact a law that binds industries to provide OJT to students compulsorily. It will lead to introduction of more efficient engineers who can drive the nation to industrial development quickly.

Often the industries hate to see the skilled employees leave. To prevent this, they should be able to retain them through OJT. OJT programme gives students a head start, potentially developing their attitude towards learning. It may pay a little in a month to provide training but it should be never forgotten that it will continue to yield benefits year after year.

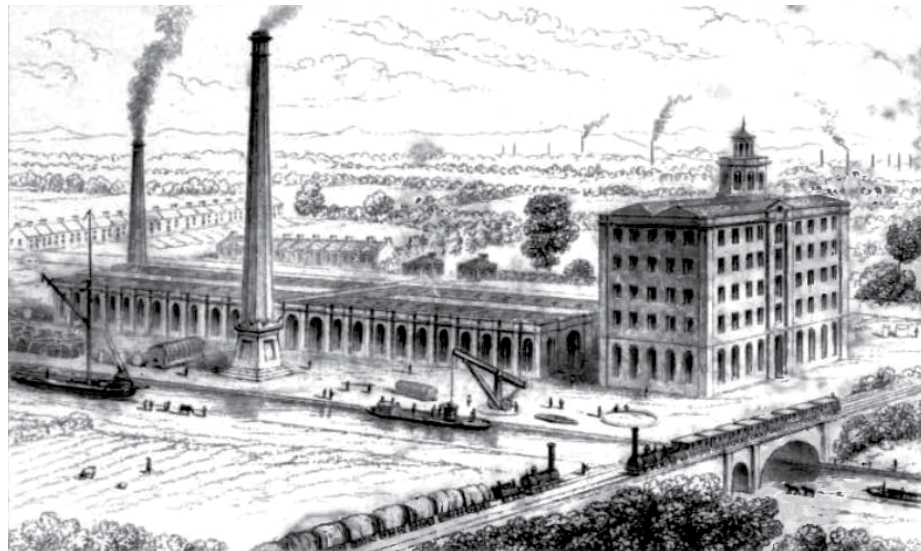


Nirajan Pudasaini
Industrial Engineer, Inspector(NBSM)

Trails Of Industrialization



Bishnu Parajuli
Saroj Lamichhane



It is in human nature to have an ever-growing lust for everything. The horizon of imagination of human mind keeps exploring and expanding ever. Idea is the source of innovation and innovation is the sparkler of all human change, improvement and progress. Innovations have led a way for the industrial age. Following its commencement from the United Kingdom, industrialization next spread throughout Europe, North America and eventually the world. No places are hidden from its impact because so inspiring and impactful it is.

The 18th century saw the emergence of the "Industrial Revolution", the great age of steam, canals and factories that changed the face of the British economy forever. Almost every aspect of daily life was influenced in some way. Most notably, the average income and the population began to exhibit unprecedented yet sustained growth.

Beginning in 1700's, series of invention in the spinning of cotton thread was a significant break-

through. The first was spinning Genny which was invented in 1764 which mechanically drew and twisted the cotton fibers into thread. Furthermore, the invention of steam engine in 1769 by James Watt was the first to convert fossil fuel to mechanical energy. The series of inventions occurred and proved a way for establishing industries for fulfilling needs of the people around the globe.

In the later part of the 18th century, the manual-labor and animal based-economy were driven towards machine-based manufacturing. Karl Marx (1818-1883) presented industrialization as the obvious destiny of all European society. Then, trade expansion was enabled by improved waterway, roads and railways.

The First Industrial Revolution, which began in the 18th century, merged into the Second Industrial Revolution around 1850, when technological and economic progress gained tremendous momentum with the development of steam-powered ships, railways, and later in the 19th century with

the rise of internal combustion engine and electrical power generation.

A Lathe from 1911, a machine tool able to shape parts (usually metal) for other machines were used. Apart from workshop lathes used by craftsmen, the first large machine tool was the cylinder boring machine used for boring the large-diameter cylinders on early steam engines. The planting machine, the slotting machine and the shaping machine were developed in the first decades of the 19th century. Although the milling machine was invented at this time, it was not developed as a serious workshop tool until during the Second Industrial Revolution. Military production, as well, had a hand in the development of machine tools.

Before the advent of machine tools, metal was worked manually using the basic hand tools of hammers, files, scrapers, saws and chisels. Small metal parts were readily made by this means, but for large machine parts, production was very laborious and costly.

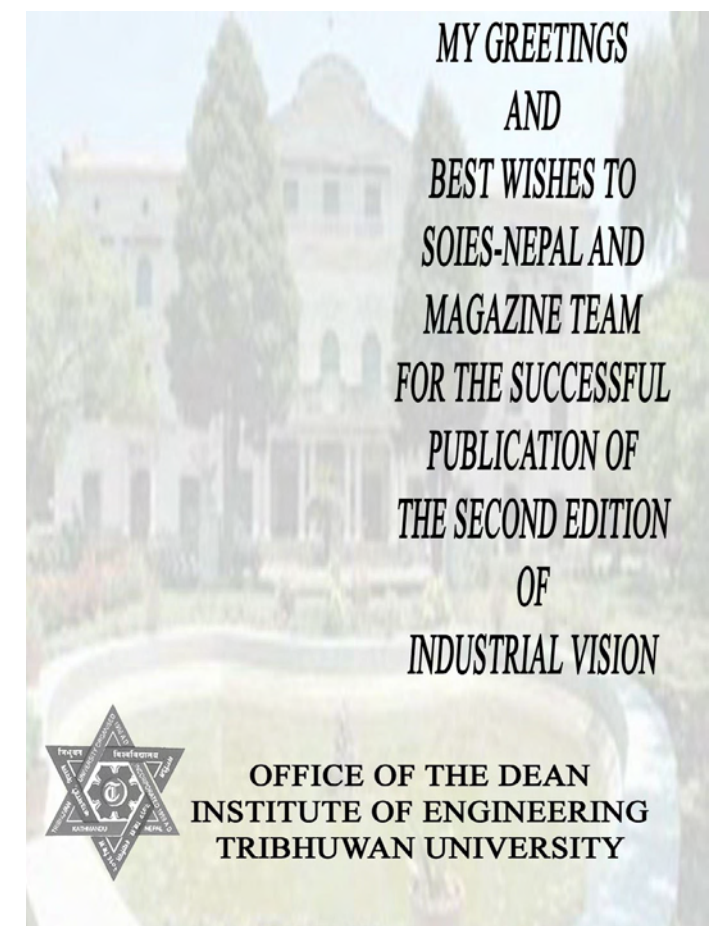
Signs of dramatic economic and technological change were already apparent. The effects spread throughout Western Europe and North America during the 19th century, eventually affecting most of the world, a process that continued as industrialization.

While looking at our country, we can find it among the least industrialized nations of the world. Although modern industries began operating in Nepal in 1936 it is still entangled in starting phase. Very few successful and multina-

tional industries exist even at this date. This identifies the lack of efficient and effective policies and policy-makers, active economic governance, and the implementation on an inclusive scale. Foreign countries take around 500,000 man power every year from our country at low wage rates. This encapsulates the dearth of industries in our country and highlights the unemployment problem its active population is facing. As pointed out by statistics, it's frustrating to acknowledge that existing number of industries is going to decline being unable to compete with cheap imported foreign products.

Responsible for utilization of available resources, overcoming the problem of unemployment, modernization of agriculture, self-sufficiency, and as a foundation for economic development, industrialization is the most appealing thing to the growing world.

Industrialization means creation and expansion of industries and use of modern technique to increase efficiency and productivity as well as it is its sustainability. In near future may our country spark transformational industrial change not solely for Nepal but more essentially for the whole world and acclaim proudly we can do it too. And for this, we must work together, unite our creative ideas and provide a better fostering execution for a sustainable and prosperous Industrial Age with huge arena of effective collaborations.



A Study of Nepalese Industrial Sector

"From Past to a Promising Future"

Industry is the production of a good or service within an economy. Manufacturing industry became a key sector of production and labour in European and North American countries during the Industrial Revolution. This occurred through many successive rapid advances in technology, such as the production of steel and coal. At the top level, industry is often classified into sectors: Primary or extractive, secondary or manufacturing, and tertiary or services on the basis of process incorporated.

In the context of Nepal, industrial production represents a small but growing segment of economic activity. Biratnagar, Birgunj, Bhairahawa and Hetuada have become hub for many small industries which have mostly localized operations based on the processing of agricultural products. For geographic and historical reasons, nearly all of Nepal's trade is with India. Attempts have been made to diversify trade through agreements with such countries as Japan, South Korea, Pakistan, the United States, Germany, Poland, and China.

The history of Nepalese industries doesn't date back too long. During the decades of 60s, Kathmandu received aids from Moscow and Beijing. Some new industries were established which used agricultural products such as jute, sugar, and tea as raw materials. Other industries were dependent on various inputs imported from other countries, mainly India. But following the 1989-90 trade disputes with India, many inputs were unavailable and traditional markets for many traditional goods collapsed. As a result, industry accounted for less than 20 percent of total GDP in the 1980s, relatively small by international standards. Among the modern industries were large manufacturing plants which produced jute, sugar, cigarettes, beer, matches, shoes, chemicals, cement and bricks. Industrial estates were located in Patan, Balaju, Hetuada, Pokhara, Dharan, Butawal and Nepalganj. The government provided the land and buildings for the

industrial estates, but the industries themselves were mostly privately owned. The 1986-87 Nepal Standard Industrial Classification counted 2,054 manufacturing establishments of 10 or more persons from 51 major industry groups, employing about 125,000 workers. That same year the total output from these industries amounted to about Rs 10 billion; value added was estimated at almost Rs 3.6 billion. It was nearly Rs 5.1 billion in FY 1989. By FY 1989, there were 2,334 such establishments recorded, employing about 141,000 persons. The history of incorporated private firms in Nepal is short. The Nepal Companies Act of 1936 provided for the incorporation of industrial enterprises on joint stock principle with limited liability. Public companies also had a varied success in between 1939 to 1963 when only 34 remained in the operation.

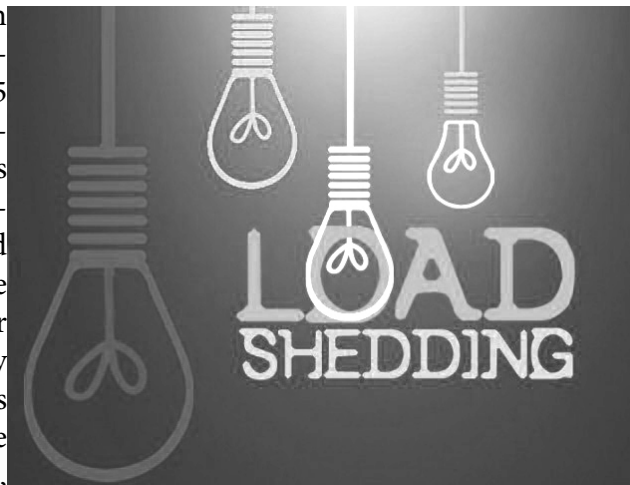
At present, Nepal's industrial sector is in a bad shape. Almost all industries are either losing money or operating at a breakeven position. Nepal's manufacturing industrial sector today is mainly dogged by three major problems: lack of energy, manpower and funds. When we started the company a decade ago, these problems were non-existent. Now they are burgeoning as serious threats. The Nepalese banks provide loan to the industries at 15%, very high compared to our neighbours India and



China. How can an export oriented industry survive at 15 per cent bank interest? And the result is very clear, our economy is import based and we have a large trade deficit with our neighbours. Security and labour unions are other oppressive concerns. All in all, Nepal does not have an industry-friendly environment.

In the context of Nepal, cottage and small scale industrial sector deserves priority as an instrument of industrialization because Nepal is facing the problem of high population growth rate, unemployment, income inequalities etc. Although large and medium scale industries also generate more employment opportunities they require comparatively heavier amount of capital, which is generally scarce in Nepal. It is necessary to make our industrialization process dynamic and consolidated by developing and expanding cottage and small-scale industries in keeping with our limited markets, level of technical know-how, position of transportation, and the geographical structure of the country. There are great possibilities of establishing cottage and small-scale industries utilizing the existing local resources due to geological and geophysical structure of the country. By the development of cottage and small scale industries, it will be enhanced to achieve the target of poverty reduction from 38 to 30 percent.

The Department of Industry (DoI) under the Ministry of Industries is responsible to register, pro-



mote and monitoring and evaluation of entire industrial sector. Nepalese industries are in downward trend in recent years. As a result, trade deficit of the country is rising due to the increased imports and slackness in exports. The contribution of the industrial sector in the national GDP is also in declining trend. It is said that there is huge potential of establishing mega industries in various sectors of the country including hydropower, agriculture and tourism. However, it is yet to be materialized. For the promotion and development of industrial sector, a congenial investment environment needs to be ensured. For this, the concerned government authorities should be made more efficient, resourceful and vibrant. The DoI is often blamed for not playing expected role for the development of the sector and just acting as a registering authority.

No doubt there is immense potential of rapid industrialization in Nepal. But it requires a large amount of capital. As we are capital deficient country, we should attract foreign investors. In order to attract investors, we should first create investment friendly environment in the country. Political stability, solution of ongoing power crisis and a good labour-management relation in the industrial sector are the minimum conditions for creating investment friendly environment.

In addition, formulation of investment friendly laws and regulations and strong will-power of the politicians and bureaucrats are also equally important for attracting more investment in the country.

Given the existing situation, the future of Nepal's manufacturing industry is really bleak. If this persists, industries will gradually die. Export oriented industries will be the first ones to go, because they cannot compete with cheaper Indian and Chinese exports.

Secondly, the companies consuming more electricity will cease to exist due to power shortage. And ultimately, even the industries based on local resources will slowly disappear. The government-stated goal for the manufacturing sector is to raise its share in GDP from ten to twenty percent between now and 2020. This implies a sectorial growth rate of ten per cent per annum. However, making commitments and setting targets alone won't work for now. The government should collaborate with the private sectors to carry out immediate changes in the scenario. It may include restructuring the existing industries, fostering future promising industries and facilitating the development

"Nepal's manufacturing industrial sector today is mainly dogged by three major problems: lack of energy, manpower and funds"

of promising industries, technological advancement with a guaranteed 24 hours of power supply.

No doubt there is immense potential of rapid industrialization in Nepal. But it requires a large amount of capital. As we are capital deficient country, we should attract foreign investors. In order to attract investors, we should first create investment friendly environment in the country. Political stability, solution of ongoing power crisis and a good labour-management relation in the industrial sector are the minimum conditions for creating investment friendly environment.

In addition, formulation of investment friendly laws and regulations and strong will-power of the politicians and bureaucrats are also equally important for attracting more investment in the country. The 2020 vision of the government to improve the industrial scenario of the nation is a breather to all the investors of the industrial sector of Nepal.



*Er. Sushant Raj Giri
Industrial Engineer, MBA(Mgmt. System & Science)*

**MY GREETINGS
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Environmentally Conscious Manufacturing



Shailesh Adhikari
Industrial Engineer

Industrialization employing advanced systems of manufacturing that contributes in both national income and employment opportunity within a country is a long felt need. While industrialization has brought about an increased volume in variety of manufactured goods and an improved standard of living of some people, it has also resulted in degradation of the environment. The environmental problems such as air pollution, ozone layer depletion, deforestation, acid rain, desertification, global warming, solid and precarious waste problems are the effects of non-sustainable industrialization. The nature has changed its characteristics as season are changing rapidly, pollution level has increased drastically; atmospheric concentration of CO₂ has increased by 35% since the beginning of the age of industrialization. The temperature of the earth surface is increasing 0.6 degree per year.

Most climate scientists agree the main cause of the current global warming trend is expansion of the greenhouse effect. The largest source of CO₂ emissions is the combustion of fossil fuels such as coal, oil and gas in power plants and industries. There is a higher percentage of solid waste from industries at landfill and globally industrial areas are most polluted areas. All these evidences support the fact that we need alternatives and improved industrial method that can address the issues of both industrialization and environmental conservation.

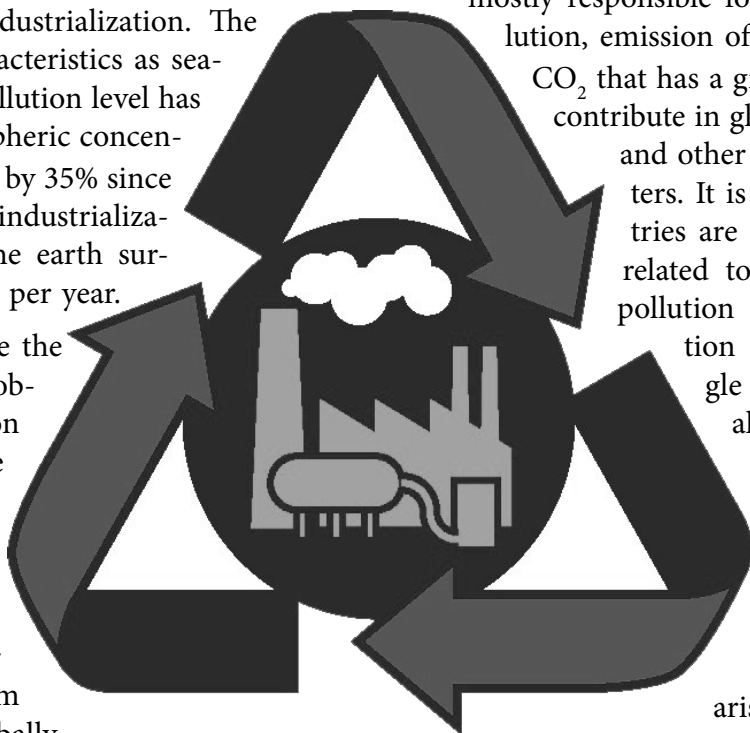
The modern industrialization theory proposes to use everything to their optimum life cycle and assumes that the manufacturing process has zero landfills. It also suggests for zero emissions and return to the earth after complete lifecycle. Hence it promotes reduced waste, reuse of product and remanufacturing of used components. The world is upgrading indus-

trialization by implementing environmental friendly acts and policy.

The concept of sustainable development has increased recognition and this becomes even more important in case of the manufacturing industries. But the industries point out precision, pragmatism and initial cost as their constraints of implementation. The basic understanding on sustainable manufacturing is that it helps the industries to save money, increase product-competitiveness and decrease environmental effects and health impacts. The manufacturing industries are

mostly responsible for environmental pollution, emission of hazardous gases like CO₂ that has a green house effect that contribute in global temperature rise and other environmental disasters. It is because these industries are one having problems related to waste management, pollution control and production efficiency. The single option solution to all such problems is to adopt sustainable production process; that ultimately reduces cost, waste and pollution.

Every year new issue arises in the industrial sector relating to the environment and public health. Some of the industries modify their operations and process to meet the environmental requirements. But most of the industries are reluctant to their production process and are operating in a conventional system. Industry within the state boundary follows state rules, so only government can direct all industries for sustainable practice; government has to address these requirements through acts and laws. Government can attract them to upgrade to sustainable industrialization. The required first step is to develop policy to include all categories of the industries and promote for sustainability. The



second and most important step is, government has to monitor regularly, how the rules are being followed and in which extent.

Environmentally Conscious Manufacturing (ECM) is a new concept about manufacturing as a major tool of sustainable industrialization. ECM emphasizes on the most efficient and productive use of raw materials and natural resources and minimizes the adverse impacts on employees and the natural environment. In its most advanced form, a product's entire life cycle is considered from design, raw material and use of natural resource to the disposal. Many of these other terms and concepts are used together with ECM, like Life cycle Assessment; LCA, Design for environment; DfE and cradle to cradle; C2C.

Life Cycle Analysis (LCA) is the systematized process of scrutinising of a product's overall life cycle, from extraction of raw materials to dumping of the used product. It suggests the "cradle to grave" observation at a process and product, in view of environmental aspects and impending effects. Life cycle analysis studies the environmental influences of a product by observing the major procedural stages of a product's development and product life up to the disposal.

A life cycle approach implies that everyone in the whole chain of a product's life cycle from cradle to grave, has a responsibility and a role to play, taking into account all the relevant impacts on the economy, the environment and the society. The impacts of all life cycle stages need to be considered comprehensively by the all stakeholders when they make decisions on consumption and production patterns, policies and management strategies.

Design for Environment (DfE) is a technique used to incorporate an environmental component into products and services before they enter the production phase. DfE seeks to discover product innovations that will meet cost and performance objectives while reducing pollution and waste throughout the life-cycle. A wide variety of techniques are available and they fall into two broad categories:

- Techniques to identify the environmental impact of a product throughout its life cycle.
- Techniques that help to improve the environmental performance of products by design.

DfE is the major improvement tools to maintain environmental impact of the product. Design plays a central role in the improvement of environment friendly products. DfE strategies used at the product planning

and problem definition stage of the design process support sustainability approach. The most common DfE practices used include:

- Design for recycling
- Design for disassembly
- Design for energy efficiency
- Design for remanufacture
- Design for disposability
- Hazardous material minimization

Cradle to cradle (C2C) manufacturing is a model that promotes the re-use of the raw materials. In nature, raw materials are constantly built up and broken down in diverse production processes, but few of the by-products of these processes end up as waste. By learning from the more efficient manufacturing processes found in nature, industrial manufacturing can reduce both raw material use and waste. The C2C model could transform the manufacturing industry by developing processes where the end products are created within a closed-loop system i.e. materials are

"Environmentally Conscious Manufacturing (ECM) is a new concept about manufacturing as a major tool of sustainable industrialization"

continuously circulated within a cyclic supply chain. Maintaining the raw materials in a closed loop system instead of a linear system maximizes

material value and simultaneously protects the environment. Also, it allows waste products within the production facility rather than ending up in a landfill that reduces the cost at the same time. The C2C manufacturing model has the potential of leading the next industrial revolution. This new model offers a compelling alternative to the traditional manufacturing system.

Finally, it is obvious that the benefits of emerging approach of industrialization and resource use will be more to developing country. Nepal being developing country as well as in the way to attract investment through industrialization is in the good stage of implementing sustainable policies and practices for future. For new industries the government can approach from beginning to save huge investment avoiding old technology through laws which required more cost and resources. To those industries which will be shifting to sustainable approach from existing can be benefited with subsidies on tax or other financial benefits. It is the importantly necessary to think of future from now so that investment from organization have highest return in long approach too.

(The writer is currently doing Masters in Sustainable Energy at Eastern Illinois University)

Treating Industrial Wastewater Naturally

Constructed Wetlands



Prakash JamarKattel
Industrial Engineer

One of the commonly found environmental problems in developing countries is water pollution caused by direct disposal of untreated wastewater. The production of wastewater in Kathmandu and other urban areas in the country are through domestic, commercial and industrial routes. The industries producing significant amount of wastewater in the country include brewery and distillery, cement, cigarette and tobacco, animal feed, iron and steel, rosin and turpentine, soap and chemical solvent, oil and vegetable ghee, jute, paper and pulp, sugar and leather tanning. The combined wastewater production in three industrial estates in Kathmandu Valley- Balaju, Patan and Bhaktapur which house nearly 200 industrial units estimated to be 800m³/day. Industrial Wastewater are contaminated with phenol compounds, cyanides, sulphides, oils and greases which ultimately results in higher Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), pH and TSS content in wastewater.

The acute shortage of water supply can be reduced by treating the domestic waters and industrial effluents in the wastewater treatment plants. Constructed wetlands are engineered systems, designed and constructed to utilize the natural functions of wetland vegetation, soils and their microbial populations to treat contaminants in surface water, groundwater or waste streams.

CWs have been used successfully worldwide for the treatment of municipal, industrial, landfill leachate, storm water and agricultural wastewater.

A constructed wetland (CW) acts as a watershed filter, a sink for the sediments and precipitates, and biogeochemical engine that recycles and transforms some of the nutrients. A constructed wetland can perform any of the functions of the convectional wastewater treatment trains (sedimentation, filtration, digestion, oxidation, reduc-

tion, adsorption, and precipitation). These processes occur sequentially as wastewater moves through the wetland. CW have been found to be effective in treating BOD, TSS, N and P as well as for reducing metals, organic pollutants and pathogens.

Table: Contaminant removal Mechanism

PHYSICAL	CHEMICAL	BIOLOGICAL
Sedimentation	Precipitation	Bacterial metabolism
Filtration	Adsorption	Plant metabolism
Adsorption	Hydrolysis	Plant absorption
Volatilization	Oxidation/reduction	Natural die-off

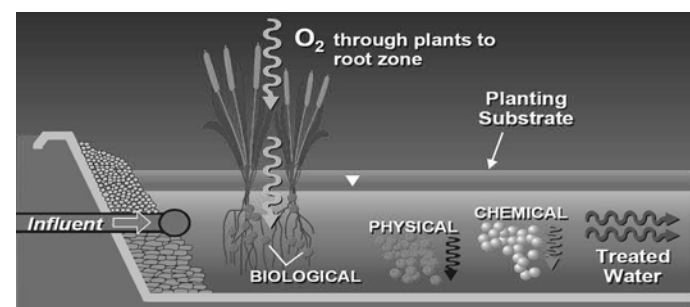


Fig: Contaminant Removal Mechanism

Some of the world wide examples for the use of CWTP to treat industrial waste water are:

Wolverton & McDonald in 1981 demonstrated that 60-90% of phenol and m-cresol could be removed by the artificial marshes containing either cattail (typha. Sp.) or reed (phragmitesaustralis) at a retention time of 24 hours.

The constructed wetland (CW) in Gradisce (Slovenia) has been in operation since 1991 for the purification of waste water from a food processing plant. Analysis showed that pollution decreased with regard to COD by 92%, BOD₅ 89%, orthophosphate 96%, ammonium 86% and nitrate 65%. The microbiological parameters indicated that the total number of coli

form bacteria is reduced by 99% and the number of faecal streptococci decreased by 98%.

Several locally available macrophyte species were transplanted into the wetland by Maine and his co-researchers in 2005 to study and analyze the Nutrient and Metal Removal in a Constructed wetland for wastewater treatment from a metallurgic industry. The wetland removed 86% of Cr and 67% of Ni. Zn concentrations were below 50 µg/l in most samplings. The FeS precipitation probably caused the high retention of Fe (95%). The outgoing water was found anoxic. Phosphate and ammonium were not retained within the wetland while 70% and 60% of the incoming nitrate and nitrite were removed. Large de-nitrification losses are suggested. Cr, Ni and Zn were retained by the macrophytes in the larger wetland and in sediment in the small-scale one.

Billore and his co-researchers in india installed a field-scale 4-celled, horizontal subsurface constructed wetland (CW) to evaluate removal efficiencies of wastewater constituents in an industrial distillery effluent. The study concluded the significant removal of BOD₅ and TSS from the influent. Nitrogen and phosphorous content were also removed to the greater extent which seen up to 92% and 75% respectively.

The treated water obtained from the CWTP can be used for gardening purpose as well as sanitary purpose so the need for the irrigational water is fulfilled by the wastewater. Wastewater not only provides the supplemental irrigation but also provides the useful nutrients, especially organic matter phosphorous and nitrogen to improve physical properties and fertility of soil. The cost effectiveness, environmentally friendly, simple in construction and process stability are some of the important features of CWs. The simple in design, economically feasible and low maintenance and operation cost makes the CW technology suitable for the industrial wastewater treatment in developing

Clean Economy

"A Daylight Dream"

No individual today is unaware of the issues of the Greenhouse gas emissions, climate change and global warming. The concepts of "zero emissions", "cleaner production" and "green economy" are no new terms either. It has been a long time that our environmental agencies and environmentalist have ranted these terms and advocated about all these. But little do we know or care how practical it is to balance the pace of industrialization with reduced emissions simultaneously.

We don't need to go back long to know how these problems of emissions and global warming were initiated. These are just the repercussions of rapid and haphazard industrialization we have started. It is often heard that if the US and China had given only one percent of attention to the environment during their rocketing industrialization back in late 90s, the world would have been a better place to live in today. The history of industrialization dates long back in the context of the United States but China came into the scene only in the late 80s. That was when many American companies searching for abundant resources and cheap manpower found China to be their best choice. Since then China began its marathon to be the leading manufacturer in the whole world and did a little to look back and see the ecological footprints its course of actions had on the environment. Many Americans today regret of those Agreements which increased two things forever: first the US trade deficit with China and second POLLUTION. However, the irony is that as much as one third of China's carbon load on the atmosphere can be traced to the export of cheap clothes, electronics, machinery and other goods consumed by the Americans and Europeans.

At the end of 2014, to the surprise of many, China emerged as "the largest economy in the world" overtaking the United States. But only a few of us know that China had already overtaken the US in 2007; that time as the world's largest producer of CO₂, the chief greenhouse gas. This is where the facts contradict. Only seven years of overtaking the US in terms of CO₂ emission and China emerges as the largest economy. Does a country have to sit on the head and

कल इन्डिया...

मात्र रु. २.९० प्रति मिनेट

साथै कतार, साउदी अरेबिया, |

यू.ए.इ., बहराइन र कुवेतमा फोन

गर्दा अब मात्र रु. १२ प्रति मिनेट।

फोन गर्ने तरिका:

१४२४ + कन्ट्रिकोड + फोन नं.



strangle the environment to stand amongst the rich nations? Can the same thing be done in a different way? A way that makes the country rich and prosperous without any harmful consequences on the environment. Can the concept of "clean and green economy" be really put into practice? But the facts shove us back into the deep ocean of cynicism. There are a number of roadblocks that stand in between a clean-energy based tomorrow and fossil fuel dependent present.

The petroleum products and natural gas (almost 80%) still constitute the major source of energy in the US, the former world's largest economy. The consequence to this comes by no surprise that, the United States is the second largest

dwarfing the \$120 million invested in incentives for renewables, according to International Energy Agency (IEA). Moreover, the IEA also estimates that the world needs to invest a trillion dollars a year to keep the average temperature of world's atmosphere from climbing up by two degrees and thereby avoid the worse effects of climate change.

The race to be the world's largest economy had begun a long ago. Actually this race is not a marathon but it is like a marble race, we used to compete in our child-

"Does a country have to sit on the head and strangle the environment to stand amongst the rich nations? Can the same thing be done in a different way?"

hood. There is no point in coming first if your marble falls on the way. In this case, the finish line is a rich and prosperous economy and not letting the marble fall is not letting the environment degrade in course of our race to be rich. The air pollution in China kills more than a million people every year, the World Bank report suggests. The global warming has resulted in melting of the high Himalayas of Nepal and rising sea level is about to engulf the island of Maldives. Both these countries combined together contribute less than 1% to the CO₂ emissions. Are we des-

tinued to endure all this? More importantly, is this fair and responsible? The fast growing economies India and China have a literacy rate of 73% and 95% re-

spectively. Almost all literates can understand the effects and consequences of the Greenhouse emissions. The problem is never with the literacy, the problem is with their poor economy. The economy that has long strived for prosperity and has just started to surge upwards would never give a damn on any issues of Environment. All it wants is to project higher and higher. One new player is ready to compete the race, the marathon one not a marble race. I remember a Cree Indian saying here, "Only when the last tree is cut down, the last fish eaten and the last stream poisoned, that we will realize we cannot eat money." The race for being largest economy began a long ago, now its time the race for a cleaner and prosperous economy to begin. It would be interesting to see who comes first here. But to our despair, China, India and the US have signaled that they will not ratify any treaty that will legally commit them to reduce CO₂ emissions as agreed in the Kyoto Protocol a long ago. This means we will have to witness the same unfair and dirty marathon for more years to follow with the future of a fairer "Marble race" in a corner of uncertainty.



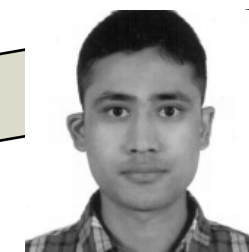
Santosh Ghimire
BIE Final Year



contributor to CO₂ emissions contributing 16.16% only behind China (24.65%). This comes in fact as a matter of shame for a country which alone employs 53,200 Environmental Engineers. There is a specific reason behind these facts; the subsidization of fossil fuels. From 1918 to 2009, fossil fuels received \$446.96 billion in cumulative subsidies from US, as opposed to just \$5.93 billion for renewables. The Government support for fossil fuels is not limited to the US, it exists worldwide. Globally more than half a trillion dollars is channeled towards subsidies for fossil fuels

hood. There is no point in coming first if your marble falls on the way. In this case, the finish line is a rich and prosperous economy and not letting the marble fall is not letting the environment degrade in course of our race to be rich. The air pollution in China kills more than a million people every year, the World Bank report suggests. The global warming has resulted in melting of the high Himalayas of Nepal and rising sea level is about to engulf the island of Maldives. Both these countries combined together contribute less than 1% to the CO₂ emissions. Are we des-

Potential Energy Generation From Cement Industries



Pradeep Singh
Industrial Engineer

With the advancement in technologies, there seem to be a lot of potential in energy saving in high energy demand industries. Energy efficient industries have been perceived with high sophisticated technologies. Moreover, the global scenarios have vitalized the concept of green industries along with industrial energy efficiency. To add up, some industries have put up their own task force and R&D to generate energy in their own premise. With the utilization of residual energy, industries are idealizing the concept of energy generation thereby, significantly curtailing the GHGs emission. Nepal is a small economic zone with industrial growth at a premature phase. However, geographically located between two emerging economies, China and India, Nepal aspires as a potential growth region. With growing trade deficit and an import based economy, industrial growth has shown a dismal performance in recent years. Adding to the woes,

the prevalent energy crisis and political turmoil have aggravated the situation, deflating most of the industrial indicators.

Industries require a variety of fuel mix depending upon its establishment, the basic requirements being electrical and thermal energy. Insufficient supply of electricity has compelled industries to heavily rely on the diesel generators for necessary backups. Thermal energy is another form of energy used in most of the industries for heating, drying, sintering and different other processes. This form of energy is available basically through direct combustion of fossil fuels, especially coal.

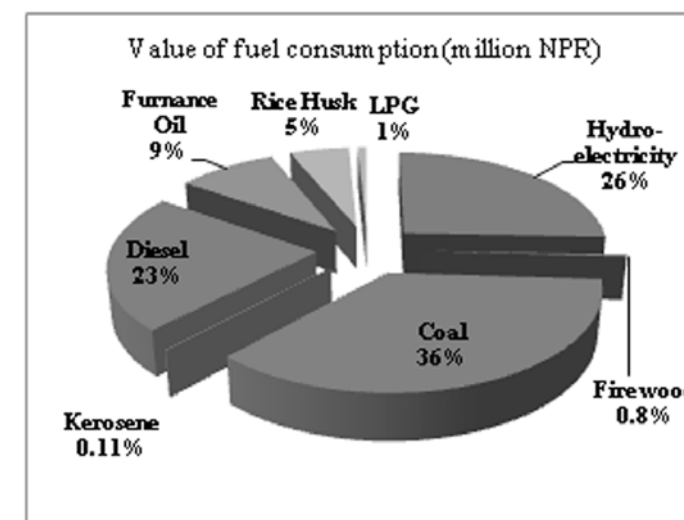
Statistically, it can be observed that fuels like coal and diesel are being used in huge amounts. In recent years, the use of diesel is seen excessively outrageous with increasing trend with extensive use in diesel gen-sets. Industries

Hence, any means of cost effective energy conservation technologies can provide temporary relief to the industries.

According to thermodynamics, absolute consumption of energy to generate equivalent amount of work is impossible. Losses do accompany energy transformation. Keeping aside the emission, with the generation of thermal energy there is always certain amount of energy in the form of waste released into the atmosphere. The residual energy can be therefore trapped to be reused in same form

"A survey in state owned cement industries show that around 1.5 MW of power can be harvested. Currently around 10 MW of power can be installed in all cement industries in operation."

or different form. The current global trend prompts the re-use of residual heat in the form of waste to generate electricity, commonly known as Waste Heat Recovery for Power Generation (WHRPG). Energy intensive industries like steel and cement have applied this novel technology into their production line. The quality of waste heat needs to be accessed along with the quantity. The division of quality is done according to temperature level as high grade, medium grade and low grade. The high grade refers to the waste heat resources whose temperature is higher than 500° C which includes high temperature flue gas such as coke oven gas, converter gas, electric furnace gas and heating furnace flue gas etc. The medium grade refers to the waste heat



are facing the burden to allocate budget for importing these fuels, resulting in high energy cost per unit of the product. Moreover, industries with high consumption of energy are always under the repeated threat of fuel shortage.

whose temperature at 150 to 500°C including blast furnace gas and sintering flue gas, exhaust gas recovery of waste heat from the primary combustion after flue gas etc. Waste heat in cement industries are generally emanated from either clinker burning or clinker cooling process. The heat range ranges from 300 to 350°C - medium grade heat. Low grade refers to the waste heat whose temperature below 150°C including waste steam and hot water, all kinds of low temperature flue gas and low temperature materials etc. Currently, none of either of these industries in Nepal have implemented this technology.

With the increase in infrastructural development, construction materials like cement and steel are mostly to be consumed in large quantity. Recent trends show the increase of cement and steel consumption by around 20 percent. A likely possibility, for more growth in future can be expected with the expansion of more infrastructure projects. Ultimately, these industries require energy at an unprecedented level creating a wider range of demand gap. Therefore, energy meeting at every level requires a wise decision, generating from all ways, WHRPG can prove to be a promising energy generation means for these industries.

Both technically and financially, many cement industries around the globe have successfully implemented WHRPG. China alone generates around 1500 MW of electricity from WHRPG in cement industries. All Indian cement industries have approved to install this facility in their cement industries by 2020. Nepalese industries should prompt itself to a more secure future where any means to substitute fossil fuels can be implemented.

<i>Financial Analysis of State owned Cement industries</i>	
<i>Net installable power capacity</i>	<i>1.5 MW</i>
<i>Electricity Generation</i>	<i>: 36 kWh/ MT clinker</i>
<i>Cost of Installation</i>	<i>: \$ 1828 per kW</i>
<i>Total initial investment</i>	<i>: ~ Nrs. 273 million</i>
<i>Installed Capacity Clinker</i>	<i>5 1 1 , 5 0 0 MT / yr</i>
<i>Cost of Power considered</i>	<i>Rs. 6.3 per kWh</i>
<i>Total saving per annum</i>	<i>: NRs.125 million</i>
<i>Estimated Payback Period</i>	<i>22.2 months</i>

Financially, WHRPG is also attractive for enterprises. A survey in state owned cement industries show that around 1.5 MW of power can be harvested with annual

saving of around NRs. 124 million yielding a payback period of around 22 months. With this statistical information, currently around 10 MW of power can be installed in all cement industries in operation. With its financial viability, the investment motivation may be slightly reduced by its initial installation cost. However, Industrial Policy-2010 highlights different aspect in promoting industrial product. The policy encourages the industries on using technologies with more efficient and are environment friendly. It also emphasizes providing different incentives to the industries on implication of energy efficient and environment friendly technologies. Cement industries can make a foray into solving the prevalent energy crisis with the implementation of WHRPG.

Industries have been benefited with energy, be it in any form, its optimal utilization not only provides energy saving paradigm but also reduces emissions and above all helps increase the business with a secured future sustainability. Wise involvement in energy saving, generation and re-use, helps foster the national economy, supports the welfare of the community with creating clean green environment.



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INTERVIEW WITH

Ms Yam Kumari Khatiwada (Baskota)
(Joint-Secretary & Spokesperson Ministry of Industry
National programme Director, Micro-Enterprise
Development Programme)



1. As a related authority of Nepalese Industries sector, how do you rate the current status of Nepalese Industries?

The current status of Nepalese Industrial sector is not up to the desired level. Some 12 or 15 years ago, the contribution of the industrial sector accounted for about 15% to the GDP of Nepal. However, due to various internal and external factors, it has been on a declining trend. The industry related policies like Industrial Enterprise Act 2049, Foreign Investment and Technology Transfer Act 2049 that we adopted after liberalizing our economy need to be revised with certain amendments. In this period, we have also joined different regional and international economic and trade networks, such as WTO, SAFTA, BIM-STEAC that resulted in termination of our long quota system and we have to compete in an open market. Our products found it even more difficult to compete globally in terms of quality and quantity of production. However, the scenario of this sector is improving now. The investment environment is being conducive and doing business is getting better in the country.

2. What major tasks is currently the Ministry of Industry(MOI) focusing on?

Ministry of Industry is focusing on the reformation of this sector to make it investment friendly. We have initiated the policies, Institutional and the procedural reforms. Similarly, we are focusing on the Industrial Infrastructure development to create a positive environment for investors who want to invest in large industries. Likewise, we are promoting small and cottage industries to uplift the rural economy for employment generation leading to poverty alleviation.

3. What policies is the Ministry of Industry currently working on?

Ministry has started the formulation of new poli-

"The role of Industrial Engineers is vital for the overall development of the Industrial Sector. Ministry of Industry recognized the need of involvement of Industrial Engineers to revive this sector"

cies and amendment of existing policies as per the requirements. Many policies and regulations are now in pipeline and some of them

have been already sent to the cabinet for approval. The draft of the new Industrial Enterprises Act has been forwarded to the cabinet for approval and to be submitted to the parliament. Similarly the new Foreign Investment Policy has been submitted to the cabinet for approval. The new Intellectual Property Policy, the amendment of Company Act, Special Economic Zone Act and Nepal Accreditation Council Act has been drafted and are in the process of public private dialogue. And some of them are ready to be sent to the cabinet.

4. What are the future plans of MOI regarding the industrial sector?

In addition to the policy reforms Ministry has declared to establish "Special Economic Zones" in 14 different places across the country. Bhairahawa, as the first economic zone is coming into operation. Some of the industrial sector such as cements has high potentiality to become self-dependent and even potential to export in a few years time. Realizing such potential the ministry is supporting for the development of basic infrastructure such as access road and the electric-

ity to such industries. We are also planning to renovate the existing Industrial estates and also working to expand new Industrial State.

To provide the administrative service and the facilities from one stop to the investors, we have proposed the one stop server center concept in the proposed Industrial Enterprises Act. In its initial phase, we have already started the visa service to the investors by setting the immigration unit in the premises of department of Industry and the focal person to deal with the tax issues of the investors. We are in the process of conducting organization and the management survey of the ministry specially focusing on the restructuring of our district level offices. We are also in the process of establishing an Industrial information unit in the ministry to manage the industrial information system.

Ministry has created some of funds like Technology fund, Women Entrepreneurs fund for the micro, small and cottage industries to facilitate such entrepreneurs for financial access and also to encourage the new innovators to invest. As ministry of Industry has the nominal budget allocation we are planning to increase our budget ceiling with an outstanding figure with some strong and justified program for the coming fiscal year.

5. Are there any special programs that MoI is planning to address the Industrial Engineers inside the country?

Currently, most of the Engineers working in this sector are from mechanical and chemical background. However, the role of Industrial Engineers is vital for the overall development of the Industrial Sector. Ministry of Industry recognized the need of involvement of industrial Engineers to revive this sector. We have also felt the need of producing new graduates as well as upgrading the skills of existing human resources in this sector to promote the industrial development in the country by exploring scholarship opportunities from different national and international institutions.

6. How will MoI employ the Industrial Engineering graduates for the betterment of Industrial sector in Nepal?

Recognizing the important role of industrial Engineers, the ministry plans to employ them in

industrial sectors. The ministry has initiated the process of conducting the management and organization survey of the ministry and its underneath organization to see the opportunities to create such post particularly to address the human resources need of large industrial corridors, Industrial estate and special economic zone and some of our technical departments. Once this get completed it will be good news for all of industrial engineering graduates.

Obviously, MoI as a leading and the parent ministry of Industrial sector we are very much serious to provide opportunities for Industrial Engineering graduates to work for the betterment of the industrial sector. Additionally, the private sector as a vibrant part of the economy will be able to provide larger employment opportunities to such graduates.

As Nepal is moving forward to the industrial development with the context of greater potential of this area the need of young engineering graduates committed for the industrial sector is immensely vital and I see the greater and bright future of all the new and emerging graduates of Industrial Engineering.

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Er. Ram Bade
Managing Director



जगदम्बा ई Fe 500 - नेपालको सबैभन्दा विश्वसनीय भुकम्प प्रतिरोधक छड।

सर्वोत्कृष्ट प्रविधि तथा प्रणाली द्वारा उच्च गुणस्तरको सुनिश्चितता
★ नियन्त्रित कच्चापदार्थ ★ नियन्त्रित उत्पादन प्रणाली ★ नियन्त्रित गुणस्तर मापदण्ड

भौतिक विवरण	जगदम्बा ई छड ई ५०० जोड	छड ई ५०० NS: १२१ सङ्कायकई	छड ई ५०० IS १८८४ : २००८ सङ्कायकई	छड ई ५०० जोड क्रिटिस सङ्कायकई	छड ई ५०० जोड अन्य साधारण छड
Yield Stress (N/mm ²)	≥ 500 ≤ 600	≥ 500	≥ 500	≥ 500	≥ 500
Tensile Strength (N/mm ²)	≥ 575	≥ 545	≥ 545	≥ 545	≥ 545
Ratio (Re) UTS/YS	≥ 1.15 ≤ 1.40	≥ 1.08	≥ 1.08	≥ 1.08	≥ 1.08
Elongation	14.5% (approx)	12%	12%	12%	12%

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Productivity Promotion

Challenges and Opportunities
in Developing Countries



Er. Ravi Kumar Mainali

Sr. Technical Expert, SEIDEU Funded Project.

Productivity is the measure of output i.e. product or services from input resources like Machine, Raw Material, Energy, Water, Space and Human Resources etc. Effective and efficient management of overall resources in the industries has become very challenging in a competitive business environment. Overall, resources can be classified broadly into two aspects. First is Technological/Hardware aspects and other one is Human Resources/ Software aspects. There are needs of technological interventions for optimization of machine, raw material, energy and other resources for a minimum input cost. Further, there are needs of interventions for optimization of human resources to their best potential abilities.

ous question arises: Where is the meeting point and solution for sustainability of these industries? The solution is effective & efficient overall input resource management to bring down the cost of products or services rendered. In addition to this, of course, Govt has to support in various aspects by upgrading and improving outdated Industrial policies. We have had some bad experiences that our Govt. has reacted to these situations only when there are a series of strikes and lock-outs. This is identical to giving Para-Cetamol to the patients to suppress the high temperature. In both cases, there is no attempt for drilling down root cause for long term solutions. It is noted that manufacturing industries can create more employment than any other industries. But the bitter truth is that investors are more skeptical to invest in manu-

Interventions on Technology (Hardware):

Recent study suggests that Nepal consumes double amount energy for same level of output of products or services as compared to developed world. Energy constitutes a major cost component for both manufacturing and service business operations these days. Therefore, saving energy ultimately minimizes the per unit cost of the products or services significantly eventually promoting the environment and leading for energy security. Most of the industries in the developing world have been facing problems of poor resource efficiency management practices eventually leading to creation of sick industries. Let me share a bitter experience; Govt. of Nepal declares and increases minimum wages of people working in the industries from time to time. Even the updated wages can't meet the basic requirements of small families of workers and as a result their livelihood becomes pathetic. On the other hand, our industries are being sick in increasing trend which are not in position to pay even existing wages scale to employees. Now, the seri-

"Interventions on Technological Advancements and Human Resources & Industrial Relations can help to boost up the Productivity Movements in holistic way at both enterprise and national Level."

input resources like energy, water and raw material we need technological advancement, competent manpower and constant innovative approaches & appropriate technology (Process Reengineering) which can save significant amount of input resources for better productivity. Almost all Asian Countries

(except few developed Countries) needs massive productivity awareness in order to be more cost competitive for global access of their products or services.



Interventions on Human Resources (Software):

It has been realized that all stakeholders (Department of

Labor, FNCCI, CNI, various research and academic institutions) related to productivity movements have concluded Human Resources are key assets for any business not the burden. All these feelings and expressions have been confined within the boundary

of workshops & seminars. In actual practice, there are many issues related with Employees-Employer relations. Due to lack of trust and transparency & honesty, we have experienced pathetic situations of the industries lock-outs, strikes up to physical attack of employers by employees. It is fact that unless employees are fully motivated towards their work, there won't be enhancement of productivity regardless of any latest technologies being adopted. There is always a blame to the management for justifiable compensation or wage rate and the employees feel they have been cheated or exploited by employers. On the other side, there is always blame from employers to the employees for not working up to their full potentials and they are under performing for day to day works and not taking ownership of their work. There is a strong need of mutual understanding between employees and employer for a better harmony in the whole Nepalese industrial and corporate cultures in order to build up level of trust and transparency. Hence, close communications



between employees and employers for decision making processes can help to reduce the lack of trust and transparency. Unfortunately, all these (software) issues of industrial relations have been given the least preference by all concerned stakeholders (Department of Labor, FNCCI, CNI and various research and academic institutions) including the policy makers. Therefore, this is the high time to accelerate the process of modernization and transformations of

industrial relations in Nepal. We can summarize that interventions on Technological Advancements and Human Resources & Industrial Relations can help to boost up the Productivity Movements in holistic way at both enterprise and national Level.

बालश्रम निवारण सम्बन्धी सूचना

१. बालश्रमीकको प्रयोग गर्नु कानुनी मात्र होइन सामाजिक अपराध पनि हो, त्यसैले बालश्रमको अन्त्य गर्ने प्रण गरौं ।
२. बालबालिकाहरुलाई दास बनाउने, बेस्यावृत्ति गराउने, भारी बोकाउने, शारीरिक यातना दिने, खानी वा कार्पेट जस्ता उद्योगमा काम लगाउने कार्य तत्काल बन्द गरौं ।
३. बालबालिकाहरुलाई लागु औषधको उत्पादन तथा ओसार पसार कार्यमा प्रयोग गरी उनीहरुको भविष्य नबिगारौं ।
४. बालबालिकाहरुलाई शिक्षा, स्वास्थ्य, सुरक्षा वा नैतिकतामा हानी पुग्ने जस्ता कार्य अविलम्ब रोकौं, राष्ट्रको भविष्यका कर्णधारको संरक्षण र संवर्द्धन गरौं ।
५. बालबालिकाको पढ्ने, लेख्ने, खेल्ने वा आराम गर्ने जस्ता नैसर्गिक अधिकारको संरक्षण गरौं ।
६. बालबालिकाहरुको शारीरिक, मानसिक र बौद्धिक विकासका लागि उपयुक्त वातावरण तयार गरौं ।
७. बालश्रम अर्को पुस्ताको लागि गरिबीको कारण हो त्यसैले बालबालिकाहरुलाई काममा नपठाई विद्यालय पठाऔं ।
८. बालबालिकाहरुलाई अन्याय, दुर्व्यबहार, दुराचार र शोषणमुलक बालश्रमबाट बचाई बाल अधिकारको संरक्षण र संवर्द्धन गरौं ।
९. के तपाईंलाई थाहा छ ? बालबालिकाको श्रम र पसिनाबाट उत्पादित सामान र सेवा सभ्य नागरिकहरुले उपयोग गर्न बहिष्कार गर्दैछन् ।
१०. आफुले पनि बालश्रम प्रयोग नगरौं र अरुलाई पनि प्रयोग नगर्न अभिप्रेरित गरौं ।
११. बाल श्रम उन्मुलन गर्ने कार्यमा सकृय सहयोग पुऱ्याऔं ।
१२. सार्वजनिक यातायातका साधनमा बालबालीकाहरुको श्रम प्रयोग नगरौं ।
१३. सबै सवारी साधनमा कार्यरत बाल श्रमीकहरुलाई उक्त क्षेत्रबाट मुक्त गरि उनीहरुको संरक्षण र बिकास गरौं ।

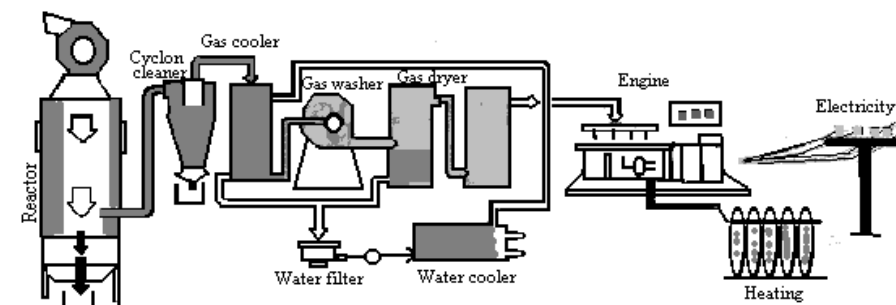


नेपाल सरकार
श्रम तथा रोजगार मन्त्रालय
श्रम विभाग

Bio-Mass Gasification



Bhishma Pandit
Senior Energy Expert



Biomass has traditionally always been an important energy source in Nepal for cooking and heating. Excessive reliance on traditional sources of energy is due to lack of other alternatives and because of poor economic conditions of a large segment of the population. These sources will continue to play a dominant role in the Nepalese energy system for years to come. Recently, there has been an increase in interest in biomass energy considering the benefits it offers: it is renewable, widely available, and carbon neutral. It also has the potential to provide significant productive employment in rural areas.

Gasification is not a new technology. Germany is a country with extensive historical knowledge in particle operation of gasifier powered vehicles, and a lot of literature is available from that time, which is not so long ago. It was during Second World War, when about 350,000 vehicles in Germany were running with gasifiers. However, it was not a free decision of the vehicle owners to fix a gasifier on the back of lorry or a private car, but was ordered by the military administration to save fuel for the war machinery.

Rural areas in developing countries are commonly characterized by scattered settlements and lack of infrastructure. A national electric grid, is a necessary catalyst for industrialization which could help raise living standards, but is still missing. Furthermore, it is extremely unlikely that it will be installed even in the medium term due to remoteness, difficult hilly terrain and poor access

between power stations, besides low level of industrialization. On the other hand, energy supply is the basic condition for improving living conditions and increasing productivity.

Many industries in Nepal use biomass as energy source, especially for thermal applications such as boilers. Nowadays industries are switching from fossil fuels to biomass for thermal requirements and power generation. Some industries have already implemented the project, others are in the process. They are using rice husks to replace furnace oil in furnaces for thermal application, and to generate electricity using gasification. One such industry, the Butwal Power Company is also undertaking a feasibility study to supply electric-

ity to Himal Iron, which manufactures Torsteel and TMT steel rods in Parsa district in the Terai. Makwana Biscuit Pvt. Ltd, Hulas Wire Industries, Hulas Steel Industries, Pioneer Wire Limited, and Arihant Group have already implemented co-generation biomass gasification projects for thermal and electricity generation. Similarly Dabur Nepal and Rajesh Metal are in the process of implementing similar projects in Nepal. The extensive use of biomass in Nepal for household and industrial energy needs indicates the potential of biomass as a viable energy source for Nepal. The use of biomass gasification for rural electrification still remains limited, though with large potential across the country.

Technology

Today, due to increasing fuel prices and environmental concerns, there is renewed interest in this century old technology, and gasification has now become a more modern and sophisticated technology.

Advantages

The primary advantage of this technology is its decentralized energy conversion system which operates economically even at small scales. Its components are also easy to build

The complete gasification system consists of gasification unit (gasifier), purification unit and energy converter - burners or internal combustion engine.

The gas producer is a simple device consisting usually of a cylindrical

container with space for fuel, air inlet, gas exit and grate. It can be made of fire bricks, steel or concrete or oil barrels. The design of a gasifier depends upon the type of fuel to be used and whether it is portable or stationary.

Process

Gasification is basically a thermo chemical process which converts biomass materials into gaseous components. This results in the producer gas containing carbon monoxide, hydrogen, methane and some other inert gases. Mixed with air, the producer gas can be used in gasoline or diesel engine, with little modifications.

Based on the design of gasifier and type of fuels used, there exists different kinds of gasifier. Portable gasifiers are mostly used for running vehicles. Stationary gasifiers combined with engines are widely used in rural areas in developing countries for many purposes including generation of electricity and running irrigation pumps. Since the technology utilizes biomass as fuel, it is of therefore of great importance.

Theoretically, almost all kinds of biomass with moisture content of 5-30% can be gasified. However, not every biomass fuel can result in successful gasification. Most of the development work is being carried out using common fuels such as coal, charcoal and wood. It was recognized that fuel properties such as surface, size, shape as well as moisture content, volatile matter and carbon content influence gasification.

The key to a successful design of gasifier is to understand fully the properties and thermal behavior of the fuel fed to the gasifier. Operation of gasification system demands a knowledgeable and skilled operator. Those interested in this technology must also remember that it requires hard work and tolerance. Compared to conventional systems with engines running on liquid fuel, biomass gasification technology may be inconvenient, but it is definitely economical for many applications, and has the potential for self-reliance in this crucial time of fuel crisis.

Gasification Process

The essence of gasification process is the conversion of solid carbon fuels into carbon monoxide by thermo chemical process. The gasification of solid fuel is accomplished in an air-sealed, closed chamber, under slight suction or pressure relative to ambient pressure.

Gasification is a complex thermo chemical process. Splitting of the gasifier into strictly separate zones is not realistic, but nevertheless conceptually essential. Gasification stages occur at the same time in different

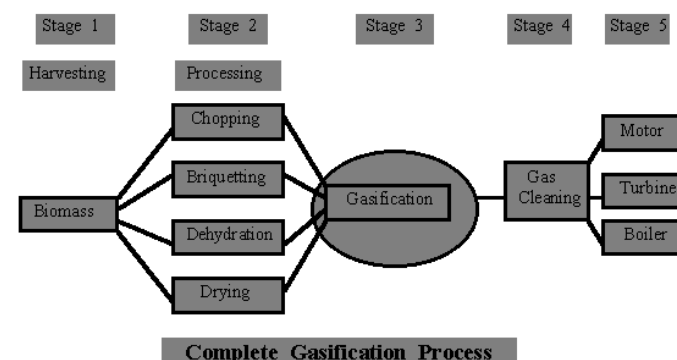
parts of gasifier.

Drying

Biomass fuels consist of moisture ranging from 5-35%. At temperatures above 1000 C moisture in the biomass is removed and converted into steam. During drying, fuels do not experience any kind of decomposition.

Pyrolysis

Pyrolysis is the thermal decomposition of biomass



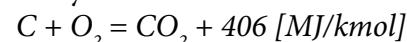
fuels in the absence of oxygen. Pyrolysis involves release of three kinds of products: solid, liquid and gases. The ratio of products is influenced by the chemical composition of biomass fuels and the operating conditions. The heating value of gas produced during the pyrolysis process is low (3.5 - 8.9 MJ/m³).

It is noted that no matter how the gasifier is built, there will always be a low temperature zone, where pyrolysis takes place, generating condensable hydrocarbon.

Oxidation

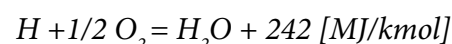
Introduced air in the oxidation zone contains, besides oxygen and water vapor, inert gases such as nitrogen and argon. These inert gases are considered to be non-reactive with fuel constituents. The oxidation takes place at the temperature of 700- 2000°C

A heterogeneous reaction takes place between oxygen in the air and solid carbonized fuel, producing carbon monoxide. Plus and minus sign indicate the release and supply of heat energy during the process respectively.



In reaction 12.01 kg of carbon is completely combusted with 22.39 of oxygen supplied by air blast to yield 22.26 of carbon dioxide and 393.8 MJ of heat.

Hydrogen in fuel reacts with oxygen in the air blast, producing steam.

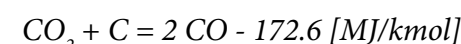


Reduction

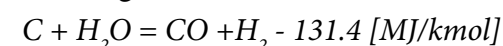
In reduction zone, a number of high temperature chemical reactions take place in the absence of oxygen. The principal reactions that take place in reduc-

tion are mentioned below.

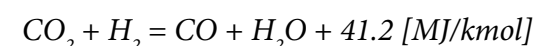
Boudouard reaction



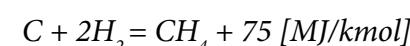
Water-gas reaction



Water shift reaction



Methane production reaction



Main reactions show that heat is required during the reduction process. Hence, the temperature of gas goes down during this stage. If complete gasification takes place, all the carbon is burned or reduced to carbon monoxide, a combustible gas and some other mineral matter is vaporized. The remains are ash and some char (unburned carbon)

Challenges of Gasification Systems:

Gasification is quite a complex and sensitive process. There exists high level of disagreement about gasification among engineers, researchers, and manufacturers. Many manufacturers claim that their unit can be operated on all kinds of biomass, but it is a quite questionable fact as physical and chemical properties vary from fuel to fuel.

Operation of diesel or gasoline engine is simple. Engine starts immediately and there is no trouble within the run. Handling of liquid fuel is also easy task. Anybody expecting something similar will be disappointed with operation of gasifier. It requires at least half an hour or more to start the system. Fuel is bulky and frequent re-fuelling is often required for continuous running of the system. Handling residues such as ash, tarry condensates is time consuming and dirty work. Driving with producer gas fueled vehicles requires much more and frequent attention than gasoline or diesel fueled vehicles.

Getting the producer gas is not difficult, but obtaining in the proper state is the challenging task. Gasoline and diesel have quite homogenous property. The physical and chemical properties of producer gas such as energy content, gas composition and impurities vary from time to time. All gasifiers have fairly strict requirements for fuel size, moisture and ash content. Inadequate fuel preparation is an important cause of technical problems with gasifiers.

Conclusion:

Gasifier is too often thought of as simple device that can generate a combustible gas from any biomass fuel. A hundred years of research has clearly shown

that the key to successful gasification is a gasifier specifically designed for a particular type of fuel. Those interested in this technology must remember that it requires hard work and tolerance. Although the technology is inconvenient, it is economical for many places and may lead to self-reliance in during these times of fuel crisis, and is especially attractive as a viable thermal and electric energy source for Nepal's rural areas where abundant biomass is available and electricity is unavailable and fossil fuel is expensive. Biomass gasifiers are also attractive as they facilitate environment conservation and protection.



MAHARSHI AND JETINKS

STAND ALONE UNIT
(HOLOGRAM APPLICATION)

The group is also involved in the manufacturing activity of Sticker (self adhesive) Labels, as a Supporting activity, as the most important input for labelling machines. The group is expanding the facility for printing unit boxes (cartons), tags, flexible packaging films, Tablet lines, filling lines, Track and Trace Solutions.

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It is a fact that Electrical Motor system account for about 60% of global industrial electricity consumption. Beside this, AC Induction motors consume more than half of the world energy. Massive energy wastage occurs during its operation as it lacks the intelligence to address energy wastage, carbon emission, wear and tear. Generally, the annual energy use of every motor system can be calculated based on standard engineering formula: *Annual energy consumption = (Horsepower X 0.746 X operating hours X motor loading) / Efficiency of the motor*

Basically, motor are mostly used in industries to generate mechanical energy. Motor generally converts electrical energy in to mechanical energy. When starting a motor it intakes high current known as “in-rush current”, which is 2 to 5 times the full load current.

“In average 1, 34,640 per month can be saved from a single motor of capacity 11 KW, if speed reduction can be decreased more than 10%”

For instance, if you need 20 Amps to run your motor continuously at full load then at the time of starting, your motor will draw 20 x 5 times the full load current which equals to 100 amps. Thus, the excessive current might results in a large voltage drops in the distribution network and even stop other machines which are already running on the supply mains. It can even lead to mechanical breakdown of motors and even peak demands penalties.

Similarly, your motor always runs at full speed, there is no any sensing mechanism through which it can sense the load so that it can maintain its speed as per load requirement. It means that motor cannot adjust their speed to match load changes and as a result it consumes more power than needed. Over sizing of motors, inefficiency could be another reason why motor consumes more power.

How to overcome such situation?

Using Drives is the best solution through which above problems could be solved and even your

system power factor (pf) can be improved. Drive is a device that controls the speed of motors by varying input frequency and voltage.

We all know that,

$N = (120f/P)$; where, N = speed of motor,

f = frequency and P = no. of poles

So, Speed (N) is directly proportion to frequency (f). Thus, varying frequency helps to vary speed.

Generally, drives provides a smooth, step-less acceleration known as “Soft Start”, to the motors through which you can avoid high initial inrush current. Installing drive will reduce mechanical breakdown of motors and even peak demands penalties. It also helps to reduce energy cost, your maintenance cost and finally helps to reduce your overall operating cost.

1% speed reduction of your motor = 3% energy saving.

Basic Saving Concept:

Suppose you have a motor with specification as below:

Motor Specifications:	
Type of Motor	Squirrel cage Induction Motor
Size of Motor	11 KW
RPM	1460
Application	Compressor
Rated Current / V	21.9 Amp / 380 V
Type of Industry	Plastic Industry

Your normal working hours/day = 16 hrs

Operating days/month = 25 days

Then your energy consumption by motor without using drive will be;

$KWh/month = (11 \times 25 \times 16) = 4400$ units

Using drive your energy consumption will be;

$KWh/month = (7.7 \times 25 \times 16) = 3080$ units (Calculation is based on 10% speed reduction means your frequency reduces by 10% which is 45 Hz)

Saving after use of VFD

Difference(unit)	1320 units
Cost of electricity(Rs.)	8.50
Savings in month(Rs.)	11,220
Savings in year(Rs.)	1,34,640

In average you are saving Rs 1, 34,640 per month from a single motor of capacity 11 KW. Saving can be extended if speed reduction can be decreased more than 10%.

Factors that should be consider while selecting drives:

- Capacity of motor (KW)
- Rated Voltage (V)
- Rated Current (I)
- Cable length distance from drive to motor
- Application of motor (whether it is for compressor, chiller etc)
- Rated Frequency (Hz)
- Rated speed of motor (RPM)
- Application areas: Mainly on Industries

- Metals, mining and mineral processing Industries
- Material handling Industries
- Chemical Industries
- Cement Industries
- Oil and Gas Industries
- Food and Beverage
- Water and Wastewater treatment
- HVAC (Pharmaceuticals, Apartments etc)

Benefits of using Drives in Industries:

- Reduce energy consumption and energy cost
- Improves product quality through smooth operation of machines
- Extends equipment life and eliminates maintenance cost
- Eliminates belt, gear and bearing wear and tear
- Smooth acceleration (Soft-Start) and de-acceleration (Safe-Stop) cycle
- ROI (Return On Investment) within a year through saving

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Trigeneration

"A way to make system efficient"

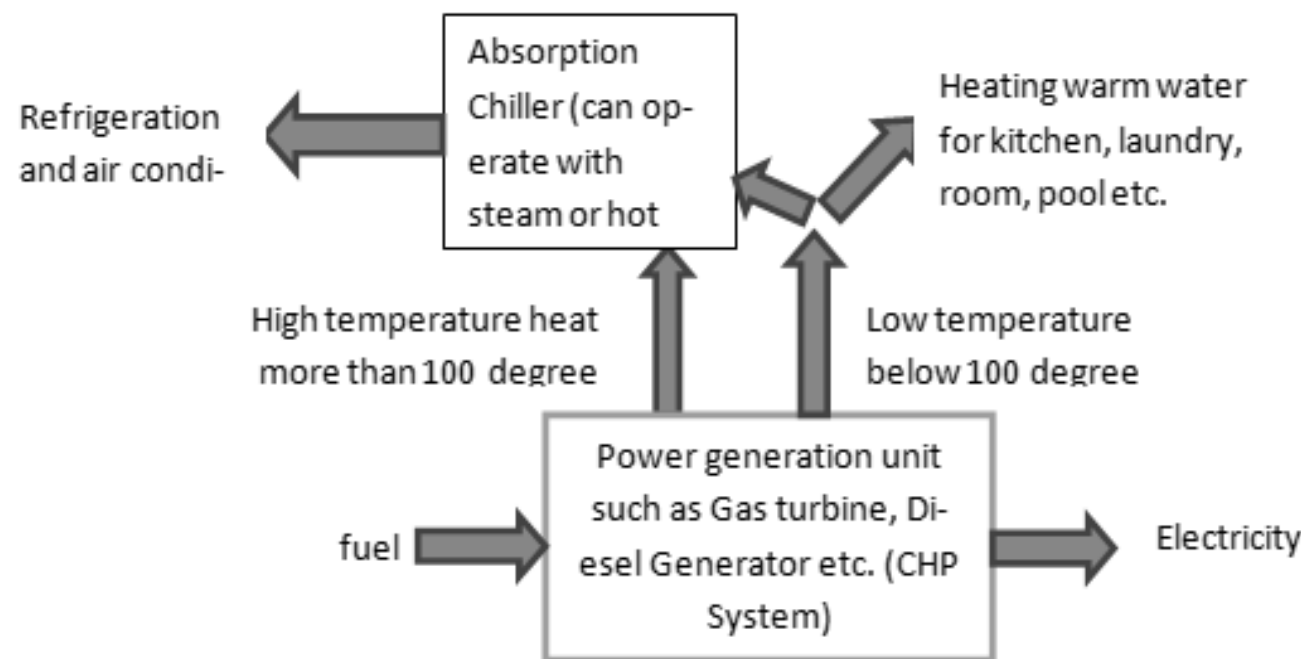


Rajan Sharma
BIE 3rd Year

Energy generation, energy efficiency and energy saving are the day to day discussion of the present world with the evolution of new technologies. The scenario of energy crisis which we have been facing and the increasing pollution are no new talks either. The world started to gallop in sector of energy, when Edison formulated a cogeneration system to supply electricity and steam to the public for the first time in 1882. Trigeneration is modern concept based on making efficient use of energy generated from cogeneration principle.

Trigeneration usually refers to the simultaneous production of cooling, heating, and power based on a single-energy source. It is also known as combined cooling, heating and power (CCHP). That is, if the heat produced from combined heat and power system (CHP) is used for cooling, as well as heating, the plant is called a tri-generation plant. CHP could refer to a cogeneration plant if it produces only heat and power. In a trigeneration plant, the waste energy from the generation units like gas turbine, diesel generator set and Boiler stack is used to drive both the heating and cooling systems. Therefore, the use of a trigeneration plant results in an improvement of the overall thermal efficiency and a reduction of the operation cost and contamination to the environment. Trigeneration plants are usually used as decentralized plants in order to keep the cooling and heating demands at the needed temperatures. Cogeneration or CHP systems combined with absorption chillers have provided lately an efficient way of recovering "waste" heat to cooling energy which increase the cycle year efficiency of a cogeneration plant.

Tri generation systems are mostly used where fuel is burnt to generate electricity and that electricity is used for



heating and cooling as in hospital, shopping complex, dairy based industries and other general offices where air conditioning system is applied. It can save energy and money in one hand and in the other hand it is helpful to decrease environmental pollution also by reducing CO₂ emission. In such places about 65% of generated electricity is used for heating and cooling purpose. By adopting tri-generation we can reduce it to half. The role played for reducing this percentage of energy is Absorption Chiller, which may be run from steam or by hot water or direct heat from the combustion heat. The hot water from the cooling circuit of any cogeneration plant and the hot exhaust gas from the gas engine is utilized as an energy source for a high efficient steam chiller or hot water chiller. Upto 80% of the thermal output from any cogeneration plant is thereby converted into

chilled water. And in cold session the heat can be utilized to cover the heat requirement. In this way the year round capacity utilization and the overall efficiency of the system is high. And due to the use of water as refrigerant replaces the use of ozone damaging substance. From this system cold water temperature can be down to 4.5 degree Celsius if lithium bromide salt is used. And temperature down to -60 degree if ammonia is used.

Load %	Gas flow rate Kg per second	Temperature	Waste heat recovery(Taking safe exhaust temperature as 180°C)
	5 MW		
60	7.5	325	$0.71 \times 10^6 \text{ kcal/hr.}$
70	9.80	330	$1.24 \times 10^6 \text{ kcal/hr.}$
90	10.08	355	$1.42 \times 10^6 \text{ kcal/hr.}$

Ref: illustration from IEMP

For the simple case, if we use 5 MW Diesel generator to fulfil our power requirement in a shopping complex, applied the generator to 90% load. The maximum attainable power efficiency for 90% load is 45-60% and remaining 55-40% of energy is converted to heat. This heat is exhausted from the stack of Generator. About 300-500 degree Celsius temperature is obtained from the stack. And also above 50-65% of electricity thus generated is used for heating and cooling i.e. for air conditioning and refrigeration. From the above table it is clear that there is chance to recover about 1.42×10^6 Kcal/hr heat energy which can be used for refrigeration and air conditioning and also for hot water by implementing tri-generation system. Thus saved energy can be used for other purpose in the plant or can be feed to the grid.

"As the saying goes the Stone Age did not end because we ran out of stones; we transitioned to better solutions.

The same opportunity lies before us with energy efficiency and clean economy" -Steven Chu

MY GREETINGS
AND
BEST WISHES TO
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THE SECOND EDITION
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PUBLICATION OF
THE SECOND EDITION
OF
INDUSTRIAL VISION



HEAD OF DEPARTMENT
DEPARTMENT OF INDUSTRIAL ENGINEERING
INSTITUTE OF ENGINEERING
THAPATHALI CAMPUS

INTERVIEW

With

Mr. Laxman Battarai

Mr. Laxman Battarai is the Executive Director of Industrial Enterprise Development Institute (IEDI), Tripureshwor, Kathmandu. IEDI is a national level autonomous resource organization committed to entrepreneurship and business development through training, research, consultancy, enterprise education and so on. It provides trainings targeted to provide practical market knowledge and exposure to existing as well as budding entrepreneurs inside the country. Here is a part of interview taken on his own office by Industrial Vision Team.

1. What types of training does the institution provide and who are your target groups?

Basically, we provide trainings under two categories: one to the potential entrepreneurs and second to the existing entrepreneurs and enterprises. Based on the abilities of potential entrepreneur, we provide them with enterprise development and new business creation trainings. In the duration of ten days, we explain them about the business, current market trends and product. At the end of the training, they have to prepare a business plan and present that in front of all. We also provide counseling services and follow up for what they are doing after they complete the training. To the existing entrepreneurs, we provide training services related to business counselling, productivity improvement, marketing, salesmanship, accounts and financial management and so on.

2. Are the trainings provided for free or are there any charges involved?

Generally, we don't take fees from the Government bodies and their officials but some NGOs and INGOs make contracts with the trainees and a small amount is charged and that charge depends on NGOs and INGOs making contracts. Recently, we provided training to a group who completed their skill training from Butwal Technical Institute (BTI).

3. What are the future activities of this Institution is planning to do?

The Government, specially, Ministry of Education has proposed to include enterprise development in the school curriculum for those who fail to complete the SLC level. The talks to include self-employment in +2 curriculums are also going in a positive direction. If



things keep going in the right direction, we will have these things implemented very soon. We have our own constraints but we are in a strategic planning related employment generation through self-employment for large amount of manpower going to Gulf countries every days.

4. Are there any programs this institution intends to do for the Industrial Engineers?

It is a long felt necessity to provide this training to Industrial Engineers who are the most probable future entrepreneurs and managers. It would provide them with required exposure and enhance their skills and competency to increase their level of understanding. We had provided the training to a batch some three years ago. But due to some technical and financial reasons, this training couldn't be continued. However, we are planning to provide such training at least once to every batch of Industrial Engineering. Let's see if we can start this trend from this year or so.

5. Are the training provided on routine basis and are there any criteria for selection of potential candidates for the trainings?

We have had no routine training in the past. We have also felt the need of a scheduled training by providing a formal notice for application. Obviously, it would generate a larger pool of interested candidates for the training and we could put some selection criteria too. But at present we are providing the trainings on a contract basis when there is a group of at least 10 or 15. We recently provided trainings to a group who returned from Israel learning Agriculture. We have future plans to make the trainings more scheduled and routine.

Entrepreneurship

Thinking Different



Santosh Bhandari
BIE 2nd Year

“Entrepreneurship is living a few years of your life like most of the people won't. So that you can spend the rest of your life like most people can't. “This statement may sound quite arrogant to the readers but actually it's more inspiring if you are a wannabe entrepreneur. Like most of the entrepreneurs out there in the world who are made, not born I aspire to be an entrepreneur in the future. There's no entrepreneurship gene that inherits generation to generation. Entrepreneurship is the process of starting a business or other organization. The entrepreneur develops a business model, acquires the human and other resources, and is fully responsible for its success or failure. Entrepreneurship operates within an entrepreneurship ecosystem.

Entrepreneurship is all about the innovation. Innovation, I would like to define as merged version of invention and commercialization. It is invention to solve a problem or develop a culture that promotes the experimentation and set of skills and commercialization to make the solution widely available or bringing up your ideas to the broader arena or audience. At present, when there is a risky situation to be jobless even when you are a university graduate, one bright insight- entrepreneurship can be a one-off decision. An entrepreneur develops a level of expertise as they are directly linked with what they are performing as business. Entrepreneurship as a career decision is hard to take as it is not a random joke that pops out in your mind having a lunch. If you want to succeed as entrepreneur, you are supposed to be serious right from the day you wish to be one. Being serious as in considering the factors that could make you a successful entrepreneur should be noted. The three main factors which may help you to be a successful entrepreneur are: experience as employee, higher education and mentors. When you are working in a big organization or corporate, you gain the experience and training you are looking for which can be helpful when you start your own firm.



Higher education has always been the driving factor no matter what career option you choose as it helps you reach the heights of success in the field you go with. You have that knowledge from your studies you pursued which you can use to brighten up your innovation. Lastly, mentors have always been the guide to your path. Having a mentor can really help you whether it may be decision taking, providing the deep technical knowledge or broad business skills. So

having these three attractive keys is a win-win game for the aspiring entrepreneurs.

Funding, people and know-how are the biggest barriers to entrepreneurial success. For an aspiring entrepreneur who only has college degree and idea, access to capital is the biggest problem. No-one is willing to risk their money on an idea which is unsure of being hit or flop on the global market. A light speed formula for funding startups can be: GF+GI+BT=Funding. Here, GF refers to Good Founder, GI refers to Good Idea and BT refers to Business Trajectory. For an entrepreneur who's having his/her first startup, being a good founder is out of the map. However, if s/he has the good idea and business trajectory, s/he may find a funder. Being an entrepreneur is basically selling your ideas or making your ideas so much luring that the investors can't stop themselves to fund you. Also if s/he has the proper business plans, market analysis, study of economical status and so on, then it's more likely of getting the idea invested. Also a single person cannot handle all the aspects of their business as s/he may not have deep technical knowledge with broad business skills. So it is essential to build a team where every single person shares the common motive.

Last but not the least; the entrepreneurship ecosystem is not far from you. It's your idea to make impact and make others life which eventually helps to shape our career in return. Build the essential assets and execute in a different way, you are not far from being a successful entrepreneur. Rise and Shine and make a better future ahead.

Entrepreneurial Engineers

Bridge-Builders to a Prosperous Nepal !



Ujwal Thapa
Chairman , BibekSheel Nepal

As an Engineer you have a choice right now: *"Either make your own dreams come true or you will be hired to make someone else's dream come true."*

If you chose to make your dreams come true, do continue below:

Engineers have to become entrepreneurs for Nepal

Why so? Because Entrepreneurs see opportunity in a problem. It could be any type of problem that we see in our everyday lives; impure food, lack of electricity and petroleum, transportation, healthcare and many others. Problems that we experience, read of and hear in any area could become an entrepreneurial opportunity.

Problems can come in various flavours – the product – too expensive, scarce, difficult to use, slow etc. Nepalese outside urban centres do not have easy access to doctors. In Nepal, we suffer from long hours of power cuts in the winter months. Food is getting very expensive in the cities. We want the world's best healthcare in Nepal, but may not have access to it, or afford it.

The harder this problem becomes, the better the opportunity for someone who can solve it. If you are an engineer, know how to create a device that can generate wind power then, you can manufacture and sell that for cheap, this is a great opportunity here. Not many people can create this device, and once you are in customers' homes, you can continue providing superior service and build a great business.

The larger the problem, bigger the opportunity is. A problem may only be for one person, or for many. If it is for one person, it is a one-time service and not a business opportunity. But if many people have the same problem, then it is a big entrepreneurial opportunity. For example, we all want to live in a well made house. However, we have serious building quality problems in earthquake prone Kathmandu now. This

is a great business with a huge market as everyone can benefit from your excellent standards. If you can solve Kathmandu's haphazard construction industry, with your business, you could become a billionaire. Plus, you would give service to millions and be thanked for the service you give.

Let us take examples of some famous entrepreneurs who were engineers, who have looked at a problem as an opportunity, built great businesses and changed the world and our lives.

In the 70s, people did not have computers in their homes like we do today. You had to go to a large main-frame computer centre and make a request to have your

work be accomplished. There may have been one or a few large mainframes in our region and your task may have taken a long time. Businesses such as cheap international calling, which depend on fast and cheap computers, were not around. It was hard

and very expensive to make an international call. If your family member were overseas, you would have only spoken once every few months. Today, we are in a connected society in which we use social networking sites Cisco, Intel, Google, Apple, Skype, Facebook and other technologies to stay connected in real-time.

In Nepal, look at how Bijay Rajbhandari and fellow engineers have transformed CE constructions into a brand known for its quality and timely delivery of its projects and how Rudra Pandey developed IT healthcare software company, D2Hawkeye and sold it for millions of dollars to Verisk in USA.

So I hope that each of you engineers start seeing an opportunity in the problems that we see every day in our lives and start solving it (instead of waiting for Pashupatinath to come and fix it for us).

Entrepreneurial Engineers have to become bridge-builders of Nepal

Did you know, Nepali engineers were actively involved

in building the Burj Khalifa, the tallest building in the world located in Dubai? Did you know that Nepali engineers are developing the next generation World cup stadiums in Qatar for 2022 rumoured to be air conditioned. Yet, Nepal regularly begs for money to renovate its old temples or build bridges/roads/IT infrastructures from foreigners. We have rarely have built any engineering marvels (or any) since Bhimsen Thapa built the Dharahara. Ask yourself why?

This is because we Nepalese have chosen to become individually excellent, but collectively as a nation remained a failure. As an engineer, I urge you rise up to move beyond becoming individually excellent to build an environment for an excellent nation. To build such a nation, we have to rise up and beyond to bring the nation builders together. Will you become this "bridge" between nation builders?

Certainly I am not talking about a plain bridge (made on roads or rivers). I am talking about a man or a woman who builds and safeguards a bridge (platform/environment) that will connect Nepal of today to the "nation builders" of tomorrow. As a bridge builder your role is simply, consistently and persistently align all the positives in Nepal, in the same direction, so

that the negatives will become irrelevant.

I believe, 'bridge builders' are the real leaders of Nepal. Bridge-builders could be someone just like you, talented men and women who decide to rise up to the challenge of building positive platforms for others. Bridge-builders forgo their short-term individual benefits in exchange for long-term all-encompassing benefits. Other nation builders will come in to build Nepal and protect our future, only if you work towards building positive platforms yourselves.

As a young bright Engineer, you have the talent, skills and grit to become our nation's leaders by becoming that "bridge-builder" everyone is looking for. In the end, I leave you with this quote,

"There are a thousand hacking at the branches of evil to one who is striking at the root." – Henry Thoreau

Ask yourself - Will you start hacking at the roots of evil in Nepal (or stick to hacking at the branches just like the thousands before you)?

(The writer can be reached on his blog www.whynepal.com)



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Challenges of Effective Supply Chain Design In Nepal



Smaran Khanal
BIE Final Year

An effective supply chain is characterized by its ability to deliver right item in right quantity at right place for right price in right condition to the customer. When any of these criteria are not addressed, we know the supply chain is not behaving in an effective manner. The supply chain of any item is affected by various factors i.e. condition of the country. For example the supply chain of a same product involving similar parties in Nepal and the United States is never the same. The physical infrastructures, cost of the logistics, integration with IT affect the status of supply chain. Some of the major challenges or obstacles for effective supply chain design in developing country like ours can be enlisted as follows:

- Higher cost of logistics
- Inadequate infrastructure scenario
- Technology usage and inadequate investments in IT
- Lack of co-ordination within the parties involved

The logistic cost involves the cost from purchase of raw materials to the delivery of the final product. The logistic cost forms a larger part in total cost due to poor infrastructural facilities in country. The logistic cost is also influenced by constraints such as shortage in electricity and skilled labor, road etc.

Transportation network is a major part of the supply chain management. Nepal being a landlocked country has no access to sea and we are also deprived of cheaper transportation railways. So obviously our foreign trade is disadvantaged. Within the country we lack a good roadway network and many places inside the country are still deprived of road transportation facility. So goods produced in one part of the country cannot reach to the market where the demand is higher. In contrary to this, the needy market has to import the goods from the neighboring countries at relatively higher price. For example: The farmers who cultivate apples never get a fair price of their production in hilly regions and the terai imports apples from nearby Indian market at a higher price.

In developed countries the concept of e-commerce and e-supply chain is very common. People have even

moved on to carrying out web business without any brick and mortar base. But in developing country like ours where still most of the population has no access to the internet, these things only exist in our fantasy tales. Information is essential to make the supply chain and logistics decisions because IT provides the global scope needed to make optimal decisions. Best in class companies in worldwide have successfully used sophisticated IT systems to streamline process and enable effective decision making. The recent technological advances in IT have made it possible to make supply chain lean and thin. But in the country like ours the technological usage is very low, which restricts the scope of increasing productivity and efficiency.

The physical infrastructures available in the country are not in the hand of a single business firm so that they can change the status to make their supply chain effective. But a major thing that can be done is to enhance a proper co-ordination between various parties of a supply chain. The major problem in supply chain of Nepalese products is it involves too many middlemen. As a result the manufacturer (farmers for agro products) never gets a good price of their products and the last party customer has to pay very high for the same product. A proper redesign of the whole supply chain and proper co-ordination between the parties would certainly help to make the existing supply chain more efficient.

Managing supply chain in a country like ours is one of the most challenging jobs for any organization because of existing business practices, governmental regulations and technological capabilities. To achieve an improved performance, the organization should focus on coordination and techniques which offer strategic opportunity to gain an increase in revenue. This is possible by improving the infrastructural development and refocusing on integrating IT with supply chain management and logistics. Organizations must realize that they must harness the power of IT to collaborate with their business alliance. It would definitely have some positive impacts on existing problems of supply chain in Nepal.



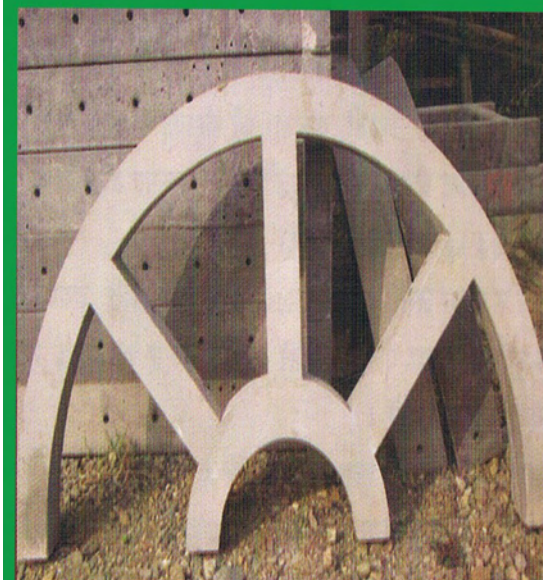
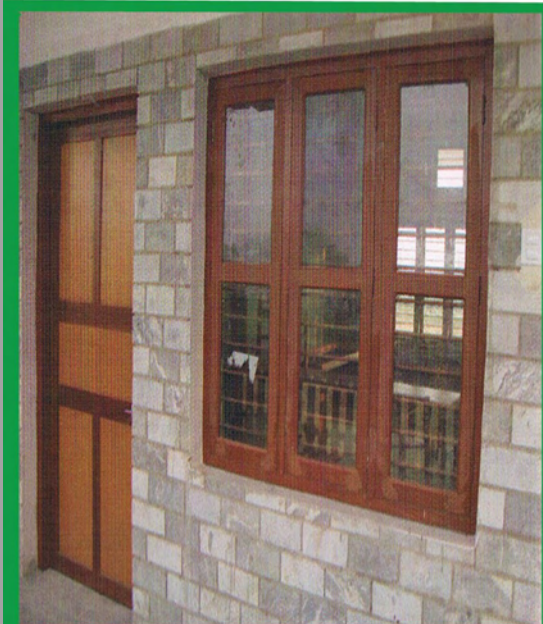
Panchakanya

Always First ... Always Ahead





विकल्प कंक्रीट उद्योग Bikalpa Concrete Udhdyog



“हरियो वन नेपालको धन” यो नारा अब केवल उखानमा मात्र सिमित हुने अवस्थामा हामी आइपुग्न लागेको स्थिति छ । यस परिप्रेक्ष्यमा हामीले वन पैदावारको जगेर्ना गर्ने उद्देश्यका साथ नेपालमा नै पहिलो पटक यस प्रकारका कंक्रीटका भ्याल, ढोकाका चौकोस, आर्क, भेन्टिलेसन आदि सामग्रीहरु अत्यन्त नविन र सुन्दर मोडेलमा बजारमा ल्याएका छौं । अहिलेको बढ्दो जनसंख्या, त्यही अनुपातको घर निर्माण, निर्माण सामग्रीको मूल्यमा आएको बृद्धि, त्यस माथि पनि काठको अभाव र मूल्यले त भन्ने निर्माण कार्य चुनौतीपूर्ण बनाएको अवस्था छ । यस्तो सन्दर्भमा हाम्रा उत्पादनहरु बजारमा काठको भन्दा धेरै सस्तो, सुन्दर र गुणस्तरीय छन् । हाम्रा उत्पादनहरुको नेपाल गुणस्तर तथा नापतौल विभागबाट कडापनको परीक्षण समेत गरीएको छ ।

हाम्रा उत्पादनहरु

भ्याल:

- ५ फिट उचाईका १ देखि ४ पल्ले (प्रति पल्ला चौडाई १८ इन्च)
- ४ १/२ फिट उचाईका १ देखि ७ पल्ले (प्रति पल्ला चौडाई २० इन्च)
- ४ फिट उचाईका १ देखि ५ पल्ले (प्रति पल्ला चौडाई १८ इन्च)
- ४ १/२ फिट उचाईका १ देखि ४ पल्ले (भेन्टिलेसन सहीत)
- ४ फिट उचाईका १ देखि ३ पल्ले (प्रति पल्ला चौडाई १६ इन्च)
- ४ फिट उचाईका १ देखि ३ पल्ले (प्रति पल्ला चौडाई १२ इन्च)

ढोका:

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भेन्टिलेसन:

- १५ इन्च उचाईका १ देखि २ पल्ले
- २० इन्च उचाईका १ देखि ४ पल्ले

आर्क:

- ४८ इन्च, ४० इन्च र ३६ इन्च

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विकल्प कंक्रीट उद्योग

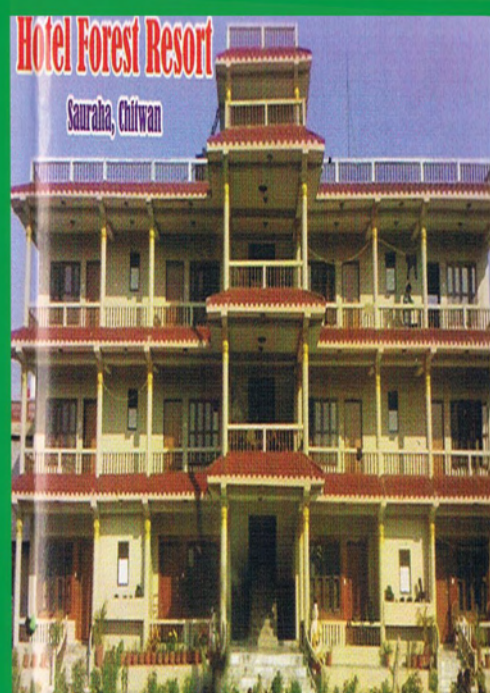
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Marketing Director: मो ९८५५०६९९७७

Email: bikalpconcrete@gmail.com

Website: www.bikalpaconcrete.com



The Voice of a Young Entrepreneur

Er. Brijesh Gupta
M.D., E Signature



Er. Brijesh Gupta, Managing Director of E-Signature Company, may be a source of inspiration for all budding entrepreneurs inside the country. He now owns a company having a turnover of three crores which he started with a small sum of Rs. 27,000. In a country where even the technical graduates strive for the job, he is not only self-employed but he has also employed 45 others from a technical background.

After graduation when most of his fellow batch mates opted for going to foreign land in search of opportunities, his confidence to do something inside his own country kept him here. But confidence alone doesn't pay off and he blended his confidence with his passion, hard work and dedication and that is the reason why he is here today. "I used to see hoarding boards in the way and contact who didn't have their own websites", he said remembering of his past. In his opinion, patience for two to three years is a must if you want to establish your own business. **"I have had difficult times at the beginning but I didn't quit. I kept struggling and that is why I am here today", he says.** That is the time when most of the entrepreneurs withdraw their hands from their business. "I have had difficult times at the beginning but I didn't quit. I kept struggling and that is why I am here today", he says.

His company makes android based apps mostly for American and Canadian companies. When asked if his company had any plans to work for Nepalese companies, he said, "Nepal is still backward in terms of technology. Hardly two lakhs people out of 40 lakhs in Kathmandu carry a smartphone with them. The condition in rural areas is even worse". "But the situation is improving and we are working on two different types of apps for a Nepalese owned company", he added. He believes there is no adequate support from Government and it's institutions to encourage the new entrepreneurs. "You can almost assume the Government support is at a zero level and this is very discouraging", he said. This is the main reason that most of the people are going out of the country. In other words, Government itself is encouraging brain drain.

"But these are all excuses; Where there is a will there is a way", said the motivated young entrepreneur.

All he wishes from the Government side is to create a positive environment so that the new entrepreneurs will enter with even more enthusiasm. The provision to provide uninterrupted power supply is the first and foremost thing the Government should assure. Secondly, the outdated labor laws should be modified dynamically along with the time. He also aspires for an up-graded labor law in IT sector.

Like all other IT companies, he dreams of establishing an office in Silicon Valley very soon. He has asked all young aspirants who wish to do something inside own country to keep patience and believe in hard work to succeed. "There are abundant problems at the beginning. But if you march on tackling each problem, you will definitely reach a height of success", he said. His company E-Signature Pvt. Ltd. also offers internship program for interested candidates time and again. This has helped to increase a number of trained and skilled manpower in Nepalese market. In the nutshell Er. Brijesh Gupta and his company are together providing new dimensions in Nepalese IT sector.

(Based on an Interview with Miss. Rishta Karki)

Industrial Automation

"Past, Present And Future"



Technological advancements in industrial automation, process monitoring and control over the past decades have contributed greatly to improve the productivity of virtually all manufacturing industries throughout the world. While 90% of global production is still controlled by analog instrumentation, almost all the controls installed as a part of a new plant or plant expansion are Digital Control Systems DCS connected by digital networks. Automatic control has played a vital role in the advance of engineering and science. In addition to its extreme importance in space-vehicle systems, missile-guidance systems, robotic systems, the automatic control has become an important and integral part of modern manufacturing and industrial processes. For example, automatic control is essential in the numerical control of machine tools in the manufacturing industries, in the design of auto pilot systems in aerospace industries, and in design of cars and trucks in the automobile industries. It is also essential in such industrial operations as controlling pressure, temperature, humidity, viscosity, and flow in the process industries.

Since advances in the theory and practice of automatic control provide the means for attaining optimal performance of dynamic systems, improving productivity, relieving the drudgery of many routine repetitive manual operations, and more, most engineers and scientists must now have a good understanding of this field.

The rear-view mirror

Over the past few decades, some innovations have indeed given industrial automation new surges of

growth: The programmable Logic Controller (PLC) – developed by Dick Morley and others – was designed to replace relay-logic; it generated growth in applications where custom logic was difficult to implement and change. The PLC was a lot more reliable than relay-contacts, and much easier to program and reprogram. Growth was rapid in automobile test-installations, which had to be re-programmed often for new car models. The PLC has had a long and productive life – some three decades – and (understandably) has now become a commodity.

At about the same time that the PLC was developed, another surge of innovation came through the use of computers for control systems. Mini-computers replaced large central mainframes in central control rooms, and gave rise to “distributed” control systems (DCS), pioneered by Honeywell with its TDC 2000. But, these were not really “distributed” because they were still relatively large clumps of computer hardware and cabinets filled with I/O connections.

The arrival of the PC brought low-cost PC-based hardware and software, which provided DCS functionality with significantly reduced cost and complexity. There was no fundamental technology innovation here – rather, these were innovative extensions of technology developed for other mass markets, modified and adapted for industrial automation requirements.

Automation software has had its day, and can't go much further. No “inflection point” here. In the future, software will embed within products and systems, with no major independent innovation on the horizon. The plethora of manufacturing software solutions and services will yield significant results, but all as part of other systems.

So, in general, innovation and technology can and will re-establish growth in industrial automation. But, there won't be any technology innovations that will



Rahul Gupta
Instrumentation and Control Engineer

generate the next Cisco or Apple or Microsoft.

We cannot figure out future trends merely by extending past trends; it's like trying to drive by looking only at a rear-view mirror. The automation industry does not extrapolate to smaller and cheaper PLCs, DCSs, and supervisory control and data acquisition systems; those functions will simply be embedded in hardware and software. Instead, future growth will come from totally new directions.

New technology directions

Industrial automation can and will generate explosive growth with technology related to new inflection points: nanotechnology and nanoscale assembly systems; MEMS and nanotech sensors (tiny, low-power, low-cost sensors) which can measure everything and anything; and the pervasive Internet, machine to machine (M2M) networking. The future belongs to nanotech, wireless everything, and complex adaptive systems.

Major new software applications will be in wireless sensors and distributed peer-to-peer networks – tiny operating systems in wireless sensor nodes, and the software that allows nodes to communicate with each other as a larger complex adaptive system. That is the wave of the future.

The fully-automated factory

Automated factories and processes are too expensive to be rebuilt for every modification and design change – so they have to be highly configurable and flexible. To successfully reconfigure an entire production line or process requires direct access to most of its control elements – switches, valves, motors and drives – down to a fine level of detail.

The vision of fully automated factories has already existed for some time now: customers order online, with electronic transactions that negotiate batch size (in some cases as low as one), price, size and color; intelligent robots and sophisticated machines smoothly and rapidly fabricate a variety of customized products on demand.

The promise of remote-controlled automation is finally making headway in manufacturing settings and maintenance applications. The decades-old machine-based vision of automation – powerful super-robots without people to tend them – underestimated the



importance of communications. But today, this is purely a matter of networked intelligence which is now well developed and widely available.

Communications support of a very high order is now available for automated processes: lots of sensors, very fast networks, quality diagnostic

software and flexible interfaces – all with high levels of reliability and pervasive access to hierarchical diagnosis and error-correction advisories through centralized operations.

The large, centralized production plant is a thing of the past. The factory of the future will be small, movable (to where the resources are, and where the customers are). For example, there is really no need to transport raw materials long distances to a plant, for processing, and then transport the resulting product long distances to the consumer. In the old days, this was done because of the localized know-how and investments in equipment, technology and personnel. Today, those things are available globally.

Hard truths about globalization

The assumption has always been that the US and other industrialized nations will keep leading in knowledge-intensive industries while developing nations focus on lower skills and lower labor costs. That's now changed. The impact of the wholesale entry of 2.5 billion people (China and India) into the global economy will bring big new challenges and amazing opportunities.

Beyond just labor, many businesses (including major automation companies) are also outsourcing knowledge work such as design and engineering services. This trend has already become significant, causing joblessness not only for manufacturing labor, but also for traditionally high-paying engineering positions.

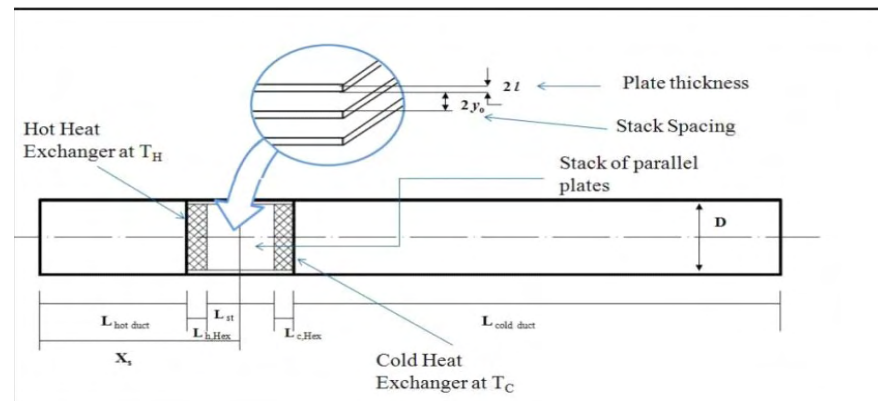
Innovation is the true source of value, and that is in danger of being dissipated – sacrificed to a short-term search for profit, the capitalistic quarterly profits syndrome. Countries like Japan and Germany will tend to benefit from their longer-term business perspectives. But, significant competition is coming from many rapidly developing countries with expanding technology prowess. So, marketing speed and business agility will be offsetting advantages.

Thermoacoustics

"A New Concept"



Sujan Adhikari
Mechanical Engineer



Thermoacoustics, the science concerned with the interaction of thermodynamics and acoustics deals with the transformation of the thermal energy (heat) is transformed into acoustic energy (sound) and called a thermoacoustic power generation. These equipments are called thermoacoustic engines or prime movers. The second one, where the acoustic energy is transformed into thermal energy and it is called thermoacoustic refrigerator or heat pump. This effect can be used to develop thermoacoustic refrigerator which have many advantages over the conventional vapor compression cycles along with many challenges as well.

Thermoacoustic devices can be classified into three main categories: A thermoacoustic heat engine or prime movers, where the thermal energy (heat) is transformed into acoustic energy (sound); a thermoacoustic refrigerator or heat pump, where the acoustic energy is transformed into a heat transfer from a cold space to a hot space; and the thermoacousti-

cally-driven thermoacoustic-refrigerator (TADTAR), which is a thermoacoustic engine driving a thermoacoustic refrigerator.

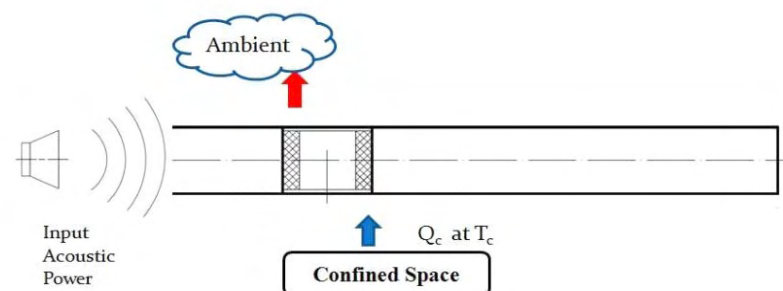
2. History of Thermoacoustics

Although the thermoacoustic effect was first investigated a century ago by Kirchhoff (1869), the word "thermoacoustic" is very recent. The earliest observations for the effects of thermal energy on sound were recorded by B. Higgins at 1777. When a hot flame was placed at certain position in a glass tube, open at both ends, sound was emitted. The explanation of how this works was given later by Lord Rayleigh. Other observations were recorded after that by Sondhauss (1850) and Rijke (1859). In the so-called Rijke tube, a screen of metal wire was used as a heat source, instead of the flame. It also found to emit audible sound when it was

heated and placed in vertical position. The frequency of the sound depends mainly on the amount of heat and geometry of the tube. Sondhauss' investigations were more empirical and systematic. He found a direct relation between the frequency and the geometry of the pipe and he also realized that the sound intensity increases with the temperature of the screen wires. Rayleigh (1896) attempted to explain these observations and highlighted the importance of the phasing between the temperature and pressure in the process. However, the credit for initiating the theoretical thermoacoustic science is given to Kirchhoff (1869). He investigated the sound attenuation in tubes due to heat transfer from the gas to the tube walls.

3. Analysis of Thermoacoustics

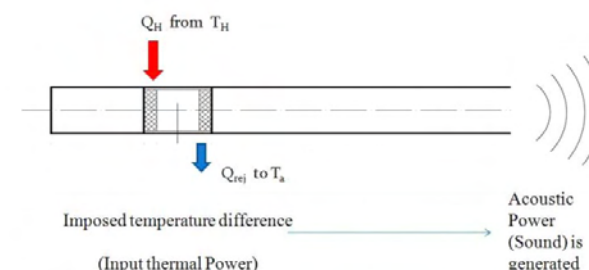
Over the past three decades huge developments were encountered in the application of thermoacoustic effects to build actual operating devices. Those devices were working properly, well tested, and proved to give high efficiency. They have two major advantages. Firstly, they are working on a completely environmentally benign gas and secondly, they have no moving parts (or at least one moving part in the acous-



tically driven devices). Adding to those, the simple structure, the fact that they can be powered by solar energy or waste heat, and the insignificant need for sophisticated material solutions, one can figure that thermoacoustic devices are a huge step towards the global implementation of clean and renewable sources of energy and the replacement of the usual fossil fuel powered devices.

"Over the past three decades huge developments were encountered in the application of thermoacoustic effects to build actual operating devices"

On the other hand, like most of the implementation techniques of renewable sources of energy, thermoacoustic devices cannot give higher efficiency than their conventional counterparts. They also suffer a very low power density (power to volume ratio) and till now they were not built in huge scale (to power a whole city for example). However, they aren't technically mature yet and maybe with further researches



they will be a great choice as a candidate for fossil fuel replacement.

4. Basic structure of thermoacoustic device

One of the most advantageous features of the thermoacoustic device is its simple structure. A schematic drawing is shown in figure below describes the basic

components of any thermoacoustic device (whether it is an engine or a refrigerator).

Any standing-wave thermoacoustic device must comprise a resonance tube (called resonator for short). Inside this resonator a stack of parallel plates is placed between two heat exchangers.

In case of power generation (i.e. engine), heat is introduced to the hot heat exchanger at high temperature.

While the other heat exchanger kept at ambient temperature, acoustic power will be produced according to the previous operating principle and some amount of heat will be rejected to the ambient, shown in figure below. In this case the acoustic power will flow into the cold duct part and can be used directly or transformed into electricity by linear alternator or a piezoelectric material, schematic shown in figure below.

In case of power consumption (i.e. refrigerator), heat is extracted from the cold hot heat exchanger at low temperature. While the other heat exchanger kept at ambient temperature, acoustic power will be consumed to make such an effect. In this case the acoustic power will flow into the hot (ambient) duct part from an acoustic driver (loud speaker), as shown in figure below. The refrigeration effect will be encountered and some amount of heat will be rejected to the ambient at the hot heat exchanger.

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AC

"HEY GOT AC (AIR CONDITIONING) IN YOUR FIRM?"



Bishal Jirel
BIE 3rd Year

The technical arm has conquered every corner of the world and made it suitable zone for habitation. Among the myriad technical boon one of the rapidly applied and developing technologies is AC. So, what is this AC technology or simply AC?

In general, AC is a system that lowers down the room temperature. But technically speaking, it is a system using vapor compression cycle for modifying the condition of air (heating, cooling, de-humidification, cleaning, ventilation or air movement) for thermal comfort and indoor air quality. However, when it comes to construction, such a complete system of heating, ventilation and air conditioning is broadly termed as HVAC (heating, ventilation and air conditioning). But the following content will be enlightening mainly the cooling function.

Who would have thought a century ago that the Middle East countries like UAE, Saudi Arabia, Israel, Qatar, and Oman etc. will be one of the leading centers of excellence for trade, tourism, commerce, industry etc. today? As a result of application of AC technology the desert world has become virtual for the inhabitants. Human accommodations and enhanced working efficiencies is just like buying one and getting another one free scheme provided by this technology, resulting in the economic boom of the vicinity which the current world is too witnessing. The technology is not limited in that region only but has left its foot prints in the various parts of the world. Some of the quotations indicating the significances of the technology –

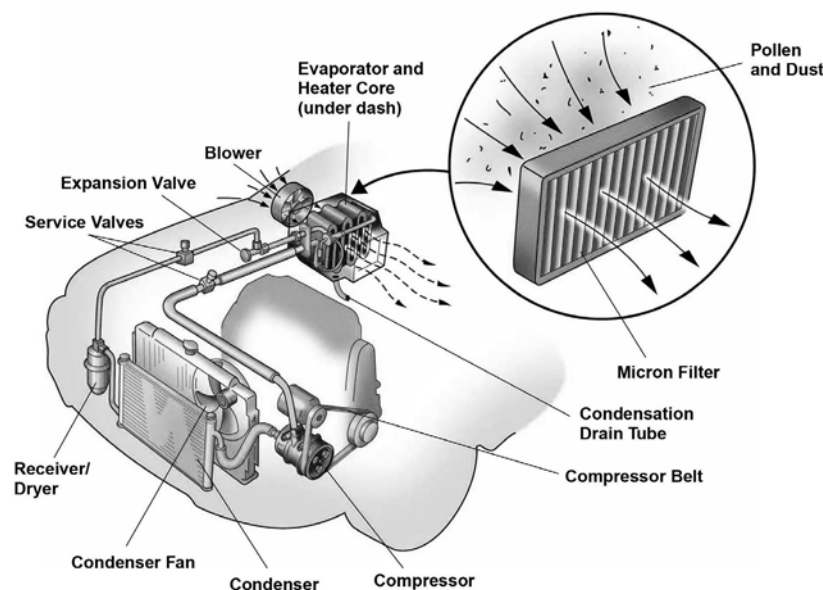
"It was luxurious like air conditioning that brought down the Roman Empire. With air conditioning their windows were shut, they couldn't hear the Barbarians coming." – **Rem Kohass**

"A true fascist is anyone who wants to take my air conditioning away or force me to ride a bike." – **David Harsoyni**

"The window air conditioner allows architects to be lazy. We don't have to think about making a building work, because you can just buy a box." – **Anonymous**

For any pioneer company or industry its manpower is its primary matter of concern. Proactive and healthy human resource human assets from different levels and their working environment are of great importance. But even though the working room seems simple, it is a gigantic heat source. Let's take a short glance below-

Air Conditioning System



1. A person involved in indoor activity will produce between 200W and 600W depending upon their age, size and specific activity. Large no. people means same amount of significant heat.

2. Each light of certain wattage and individual bulbs can be in the range

of 100W.

3. Any electric appliances that use electricity will produce certain amount of heat as a waste.

4. Heating of walls and roofs due to sunlight also add significant amount of heat to the room.

5. Although hot winds are a rare cases in our country but it will add too some amount of heat in the room at the time of its existence.

This figure implies that the large workshop is a lump of heat source, undesirable smokes and dust. The more heat means more sweating by the workers, more prone to severe health problems and spreading of communicable diseases like tuberculosis, influenza, meningitis etc. at ease. Cornell University's (U.S.A) research paper showed that employees committed 44% more errors below 68 degree Fahrenheit (20°C) and were less than half productive above 78°F (25.56°C). So, maintaining a healthy environment in the industrial premises for better human ergonomics and to promote efficiency has become a dire necessity and a great challenge too. Big companies like Chaudhary Group, Shekhar Shoes spend loads of money in doctor facility and medicines weekly for the health care of their workers. Although it sounds good but a proper AC and ventilation application would have greater impact on their health and for sure will reduce the toll of patients with less cost margin leading by greater human productivity.

How will it benefit the firm?

1. Increased working efficiency:

AC makes the working temperature in comfort level resulting in a better working condition. Uncomfortable temperature causes irritation of mind and lack of concentration. The person gets tired fast in hot condition. At the comfort condition created by the AC, the person feels calm from deep inside and is able to work at more ease.

2. Better health:

AC circulates filtered air inside the working place. The air is free from dust and dirt particles, smoke, microorganisms, and airborne bacteria. Due to this, health of the worker is improved.

3. Eliminate noisy condition:

The air conditioned room has its windows and doors closed; due to this less outside noise enters the room. Even the noise from AC is very low. Therefore employer can concentrate on his job and his efficiency increases.

4. Fresh air:

As mentioned earlier, the moment you are at the sight of AC you will be inhaling fresh air, making you much healthier. It reduces dust, house mites, pet fur and pollen.

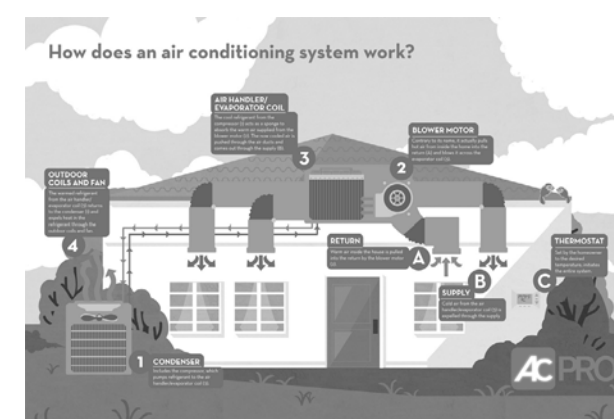
5. Multipurpose:

Though AC is known for cooling function mostly but the fact is it can be used for heating purpose as well consuming up to 80% less power than any other form of electric heating, for e.g. Electric heater, and resulting in less electric bill.

For the western side and Middle East part of the world AC has become luxury par necessity, both for household and industrial purposes. The U.S. department of labor enforces the law of maintaining the minimum temperature for indoor workplace of 68 degree Fahrenheit (20°C) to maximum of 78 degree Fahrenheit (25.56°C) which indeed promotes the wide use of AC.

In Nepal, the technology is making its way for the advancement. Since it's futile to designate time and again the same importance of human asset's efficiency from the firm's perspective for overall prosperity; therefore, the wise step is to adapt the technology.

The installation cost of the system might seem a bit high but overall the firm will remain in profit. The companies like Air Tech Industries Pvt. Ltd. and R R Trade Link Pvt. Ltd. provide from installation to various maintenance facility in Nepal. Despite having uneven pros and cons, as an Industrial Engineering student I strongly recommend the firm holder to adapt one of its kinds to make workplace better for employer because if the foundation is strong, the remaining structure will obviously be strong.



MY GREETINGS
AND
BEST WISHES TO
SOIES-NEPAL AND
MAGAZINE TEAM
FOR
THE SUCCESSFUL
PUBLICATION OF
THE SECOND EDITION
OF
INDUSTRIAL VISION

Prakash Acharya
Former President
SOIES-Nepal

Industrial Revolution



Bipin Bashyal
BIE 1st Year



The fundamental questions before the initiation of any discussion are: What, why and how? Rushing into the conclusions without giving the reader a general idea of the topic being discussed makes it one of the many futile speeches offered by those whose only skill is to talk.

So, let us begin with the 'what'.

What is industrial development? The preceding term has been circulating around the globe almost since the early eighteenth century. To minimize human labour, and establish the work force that functions on machines on a larger part is what industrial development has been leading us to. The first of these revolutionary acts were done largely due to the development of powerful energy sources like: bio-fuel functioning machinery. Then came the steam engines, and now most of our industries run solely on electricity.

Let us now proceed with the 'why'.

It not only brought dramatic change in the industrial sector, it also changed the entire scenario of living standards of the common public.

In context of Nepal, we have a poor number of industries, thereby increasing the import to export ratio; and also catalysing the unemployed population. Our industries are doing pretty good on their production and profit margin. But lately, establishment of new industries is a topic barely heard of. We have been indulged in the act of consuming large pies of imported goods. The public alone isn't to be blamed for it. Most of domestically produced goods are just around the standard margin.

If there are ample amount of industries in Nepal that meet most of the public demand, the cost of the products would become significantly less, without disturbing the overall profit margin of the first hand parties involved. To make it more clear and understandable, consider this instance: Nepal-made biscuits are 2-10 rupees cheaper than the similar quality imported from India. Now, that may not sound much while considering on individual lev-

el, but once we go to the larger statistical figures, it brings changes in the figure of seven. That means we would be aiding less to the foreign and more to the domestic economy.

Similarly, if we are capable of locally manufacturing the machinery and other essential requisites, then fields with infinite bounty, like hydropower can be developed at an efficient speed.

The establishment of industries demands a heavy funding, and with the current faltering political situation, it becomes twice as hard to raise that amount of sum. Each topic we discuss, it slowly unshackles the chains that has been rusting in our mind. There may be few who actually know the significance of constitution, but most of us have no idea of it beyond it being 'the law of a country'. For now, think of it as: the amendment of

"In today's context development doesn't come alone; it comes with sustainability, This is what the third industrial revolution is all about."

the constitution would and should bring policies that make it easy for both national and international sector to invest in the developmental program

concerning various sectors.

We have already begun to answer the 'how'.

Underdeveloped countries have scant amount of human resources to deploy for development and developed countries have done their part to impoverish the social and economic standard of the country. We still count as a developing country in the world. That means there is a vast realm of possibilities of successes in various fields still today.

We have abundance of natural resources and lately, skilled manpower too. The problem is we're giving away both our resources to foreign nations. These groups of people, once they stop settling in other parts of the world, have the potential to both invest and establish, if not large, at least medium and small scale industries. All they now lack is proper background and understanding of the industry field. This is where industrial engineers come into light. IEs have knowledge of both technical and management field. The collaboration of these two parties can initiate a national level change, one that would mitigate brain drainage and open up new scopes in other less-stereotypical fields as well.

We also have this superstitious thinking that running a business is an inheritance passed down through the genes. So, what we have is business is for: Newari and Marwadi families and only the males can do it. Such antique cultures that have already been outdated in the world still prevail in our minds and we're corrupted and dominated by it. All one needs is skill, knowledge and finance. A person; be it of any caste or gender can perform it equally well.

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In today's context development doesn't come alone; it comes with sustainability. Enough nature has been exploited, and many, along with us have faced the consequences of it, as well. For the last decade, it has been the talk of the globe, an issue on which awareness needs to be raised. This is what the third industrial revolution is all about.

Nature has given us all it has. Rather we have been digging volumes from its bounty. Now is the time we use it wisely. Earth has been a living place, for thousands of species for a long time and it's we human inhabitants whose prime responsibility it is as the superior species to maintain it for future lives as well.

In case of industries, they are the most responsible for producing pollutants. It is high time we maintained the waste we produce. Reuse, reduce and recycle should be the main motto of every industry and every of its products. Nepal is globally famous for its floras, faunas and wildlife. Thus, we should preserve and protect the few good things that we are left with.

We have done revolutions to dethrone monarchy, and have brought with the blood of masses, a new start as a democratic country; and we're just one revolution away to be a global participant of change and that is industrial revolution.

MY GREETINGS
AND
BEST WISHES
TO MAGAZINE TEAM AND
SOIES-NEPAL FOR THE
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MISSION
OF PUBLISHING
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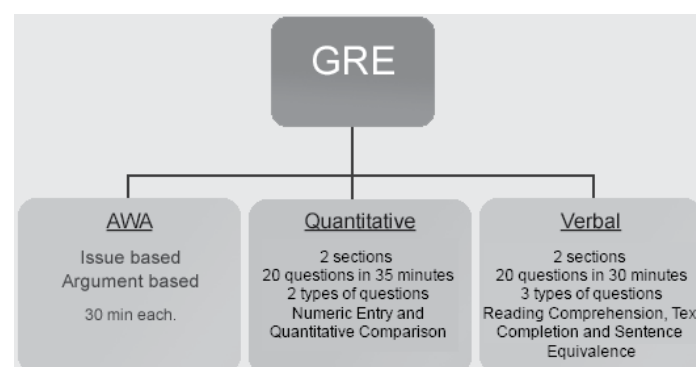
What do YOU need to know about the GRE?



The GRE has, over the years, become almost synonymous with Graduate Education in the USA, and we demystify this important examination through a series of posts. This first post talks about seven key things to know about the GRE through questions that we have seen cropping up in the minds of the GRE aspirants

at it. Ideally find a reputed institute whose impact analysis you can find online – for example, Jamboree has a great track record at preparing motivated individuals for the GRE, and we have many GRE coaching programs, one of which is sure to fit your unique situation.

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whom we have guided and coached over the years.

What is the GRE?

The Graduate Record Examination is a usually computer based test that is a standard admissions requirement for graduate programs across the USA, and tests verbal, quantitative and analytical skills.

When should I take the GRE?

You should ideally choose a GRE date between three and six months before the date you will need to apply. Increasing numbers of students are taking the GRE well before their application date – sometimes a little more than a year before they graduate – so that they can capitalize on the greater time to study in their pre-final year, and use the fact that GRE scores are typically valid for five years.

How do I prepare for the GRE?

First, you need to find a coach. The GRE is one of the tougher competitive exams for higher education, and you will maximize your chances of success if you find someone who has helped others succeed

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